

The 9th Annual CTT Meeting 2003
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Abstracts

Mini-Oral Presentations Session I

Innovative Enabling Cardiac Techniques

Abstract 1. FACILITATED APPROACH TO PROXIMAL VEIN ANASTOMOSES IN CORONARY SURGERY: ONE YEAR ANGIOGRAPHIC RESULTS

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OBJECTIVE: To determine the feasible, effective and procedural risk factors in one-shot proximal anastomotic device in coronary surgery.

METHOD: Since November 2000 68 Simmetry Aortic Connector (St Jude Medical Inc) (SAC) were deployed in 59 patients (pts) undergoing coronary revascularization. Preoperative clinical risk-score was 5.82 ± 3.32 . Six pts (10.1%) were reoperation and 44 (74.6%) were off pump. Graft function was tested intraoperatively measuring blood flow by Doppler analysis; postoperatively and one year after surgery angiography was performed.

RESULTS: Deployed of the SAC, without aortic clamping, was instantaneous and no technical problems were detected in all pts. One (1.6%) pt died of myocardial infarction following acute thromboses of the SAC four days after surgery. Postoperative angiography was done in 54/58 pts (93.1%); 60/63 SAC (95.2%) were patent between these 2 pts (3.3%) revealed a sub-occlusion of the vein graft due to kinking. One year angiographic control in 10/56 pts (17.8%) showed a good patency rate in 90.9% of the SAC.

CONCLUSION: The SAC for saphenous vein graft anastomoses creates a safe reproducible results especially in off-pump procedure. The use of sutureless device reduces the technical demand and avoids aortic clamp. SAC should be very carefully positioned to avoid any graft kinking.

Abstract 2. DO CARDIAC STABILIZERS REALLY STABILIZE THE ANASTOMOTIC SITE?

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OBJECTIVE: Anastomotic site motility measurement during "off pump" CABG.

METHODS: Three different stabilizers have been valued in 10 Italian landrace pigs. Reconstruction of the anastomotic site movement was done in the three-dimensional space after images obtained by 2 digital cameras acquisition and elaboration with an original algorithm. Continuous monitoring of BP, PAP, LAP, RAP has been assessed.

RESULTS: The 3-Dimensional Distance showed a significant movement reduction using stabilizers (LAD 5.32 ± 0.5 vs 1 ± 0.1 mm; $p < 0.0001$; LPD 4.16 ± 0.3 vs 0.8 ± 0.2 mm; $p < 0.0001$; MB 4.13 ± 0.3 vs 1 ± 0.25 ; $p = 0.0101$). The average motility reductions were 81.4%, 80.5%, 75.7%. The stabilizer use showed a heart rate increase: (41% on LDP $p < 0.0001$ and MB $p < 0.0001$; 27% on LAD $p < 0.002$), a mean BP reduction (-35% on LDP $p < 0.0001$, -44% on MB $p < 0.0001$, -30% on LAD $p < 0.0001$); on LAD only an increase in mean LAP (+38%; $p = 0.046$) and an increase in RAP: 43% on LDP ($p = 0.037$), 52% on MB ($p = 0.006$).

CONCLUSION: Cardiac stabilizers can reduce but not cancel the anastomotic site motility in association with peculiar hemodynamic modifications related to the involved artery.

Abstract 3. ROBOTIC LIMA TO LAD ANASTOMOSIS DURING FULL STERNOTOMY ON PUMP MULTIVESSEL CABG: PRACTICAL SUPPLEMENTATION OR QUESTIONABLE DIVERSION?

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INTRODUCTION: Technical and time related considerations during totally endoscopic coronary artery bypass (TECAB) are reported. We questioned whether it is possible to use the Zeus Microwrist in a safe and timely manner during routine CABG operations.

METHODS: We report about 36 patients (mean age 63.2 ± 4.6 years; 30 male; EF $53 \pm 8\%$) in which we used the Zeus with 3D visualization for the distal IMA-LAD anastomosis. The Zeus arms were mounted pre-operatively and remained sterile until deployment. We used a virtual alpha port as instrument holder in order to avoid insertion of trocars.

RESULTS: The duration of Zeus supported anastomosis (Prolene 7.0/8cm) reached a mean of 28 ± 8 minutes. In 7/36 patients the suturing was completed manually. In 5 cases correction stitches were necessary. IMA flow was adequate in all patients.

CONCLUSION: The Zeus telemanipulator facilitates the application of robotic technology not only in selected patients scheduled for TECAB operations, but also in patients with fully equipped onpump multivessel CABG. Adoption of this integrated concept can back up the learning curve and increase the acceptance of otherwise time-consuming complete robotic operations.

Abstract 4. AGGRESSIVE INTRAOPERATIVE THERMOREGULATION IMPROVES OFF-PUMP CORONARY ARTERY BYPASS GRAFTING OUTCOMES

Y. Joseph Woo, M.D., Albert T. Cheung, M.D.

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BACKGROUND: Unintentional systemic hypothermia is common during off-pump coronary artery bypass grafting (OPCAB) and results in peripheral vasoconstriction and elevation in systemic vascular resistance, cardiac afterload, and myocardial oxygen requirements as well as coagulopathy and increased postoperative bleeding and transfusion requirements. These issues may be magnified in robotically assisted cases where total operative times are prolonged. Raising ambient room temperature, and warming intravenous fluids and ventilator gases have limited effect. Warm air circulating blankets placed around the entire periphery of the patient are cumbersome and pose a theoretical risk of blowing non-sterile air around the operative field. Commercially-available, computer-controlled, water-circulating, dorsal surface, active warming systems were utilized during OPCAB and patient outcomes were evaluated.

METHODS: Fifty-two consecutive patients underwent OPCAB by a single surgeon, either with the described adjunctive warming system (thermoregulator group, $n = 27$) or without (control group, $n = 25$). Multiple perioperative parameters were retrospectively compared among the two groups and statistically analyzed.

RESULTS: See table below. Additional demographic parameters such as the incidence of various comorbidities were not statistically different between groups. Thermoregulated patients began OPCAB at the same core temperature as controls but maintained a more physiologic temperature

intra- and postoperatively. Thermoregulated patients bled less postoperatively, required less transfusions, recovered more quickly and were discharged sooner. There were no reexplorations, major perioperative morbidities or mortalities in either group.

Parameter	Control	Thermoregulator	Pvalue
Age	63.5 ± 2.2yrs	63.9 ± 2.1yrs	NS
Ejection Fraction	48 ± 3%	52 ± 3%	NS
Number of Grafts	2.6 ± 0.2	2.9 ± 0.2	NS
Starting temp	35.8 ± 0.2°C	36.0 ± 0.1°C	NS
Lowest intraop temp	35.0 ± 0.2	35.8 ± 0.1	0.002
Ending temp	35.6 ± 0.2	36.7 ± 0.1	0.00004
One hour postop temp	35.8 ± 0.2	36.8 ± 0.1	0.0006
24hour chest tube output	144 ± 153ml	769 ± 58ml	0.015
PRBC transfusion	2.7 ± 0.6U	1.3 ± 0.3U	0.027
Time to extubation	11.1 ± 2.0hr	7.2 ± 0.9hr	0.045
Length of Stay	5.2 ± 0.3days	4.1 ± 0.2days	0.002

CONCLUSIONS: Aggressive maintenance of a more physiologic temperature during OPCAB reduced postoperative bleeding, transfusion requirements, mechanical ventilation time, and length of stay. Although not directly investigated in this initial report, these results may be due in part to the improving cardiac afterload and blood component function. These effects may become even more pronounced in patients requiring extensive off-pump revascularization, reoperations, and robotically-assisted cases.

Abstract 5. ALTERNATIVE REVASCULARIZATION STRATEGIES: CAREFUL PATIENT SELECTION WITH TMR YIELDS IMPROVED OUTCOMES

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BACKGROUND: Alternative myocardial revascularization techniques are providing various new options to maximize patient benefit beyond the traditional standards of CABG and PCI. Transmyocardial revascularization (TMR) has emerged as one of these options.

METHODS: 34 consecutive limited-option patients were carefully selected and underwent TMR via left lateral thoracotomy with a Holmium:YAG laser. Patients were followed for 12 months. Baseline characteristics included maximum doses of at least two anti-anginal medications and previous CABG and/or PTCA in all patients, >90% with triple-vessel disease, 85% with hypertension, 50% with diabetes, mean LV function of 47%, 95% in CCSAS Class III and 5% in Class IV. LVEF < 30% and CHF were exclusion criteria. An epidural catheter was used to reduce postoperative pain.

RESULTS: 91% of TMR-treated patients had 2-class angina reduction at 12 months. No patients were readmitted for cardiac complications. Average length of hospital stay was 4.5 days. Mortality was 3%.

CONCLUSION: Careful patient selection in this challenging cohort resulted in significant angina improvement and low mortality. 85% of TMR-treated patients were in CCSAS Class I, or lower, 12 months after TMR.

Abstract 6. A NEW APPROACH FOR ATRIAL SEPTAL DEFECT CLOSURE IN PEDIATRIC PATIENTS—LATERAL MINI-THORACOTOMY IN PEDIATRIC PATIENTS

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OBJECTIVES: Antero-lateral thoracotomy has been advocated as a cosmetically superior alternative to sternotomy for closure of atrial septal defects (ASD). However, the incision has led to several complications such as phrenic nerve palsy or subsequent breast and chest wall deformities. We report the initial results of using a lateral mini-thoracotomy at the mid-axillary line for repair of ASD in pediatric patients.

METHODS: 15 patients (male 6, female 9) with a median age of 5 years (range: 4-14) were operated on for ASD type II (n = 14) and partial AV-canal (n = 1) via a lateral mini-thoracotomy between 10/1999 and 3/2002. Two patients had a partial anomalous pulmonary venous return (APVR)

and one patient a mitral cleft. Special features of the approach included a short incision, preservation of the parietal musculature, establishment of cardiopulmonary bypass (CPB) with a central (n = 8) or peripheral (n = 7) cannulation, and repairing of the defect under ventricular fibrillation (VF). TEE was available in all patients. The defect was closed primarily in all but the two patients with APVR (where a baffle patch was used); the mitral cleft was closed.

RESULTS: Median CPB-time was 45 min and VF-time 13 min. No intra- or post-operative complications occurred. TEE confirmed perioperatively the absence of residual defect. The length of the incision ranged between 4 to 6 cm; the incision is hidden by the arm in a resting position in all patients.

CONCLUSIONS: Lateral mini-thoracotomy can be safely performed to repair ASD with cosmetically superior results compared to median sternotomy and right anterior thoracotomy. This approach could be the best alternative to percutaneous closure of ASD.

Abstract 7. EXTRAPLEURAL APPROACH FOR THE REPAIR OF AORTIC ISTHMUS STENOSIS IN INFANTS: A USEFUL TECHNIQUE

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OBJECTIVE: To study the feasibility and usefulness of an extrapleural approach (EPA) for extended resection and end to end anastomosis of aortic isthmus stenosis (AIS) in infants.

MATERIALS and METHODS: 10 consecutive patients undergoing surgical repair for AIS using EPA from June - Dec 2002. The median age was 7 days and median weight 3210 grams (Range: 980-3570gms). The aorta was approached through a 4th space posterior minithoracotomy. The latissimus-dorsi was split; not the serratus anterior. The parietal pleura was gently spread apart from the thoracic cage to expose the thoracic aorta. The isthmus resection was performed in a standard manner. Three patients underwent PA banding. Except in 2 patients with opening of the pericardium, the thorax was closed without drainage.

RESULTS: All patients survived the operation. Postop echocardiography showed no significant gradients across the neoisthmus. The ratio of descendens/ascendens flow velocity decreased from 2.2 to 1.45 (Median). The median cross clamp time was 25 min (25 ± 7) and the duration of operation was 90 min (101 ± 27).

CONCLUSIONS: EPA for surgical repair of AIS is feasible and safe and offers a comfortable exposure of the aorta. It minimizes lung trauma and keeps the pleural space free of adhesions. This may be helpful in patients requiring a subsequent sternotomy or thoracotomy.

Abstract 8. CONCOMITANT ANTI-ARRHYTHMIA SURGERY, USING IRRIGATED RADIOFREQUENCY ABLATION (SICTRA) IN CABG PATIENTS

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BACKGROUND: This prospective study evaluated a new indication for an additional anti-arrhythmic surgical procedure, in CABG patients with chronic atrial fibrillation.

METHODS: 32 CABG patients, with a mean (SD) age 67.9 yrs (8.0); left atrial diameter 46.4 mm (8.0), duration AF 78 months (79), LVEF 53% (15), euroscore 5.6 (2.6), had a SICTRA procedure, which was performed with a hand-held cooled-tip ablation catheter: Only metoprolol (95 mg retard) was given postoperatively. Cardioversion was not performed before the 6th postoperative month.

RESULTS: The mean (SD) number of distal anastomosis was 3.3 (1.2), aortic cross-clamp time 92 minutes (18). Thirty-day mortality was 3.1% (1/32). The mean (SD) follow up was 22.3 months (14.4). The cumulative survival rates at 12 and 24 months 95% and 89%. The cumulative postoperative SR rates at 3, 6 and 12 months are 54%, 69%, 76%.

CONCLUSION: Chronic AF, in CABG patients, is an appropriate new indication for a concomitant SICTRA procedure.

Abstract 9. ALLOGENEIC BLOOD TRANSFUSION REQUIREMENTS AFTER MINIMALLY INVASIVE VERSUS CONVENTIONAL AORTIC VALVE REPLACEMENT: A RISK-ADJUSTED ANALYSIS

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BACKGROUND: Aortic valve replacement (AVR) through a partial sternotomy (mini-AVR) was associated with improved outcomes, when compared with conventional AVR. We sought to investigate whether mini-AVR may yield decreased transfusion requirements over conventional AVR.

METHODS: From January 1997 through December 2001, 559 patients underwent isolated AVR (mini-AVR, n = 56 Vs. conventional AVR, n = 503). A multivariate logistic regression analysis was used to adjust for potential imbalances between groups. Risk score of the Parsonnet's risk stratification model was included as a covariate.

RESULTS: No patient in the mini-AVR group required conversion to sternotomy. Cardiopulmonary bypass time was longer in the mini-AVR than in the conventional AVR group [103 (50-367) Vs. 76 (45-442) min, $p < 0.01$]. A total of 31 patients (55.4%) in the mini-AVR and 377 patients (75.0%) in the conventional AVR group were transfused throughout their hospital stay ($p < 0.01$). After adjusting for Parsonnet's scores the difference was not statistically significant (Odds ratio = 0.65, 95% Confidence intervals = 0.35-1.21, $p = 0.18$).

CONCLUSION: Mini-AVR may produce better wound cosmesis and less surgical trauma but requires prolonged cardiopulmonary bypass time to perform. Risk-adjusted analysis failed to demonstrate a significant difference in blood transfusion requirements after mini vs. conventional AVR approach.

Fireside Chat Clinical Rounds I

Session A: Anastomotic Complications

Abstract 10. THIS IS A REPORT OF A LETHAL COMPLICATION FOLLOWING APPLICATION OF THE ST. JUDE AORTIC CONNECTOR

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A 57-year-old male underwent urgent OPCAB operation for peri-infarction angina due to multi-vessel in-stent restenoses. The proximal graft to the aorta for the RCA bypass was done using a St. Jude Symmetry device without incident. Satisfactory graft flows were measured with low PI's (pulsatility index) On the morning following surgery, the patient suffered a sudden cardiopulmonary arrest after a few seconds of severe bradycardia progressed to ventricular fibrillation. The patient was returned to the operating room. The sternal incision reopened, and the proximal part of the aorta was covered with a hematoma containing an ongoing oozing site. Removal of this hematoma revealed the aortotomy for the RCA graft intact but freely bleeding. The symmetry device connector with the attached proximal end of the right coronary vein graft was found within the hematoma approximately 2 centimeters from its aortotomy. Although satisfactory re-grafting was done, and the patient separated from bypass with use of an intra-aortic balloon assist, the patient had shown no signs of awakening and developed severe hypoxic encephalopathy, and subsequent death. Until the mechanism(s) of these device failures are determined and preventative measures developed, we would urge caution in the use of these devices.

Abstract 11. COMPLICATION OF SUCTIONS STABILIZING DEVICES DURING OFF PUMP CORONARY ARTERY SURGERY

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AIM: To understand the hazardous effects of suction pads on the epicardium and myocardium and to take preventive actions.

MATERIAL & METHODS: Cardiac stabilizers with suction pads became available to us by January 2002. The use of this stabilizer allowed the exponential growth in the number of offpump surgeries all over the world, as the coronary arteries on the back of the heart became accessible for grafting. From 1st January 2000 till 30th June 2002, 1377 patients underwent offpump coronary artery surgeries. Two of these 1377 patients developed complication directly related to the suction device. Epicardium got separated from the myocardium avulsing the intramyocardial blood vessels underneath the imprint of suction pads producing haematoma, which progressed undermining epicardium over a large portion of heart and produced burrowing of haematoma into the myocardium. It gave the appearance of ruptured heart with torrential bleeding. Both these patients were treated by going on C P Bypass by evacuating haematoma and obliterating the cavity with biological glue.

RESULTS: One patient died 2 hrs postoperatively due to uncontrolled bleeding. The next patient survived the operation and was discharged home on 12th P.O. day.

CONCLUSION: Any expansion of suction pad mark should be immediately treated and it should not be allowed to progress and expand and burrow within the myocardium. This complication can occur at low or normal level of suction pressure and may be attributed to the weakness between the epicardium and myocardial fibrils.

Abstract 12. ACUTE AORTIC DISSECTION OR GRAFT CLOSURE—AND NOT PULMONARY EMBOLISM—ARE THE LEADING CAUSES OF SUDDEN DEATH AFTER CABG

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BACKGROUND: Acute aortic dissection (AOD) can occur intraoperatively or late, up to several years after cardiac surgery. Its recognition and management are well documented. Recent reports indicate it may also occur very early, within a few days of an otherwise uneventful operation. Its recognition then is more difficult, and its lack of may result in sudden unexplained death, previously attributed to "massive PE". Similarly sudden death may occur after acute graft occlusion, particularly after OPCAB, and earlier reports have prompted systematic prophylactic anticoagulation to prevent this catastrophic event.

METHODS AND RESULTS: In our Institution (650 cardiac operations/year), postoperative sudden unexpected hemodynamic collapse (POSHC) has occurred on an average 2 to 3 times each year, during hospitalization or early after discharge, in CABG patients (both OPCAB and ONCAB), usually resulting in death from "massive PE" without autopsy confirmation. In the past year, 2 patients ready for discharge and 1 already discharged sustained POSHC. 2 had early acute AOD originating at the proximal anastomosis (1 conventional and 1 using a mechanical connector on an atheromatous aorta). Initial presentation was lower extremities paresis 5 days post OPCAB in a 75 year old male, and CHF with new AI murmur in an 89 year old female a week after discharge and ONCAB. Diagnosis was confirmed by TEE and CT. The first underwent successful repair while the second refused surgery and died. The 3rd patient complained of severe shoulder pain, then went into POSHC 5 days after uneventful OPCAB. After open chest resuscitation she was found to have an occluded vein graft to a dominant RCA and survived surgery.

CONCLUSION: In the past, sudden unexpected POHC after uneventful OPCAB or ONCAB was attributed to PE. Closer review indicates it is more commonly the result of acute graft closure or early AOD. Both entities are difficult to recognize early and require a high index of suspicion as any delay in surgical treatment is associated with a definite risk of death from massive infarction and cardiogenic shock in the former, or rupture and tamponade in the latter. Expeditious bedside resuscitation and return to the OR, or TEE and CT when possible, allow successful management of these dreadful and probably not so infrequent complications of CABG. Though recently

reported in the literature, the role of proximal mechanical connectors in initiating early postoperative graft closure or AOD remains unclear and will require prospective studies.

Abstract 13. EARLY GRAFT OCCLUSION IN CABG ASSOCIATED WITH NITNOL PROXIMAL CONNECTORS

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At BUMC, we have implanted many proximal connectors with success. With two however, we have documented early proximal graft occlusion. In one patient antibodies to heparin were noted and continued to circulate at the time of surgery; hirudin was used as the anticoagulant. In the second case a thoracic approach was used to create one vein graft to the obtuse marginal. In both patients "full anticoagulation" was accomplished during the CABG. Plavix was not used in either patient in the perioperative period. Both occlusions occurred after post operative day 3. I consider use of plavix to be critical in patients who have this device implanted because of the amount of exposed nitinol.

Abstract 14. PERIOPERATIVE ISCHAEMIA AFTER CORONARY REVASCULARISATION: VALUE OF EARLY INTERVENTIONS

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AIM: To assess the value of early interventions for perioperative ischaemia (PI) in patients (pts) after coronary revascularisation (CR).

MATERIAL AND METHOD: Among 2826 consecutive pts underwent CR, 70 pts (2.5%) due to PI required early intervention (up to 24 hours), 48 pts (1.7%) - acute angiography and 22 pts (0.8%), because of haemodynamic instability, immediately reoperation.

RESULTS:

	Early angiography, n = 48 pts			Perioperative, n = 22 pts	P
	all n = 48	normal n = 11	abnormal n = 37		
- graft occlusion -17		TIMI III	PCI-22 (45.8%)		
- graft stenosis - 6			reoperation-12 (25%)		
- graft spasm -2					
- TIMI I - 6					
- poor distal run-off - 3					
MI	37 (77.1%)	6 (54%)	31 (83%)	16 (72.7%)	0.88
Death	7 (14.6%)	1 (9.1%)	6 (16.2%)	14 (63.6%)	0.004

CONCLUSION: Early angiography in PI after CR is a safe and effective procedure. Pts with acute PI after CR may develop myocardial infarction despite normal angiographic findings. Mortality among those pts with PI who have to be immediately reoperated is significantly higher compare to pts with stable PI.

Abstract 15. ACUTE CORONARY ANGIOGRAPHY AFTER CABG: NECESSITY AND CONSEQUENCES

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INTRODUCTION: Current standard of quality assessment of CABG is coronary angiography, but often the question arises when to perform angiography and with what consequences.

MATERIAL AND METHODS: We retrospectively analyzed 43 patients receiving acute coronary angiography from 01/2001 to 08/2002 after CABG. Seventeen patients (group 1) had CKMB/CK higher than 10%, 9 patients (group 2) received angiography due to new ischemia signs on ECG, 15 patients (group 3) due to both, and 2 patients (group 4) due to ventricular fibrillation.

RESULTS: In group 1 fourteen patients (88%), in group 2 seven patients (78%) and in group 3 fourteen patients (88%) had anastomotic problems. In group 4 angiography revealed good patent grafts. Ten patients received subsequently additional operation and 2 patients (20%) died being already in

cardiogenic shock. Nine patients received acute PTCA and/or stenting and 1 patient (11%) died. The remaining 16 patients with anastomotic complications underwent conservative therapy and 1 patient (6.3%) died.

CONCLUSIONS: Equal sensitive criteria for detection of anastomotic failures after CABG are the combination of increase of cardiac enzymes plus ECG ischemia signs or isolated increased cardiac enzymes. Reoperation during acute stadium offers best outcome unless patients are in cardiogenic shock.

Session B: Intraoperative Management and Anticoagulation

Abstract 16. STANDARD FORMULAS OVERESTIMATE PROTAMINE REQUIREMENTS IN OFF-PUMP CORONARY ARTERY BYPASS GRAFTING

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BACKGROUND: Over the past eight years, approximately 8,000 cardiac surgical patients were operated upon at our institution and underwent activated clotting time (ACT) monitored heparin anticoagulation for cardiopulmonary bypass and protamine administration based upon a standard formula that has not changed during this period. This formula reflects the physiologic effects of bypass pump-induced dilutional coagulopathy, platelet dysfunction, and coagulation/fibrinolytic cascade component activation, factors not necessarily pertinent in off-pump coronary artery bypass grafting (OPCAB). This study sought to evaluate a strategy of decreased protamine dosing in OPCAB.

METHODS: Forty-seven consecutive patients underwent primary OPCAB by a single surgeon with full heparinization calculated for a goal ACT of 400 sec. A mean of 2.83 ± 0.14 grafts/patient were performed. For heparin reversal, protamine dosing was calculated by the standard institutional formula, 50% of this dose was administered, and the ACT was measured.

RESULTS: The mean baseline ACT was 137 ± 5 sec. After heparin administration, the mean ACT was 452 ± 12 sec. Just prior to protamine dosing, the mean ACT was 390 ± 10 sec. After protamine administration, the mean ACT was 123 ± 2 sec. Normalization of ACT to baseline levels was achieved with 50% protamine dosing in 43 of 47 patients, four patients required an additional 25% dose. All patients demonstrated intraoperative clinical evidence of hemostasis. Mean partial thromboplastin time (PTT) upon arrival in the intensive care unit was 39.5 ± 2.3 sec, statistically equivalent to a preoperative mean PTT of 34.8 ± 3.6 sec. ($p = 0.26$). Mean 8-hour chest tube output was 412 ± 29 ml and mean 24-hour output was 807 ± 39 ml although this later value tends to reflect predominantly serous drainage from the left internal thoracic artery harvest bed. Mean PRBC transfusion was 1.5 ± 0.3 units/patient. There were no transfusions of platelets, fresh frozen plasma, or cryoprecipitate, no re-explorations, and no mortalities. Patients were discharged a mean 4.5 ± 0.2 days postoperatively.

CONCLUSIONS: A standard protamine dosing formula adequate for on-pump cardiac surgical procedures significantly overestimates protamine requirements for OPCAB. Decreasing protamine administration does not appear to adversely affect patient outcome.

Abstract 17. CARDIOPULMONARY BYPASS UNDER RECOMBINANT HIRUDIN: SAFE AND EFFECTIVE IN A PATIENT WITH TERMINAL KIDNEY DYSFUNCTION

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OBJECTIVE: The isolated thrombin inhibitor recombinant (r-) hirudin has been used successfully in patients with heparin-induced thrombocytopenia (HIT) type II during cardiopulmonary bypass (CPB). Terminal kidney dysfunction is regarded as contra-indication for the use of recombinant hirudin because r-hirudin is mainly eliminated via the kidneys and no antidote is available.

MATERIAL AND METHODS: We report on a 67 year old woman (46 kg) with cardiac decompensation due to severe aortic, mitral, and tricuspid valve regurgitation besides chronic atrial fibrillation. After diagnostic heart catheterization the patient had developed anuria requiring daily hemodialysis.

sis. Furthermore she developed a HIT with positive HIPA-test and ELISA. Standard CPB was performed using r-hirudin anticoagulation (Refludan, Pharmion Ltd, Cambridge, England). After an initial bolus of 12.5 mg to the patient and another bolus of 10 mg into the priming of the CPB r-hirudin plasma levels were kept higher than 2.5 µg/ml by additional 5 mg boluses. Anticoagulatory monitoring during CPB was performed using the ecarin clotting time (ECT) assessed every 15 min.

RESULTS: Mechanical prostheses (aortic 23mm, mitral 29mm) were implanted and tricuspid annuloplasty (32mm) were performed without intra- and postoperative complication. During CPB the ECT was measured between 38 and 51 seconds corresponding to r-hirudin plasma levels between 3 and 5 µg/ml. The total amount of r-hirudin used during CPB was 57.5 mg. Towards the end of CPB a period of 69 min hemofiltration with a rate of 166 ml/min (total amount added volume 11.5 L) was carried out. A total amount of 9.43 mg r-hirudin was eliminated by hemofiltration.

CONCLUSION: Recombinant hirudin was used safely and effectively during CPB in a patient with HIT and terminal kidney dysfunction.

Abstract 18. FIRST PROSPECTIVE STUDY OF FIBRINOGEN AND LIPID LOWERING BY HELP (HEPARIN-MEDIATED EXTRACORPOREAL LDL-/FIBRINOGEN PRECIPITATION) - APHERESIS TO PREVENT EARLY GRAFT OCCLUSION AFTER CABG

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BACKGROUND: Early graft occlusion due to thromboembolism occurs in up to 12% after CABG (Coronary Artery Bypass Grafting). Postoperatively highly elevated plasma fibrinogen levels, graft endothelial damage and the resulting activation of the coagulation cascade favor a prothrombotic response. In a prospective study we sought to determine whether postoperative lowering of fibrinogen and lipids by HELP (Heparin-mediated Extracorporeal LDL-/Fibrinogen Precipitation) - apheresis prevents early graft vessel occlusion in hyperlipidemic patients undergoing CABG.

METHODS: Between 12/2000 and 10/2002 fifteen hyperlipidemic male patients, mean age 60 ± 2 years, underwent CABG. Mean preoperative levels were for: Fibrinogen = 365 ± 12, LDL-Cholesterol = 117 ± 16 Lpa = 39 ± 12, Triglycerids = 402 ± 152mg/dl. Postoperatively HELP-apheresis was employed when fibrinogen values exceeded 350mg/dl on day 1 and 250mg/dl every consecutive day up to day 8. Pre- and post-apheresis blood samples were obtained and reduction of plasma fibrinogen, LDL-cholesterol, Lpa and triglycerids was calculated. Coronary angiography was performed within 9-16 days.

RESULTS: 55 bypass grafts (27 arterial, 28 vein grafts) were performed in 15 patients (3.7 grafts/patient). Postoperatively 83 HELP-apheresis were applied (mean 5.5/patient) from day 1-8. Fibrinogen levels were lowered from 360 ± 12mg/dl (pre-apheresis) to 157 ± 46mg/dl (post-apheresis) (p<0.01), LDL-cholesterol from 48 ± 12 to 23 ± 1 (p<0.01), Lpa from 16 ± 2 to 8 ± 1 (p<0.01), triglycerids from 155 ± 8 to 99 ± 5mg/dl (p<0.01). Coronary angiography revealed graft patency in 54 of 55 grafts (98% patency) with one closed Y-graft to a diagonal branch of 1mm in diameter. No HELP-related complications were observed.

CONCLUSIONS: Early and drastic postoperative reduction of Fibrinogen-, LDL-Cholesterol-, Triglycerid- and Lpa-levels by HELP-apheresis offers a safe and promising tool in the prevention of early graft occlusion in hyperlipidemic patients undergoing CABG. To evaluate superiority of HELP- to non-HELP-apheresis treated patients further investigation concerning longterm graft patency is ongoing.

Abstract 19. COMPOSITE ARTERIAL GRAFTING: INFLUENCE AND COMPETITIVE FLOW ON GRAFT PATENCY

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BACKGROUND: Composite arterial grafting cause splitting of internal mammary artery flow to various myocardial regions. The amount of flow supplying each region depends on severity of coronary arteries stenosis.

METHODS AND RESULTS: We show postoperative coronary angiograms demonstrating the influence of competitive flow on graft

patency. The first patient had left internal thoracic artery (ITA) to LAD and radial artery (RA) to marginal and posterior descending artery (PDA). PDA stenosis was 70%. An angiogram with normal injection demonstrated absence of RA segment between marginal and PDA. Forced injection via ITA demonstrated this segment. The second and third angiograms demonstrated closure of segment of left ITA. Revascularization was performed for 70% LAD stenosis in the second case and 60% left main in the third case. In both cases, thallium SPECT showed normal perfusion of the anterior wall.

CONCLUSION: These findings suggest that composite grafting should be reserved for coronary vessels with severe and critical stenosis.

Abstract 20. OFF-PUMP CORONARY ARTERY BYPASS GRAFTING ATTENUATES POSTOPERATIVE BLEEDING ASSOCIATED WITH PREOPERATIVE ASPIRIN AND CLOPIDOGREL ADMINISTRATION

Y. Joseph Woo, M.D., Nicholas Valettas, M.D.

University of Pennsylvania

OBJECTIVE: Clopidogrel and aspirin are commonly administered prior to cardiac catheterization in preparation for possible coronary stent implantation but surgical anatomy is often discovered. Recent findings indicate that patients surgically revascularized within seven days of clopidogrel exposure have markedly increased postoperative bleeding, transfusion requirements, and a ten-fold risk of reexploration and thus suggest delay of surgery, platelet administration, and elimination of the routine practice of pre-angiography clopidogrel administration. (1) This study sought to evaluate the potential role of off pump coronary artery bypass grafting (OPCAB) in eliminating the need to delay surgery and in decreasing postoperative bleeding.

METHODS: A retrospective review was conducted of ten patients who received clopidogrel in combination with aspirin prior to cardiac catheterization in anticipation of coronary stent implantation, were found to have surgical anatomy, and then underwent OPCAB without delay by a single surgeon. Eight and twenty-four hour chest tube outputs, transfusion requirements, and postoperative length of stay (LOS) ≤5 days were analyzed and compared to a published group of 51 patients serving as a historical control. (1)

RESULTS: Postoperative chest tube outputs, blood product transfusions, and length of stay are detailed below. Among the ten OPCAB patients, there were no mortalities, reexplorations, myocardial infarctions, strokes, respiratory complications or sternal wound infections.

Parameter	Historical Control	OPCAB
N	51	10
8 hr Chest Tube Output (ml)	817 ± 761	343 ± 50
24 hr Chest Tube Output (ml)	1274 ± 1165	814 ± 77
PRBC (units)	2.6 ± 2.5	1.1 ± 0.3
Platelets (units)	0.9 ± 1.3	0
FFP (units)	0.8 ± 1.8	0
Cryoprecipitate (units)	0.2 ± 1.4	0
LOS ≤5 days (% patients)	34%	80%

CONCLUSIONS: Among these ten OPCAB patients with immediate preoperative administration of clopidogrel and aspirin, postoperative bleeding, transfusion requirements and length of stay were less than historical controls. Recommended approaches to preoperative clopidogrel administration such as delay of surgery and platelet transfusion were not necessary in this group. The current practice of pre-angiography clopidogrel administration would not seem to require modification.

I. Hongo RH, Ley J, Dick SE, Yee R. The effect of clopidogrel in combination with aspirin when given before coronary artery bypass grafting. J Am Coll Cardiol 2002;40:231-7.

Abstract 21. NEW APPROACH TO ANESTHESIA IN CARDIAC SURGERY FOR HIGH-RISK PATIENTS

S. Casalino, F. Mangia, L. Biancardi, C. Alessi, A. Benedetti, F. Guerra

AIM: The benefits ascribed to the employment of high thoracic epidural anesthesia (HTEA) include faster extubation, better control of postoperative pain and fast recovery of the respiration function.

MATERIALS AND METHODS: We enlisted 50 patients who had undergone CABG in 2 groups of 25 patients. Each group received intravenous

anesthesia (TIVA: remifentanyl 0.2- 0.3microgr/kg/min and propofol 3-5 mg/kg/h). Group B received blended anesthesia (HTEA T1-T2: bupivacaine 250mg and alfentanil 1 mg and propofol 3-5 mg/kg/h). Postoperatively, group A received morphine 0.07mg/kg every 6 hours; group B:bupivacaine 0.07mg/kg/h and alfentanil 4 microgr./kg/H in the peridural catheter. Postoperatively, we estimated the length of intubation, FEV1 and VAS at 24 and 72 hours.

RESULTS: The 2 groups were homogeneous in age, time of extracorporeal circulation and time of aortic clamping. At 24 hours FEV1 reduced to 32.2% in Group A and to 38% in Group B ($p = 0.14$) vs the preoperative values. VAS was 5.4 (range 0-10) in GROUP A and 5.2 in Group B ($p = 0.2$). At 72 hours FEV1 reduced to 44.4% in Group A and to 54% in Group B ($p = 0.07$). VAS was 3.1 in Group A and 2.9 in Group B. Length of intubation: Group A 125 ± 45 min. and Group B 110 ± 80 min. ($p = 0.18$).

CONCLUSION: Although this study did not show a real advantage of HTEA vs TIVA in this group of unselected patients, we think that larger dosage of anesthetic provides more effective control of postoperative pain, and the application of HTEA in patients with compromised respiratory function underscores the real advantages of this method versus TIVA.

Session C: Sternal Wound Complications and Strokes

Abstract 124. PRIMARY STERNAL PLATING IN HIGH-RISK PATIENTS AS PROPHYLAXIS AGAINST MEDIASTITIS

David H. Song, MD

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BACKGROUND: Sternal instability predisposes to post-sternotomy mediastinitis (PSM). Sternal osteotomies are predominantly closed with wire. Rigid plate fixation has been used successfully to increase stability and prevent infection following osteotomies for other bones. Therefore, we studied the utility of this technique for sternotomies in high-risk patients.

METHODS: High-risk patients were identified as having >3 recognized risk factors for PSM. Between July 2000 and December 2001, 45 patients (Group 1) had prophylactic rigid plate fixation, compared to a matched cohort of controls (Group 2) with similar risk factors that underwent conventional sternal wire closure ($n = 207$).

RESULTS: Mean follow-up was 15 weeks (range 8 to 41 weeks). There were 4 peri-operative (8.8%) deaths in Group 1 and 18 in Group 2 (8.6%), unrelated to sternal complications. Incidence of PSM in Group 1 was 0, compared to 14.8% ($n = 28$), in Group 2 ($p = 0.006$). Total institutional incidence of PSM during the study period was 4.2%.

CONCLUSIONS: Mediastinitis increases morbidity, mortality and hospital stay after open-heart surgery. Primary sternal plating is an effective way of ensuring sternal immobility thereby reducing the substrate for bony infections. Application of this technique may act as prophylaxis against mediastinitis and promote early mobilization and recovery in high-risk patients.

Abstract 23. TREATMENT OF STERNAL WOUND COMPLICATIONS WITH THE VACUUM-ASSISTED CLOSURE DEVICE

Claudio Muneretto, Gianluigi Bisleri, Jacopo Manfredi, Alberto Negri

Division of Cardiac Surgery, University of Brescia Medical School, Brescia, Italy

We evaluated the effectiveness of the Vacuum Assist Closure (VAC) device in the treatment of sternal wound complications. The VAC device consists of a sterile polyurethane foam dressing with an open-pore structure that can be trimmed in different shapes in order to fit the sternal wound. The wound is sealed with adhesive drape and a continuous negative pressure is applied. We used the VAC device was used in 16 patients (mean age: 75 ± 7 years) with sternal wound complications: positive cultures were found in 13 patients (S. aureus: 10 pts.; Enterobacter: 4 pts.). We observed a particularly high prevalence of diabetes (62.5%) and COPD (75%). Dressings were changed out every 48 hours. We did not observe any extension of infection to deeper layers. Wound healing was achieved in all patients after a mean period of 18 ± 3 days despite an initial consistent lacking volume of tissue (mean 70 mL). Antibiotic therapy was administered for 10 ± 2 days. The VAC device provided excellent results in the treatment of sternal wound compli-

cations stimulating granulation tissue ingrowth and promoting tissue approximation.

Abstract 24. A NOVEL TECHNIQUE FOR THE TREATMENT OF STERNAL WOUND INFECTION USING APPLICATION OF MACROPHAGES

Erez Kachel

Sheba Medical Center, Tel Aviv, Israel

BACKGROUND: Sternal wound infection remains a significant complication after open heart surgery. Reported mortality is up to 40%, time of hospitalisation may reach months and the average cost of hospitalization is three times higher than that of patients with an uncomplicated postoperative course. The heart - lung machine reduces the number and function of the macrophages by 70%. By using this technique, we aim to overcome this reduction. We describe here the practical aspects of managing post sternotomy wound infection using this approach.

METHODS: After developing a method for preparation of human macrophages suspension from a blood unit in a closed sterile system, the cells were activated by a hypoosmotic shock and injected into the infected open sternal wound incision. 65 patients were treated.

Group 1 - 28 superficial sternal wound infection

Group 2 - 29 deep sternal wound infection

Group 3 - 8 patients post failed sternal reconstruction surgery

RESULTS: Complete wound closure was achieved in 61 patients at 10 to 138 days (mean 46). In two patients a marked improvement was achieved and finally a simple direct closure was needed. Two patients died during the follow up.

CONCLUSION: In the appropriate patients, treatment with macrophages may reduce morbidity, lower mortality, prevent reoperation, and reduce the average postoperative hospitalization period and costs.

Abstract 25. NEW METHOD FOR DELAYED STERNOTOMY HEALING: THE VACUUM THERAPY

Roland Demaria, Uberto Giovannini, Luc Téot, Jean-Marc Frapier, Bernard Albat

Department of Cardiovascular Surgery and Department of Burns and Plastic Surgery, Arnaud de Villeneuve Hospital, Montpellier, France

PURPOSE: The purpose of this investigation was to apply the vacuum therapy in cardiac surgery in order to achieve healing of delayed sternotomy closure.

MATERIAL AND METHODS: A total of 7 patients operated for coronary bypass surgery by median sternotomies presented a non healing sternum surgical wound treated by vacuum therapy. Aspiration maintained between -125 and -200 mmHg was done on the surface of the wound using a sponge connected hermetically to an aspiration system. The treatment was associated with an antibiotherapy adapted to the bacteriological results.

RESULTS: All patients with delayed sternotomy closure healed in about 8 weeks (2 to 12 weeks) but one who died of multiorgan failure. The treatment was possible by vacuum therapy alone ($n = 2$) or associated in second intention with a skin graft ($n = 1$) or both with a muscular pectoral flap ($n = 4$).

CONCLUSIONS: This new therapy offers an alternative to classic treatment of infected sternotomies in cardiac surgery, especially to prepare rewiring and muscular flaps.

Abstract 26. CEREBRAL PROTECTION IN MINIMALLY INVASIVE HEART VALVE SURGERY: EVALUATION OF CARBON DIOXIDE INSUFFLATION IN A PORCINE MODEL

S. Martens, A. Theissen, * J. Balzer, ** M. Dietrich, K. Graubitz, M. Doss, A. Moritz

Department of Thoracic and Cardiovascular Surgery, *Central Research Facilities, **Department of Diagnostic and Interventional Radiology, J.W. Goethe University Hospital, Frankfurt, Germany

BACKGROUND: Major risk of central or peripheral organ damage is attributed to air embolism from incompletely deaired cardiac chambers after minimally invasive heart valve operations. Replacement of air by carbon dioxide insufflation into the thoracic cavity is widely used. Diffusion weighted magnetic resonance imaging (DWI) was utilized to visualize reversibility of ischemia after gas embolization in a porcine model.

METHODS: After selective catheterisation of a common carotid artery in 15 pigs, boli of 1 ml/kgBW of air (group I, n = 5) or carbon dioxide (group II, n = 5) were applied. Group III (n = 5) received 2 ml/kgBW of carbon dioxide. Diffusion weighted MRI (DWI) of the brain was performed 2, 5, 10, 15 and 25 minutes after embolization.

RESULTS: In group I, DWI revealed irreversible hyperintense signals in both hemispheres. In group II, no change in signal intensity was observed in two pigs, three others showed reversible changes in signal intensity, without important circulatory reactions. In three animals of group III, hyperintense signals were reversible, but two others presented with bilateral, irreversible signals in DWI.

CONCLUSION: Early reversibility of ischemic lesions visualized in DWI encourage the use of carbon dioxide insufflation to the operative field as a protective method in minimally invasive heart valve surgery.

Abstract 111. AORTIC LEAFLET REPLACEMENT WITH THE NEW 3F STENTLESS AORTIC BIOPROSTHESIS. CLINICAL EVALUATION OF HEMODYNAMIC PERFORMANCE AND CORONARY FLOW

Mirko Doss

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BACKGROUND: The 3F aortic bioprosthesis is a stentless biological heart valve fabricated from three equal leaflets of equine pericardium, assembled in a tubular shape, and implanted in the native aortic root, to replace the patient's diseased aortic leaflets. Clinical trials began October 2001 and being one of the first centres to implant this prosthesis in humans, we would like to present our experiences with this new device.

METHODS: Between January 2002 and August 2002, 24 3F aortic bioprosthesis were implanted at our institution. Effective orifice area, mean gradients and ejection fraction were evaluated echocardiographically at discharge and 6 months after surgery. Furthermore coronary flow before and after the implantation of the device were assessed via MRI-angiography.

RESULTS: At 6 months of follow-up the 3F bioprosthesis showed a good hemodynamic performance with a significant drop of mean gradients to 15.9 mmHg, a mean effective orifice area of 1.7 cm² and a mean ejection fraction of 61.5%. Coronary flow had significantly improved compared to preoperative values and reversal of preoperative systolic flow was abolished.

CONCLUSION: The clinical performance of the new 3F aortic bioprosthesis is comparable to regular stentless aortic valves. Its unique design features make it easier and quicker to implant than conventional stentless valves additionally an excellent restoration of coronary flow is achieved by this prosthesis.

Session D: Potpourri of Videos

Abstract 27. MINIMALLY INVASIVE RADIAL ARTERY HARVESTING UNDER DIRECT VISION

G. Gelpi, M. Lemma, A. Mangini, A. Innorta, C. Antona

Dept. of Cardiovascular Surgery, L. Sacco Hospital, Milan, Italy

OBJECTIVE: Evaluation of a new method for radial artery (RA) harvesting under direct vision through a minimally invasive approach.

METHOD: From August 2002 in 35 pts the RA was harvested under direct vision through a skin incision of 3.5 ± 0.3 cm at the distal third half of the forearm with the aid of the RadLITE system (Genzyme, USA). In 8 pts a second incision of 2 cm was needed proximally in the forearm, to reach the full length of the RA.

RESULTS: The mean length of the RA harvested was 18.2 ± 0.9 cm and in all cases except two was anastomized proximally to the LITA as a Y-graft. These technique allowed to perform 3.1 ± 0.7 anastomosis/pt and 1.7 ± 0.4 anastomosis/pt with RA. No death or MI occurred postoperatively. 20 pts underwent a pre-discharge angiogram that showed the patency of all anastomosis. Postoperatively no pts revealed ischemia or motor dysfunction of the thumb; only two pts complained a transient abnormal sensation of the dorsal part of the tenar.

CONCLUSIONS: This new approach is safe and effective both for the patient and for the RA; it allows harvesting the RA under direct vision, alone and through a minimally invasive skin incision.

Abstract 28. TECHNICAL ASPECTS OF HARVESTING THE RADIAL ARTERY WITH HARMONIC SCALPEL

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BACKGROUND: Harvesting the Radial Artery (RA) with Harmonic Scalpel (HS) reduces spasm induced by surgical handling. Topical exposure to Regitine exerts an additional effect of vasodilatation.

METHODS: RA was harvested as a pediculated vessel with HS in 100 patients undergoing myocardial revascularization. A fasciotomy of the pedicle was carried out after harvesting. Composite graft with reverse free RA on in situ left internal thoracic artery (LITA) was prepared before construction of distal coronary anastomoses. The RA was then put in a syringe filled with Regitine (Phentolamine Methansulphonic) (0.07 mcg/ml) for 10 minutes.

RESULTS: The mean number of grafts/patient was 3.0. The mean number of radial anastomoses was 2.0/patient. LITA free flow was: 105 ± 34 ml/min. Regitine increased radial free flow from 60 ± 35 to 82 ± 30 ml/min (p<0.05). Ten patients underwent postoperative coronary angiography. All radial anastomoses were patent.

CONCLUSION: The compound effect of RA harvesting with the harmonic scalpel and topical treatment with the α -blocking agent Regitine) increases RA free flow and significantly decreases intra-operative spasticity.

Abstract 29. TOTAL MYOCARDIAL REVASCLARIZATION ON THE BEATING HEART VIA LEFT THORACOTOMY

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Centro Medico Guerra Mendez-FUNDACARIO; Valencia, Carabobo, Venezuela

We report herein the case of 56-year-old male patient with triple vessels coronary disease and increased body-mass index (36, 81), scheduled for elective coronary artery revascularization. To avoid the morbidity associated with median sternotomy, we decided for a Left Thoracotomy approach. The Left Internal Thoracic Artery (LITA) and Right Radial Artery were dissected in Skeletonized fashion and anastomosed for a composite "Y" graft. Two Saphenous Vein Grafts (SVG) were anastomosed to the Ascending Aorta using the Symmetry Aortic Connector device. Four By-Pass grafts on the beating heart were performed: LITA to LAD, Radial to Diagonal Branch, Saphenous vein graft to Marginal branch and to Right Coronary artery with the left lung collapsed during the procedure. The surgery was successful, with the patient extubated on the OR and the postoperative course uneventful. A video recording of the technique used will be presented.

Abstract 30. COMBINED TREATMENT OF AORTIC TYPE A DISSECTION: ASCENDING AORTA REPAIR AND PLACEMENT OF A STENT IN THE DESCENDING AORTA

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INTRODUCTION: The established treatment modality of acute Stanford type A dissection includes repair of the ascending aorta and a variable part of the aortic arch, leaving the descending aorta untreated. We report a simultaneous approach of open repair of the ascending aorta with transluminal placement of a stent in the descending aorta to minimize the consequences of an untreated descending aorta.

METHODS: Two cases of aortic dissections type A with the entry port in the descending aorta in one case and in the aortic arch in second one were treated by replacement of the ascending aorta (and aortic arch in second case) and placement of a stent in descending aorta with a new device under circulatory arrest and deep hypothermia. The device consists of a stent DJUMBODIS (r) (Saint Come-chirurgie, Marseille, France) mounted on a compliant balloon. This stent is made of a Steel 316 L, and can be adapted to the shape of the aortic arch or descending aorta. Three different lengths are available 4, 9 and 14 cm. The device has a diameter of 9 mm.

RESULTS: The early results were satisfactory with a complete thrombosed false lumen in one case, and a partial thrombosed false lumen in another one, on postoperative transesophageal echocardiography control. A follow up computed tomographic chest scan was done at 12 months for the first case and 7 months for the second case, which confirmed the good surgical results.

CONCLUSION: This preliminary study shows that combined surgical and endovascular treatment of acute type a dissection is feasible and at least partial thrombolysis of the false lumen can be achieved, potentially minimizing the risk of further dilatation or rupture. The early results are encouraging but more cases and long-term results are warranted to demonstrate the effectiveness of this new combined treatment modality.

Abstract 31. NEW APPROACHES FOR PORT-ACCESS CARDIAC SURGERY—JAPANESE EXPERIENCES

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We will describe our experience with port-access cardiac surgery conducted under the support of our new technology. The author developed a direct endoaortic balloon (Yozu balloon), which is a triple-lumen balloon catheter of 3.6mm in outer diameter and 40 cm in full length. The balloon is inserted directly into the ascending aorta. Injection of cardioplegia and aortic vent can be conducted. Also, we introduce a modified Cosgrove flex clamp to apply in small-incision surgery, aiming at a less invasive procedure. The modified point is that the original, united Cosgrove flex clamp can be divided into the handle part equipped with a ratchet, and the shaft part equipped with a clamp jaw. By this modification, it became possible to apply the Cosgrove flex clamp transthoracically like a Chitwood sliding aortic clamp; that is, it became possible to conduct aortic clamping more safely and securely through this 8 mm hole. Of the 82 pts. who underwent port-access MICS (ASD 46, MVP 30 others 6). No pts. died, and outcomes were uniformly favorable. All pts. returned to work early. The average of pts.' postoperative hospital stay is 5 days (shortest: 3 days). None of these pts. have been readmitted. In view of future technological progress, we can expect the gradual but wide popularization of this method.

Abstract 32. SYNCRUS: A NEW SYSTEM FOR POSTOPERATIVE AF Cardioversion

Klein, Peter

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Atrial fibrillation (AF) commonly occurs following open heart surgery. Although the prognosis of this dysrhythmia is generally good, hemodynam-

ics may be impaired during the AF period and mobilization is delayed. Various studies have demonstrated increased length of hospital stay caused by AF. Since 2002 a new device for treatment of postoperative AF has been available. Via SYNCRUS heart wires (Guidant Inc., Santa Clara, CA) implanted on the left and right atrium during open heart surgery low-energy internal cardioversion shocks can be applied postoperatively. The SYNCRUS system is FDA approved and CE marked. Effectiveness and safety have been demonstrated in a pilot study. Especially a reduction in the length of AF periods was achieved by the heart wire system. The video demonstrates the surgical technique of implantation of SYNCRUS wires during open heart surgery (CABG operation) in the first part. The second part of the video shows the performance of internal cardioversion to terminate postoperative AF on the normal ward. Technical details and safety requirements are included in the video tape.

Abstract 33. IMPLANTATION TECHNIQUE OF A NEWLY DESIGNED STENTLESS MITRAL VALVE

Jose L. Navia, Kazuyoshi Doi, Mario Garcia, Kiyotaka Fukamachi, Pablo Ruda Vega, Michael Kopcak, Eugene H. Blackstone, Patrick M. McCarthy, Delos M. Cosgrove III

The Cleveland Clinic Foundation, Cleveland, OH

OBJECTIVE: To demonstrate the feasibility and reliability of an implantation technique for a newly designed stentless mitral valve (SMV).

METHODS: A bovine pericardial bileaflet SMV with chordae-like structure resembling the native mitral valve was implanted in a sheep model through a left thoracotomy. Under cardiopulmonary bypass, the mitral valve leaflets and chordae were excised through a left atriotomy. The size of the mitral annulus (MA) and the distance between the mitral commissure and the papillary muscle (PM) were measured to determine the size and height of the SMV. Each chord of the SMV was sutured to the head of the PM, and the inflow orifice of the SMV was fixed to the native MA.

RESULTS: Postoperative echocardiography showed no to trivial mitral regurgitation, large effective orifice area and low transvalvular pressure gradient (Rest: 1.8 ± 1.1 , Dob: 2.3 ± 1.2) in six acute animal models.

CONCLUSIONS: The implantation technique was simple, feasible, and maintained physiologic MA-PM continuity. The new SMV showed an excellent valvular performance.

Scientific Session I

Three Best Original Presentations

Abstract 34. INTEGRATED MINIMALLY INVASIVE CORONARY ARTERY BYPASS GRAFTING AND ANGIOPLASTY. A CLINICAL AND ANGIOGRAPHIC FOLLOW-UP

Marek Cisowski, Rafik AbuSamra, Janusz Drzewiecki*, Wojciech Kruczek**, Krzysztof Toczek**, Sławomir Szczesniak, Andrzej Bochenek

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BACKGROUND: Minimally invasive coronary artery bypass (MICAB) through the anterolateral minithoracotomy has become a promising therapeutic option in patients (pts) with lesion in left anterior descending artery (LAD)—especially in multi-morbid, elderly and re-operated pts with type C or B lesions. To expand the benefits of MICAB concept to patients with multivessel disease, a hybrid myocardial revascularization procedure (HMR) combining minimally invasive surgery of the LAD with percutaneous coronary intervention (PCI) procedures for additional coronary lesions has recently been introduced.

METHODS: Between January 1999 and February 2002, 62 pts (46 male, 16 female, mean age 54.8 ± 20.1 years) underwent a HMR procedure. MICAB with endoscopic left internal thoracic artery (LITA) harvesting followed by PCI for additional coronary lesions \bar{n} percutaneous transluminal coronary angioplasty (PTCA) was performed in 16 pts (26%) and stenting in 46 pts

(74%). Angiographic assessment of graft patency was performed in all pts. Clinical follow-up period was 6 to 40 months.

RESULTS: There were no early and late deaths. Baseline Canadian Cardiology Society (CCS) class was 2.8 ± 0.7 versus 1.1 ± 0.9 ($p < 0.001$) 30 days after HMR procedure. There were no major acute in-hospital cardiac events. Angiographic studies showed patent LIMA-LAD graft in 62 pts (100%). We showed good quality of anastomosis in 61 pts (98.3%). There was a moderate graft stenosis in one patient (1.7%). At long term follow-up, the rate of major cardiac events was 11.3%. Six pts (9.7%) developed restenosis after PCI, and one patient (1.6%) developed significant stenosis in site of LITA-LAD anastomosis - PCI were performed successfully.

CONCLUSIONS: The hybrid procedure is a safe and effective method for complete revascularization in selected pts with multi-vessel coronary artery disease. This method allows the performance of complete revascularization with minimization of surgical trauma. So far, long-term results of HMR are limited by the results of PCI.

Abstract 35. SKELETONIZED RIGHT GASTROEPIDIC ARTERY AS A THIRD ARTERIAL CONDUIT; EARLY AND MIDTERM RESULTS AFTER OFF-PUMP TOTAL ARTERIAL REVASCLARIZATION

Ki-Bong Kim, Hyun-Joo Lee, Chang Hyun Kang, Woo-Ik Chang

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BACKGROUND: The aim of this study was to evaluate the early and midterm results of off-pump total arterial revascularization using the skeletonized right gastroepiploic artery (RGEA) as a third arterial conduit.

METHODS: We prospectively analyzed 86 patients who underwent off-pump total arterial revascularization using bilateral internal thoracic arteries (ITA) and RGEA. The RGEA was used as in situ graft in 74 patients, composite graft in 8 patients, and free graft in 4 patients. Postoperative coronary angiographies were performed before discharge in 83 patients, and at post-operative one year in 70 patients.

RESULTS: The RGEA showed a significantly higher free flow (100 ± 78 ml/min) than that of right ITA (92 ± 46 ml/min) or left ITA (89 ± 41 ml/min), which was measured before anastomosis ($p < 0.05$). The total number of distal anastomoses was 3.8 ± 0.7 . The number of distal anastomoses per bilateral ITAs was 2.8 ± 0.7 , and the number of distal anastomoses per RGEA was 1.0. There were three mortalities including one operative mortality. Two late mortalities were not related to cardiac events. Early postoperative morbidities were atrial fibrillation in 10 patients, bleeding reoperation in 2 patients, mediastinitis in 2 patients, and perioperative myocardial infarction in 1 patient. Postoperative coronary angiographies showed the early patency rate of 98.3% (228 / 232) for ITA and 97.6% (81/83) for RGEA, respectively ($p = ns$), and the one-year patency rate of 94.9% (185/195) for ITA and 91.4% (64/70) for RGEA, respectively ($p = ns$).

CONCLUSIONS: The skeletonized RGEA demonstrated excellent early and midterm patency rates and could be used as a third arterial graft following the bilateral ITAs.

Abstract 36. MULTI-VESSEL, ALL-ARTERIAL, OFF-PUMP SURGICAL REVASCLARIZATION WITHOUT DISRUPTION OF THE THORACIC SKELETON

Thomas A. Vassiliades, Jr., MD

BACKGROUND: Multi-vessel, minimally traumatic coronary artery bypass grafting continues to evolve.

METHODS: Thirty-eight patients underwent all-arterial, off-pump revascularization through incisions avoiding manipulation of the thoracic skeleton. The technique consisted of a unilateral approach to bilateral thoracoscopic internal mammary artery harvesting followed by a non-rib spreading, muscle-sparing opening in the soft tissue of the thorax. A thoracoscopic suction device and stabilizer exposed and steadied the target coronary arteries under the chest opening. The anastomoses were then constructed off-pump through the natural width of the intercostal space.

RESULTS: The mean number of grafts per patient was 2.2 ± 0.4 . Transit time flow measurements confirmed a patent graft before closure in every patient. The mean operating time was 4.4 hours (range 3.4 to 5.6). Hospital length of stay was 2.6 ± 1.9 days. There was no early or late mortality. Complications were primarily pulmonary (6 patients, 15.8%). Dobutamine stress echo at three months verified successful target vessel revascularization in 97.4% (37/38) of patients.

COMMENT: A grafting approach that avoids any manipulation of the thoracic cage offers significant patient value; previously this was limited to single-bypass cases.

Video Library

Abstract 37. AORTIC VALVE-SPARING OPERATION ACCORDING TO DAVID IN A PATIENT WITH AORTIC ROOT ANEURYSM USING A NEW PROSTHESIS FOR ANATOMICAL RECONSTRUCTION OF THE SINUSES OF VALSALVA

Friedrich-Christian Riess

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OBJECTIVE: Valve-sparing operations in patients with aortic root aneurysm seem to be the treatment of choice because of good hemodynamic results and avoidance of anticoagulation. However, resection of aortic sinuses and substitution by a straight Dacron prosthesis with diminished compliance result in increased stress to the cusps.

METHODS: A video is presented, showing an aortic valve-sparing operation according to David in a patient with aortic root aneurysm using a new aortic prosthesis for anatomical reconstruction of the sinuses of Valsalva by means of a new aortic root Dacron graft (Gelweave Valsalva, Vascutek, and Renfrewshire, Scotland).

RESULTS: The operation was performed without complications. Due to the special design, which provides compliance in a horizontal plane and recreates the anatomy of the sinuses of Valsalva the implantation of both coronary arteries was easy to perform with less dissection of the coronary arteries. Postoperative MRT assessment demonstrated a competent aortic valve and anatomical reconstruction of the sinuses of Valsalva.

CONCLUSION: A new aortic root Dacron graft was used safely and effectively in a patient with aortic root aneurysm, for aortic valve-sparing operation according to David allowing an anatomical reconstruction of the sinuses of the Valsalva.

Abstract 38. COELIOSCOPIC HARVESTING OF THE GASTROEPIPLOIC ARTERY FOR MIDCAB

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BACKGROUND: Utilisation of the right gastroepiploic artery (RGEA) has allowed arterial revascularisation of the right coronary branches with good permeability results. Anyway, harvesting of this vessel implicates opening of the abdominal cavity with subsequent possible complications.

METHODS: 7 patients underwent totally coelioscopic harvesting of the right gastroepiploic artery for coronary artery bypass. Artery was liberated with help of ultrasonic coagulation and right coronary artery exposed after xyphoid resection. Usual hole was made into the diaphragm and anastomosis was performed on the beating heart to the right coronary artery or the posterior descending artery. 6 patients underwent concomitant thoracoscopic harvesting of the left internal mammary artery and grafting of the LAD by a small parasternal thoracotomy in the fourth left intercostal space.

RESULTS: No patient died or suffered postoperative infarction. The first 3 patient underwent postoperative angiography showing good patency of the grafts. Mean follow up was 13 months. No patient died or presented recurrent angina. All grafts were controlled by echo-doppler evaluation and were found to be patent.

CONCLUSIONS: RGEA can be used after coelioscopic harvesting. Combination with endoscopic harvesting of the left internal mammary artery allows complete MIDCAB arterial revascularisation in selected cases with excellent midterm results.

Abstract 39. OFF PUMP LONG ONLAY PATCH ANGIOPLASTY TO THE LAD USING LEFT INTERNAL MAMMARY ARTERY

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AIM: Surgical treatment for diffusely diseased coronary artery was considered to be a relative contraindication for OPCAB and the long onlay patch grafting with OPCAB technique has not been described in our knowledge.

MATERIALS AND METHODS: Two sets of tissue stabilizers (Octopus-3, Medtronic, Minneapolis MN) were placed longitudinally along the target coronary artery. This allowed us to performed surgical angioplasty and bypass grafting without cardiopulmonary bypass support (Double Octopus technique).

RESULTS: We report our early experience of off-pump long onlay bypass grafting using left internal mammary artery in a case of diffuse disease of the left anterior descending coronary artery. Patients who have severe diffuse coronary lesion and are high risk for cardiopulmonary bypass will benefit from this technique.

Original Presentations Breakout Session I

Enabling Technology for Coronary Revascularization

Abstract 40. EVALUATING CORONARY ARTERY BYPASS GRAFTING

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OBJECTIVES: To evaluate coronary artery bypass grafting (CABG) performed with minimal extracorporeal circulation (MECC) either as beating heart hemodynamic support or under cardiac arrest with warm cardioplegia. **MATERIAL AND METHOD:** From September 2000, to September 2002, 243 consecutive patients were operated with a closed CPB incorporating a centrifugal pump (RotaFlow JOSTRA) and a membrane oxygenator (QUADROX JOSTRA). The whole system is covalently heparine coated, and the priming is reduced to 400ml. The system was used either as a complete CPB in patients with ejection fraction (EF) > 30% (n = 203), or as a hemodynamic support device on the beating heart in patients with an EF < 30% (n = 40). In a prospective substudy the MECC group with cardioplegia was compared with a control group (40 vs 40) in order to analyze thrombocytes, PaO₂/FiO₂, leucocytes, CRP, platelets, transfusion. All venous anastomosis were done before bypass, which were conducted in normothermia. Preoperative risk factors showed a higher risk group in the beating heart as compared to the cardioplegia group.

RESULTS: Operative data were respectively for the cardioplegia and the beating heart: distal anastomosis 2.9 and 2.5, aortic clamp time 42 min, pump time 58 and 64 min. Hematology data were respectively: preoperative hematocrit 40% and 35%, peroperative hematocrit 31% and 30%, peroperative blood transfusion 2% and 10%, total blood transfusion 30% and 47%. Inflammatory response and transfusion was lowered in the MECC group with cardioplegia (n = 40) as compared with an open system (n = 40) as evidenced by a 15% reduction in CRP, and a 20% reduction in leucocytes count, and a 20% reduction in transfusion. Also postoperative platelets count was 15% higher in the MECC group. Postoperative data were respectively: intubation time 10h and 12h, ICU stay 2.8 d and 3.2d, MI 1%, inotropic support 2.4% and 18%, cerebrovascular event 1% and 2.3%, hospital mortality 1.4% and 5%.

CONCLUSION: MECC allows complete and safe coronary revascularisation in good and high risk patients. It provides a reduction in hemolysis, hemodilution, inflammation and intraoperative transfusions can be reduced.

Abstract 41. THE TOTAL MINIMIZED EXTRACORPOREAL CIRCULATION: AN IMPORTANT BENEFIT FOR CORONARY ARTERY BYPASS GRAFTING IN JEHOVAH WITNESSES

Claude Vaislic MD, Olivier Bical MD, Claude Farge MD, Didier Gaillard MD, Olivier Ponzio MD, Yves Ollivier MD, Youcef Abdelmoumen MD, Bruno Robine MD, Gérard Souffrant MD, Touami Bouharaoua MD

INTRODUCTION: Jehovah Witnesses who require cardiac surgery represent a challenge to the physician because of the patient's refusal to accept blood transfusion. As Coronary artery bypass grafting (CABG) is performed by most surgeons under cardio pulmonary bypass (CPB) which has potentially deleterious effects on hemostasis, we used a new concept called Minimal Extra Corporeal Circulation (MECC) that includes an heparin coated tubing, a centrifugal pump and an oxygenator. There are no venous reservoir or vent, and suction is used through the cell saver.

HYPOTHESIS: We assessed the hypothesis that MECC in combination with a low volume blood cardioplegia preserves more hemoglobin than conventional CPB in standard CABG.

METHODS: In 20 patients of Jehovah Witness faith undergoing CABG with the use of MECC and an intermittent warm blood cardioplegia, clinical and biological data as well as parameters of hemolysis (plasma Hb) and myocardial damage (troponin-T) were determined. The results were compared to those of a control group of 20 patients who were operated on with standard CPB.

RESULTS: Demographic, hemodynamics, number of anastomoses, CPB and Cross-clamp time were comparable between the groups. MECC patients demonstrated significantly lower peak level of plasma Hb (35.4 ± 15

vs 21.8 ± 11.4 mg/dl), troponinT (0.12 ± 0.4 vs 0.65 ± 0.7 ng/ml), higher minimum hematocrit level during CPB (30 ± 7% vs 23 ± 6%) and higher hemoglobin level 2 days after surgery (13 ± 3 g/100ml vs 9.4 ± 0.98 g/100ml) for preoperative value non significantly different.

Conclusion: In conclusion the use of MECC instead of conventional CPB reduces hemolysis, hemodilution, blood loss, and myocardial damage, and is a valuable adjunct to treat Jehovah Witness patients.

Abstract 42. HEMODILUTION DURING OPCAB: CAN WE IMPROVE FLOW AND REDUCE EARLY HYPERCOAGULABILITY?

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OBJECTIVES: We compared intraoperative coronary graft flows performed on and off pump and evaluated the effect of hemodilution on graft flows in off-pump CABG patients using transit time flow measurements.

MATERIAL AND METHODS: During 2 years, 300 CABG patients were enrolled in a prospective randomised way. Group 1 consisted of 100 patients operated with standard CPB. Group 2 consisted of 100 pts operated with off-pump CABG. Group 3 consisted of 100 patients operated with off-pump techniques under controlled hemodilution (Htc: 24-26%).

RESULTS: Mean flows for LAD (p < 0.05), RCA (p < 0.05) and Circumflex artery (p > 0.05) were lower in group 2 patients. Group 3 patients had significantly higher graft flows compared to group 2 patients. The pulsatile index values were similar in all groups. Coronary angiography, performed one week after the surgery in 25 patients in each group revealed similar ITA patencies, but lower SVG patencies for group 2 (p > 0.05)

CONCLUSION: We hypothesise that hemodilution can be used as a tool to improve graft patency during the early "hypercoagulable period" in OPCAB patients.

Abstract 43. PRECiSe (PRIMING REDUCED EXTRACORPOREAL CIRCULATION SETUP) WITH THE DELTASTREAM DIAGONAL PUMP

Sven Beholz, Michael Kessler, Wolfgang Konertz

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PURPOSE OF THE STUDY: Different systems low priming systems limited to CABG have been introduced. We describe PRECiSe (Priming reduced extracorporeal circulation setup), a new low priming system which supplies all features of cardiopulmonary bypass.

MATERIAL AND METHODS: PRECiSe incorporates the Deltastream diagonal pump, which pumps blood from the right atrium to the aorta via a membrane oxygenator and a filter; the system is placed beneath the patient's head resulting in extremely short tubings. A reservoir allows the use of suckers and vents. Autologous blood priming further reduces hemodilution. In the safety study the system was used for extracorporeal circulation in 11 patients undergoing CABG without adverse events. By use of PRECiSe mean priming was reduced to 268.5 ml resulting in minimal hemodilution and transfusion requirements.

CONCLUSION: The use of PRECiSe for extracorporeal circulation in CABG is safe and reduces priming volume as well as transfusion requirements. Further studies are necessary to investigate the clinical benefit for the patients as well as the use of the system in open heart procedures.

Abstract 44. PRACABG (PERFUSION ASSISTED OPCABG)—CHEAP ENABLING TECHNOLOGY FOR OPCABG

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PURPOSE: Right Heart support during OPCABG is well documented to achieve hemo-dynamic stability. Currently the most widely used device ParaFlow (A-Med) costs \$1000 per case for the hospital. We have designed a simple pump using 3/8 inch tubing and have reduced this cost to \$70 per case.

METHODS: We make a pump using 3/8 inch tubing and use one of the roller pump that is normally used for cardiotomy suction. The bypass is done between right atrium to Pulmonary artery using standard venous and arterial cannulas. 10 patients were done using this procedure. 43 grafts were done. 55% required no pressor support.

RESULTS:

Coronary Vessels	Support	MAP	CO	SV02
Diag	Off	64	4.5	69
	On	72*	5.2*	74
OM	Off	59	3.2	68
	On	70*	5.0*	74
PDA	Off	62	4.2	70
	On	68	5.2*	72

*P<.05

CONCLUSION: We have achieved a cost effective RV support that enables OPCABG. Also this technology embraces our perfusionist actively in managing these complex patients as if we have to convert they would prime the pump and will be there to go on bypass. PRCABG is cost effective and practical in the current OPCABG market.

Abstract 45. AUGMENTING LEFT VENTRICULAR PRELOAD WITH A MINIATURE RIGHT HEART SUPPORT SYSTEM IMPROVES CARDIAC OUTPUT AND STROKE VOLUME DURING BEATING HEART CORONARY ARTERY BYPASS GRAFTING

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BACKGROUND: Certain manipulations to access anastomotic sites during beating heart CABG compromise hemodynamics that may impact end-organ perfusion and limit patient selection. Evidence suggests right heart support (RHS) augments left ventricular preload and improves hemodynamics.

METHODS: Beating heart surgery (BHS) was performed on 43 patients with LV preload managed with RHS (A-Med Systems, Inc., West Sacramento, CA). Average age was 65; average EF was 44%. Cardiac output (CO), stroke volume (SV), mean arterial pressure (MAP), and cardiac index (CI) were taken at baseline, during each anastomosis with optimal heart position, and when RHS was interrupted prior to heart release.

RESULTS: One-hundred forty-eight vessels were grafted. Reductions in CO, SV, MAP, and CI were consistent for all target vessels when RHS was stopped, most evident for posterior and lateral target vessels. There were no surgical interruptions, bypass conversions, intraoperative IABPs, or deaths.

Target Vessel	Average% Reduction with RHS Off			
	CO	SV	MAP	CI
Circumflex	19.3	20.1	15.8	19.3
OM-1	28.3	27.3	20.5	28.3
PDA	22.4	20.3	14.7	22.2
OM-2	13.6	12.5	11.2	13.6
Diagonal	13.9	14.6	7.2	13.9
RCA	14.6	17.1	10.2	14.6
LAD	13.0	15.3	8.6	13.0

CONCLUSION: Augmenting LV preload improves hemodynamics during BHS and may improve end-organ perfusion.

Abstract 46. BIVENTRICULAR PACING ENABLES OPCABG IN HIGH RISK PATIENTS

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University of Chicago Hospitals, Chicago IL

OBJECTIVE: With the improvement in the techniques of off pump coronary artery bypass surgery (OPCAB), patient with multiple co-morbidity undergo surgery. Many of these patients have various degree of occult inter-

ventricular conduction delay. During complex manipulation of the heart to bypass the lateral and posterior vessels, ventricular conduction delay caused dysynchrony. We have used Biventricular Pacing (BVP) to achieve hemodynamic stability. Intraoperative TEE with 2D and tissue Doppler imaging was used to measure peak systolic tissue velocity, strain and strain rate as index of myocardial performance changes before and after biventricular pacing.

METHODS: Patients scheduled for elective off-pump cardiac surgery with ischemic cardiomyopathy, were deemed potential candidate for biventricular pacing. All patients received invasive lines and cardiac output monitoring and a comprehensive intraoperative TEE exam. Prior to manipulations, two epicardial pacing leads were placed on the heart, one on the lateral wall of the right ventricle and one on the inferior wall of the left ventricle. The patient was then paced at 90 bpm at DDD pacing mode.

RESULTS: We had a 65% increase in Cardiac Index, with 25% increase in EF. The Septal Peak Velocity increased by 20% and the Time to peak decreased by 50 milli seconds. The time to reach maximum strain and peak velocity were also noted to decrease. All the patients were completed as OPCABG without any complications. The cases above demonstrate that biventricular pacing can be used safely and effectively in the acute intraoperative setting to achieve better hemodynamic control and improve cardiac performance.

CONCLUSION: We have demonstrated that biventricular pacing can be used safely and effectively in OPCABG to achieve better hemodynamic control and improve cardiac performance. These data support our hypothesis that acute left ventricular performance improvement is a consequence of improved interventricular septal synchrony between the LV and RV.

Abstract 47. INDOCYANINE GREEN LASER CORONARY ANGIOGRAPHY: A NOVEL METHOD OF INTRAOPERATIVE PATENCY ASSESSMENT

Nimesh D. Desai, M.D., Marc P. Pelletier, M.D., Hari R. Mallidi, M.D., Gideon Cohen, M.D., Bernard S. Goldman, M.D., Stephen E. Fremes, M.D.

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BACKGROUND: The proliferation of minimally invasive techniques and anastomotic connectors in cardiovascular surgery has increased the need for intraoperative patency assessment. The purpose of this investigation was to determine the safety and technical feasibility of a new method of intraoperative angiography.

METHODS: This technique uses the fluorescent properties of a dye compound that is excited with dispersed laser light to create an angiographic depiction of the graft, native vessel, and anastomosis. Indocyanine green dye (ICG) is a fluorescent compound which can be administered intravenously or intra-arterially. The dye absorbs the dispersed laser light in the near infrared region at 806nm and emits light at 830nm. A CCD video camera digitally records the images.

RESULTS: Forty patients have been assessed at our institution with ICG angiography. Technical success improved from 40.6% in our first five patients to greater than 80% in our current patients. In this initial series, one patient (2.5%) was found to have a twisted vein graft that was revised successfully. No adverse effects from the laser or dye compound occurred.

CONCLUSIONS: Indocyanine green angiography is safe and provides excellent visualization of graft, anastomosis and native vessel. This method of angiography may become an essential tool for routine patency assessment.

Abstract 48. INSTANT INTRAOPERATIVE QUALITY ASSESSMENT OF BYPASS GRAFTS BY DIRECT LASER ANGIOGRAPHY

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INTRODUCTION: So far, no intraoperative digital method for an instant quality assessment has been proposed to judge the functioning of bypass grafts in coronary artery surgery. Coronary angiography is always correlated to certain risks and is not always at hand. We present a simple non-invasive direct method of fluorescence laser angiography for the quality control of coronary anastomoses with a minimal OR setup.

METHODS: We derived a method from plastic surgery for the measurement of blood flow and changed the procedure so that the contrast medium could be applied directly to the coronary artery grafts. Our protocol is based on the intraoperative application of an albumin adhering substance, which can be mea-

sured by means of its fluorescing nature via a digitally laser enhanced camera. **RESULTS:** A first series of 5 patients suffering from coronary artery disease was operated on pump in order to evaluate the efficacy of this new method. Graft patency, run-off and further lesions can be judged with direct laser angiography (DLA).

CONCLUSION: Our preliminary results are positive, represent first steps in the development of an intraoperative quality assessment of bypass grafts by DLA and are aiming at establishing a safety standard for OPCAB surgery in addition to flow-measurement.

Abstract 49. INTRAOPERATIVE COLOR DOPPLER ULTRASOUND ASSESSMENT OF LIMA-LAD ANASTOMOSES DURING OFF-PUMP CORONARY ARTERY BYPASS SURGERY CORRELATES WITH ANGIOGRAPHIC EVALUATION AT EIGHT MONTHS FOLLOW UP

Ole Tjomsland, Rune Wiseth, Nicola Vitale, Arve Tromsdal, Stein O. Samstad, Alexander Wahba, Rune Haaverstad

St Elisabeth Heart Center, Norwegian University of Science and Technology, Trondheim, Norway

OBJECTIVE: The study was performed to evaluate the correlation between intraoperative color Doppler ultrasound assessment of LIMA-LAD

anastomoses performed on beating heart and the angiographic assessment after eight months.

METHODS: Twenty patients (M/F 15/5, age 63 ± 9) underwent epicardial color Doppler imaging with a 10 MHz linear array GE Vingmed transducer/GE Vingmed System Five. Coronary angiography after 245 (128-320) days allowed assessment of TIMI flow and Fitz-Gibbon grading in all patients. Detailed quantitative coronary angiography (QCA) was performed in 10 patients measuring LAD diameter at the toe of the anastomosis (D1) and downstream LAD (D2).

RESULTS: Intraoperative ultrasound revealed 19 (95%) patent LIMA-LAD anastomoses. A $>50\%$ anastomotic stenosis was detected and subsequently successfully revised. Angiography showed TIMI-III flow and Fitz-Gibbon grade A in 18 grafts, one anastomosis had Fitz-Gibbon grade B stenosis and one was occluded. The D1/D2 ratios of the LAD measurements assessed with intraoperative ultrasound and follow-up QCA correlated significantly (r -square = 0.62, $p < 0.01$).

CONCLUSION: Intraoperative color Doppler ultrasound allows a detailed evaluation of LIMA-LAD anastomoses during off-pump surgery, which correlates significantly with angiographic evaluation after 8 months. Epicardial ultrasound may reduce the risk of impaired graft patency caused by technical errors.

Original Presentations Breakout Session II

Heart Failure: New Devices and Procedures

Abstract 50. OFF-PUMP MITRAL VALVE REPAIR USING THE COAPSYS DEVICE: ACUTE QUANTITATIVE ECHOCARDIOGRAPHIC RESULTS

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BACKGROUND: Functional mitral regurgitation (MR), which frequently accompanies dilated cardiomyopathy, is associated with dilatation of the mitral valve annulus and/or lateral/apical displacement of the papillary muscles. This study evaluated the ability of the Myocor Coapsys device to reduce MR acutely in a canine model of functional MR.

METHODS: The Coapsys device was implanted in 8 dogs in which rapid ventricular pacing induced both cardiomyopathy and significant functional MR. The device consists of two epicardial pads connected by a sub-valvular chord. The posterior pad was positioned at the annular level and centered on the posterior leaflet. The sub-valvular chord bisected the valve coaptation line. The device was sized by reducing its dimension, drawing the posterior annulus toward the anterior annulus until MR was maximally reduced. Epicardial echocardiography was performed during the implant procedure prior to and after sizing of the device. Effective regurgitant orifice area (EROA) was calculated using the continuity equation. MR jet area and the ratio of MR jet area to left atrial (LA) area were measured. Regurgitant volume and fraction were also calculated. Results: The table summarizes the pre-sized and post-sized results (mean (SD), along with the p-values of a paired t-test. MR grade is included for completeness.

CONCLUSIONS: The Coapsys device significantly reduced MR acutely. Further study will be required to assess the chronic stability of the repair in this animal model.

Observations	Pre-Sizing Value	Post-Sizing Value	p-value
MR Grade	3.1 ± 0.7	0.6 ± 0.7	<0.001
EROA (cm ²) (n = 7)	0.07 ± 0.03	0.01 ± 0.01	0.003
MR area (cm ²)	3.4 ± 1.2	0.9 ± 0.4	<0.001
MR/LA area	0.31 ± 0.08	0.09 ± 0.04	<0.001
Regurgitant Volume (ml) (n = 7)	8.3 ± 4.4	2.4 ± 2.1	0.014
Regurgitant Fraction (%) (n = 7)	39.3 ± 12.2	17.3 ± 13.2	0.010

Abstract 51. EFFECTS OF ELASTIC VENTRICULAR RESTRAINT ON CARDIAC REMODELING IN EXPERIMENTAL HEART FAILURE

James Magovern, Walter McGregor, Dennis Trumble, and Sunil Mankad
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BACKGROUND: This study evaluates the effects of an elastic restraint device made from nitinol mesh on ventricular function in a heart failure model.

METHODS: Heart failure was induced in 12 mongrel dogs by rapid ventricular pacing for 4 weeks. Echocardiography, right heart catheterization, and pressure-volume analysis were done after pacing to establish a heart failure baseline. The device was placed in 6 animals and the other 6 served as controls. Rapid pacing was continued for an additional 4 weeks, at which point final studies were done.

RESULTS: Comparison of baseline and final studies showed significant advantages in the device group. Indexed ventricular volumes were lower (LVEDVi = 2.06 ± 0.3 vs. 2.57 ± 0.47 mL/Kg, $p = 0.04$; LVESVi = 1.50 ± 0.27 vs. 2.03 ± 0.39 mL/Kg, $p = 0.02$), central venous pressure was lower (4.3 ± 1.2 vs. 8.1 ± 3.1 mmHg, $p = 0.02$), and ventricular elastance was more preserved in the device group ($E_{max} = 5.5 \pm 3.0$ vs. 1.7 ± 1.0 , $p = 0.02$). Indices of diastolic function were similar between groups.

CONCLUSIONS: An elastic nitinol restraint device prevented the progression of pacing induced heart failure without producing diastolic dysfunction.

Abstract 52. NEW INTRACARDIAC IMPLANTABLE MINI ASSIST DEVICE PROVIDES SIGNIFICANTLY EFFECTIVE VENTRICULAR UNLOADING

Koen Reesink

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INTRODUCTION: We tested a new, implantable intracardiac mini pump (IP) which was introduced clinically recently. This catheter-based assist device features a 6.4 mm diameter integrated cannula-pump assembly with a capacity of 4.5 l/min for use in trans-aortic valve position. Introduction is either percutaneously or intraoperatively. The efficacy of the IP had yet to be established. We compared the IP with the standard in minimally invasive support: Intra-aortic balloon pumping (IABP).

METHODS: Reversible acute mitral insufficiency (AMI) was created in calves (n = 7) by stenting the mitral valve using a vena cava filter. In each animal maximum IP assist was compared with standard 1:1 IABP assist. Results: Both assist systems (IP/IABP) improved cardiac output (25%/4%), diastolic coronary flow (26%/96%), aortic pressure (17%/11%) and carotid flow

(47%/8%). Left atrial pressure was reduced (-2.4/-0.7 mmHg) as well as left ventricular work (-46%/-4%). All significant ($p < 0.05$).

CONCLUSION: The IP unloads the left heart more effectively than IABP. However, IABP favored coronary perfusion more. The IP may be a viable mechanical support alternative in case of acute ventricular failure to existing systems like the IABP and extracorporeal life support.

Abstract 53. IMPROVED SURVIVAL IN CARDIOGENIC SHOCK AFTER MYOCARDIAL INFARCTION WITH VENTRICULAR ASSIST DEVICE (VAD) SUPPORT

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Cardiogenic shock after acute myocardial infarction is associated with a very high mortality rate. To improve survival in these patients, we have provided mechanical cardiac support using the Abiomed BVS 5000 to 15 patients (average age 58.5 years) in cardiogenic shock after myocardial infarction who were failing medical management, and in whom death appeared to be imminent. Ten patients were suffering primarily from left ventricular dysfunction and were supported with a left ventricular assist device (LVAD). Eight of these patients were weaned from device support, and 6 survived. In contrast, 5 patients presented with bi-ventricular failure or combined pulmonary and left ventricular failure, and were supported with bi-ventricular VADs (BiVAD) ($n = 4$) or an LVAD with extracorporeal membrane oxygenation (ECMO) ($n = 1$). None of these patients could be weaned from device support. Two BiVAD patients underwent cardiac transplantation, and only one survived. Thus, in the presence of left ventricular failure producing cardiogenic shock after myocardial infarction, LVAD support can produce a 60% survival rate in those patients who are failing medical management. However, in patients requiring bi-ventricular support or ECMO after myocardial infarction, BiVAD support may be used to stabilize the patient until transplantation, but the overall prognosis remains poor.

Abstract 54. SURGICAL TREATMENT OF HEART FAILURE IN PATIENTS WITH PRIMARY AND ISCHEMIC DILATED CARDIOMYOPATHY

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OBJECTIVE: The aim of this study is to show hemodynamic and clinical improvement of heart failure after Reductive Annuloplasty of Double (mitral and tricuspid) Orifices (RADO) in ischemic (IDCM) and primary dilated cardiomyopathy (PDCM).

MATERIAL & METHOD: There were 341 patients, operated due to DCM in the period from November 1986 to July 15, 2002. The group IDCM consisted of 231 pts (68%) with mean ejection fraction (EF) 23.3%. From July 1991, 110 pts from the group PDCM with mean EF 22.9% were operated on.

RESULTS: Postoperative 30-day mortality was 5.9% for the whole group, 7.3% for IDCM and 2.7% for PDCM. Follow up survival was: for IDCM at 5 years $61.5 \pm 4.0\%$ and at 14 years $38.2 \pm 8.0\%$, and for PDCM at 5 years $43.9 \pm 5.6\%$ and at 10 years $21.3 \pm 8.5\%$.

CONCLUSION: RADO corrects remodeling of the fibrous skeleton of the heart, changes spherical geometry of the left ventricle, improves hemodynamic action of the left and right ventricle and slows down progression of heart failure. We recommend RADO procedure as an important associated procedure in IDCM and as a new surgical alternative in the early stage of PDCM, immediately after the first decompensation.

Abstract 55. IMPROVED PATIENT OUTCOMES OBSERVED WHEN TMR IS UTILIZED FOR HYBRID REVASCLARIZATION

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BACKGROUND: Improved outcomes were found when Transmyocardial Revascularization (TMR) was used as an alternative, or as a hybrid technique, to more completely revascularize limited-option patients.

METHODS: 45 patients with mean CCSAS baseline angina score of 3.4 matched our patient selection criteria and were treated with TMR using a

Holmium:YAG laser. Inclusion criteria was EF $> 30\%$, no identifiable surgical targets on anterior or lateral wall and/or documented reversible ischemia. Exclusion criteria were unstable angina or recent MI. 36 of these patients received a hybrid CABG/TMR procedure while 9 patients solely received TMR.

RESULTS: Average CCSAS score was 0.9 at 9 months. The TMR group vs. the average CABG patient had 0% mortality vs. 2.12%, 0% bleeding re-op vs. 0.085%, 0% respiratory and renal failure vs. 2.8% & 1.7% respectively, and 0% neurologic complications vs. 1.2%. Length of stay for the TMR/CABG hybrid technique was 7.1 days vs. 8.2 for CABG alone.

CONCLUSION: TMR as an alternative or hybrid revascularization technique is an effective treatment for surgical patients with limited options.

Abstract 56. USE OF CARDIAC RESYNCHRONIZATION THERAPY FOR TREATING HEART FAILURE IN DILATED CARDIOMYOPATHY

Brofman, P., Milani, R., Giffhorn, H., Moutinho, J., Guimarães, M., Pontarolli, R., Maia, F., Silva, M., Barberato, S.

Pontifícia Universidade Católica do Paraná

INTRODUCTION: For more than a decade, cardiac resynchronization therapy has been suggested as an alternative for treating heart failure in patients with dilated cardiomyopathy resistant to pharmacological therapy. Three different modes of stimulation have been suggested: electrotherapy using dual chamber pacemaker with short atrioventricular interval, atrioventricular pacing or right ventricular bifocal pacing, and atrioventricular or biventricular pacing. After this period, the clinical and functional improvement of patients was evident with the last mode of pacing, in both randomized and nonrandomized studies.

OBJECTIVE: To show the results of 22 patients (60% female) submitted to surgery in the Hospital Universitário Cajuru – PUCPR and Hospital Vita de Curitiba for cardiac resynchronization therapy and evaluated through analysis of functional class (NYHA), maximum oxygen consumption (6 patients), final left ventricular diastolic diameter (LVDD) and left ventricular ejection fraction (LVEF).

RESULTS: In the right atrium and ventricle all leads were implanted through endovascular via. In the LV, 12 leads (Corox LV-P/H, Biotronik) were implanted through coronary sinus (with 3 complications), and 13 through small left thoracotomy by using epimyocardial pacing leads (ELC 54UP, Biotronik) (including the 3 patients who presented complications with the endovascular pacing leads). Three patients had association with replacement of mitral valve due to heart failure secondary to cardiomyopathy—one of them died in the hospital and the other 2 died during the post-operative (one cardiac death and one sudden death). The follow-up period ranged from 1-24 months (m), with an average of 10 ± 5.7 m. The functional class of 3.7 in the pre-operative (PRE) dropped to 2.1 in the post-operative (POS) $p < 0.023$. The maximum oxygen consumption (mL/kg/min) in the PRE changed from 13.1 ± 2.1 to 14.9 ± 1.4 in the POS, $p < 0.043$, the final LV diastolic diameter (mm) in the PRE changed from 72.5 ± 5.7 to 69.4 ± 7.5 in the POS, $p < 0.048$, the ejection fraction in the LV (%) changed from 0.33 ± 0.027 to 0.42 ± 0.072 , $p < 0.018$.

CONCLUSION: After an average follow-up of 10 ± 5.7 m all survivors presented stable improvement in the parameters assessed.

Abstract 57. CARDIAC-COMMITTED STEM CELLS FROM HUMAN UMBILICAL CORD AND BONE MARROW: IN VITRO RESPONSE TO INDUCERS AND FUNCTIONAL CELL CHARACTERIZATION AT THE CLONAL LEVEL

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Our aim is to address the problem of in vitro differentiation of human umbilical cord (UC) and bone marrow (BM) stem cells into cardiomyocytes at the clonal level. UC is a convenient source of stem cells, and preliminary results in our lab show that UC mesenchymal cells with cardiac potential can be recovered with yields comparable to those obtained from the BM. Moreover, clones of differentially-committed cells have been obtained, some of which are responsive to cardiac-inducing stimuli. Differentiation was shown to depend on a wide array of soluble factors, activation of cardiac-specific genes, interactions of differentially expressed integrins with the extracellular matrix (ECM),

intercellular contacts and anatomical as well as functional integration. Most of these features have not been clearly defined in humans and were addressed in this study, in order to achieve practical outcomes, including the possibility of a safer autologous or histocompatibility-matched stem cell transplantation.

Abstract 58. HEART CELL THERAPY AND ANGIOGENESIS: HUMAN MYOBLASTS CARRYING HUMAN VEGF165 FOR REHABILITATION OF INJURED MYOCARDIUM

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INTRODUCTION: HM as carriers of exogenous VEGF165 for localized and transient expression of VEGF to achieve concurrent angiogenesis and myogenesis to restore global myocardial function in a failing heart.

METHODS: HM were transduced with retroviral and adenoviral vectors carrying lac-z and human VEGF165 genes respectively. The cells were characterized for VEGF165 expression by immunostaining, ELISA and RT-PCR. A rodent heart model of cryoinjury was created in rats. The animals were grouped as control (n = 12) and cell transplanted (n = 16). Ten days later, PBS or 3x10⁶ HM carrying VEGF165 and lac-z genes were injected intramyocardially in the infarct. The animals were maintained on cyclosporine (5mg/kg) post cell transplantation. Heart function was assessed by Echocardiography at 6 weeks after cell transplantation.

RESULTS: The donor biopsies yielded >98% desmin positive HM. The transduction HM continued to secrete VEGF165 at least 18 days in vitro, sig-

nificantly higher (37 ± 3ng/ml) than the control HM. Histological examination showed the presence of grafted myoblasts expressing lac-z gene in the cardiac tissue at six weeks post transplant. Echocardiographic assessment revealed significant improvement in ejection fraction in cell transplanted animals as compared to the control animals (p<0.05). Immunostaining for vWF VIII showed increased vascular density in low power field, (17.5 ± 1.05) in transplanted animals as compared to control animal group (3.6 ± 0.7; p<0.01).

CONCLUSION: We conclude that HM are potential therapeutic transgene carriers for the repair of damaged heart muscle.

Abstract 59. NOVEL IMPLANTATION OF A LEFT VENTRICULAR ASSIST DEVICE WITHOUT CARDIOPULMONARY BYPASS: OFF-PUMP LVAD

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Left ventricular assist devices have become a useful therapy in patients with decompensated congestive heart failure. These devices have been utilized as bridges to transplantation, recovery and "destination". However, insertion of these devices normally requires cardiopulmonary bypass support. Cardiopulmonary bypass support may exacerbate already present multiple organ dysfunction and right ventricular failure, respectively. We present a surgical technique of a Thoratec Heartmate VE left ventricular assist system insertion performed without cardiopulmonary bypass using a cardiac stabilization device in a patient with severe end-stage heart failure.

Original Presentations Breakout Session III

Atrial Fibrillation and Arrhythmia Surgery

Abstract 60. RADIOFREQUENCY MODIFIED MAZE THROUGH A PORT ACCESS APPROACH: MID-TERM RESULTS

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OBJECTIVE: We assessed the feasibility and effectiveness of the irrigated radiofrequency modified Maze procedure (RFMM) through a port access approach during concomitant mitral valve surgery and evaluated early and mid-term results.

MATERIAL AND METHODS: Between February 2001-November 2002 31 patients underwent the combined procedure through a port access approach. Mean age was 52 + 9 years and the mean duration of AF was 20 + 10 months. Concomitant procedures were mitral valve replacement in 19 and valve repair in 12 patients.

RESULTS: Early mortality was 1 (3%). One patient required reoperation for bleeding and one patient required a permanent pace maker for heart block (3%). Freedom from AF was 100% at the end of the operation (71% sinus, 29% pace) Six and 12 months freedom from AF was 88% and 93% respectively. A transthoracic Doppler examination at 12 months revealed that atrial transport function was present in 90% of cases who were in sinus rhythm. At 12 months, the functional capacity had improved from 2.8 + 0.6 to 1.1 + 0.3 (p<0.05).

CONCLUSIONS: The combination of mitral valve surgery and RFMM was safe and effective through this approach; without any procedure related complication. In terms of feasibility, sinus rhythm restoration and overall outcome the results were encouraging and support the use of this combined procedure through a port access approach in selected cases.

Abstract 61. IRRIGATED RADIOFREQUENCY SURGICAL ABLATION TO TREAT ATRIAL FIBRILLATION

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OBJECTIVE: This prospective study evaluated the safety and effectiveness of the irrigated cooled-tip radiofrequency ablation (SICTRA).

METHODS: 160 patients with a mean (SD) euroscore of 6.5 (3.0), duration of AF 55.2 months (61), left atrial diameter 50.4 mm (10.4) and 21 patients with paroxysmal AF had a concomitant anti-arrhythmic SICTRA procedure, which was performed with a hand-held, flexible, pen-catheter (20-32 Watt; 200-320 ml/ hour irrigation speed), which enabled the surgeon to match the delivered amount of radiofrequency energy to the estimated atrial wall thickness, creating a conduction block without any tissue dehiscence. Formation of yellow-white blistering endocard lesions, induced by oscillating catheter movements, were considered sufficient. Stable catheter-tissue contact was preserved, without pressurizing the atrial wall against adjacent mediastinal structures. Physical examinations, transthoracic echocardiograms, 24-hour Holter ECG's were obtained 3, 6, 12 and 24 months postoperatively.

RESULTS: 38 CABG-, 62 mitral-, 21 aortic-, 39 double valve procedures ± CABG were performed. No oesophageal-, pulmonary orifice- or circumflex artery injuries were observed. Mean (SD) follow-up is 17.3 months (15.2). Cumulative postoperative stable SR rates, excluding paroxysmal AF patients, at 3, 6 and 12 months were 63%, 72% and 74%.

CONCLUSIONS: SICTRA is safe and effective.

Abstract 62. EARLY AND LATE OUTCOME AFTER MICROWAVE ABLATION FOR CHRONIC VALVULAR ATRIAL FIBRILLATION

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AIM: The aim of the study was to identify clinical parameters, which influence early and late success after surgical microwave ablation (SMWA) for chronic atrial fibrillation (AF) in patients (PTS) undergoing valvular operations.

MATERIAL AND METHODS: 42 consecutive PTS underwent mitral valve surgery and simultaneously SMWA for chronic AF. We selected two groups at two time points: PTS remaining on sinus rhythm (SR group) and AF (AF group) at discharge, and PTS demonstrating SR (late SR) and AF (late AF) during mean 7.3 months follow-up. Factors examined included: gender, age, AF duration, left atrial diameter (LAD), type of surgical procedure and surgical order. Presence of stable SR at discharge and incidence of

early AF recurrence were additionally evaluated as factors influencing late outcome. Logistic regression was performed to select independent predictors of success.

RESULTS:

	SR (n = 32)	AF (n = 10)	Late SR (n = 28)	Late AF (n = 14)
Female	19 (45 %)	7 (70 %)	17 (61 %)	9 (64 %)
Age (y)	55.5	57.4	54.7	58.3
AF Duration (y)	3.6xx	7.4	3.5*	6.5
LAD (mm)	54.9xx	65.4	54.6*	63
Initial 15 cases	11 (34 %)	4 (40 %)	9 (32 %)	6 (43 %)
Mitral + Tricuspid	9 (28 %)	3 (30 %)	8 (29 %)	4 (29 %)
Early AF			15 (54 %)	11 (79 %)
SR at discharge			28 (100 %)**	4 (29 %)

xx 0.001 vs AF, * p<0.05 vs late AF, ** p<0.001 vs late AF

When considering simultaneously, both LAD and AF duration were independent predictors of early and late success.

CONCLUSIONS: LAD and AF duration have the influence on early and late outcome after SMVA. SR at discharge is prognostic for rhythm preservation during follow-up.

Abstract 63. INTRAOPERATIVE MICROWAVE ABLATION IN PATIENTS UNDERGOING VALVULAR SURGERY: MID-TERM RESULTS

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PURPOSE: To assess the safety and efficacy of intraoperative microwave ablation to restore sinus rhythm and systolic atrial function in patients undergoing valvular surgery.

MATERIALS AND METHODS: We operated 41 patients with atrial fibrillation (AF). Mean age was 61 years (range: 45-76); AF was permanent in 30 pts and paroxysmal in 11; Associated cardiac procedures were mitral valve repair in 10 pts, mitral valve replacement in 12 and mitro-aortic valve replacement in 19. The microwave procedure (FLEX, AFX Inc.) was performed creating endocardial bilateral, encircling isolation of the ostia of the pulmonary veins.

RESULTS: There was no hospital mortality or morbidity. Mean Follow-up (FU) was 14.2 months. At FU, sinus rhythm was found in 34 patients (83.3%). Echocardiography at FU showed no major or minor left atrial thrombosis and only a mild impairment of the systolic left atrial (LA) function.

CONCLUSION: Intraoperative microwave ablation is a safe and effective treatment to restore sinus rhythm and a mildly impaired LA function in patients with AF undergoing cardiac surgery.

Abstract 64. EPICARDIAL ABLATION USING ARGON CRYO

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PURPOSE: Cryosurgery is a well known technique to destroy myocardial conductive properties. The purpose was to investigate whether epicardial cryoablation of the pulmonary veins (PV) would safely and effectively abolish atrial fibrillation (AF) in patients undergoing CABG and/or valve surgery.

MATERIALS AND METHODS: 40 consecutive patients (32 men), mean age 71 (48-81), with persistent (17) or paroxysmal (25) AF of long (1-31 years) duration, were included. The PV orifices were dissected and epicardial PV isolation was performed using an argon-based cryo system with a malleable, handheld probe producing 7 standardized cryolines around each pair of PV at minus 100-160°C for 60 seconds each. The cryoprocure was done on bypass, on beating heart, and before other surgical procedures. The mean duration of the cryoprocure was 18 minutes.

RESULTS: 60% were in sinus rhythm at discharge and 92 % at 3-month follow-up. There were no complications related to the cryoablation.

CONCLUSION: Epicardial cryoablation of the PV is a safe and simple technique to abolish AF in patients undergoing CABG/valve surgery.

Abstract 65. ELECTROMECHANICAL ASSESSMENT OF LEFT ATRIAL FUNCTION FOLLOWING BEATING HEART ATRIAL ABLATION

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AIM: Current data suggest that left atrial (LA) ablation can cure atrial fibrillation. The aim of the study was to investigate the feasibility, safety and electromechanical consequences of beating heart left atrial ablation using a bipolar radiofrequency (RF) device.

METHODS: Five healthy adult pigs (35-50 kg) underwent a median sternotomy and off pump LA ablation using a bipolar RF device (Atricure Inc.). LA electromechanical properties were studied prior to and after ablation using percutaneous endocardial catheter mapping (NOGA®, Biosense-Webster) and intracardiac echocardiography (AcuNav®, Acuson). Translesion conduction was assessed and pathologic analysis performed.

RESULTS: A lesion pattern recapitulating the LA component of the Maze III procedure was safely delivered. All lesions produced conduction block and resulted to be uniform and transmural with no evidence of charring or barotrauma. Although a significant portion of electrically isolated (EI) atrial tissue was created, the ablation procedure was not associated with significant alterations in global LA conduction time (CT) and mechanics, pulmonary veins anatomy and flow (PVF), and in mitral valve flow (MVf) or left ventricular ejection fraction (EF). There was no evidence of intraatrial thrombus or pulmonary vein stenosis. Results are summarized in the table.

CONCLUSION: The bipolar device enabled the deployment of LA lesions in the beating heart avoiding atriectomies and without adverse effects on LA electromechanics.

Parameter	Preablation	Postablation	p value
EI (%)	13.7±3.4	7.75±9.5	<0.01
LACT (sec)	56.7±6.8	68.5±11	0.2
LAEF (%)	0.22±0.03	0.18±0.03	0.15
LVEF (%)	46.75±8.8	50.75±6.1	0.4
PVF (m/s)	0.97±0.3	1.05±0.2	0.5
MVf (m/s)	2.27±0.3	2.35±0.2	0.4

Abstract 66. IRRIGATED RADIOFREQUENCY ABLATION, TO SURGICALLY TREAT CHRONIC ATRIAL FIBRILLATION: LEFT ATRIAL VERSUS BIATRIAL LESION PATTERN

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AIM: The effectiveness of the left atrial ablation, using irrigated radiofrequency ablation (SICTRA), was compared with the bi-atrial procedure in patients with chronic atrial fibrillation (AF).

METHODS: 139 patients, with chronic AF had a SICTRA procedure; 61 a left atrial pattern (Group A) and 78 a bi-atrial pattern (group B).

RESULTS: The mean (SD) age, left atrial diameter, preoperative duration of atrial fibrillation (AF), and Euroscore for group A and B were 68.2 (9.5) versus 66.6 (8.6) years, 51 (12) versus 51 (8.6) millimeters, 58 (64) versus 60 (66) months, 7.3 (3.5) versus 6.0 (2.2) euroscore. The aortic cross clamp time was 99 (21) versus 101 (21) minutes. Mean follow up was 15.2 (11.7) versus 21.8 (17.6) months. The cumulative SR rate at 6 and 12 months for group A and B are 60 % versus 67% and 73 % versus 75 %.

CONCLUSION: The left atrial ablation appeared to be an acceptable surgical alternative to the bi-atrial procedure in patients with chronic AF.

Abstract 67. EPIMYOCARDIAL VERSUS ENDOVASCULAR PACING LEADS IN THE LEFT VENTRICULAR PACING IN THE CARDIAC RESYNCHRONIZATION THERAPY: SURGERY EXPERIENCE

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AIM: To show the study and results of epimyocardial and endovascular pacing leads for left ventricular pacing in 22 patients submitted to

surgery in the Hospital Universitário Cajuru da Pontifícia Universidade Católica do Paraná and Hospital Vita de Curitiba, between August 2000 and July 2002.

RESULTS: Twelve patients received endovascular pacing leads (Corox LV-P/H, Biotronik) and 13 patients received epimyocardial leads (ELC 54 UP, Biotronik). The average time for implanting the endovascular lead was 166 ± 55.2 minutes and the success rate of the implantation was 66.6%, and the average time for implanting the epimyocardial lead was 48 ± 8.3 minutes ($p < 0.003$) and the success rate of the implantation was 100% ($p < 0.001$). Right atrial leads were used in 20 patients (the 2 others presented chronic AF). The acute thresholds of endovascular leads ranged from 0.20 to 0.55 mV with an average of 0.34 ± 0.07 mV, the width of the R-wave ranged from 14V to 31V with an average of 23.5 ± 4.0 V, and the impedance ranged from 619 to 920 W. In the epimyocardial leads the acute thresholds ranged from 0.4 to 1.8V with an average of 0.73 ± 0.4 V ($p < 0.02$), the width of R-wave ranged from 9.0 to 27.0 mV with an average of 18.1 ± 4.5 mV ($p < 0.002$), and the impedance ranged from 614 to 886 W with an average of 713 ± 68 W ($p < 0.024$). Three endovascular leads had complications (25%) one because of infection (8.3%), one because of dislocation (8.3%) and the other for threshold raise. Two of the epimyocardial leads presented loss of command (15.2%) and one of them needed repositioning (7.6%). The average time of progression of the patients ranged from 1 to 24 months with an average of 10 ± 5.7 months. During hospitalization and follow-up, three patients died (13.6%).

CONCLUSION: In this study, the epimyocardial leads were easier to implant and had lower incidence of complications in the post-operative follow-up in this group of patients.

Abstract 68. TOTALLY ENDOSCOPIC TECHNIQUE FOR OFF-PUMP EPICARDIAL ABLATION OF ATRIAL FIBRILLATION ON BEATING-HEART

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INTRODUCTION: We report in this abstract the feasibility of a totally endoscopic technique to treat atrial fibrillation (AF). A surgical microwave ablation procedure was performed on a 74-year-old female patient with paroxysmal AF.

METHODS: Three ports were created both into the right and left pleural spaces. After opening the pericardial sac on the right side, the superior and inferior vena cava were dissected free, as was the inter-atrial groove. The Flex 10 (AFx Inc., Fremont, CA) was passed completely around the four PVs.

The location and orientation of Flex 10 was confirmed posterior to the LA appendage. The ablation procedure was performed by sequentially heating adjacent 2-cm ablation sections until the pulmonary veins were isolated. A total of 8 sections were activated, for an overall ablation time of 12 minutes. The LA appendage was then removed using an EndoGIA stapler. Hemostasis was immediate.

RESULTS: The patient was in normal sinus rhythm after the procedure.

CONCLUSION: Totally endoscopic off-pump epicardial AF microwave ablation procedures are safe and technically feasible. This report demonstrates the first step toward performing a completely endoscopic ablation pattern similar to the original maze for patient with chronic AF with the FLEX 10 device.

Abstract 69. SURGICAL TREATMENT OF CHRONICAL ATRIAL FIBRILLATION WITH RADIOFREQUENCY ABLATION DURING MITRAL VALVE REPAIR

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OBJECTIVE: With respect to the result the surgical Maze is the gold standard for treatment of atrial fibrillation (AF). However, this procedure is invasive and time consuming. We present our surgical approach of left atrial ablation during concomitant cardiac surgery using radiofrequency (RF).

MATERIAL AND METHODS: The video shows a mitral valve repair with partial resection of the posterior leaflet and annuloplasty. Chronical AF is treated by a modified Maze procedure consisting of a standard left atrial endocardial ablation using a Saline Irrigated Tip Radiofrequency Ablation (SITRA) (Cardioblate, Medtronic, Minneapolis, MN, USA). A sponge behind the left atrium protects structures of the posterior mediastinum. While performing the ablation line between the left pulmonary veins and the mitral annulus, cold modified blood cardioplegia is administered in order to prevent damage to the circumflex artery. Between: 7/2001 and 12/2002 a total of 34 patients (21 male/13 female), mean age 64.2 ± 9.5 years (32 to 82 years) suffering from chronic AF and additional cardiac diseases were treated with SITRA by five different surgeons.

RESULTS: All operations were performed without complications. Until now in 26 (77%) patients the 6-months follow-up was carried out. 15 patients (57.7%) are in stable sinus rhythm, while the remaining 11 (42.3%) patients demonstrate AF.

CONCLUSIONS: Left atrial SITRA using the Cardioblate device offers a safe and easily to perform surgical method for the treatment of chronic AF. We expect the results to improve with growing case numbers.

Scientific Session III

Surgical Approaches for Left Ventricular Failure

Abstract 70. LINEAR SEPTO-ANTERIOR WALL SUTURE AND SEPTO-ANTERIOR WALL-APICAL PATCH FOR EXCLUSION OF ANTEROSEPTAL SCAR

A.M. Calafiore

BACKGROUND: After left anterior descending artery occlusion septal involvement is often higher than anterior free wall involvement. A technique is described that allow to exclude anteroseptal scar recovering a conical shaped cavity without reducing its longitudinal length. The technique is the following: A) Some interrupted sutures (generally 2) are used to join the scarred septum in its higher portion to the anterior wall. Sutures stop at the level of the papillary muscles. B) Four stitches are placed in the septum (where the sutures end), in the new apex (maintaining obliquity), deep in the septum (at the border between scar and healthy muscle) and in the anterior wall (again at the border of the scar). C) An oval patch is tailored (generally

60x30mm) and sutured among the septum, the anterior wall and the new apex, following the 4 stitched previously placed. It will represent the new distal akinetic septum.

MATERIAL AND METHODS: From January to December 2002, 22 consecutive patients underwent anteroseptal scar exclusion using the technique previously described. Mean NYHA Class was 2.7; 10 had mitral regurgitation and underwent mitral valve overreducing annuloplasty. Echocardiographic volumes (ml/m²) were 119 (end diastolic, ED) and 76 (end systolic, ES), with a mean ejection fraction (EF) of 38%. Seven patients had an EF $\leq 35\%$, with 165 ED and 118 ES and EF 29%.

RESULTS: No patients died and only one had a major complication (acute renal failure). After a mean follow up of 4 months (1-12), volumes changed from 119 to 81 (ED), $p < .001$, and from 76 to 49 (ES), $p = .002$, with EF from 38% to 40%, $p = ns$. Longitudinal length remained unchanged and sphericity index lowered from 0.60 to 0.52, $p < .001$. In patients with EF $\leq 35\%$, volumes changed from 165 to 98 (ED), $p < .001$, 118 to 68 (ES), $p < .001$, EF from 29% to 44%, $p < .001$. Longitudinal length remained unchanged and sphericity index lowered from 0.62 to 0.55 $p < .001$.

CONCLUSIONS: The technique by us described allows to treat all the dysknetic or akinetic areas following LAD occlusion when the septal involvement is higher than anterior free wall with good clinical and morphological results.

Abstract 71. COMPLETE HEALING AND LONG-TERM PATENCY OF A VASCULAR ANASTOMOSIS CREATED WITHOUT INTIMAL APPPOSITION USING A NOVEL DEVICE AND CATHETER-BASED DELIVERY SYSTEM

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OBJECTIVE: Vascular anastomosis is achieved by approximation of target and graft vessels with suture, clips or metallic couplers. A novel concept of approximation by passive sealing has been developed. The anastomosis is constructed using pliable non-metal flanges connected by a flow channel. The one-piece device enables physiologic blood flow and vessel wall compliance to form the seal. The study purpose is to evaluate feasibility, healing, and long-term patency.

METHODS: Fourteen vascular anastomoses were performed with a Vasconnect device delivered either by surgical technique (n = 6) or via a proprietary catheter delivery system (n = 8) in 12 animals (6 sheep, 6 swine). In 8 animals, a standard sutured anastomosis was also constructed with 5-0 or 6-0 polypropylene suture to serve as concurrent controls for comparison of same-phase healing and patency. Anti-platelet therapy with aspirin and either ticlopidine or clopidogrel was given throughout the survival period. Animals were evaluated multiple times in the survival periods for sealing, stability?

Abstract 72. LESS INVASIVE REPAIR OF FUNCTIONAL MITRAL REGURGITATION USING THE MYOCOR COAPSYS: A CLINICAL DEMONSTRATION

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OBJECTIVES: Functional mitral regurgitation (MR) results from dilatation of the mitral valve annulus and / or lateral papillary muscle displacement in dysfunctional left ventricles. The Myocor (Coapsys) device restores leaflet apposition and valve competency off pump without atriotomy. It is currently being investigated in patients with functional MR undergoing concomitant coronary artery bypass grafting (CABG). This video demonstration shows the site identification, implantation and echo evaluation steps for the Coapsys device in a patient with functional MR.

METHODS: The Coapsys device is surgically implanted in patients with functional MR of grade 2 or greater. The Coapsys consists of anterior and posterior epicardial pads connected by a sub-valvular chord. The posterior pad is positioned at the annular level and centered relative to the posterior leaflet. The sub-valvular chord bisects the valve perpendicular to the coaptation line. The Coapsys is sized by reducing the device dimension, drawing the posterior leaflet and annulus toward the anterior leaflet. During sizing, MR grade is assessed in real-time using color flow Doppler echocardiography. Final device sizing is selected when MR is minimized or eliminated.

RESULTS: As demonstrated, the Coapsys device can be safely and easily implanted off pump without atriotomy. Additionally, it can be readily used as an adjunct to procedures such as CABG.

CONCLUSIONS: The Coapsys device shows promise as a less invasive method of repair for patients with functional mitral regurgitation. Clinical evaluations are currently underway to assess the acute efficacy and chronic stability of the repair.

Mini-Oral Presentations Session II

Coronary Revascularization: Technique and Results

Abstract 73. MIDTERM RESULTS OF ROUTINE BILATERAL INTERNAL THORACIC ARTERY GRAFTING

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BACKGROUND: Skeletonized dissection of internal thoracic arteries (ITAs) decreases occurrence of sternal devascularization, thus decreasing risk of postoperative sternal complications. This report evaluates routine use of the skeletonizing technique for bilateral ITA (BITA) grafting.

METHODS: From April 1996-July 1999, 1000 consecutive patients underwent skeletonized BITA grafting. There were 763 males and 237 females; 340 patients were older than 70 and 304 were diabetic.

RESULTS: Operative mortality was 3.4%. Four-year survival (Kaplan-Meier) was 90%. Cox regression analysis revealed increased overall mortality (early and late) in patients with chronic obstructive pulmonary disease (COPD) (RR2.16, 95% CI 1.2-4.7). Early postoperative morbidity included sternal infection (2.1%), cerebrovascular accident (1.6%) and perioperative myocardial infarction (1%). Multiple regression analysis showed COPD to be an independent predictor of sternal infection (OR 3.66, 95% CI 1.24-10.75). During follow-up, angina returned in 49 patients.

CONCLUSION: Bilateral ITA grafting is associated with satisfactory midterm results. However, we do not recommend its use in patients with COPD.

Abstract 74. ACUTE MYOCARDIAL REVASCULARISATION ON THE BEATING HEART AFTER MYOCARDIAL INFARCTION

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INTRODUCTION: Acute myocardial revascularization after myocardial infarction is associated with high morbidity and mortality. Myocardial revascularization without cardiopulmonary bypass has been proposed as an alternative technique to decrease the operative risk.

METHODS: From 01/2000 to 10/2002, among 582 patients (pts) which underwent OPCAB (off pump coronary artery bypass) surgery, 37 pts (6.4 %, age 67 ± 9 years; LVEF 50 ± 14%) were operated during an ongoing acute myocardial infarction. 27 pts (73%) were admitted to surgery for acute revascularization, 10 pts (27%) received a re-do procedure after conventional CABG and 3 pts (8%) out of the series were operated in cardiogenic shock. All pts received surgery after a mean time of 16 ± 37 hours (min. 1 hour, max. 114 hours).

RESULTS: The mortality rate was 13.5 %. The mean number of grafts per patient was 2.2 ± 1.0. Five pts (13.5%) received an IABP preoperatively and 4 pts (11%) postoperatively. Twelve pts (32%) had additional inotropic drug support. All perioperative data were recorded and analyzed.

CONCLUSION: The presented results suggest that OPCAB procedures in acute myocardial infarction present more than a reasonable alternative to CPB procedures if patients are not operated in cardiogenic shock.

Abstract 75. INFLUENCE OF Y-GRAFT VERSUS BILATERAL IN SITU GRAFTS ON THE RECOVERY OF MYOCARDIAL PERFUSION RESERVE AFTER CORONARY ARTERY BYPASS USING BILATERAL INTERNAL THORACIC ARTERIES

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BACKGROUND: There is a concern that construction of a Y graft may cause inadequate graft flow, compared with bilateral in situ internal thoracic artery (ITA) grafts.

METHODS: Eighty-five patients, who underwent off-pump coronary artery bypass using bilateral ITAs for revascularization of the left coronary system, were studied prospectively. Myocardial SPECT was performed preoperatively and 4.7 ± 2.1 months postoperatively, and the graft patency was verified by postoperative coronary angiographies in all patients. Myocardial perfusion reserve was compared between the patients using bilateral ITAs as a Y graft (group I, n = 42) and those using bilateral ITAs as in situ grafts (group II, n = 40). The left coronary territory was divided into 16 segments, and a total of 943 segments (484 segments in group I, and 459 segments in group II) which showed decreased stress perfusion value under 70% at basal segments and 80% at other segments were included in this study.

RESULTS: The mean values of preoperative stress perfusion were significantly lower in group II than group I ($63.6 \pm 12.4\%$ for group I and $61.2 \pm 12.7\%$ for group II, respectively, $p < 0.05$). In the postoperative SPECT, the values of stress perfusion were not different between two groups ($68.6 \pm 13.4\%$ in group I and $68.5 \pm 13.6\%$ in group II), with significantly increased stress perfusion compared with the preoperative value ($p < 0.05$).

CONCLUSION: Myocardial revascularization using bilateral ITAs as a Y graft demonstrated a significantly increased stress perfusion after surgery and comparable stress values with bilateral in situ ITA in the postoperative SPECT.

Abstract 76. OPERATIVE TACTICS FOR OFF-PUMP CORONARY RE-DO

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OBJECTIVES: Evaluation of the benefit for OPCAB in selected patients undergoing coronary reoperation.

METHOD: 51 patients presenting for elective or urgent redo coronary where considered to be suitable candidates for OPCAB (total OPCAB - patients - 538). The Eurosore was used to evaluate predicted mortality. Following re-sternotomy an apical suction device was already used to expose the LAD (Xpose™, Guidant CA). After restoration of blood flow to the anterior-septal myocardium further dissection of the ventricle was performed if necessary with the aide of the Xpose that served as a "smooth" retractor and exposition device.

RESULTS: Overall, patients received a mean number of 2.0 grafts per patient (range from 1-4). The perioperative course of all patients showed no signs of infarction (Troponin T < 0.5 ng/ml). One patient died following discharge resulting in an observed mortality of 2.2 % compared to a mean predicted mortality of 8.9 % (± 9.3 %).

CONCLUSION: Off-pump surgery is a safe procedure for coronary reoperations. Step-wise restoration of blood flow according to functional relevance is the key to operative success.

Abstract 77. OFF-PUMP REVASULARIZATION IN THE AWAKE AND SPONTANEOUSLY BREATHING PATIENT—A STEP TOWARDS A MORE "PHYSIOLOGICAL APPROACH"

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BACKGROUND: Minimally invasive strategies play an increasing role in coronary revascularization. Maintenance of physiological function of organs is the central point of those concepts. Our strategy of beating heart revascularization in the awake and spontaneously breathing patient includes lung function in this concept.

METHODS: Between 12/2001 and 10/2002, the concept was realized in 28 patients (22 male, 6 female). Perioperative analgesia was achieved using cer-

vical thoracic epidural anaesthesia with sensoric blockade C3 to T6 which allowed a painfree sternotomy and all kinds of manipulations during the procedure. Age ranged from 42 to 74 years (mean under 62 years). In the majority of patients regional myocardial immobilization was achieved by using the x-pose de ice (Guidant). No anaesthesia related complications occurred during hospital stay.

RESULTS: All patients but one could be revascularized without the use of the heart lung machine. 1.5 bypasses per patient were created. Time of operation varied between 90 and 255 minutes (mean under 144 minutes). No myocardial infarction occurred; no catecholamins were used. The bleeding was 320ml on average (60ml-625ml) after 6 hours. All patients left the hospital for rehabilitation.

CONCLUSION: Minimally invasive revascularization in the spontaneously breathing patient has been introduced successfully into clinical practice and has shown the feasibility of the concept. The maintenance of the physiological function of the lung may be an important advantage in patients with impaired lung function and therefore contribute to an improved perioperative outcome.

Abstract 78. EXPAND BENEFITS OF NEW TECHNOLOGICAL ADVANCES IN OFFPUMP CARDIAC SURGERY WITH QUALITY IMPROVEMENT INITIATIVE

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PURPOSE: Improved outcomes with off-pump procedures using an apical suction device mandate pathway / process changes and education.

METHODS: To optimize the benefits and improve results of off-pump coronary artery bypass surgery (OP-CAB) and endoscopic vein harvest; a process improvement team (PIT) was developed. The goal was increased staff/patient involvement through education. New technology, process review and changes in clinical pathways were reviewed monthly. Live interactive telecast OP-CAB and didactic sessions were mandated for each staff member.

RESULTS: PIT team organized May 2001. From May 2001 through 09/30/02, 93% of all isolated primary and redo CAB were performed off pump (N = 586). Mean 3.3 grafts/patient with 1.9 mean arterial conduits were completed. STS predicted operative mortality was 3.56%. Our 30 day mortality was 0.55% and stroke rate 0.98%. This data compares strikingly with a mortality consistently >3% for on-pump CAB done at same institution from 1990 - 09/30/02 (N = 6482) and OP-CAB most without apical suction device (N = 506) performed prior to PIT. Benefits of OP-CAB using apical suction device require a paradigm shift in post-operative care and treatment.

Abstract 79. MINIMALLY INVASIVE CORONARY ARTERY SURGERY—ART AND TECHNOLOGY AT ITS BEST

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AIM: This study is done to evaluate the data and emphasize the feasibility of doing more than 90% of coronary bypass surgeries off pump with excellent results.

MATERIAL AND METHODS: We started coronary artery surgery in 1995. Between 1st January 1996 and 30th June 2002. 2209 patients underwent offpump coronary artery surgery. Cardiac Stabilizers became available to us from January 2000. We analysed our data from 1st January 2000 till 30th June 2002. Total number of CABGs performed were 1474 out of which 1377 (95.43%) were done off pump. Ninety seven patients those who were done on C P Bypass, 63 of those were intended to be done offpump but had to be converted to C P Bypass due to haemodynamic instability. One hundred and sixty three patients were not suitable for offpump surgery were still done offpump. Four hundred and ninety three out of 1377 patients had composite 'Y' grafts using various conduits. In 1377 patients, 4699 anastomoses were performed (3.41 grafts/patient).

RESULTS: Two patient developed CVA, 5 patients were explored for bleeding and 14 patients died (1.01%). One hundred and sixty seven patients underwent graft angiography before discharge. All arterial grafts were patent either individual or composite (100% patency rate). One individual saphenous vein out of 18 got blocked (94.4% patency rate).

CONCLUSION: This data over last 30 months, suggests that large number of patients can be done offpump with good results. Immediate graft patency rates are excellent.

Abstract 80. INFLUENCE OF INNOVATIVE TECHNIQUES ON MID-TERM RESULTS IN OFF PUMP CORONARY ARTERY BYPASS

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PURPOSE: There is need for documentation of mid-term OPCAB results.

MATERIALS AND METHODS: 3670 coronary artery bypass patients were risk stratified by EuroSCORE. 52 OPCAB between 1992 and 1997 were compared with 1796 on pump patients (CABG) of similar EuroSCORE. 89 OPCAB between 1998 and 2002 (employing "innovative techniques") were compared with 796 CABG patients. National Death Index assessed mortality and Kaplan-Meier curves were constructed. Arterial grafts, number of anastomoses, complications and length of stay (LOS) were noted.

RESULTS:

	OPCAB 1992-1997	CABG 1992-1997	P-value	OPCAB 1998-2002	CABG 1998-2002	P-value
EuroSCORE	11.5±1.8	11.4±0.3	0.949	13.2±1.5	13.3±0.4	0.946
Complications %	11.5	16.6	0.333	10.1	12.6	0.502
Risk adjusted 30-day mortality	1.2%	0.7%	0.524	0.5%	0.7%	0.641
LOS	13±1.5	11.7±0.3	0.489	7.2±0.6	9.6±0.3	0.019*
Kaplan-Meier avg survival in months	82.1±0.9	94.5±0.9	0.023**	47±2	46.4±0.6	0.534

Statistically significant: *t-test, **log-rank

CONCLUSIONS: The advent of innovative surgery significantly improved LOS and "equalized" survival to five years in OPCAB patients when compared to similar risk "on pump" CABG patients.

Abstract 81. LEFT INTERNAL THORACIC ARTERY (LITA) AS A SOURCE FOR COMPOSITE GRAFT FOR TOTAL ARTERIAL REVASCLARIZATION IN OPCAB

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AIM: To avoid cerebral vascular accidents (CVA) arterial revascularization with composite graft has been applied for off-pump CABG. Our study is looking at clinical, angiographic and perioperative flow measurement data. Results were compared to control group having free radial artery (RA) or free ITA graft performed.

METHODS: 88 patients were prospectively recruited to the study. There were two groups: 53 patients with composite arterial grafts (composite group) and 35 with free arterial grafts (free group). Mean age at operation

were 61,4 + 6,6 vs 57,2 + 9,2, average number of grafts: 2,4 + 0,7 vs 2,6 + 0,8 in composite and free graft groups respectively. 20 preselected patients with intension to perform two grafts to LAD and Cx territories were randomly assigned to either of groups and were followed with Transient Time Flow (TTF) and Pulsatile index (PI) measurements perioperatively and angiographic study postoperatively.

RESULTS: There was no mortality in either of groups. Postoperative complications for overall group included three IABP insertions (3.4%), three conversions to CPB (3.4%), four respiratory complications (4.52%), two wound infections (2.3%). TTF studies revealed for composite vs free group respectively: LITA flow value of 11,5+8,18 vs 10,28 + 6,04 (p = ns), PI: 3,57 + 1,67 vs 5,98 + 2,36 (p = ns); RA flow value 16,5 + 8,34 vs 16,57 + 6,02 (p = ns) with PI 2,5 + 0,78 vs 2,38 + 0,49 (p = ns). Angiographic studies showed patent grafts in both groups.

CONCLUSIONS: Arterial revascularization in Off-pump CABG can be achieved with composite grafts, with satisfactory clinical outcome. Flow parameters detected by Transient Time modification of ultrasound method is showing comparable results between composite and free grafts.

Abstract 82. MYOCARDIAL REVASCLARIZATION USING ARTERIAL T-GRAFT—WHICH CONDUIT SHOULD BE CHOSEN FOR FREE GRAFT?

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OBJECTIVES: The T-graft is achieved by the end-to-side implantation of a free arterial graft into the left internal thoracic artery (LITA) left in situ. We analysed our experience in T-grafting to evaluate whether the right internal thoracic artery (RITA) or the radial artery (RA) is better suited as a free graft. **METHODS:** Between 1997 and 2001 the RITA was used as a free graft in 129 patients (group I) and RA in 84 (group II).

RESULTS: RITA was more frequently used in male patients (p<0.02) and in patients with a reduced left ventricular ejection fraction (<40%; p<0.03). Group II patients received more coronary anastomoses (3.7 ± 0.8 versus 3.3 ± 0.8; <0.002). Early mortality (0.8% in group I and 1.2% in group II) and morbidity was comparable. Blood loss however was significantly higher in group I (858±/500 ml) than in group II (731±/380 ml; p<0.05). During a mean follow-up time of 25.1 ± 1.3 months no significant differences regarding late mortality (5.4% in group I and 0% in group II) and the recurrence of angina (group I: 2.7% vs. 1.4% in group II) occurred. Angiography was performed in 20 symptomatic patients showing a patency rate of all peripheral anastomoses of 90.9% in group I and of 91.3% in group II.

CONCLUSIONS: Based on our experience we recommend to use the RITA as a free graft in tall men also in cases of reduced left ventricular ejection fraction, diabetes and obesity. RA should be used in petite women, if there is a high risk of bleeding and if it is necessary to perform multiple grafting.

Original Presentations Breakout Session IV

Coronary Revascularization: Improving Outcomes

Abstract 83. MIDCAB VERSUS OPCAB FOR ONE VESSEL DISEASE: MID-TERM RESULTS

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OBJECTIVES: Off-pump cardiac surgery is becoming an established method of surgical revascularization. However, performing anastomoses on the beating heart may be challenging especially through small incisions. We compared our mid-term results in patients with one-vessel disease using full sternotomy (OPCAB) or minimal invasive incisions (MIDCAB).

METHODS: Between December 1996 and December 1998 102 patients (OPCAB = 45, MIDCAB = 57; age: 61 ± 11 years, 69% male) underwent off-pump myocardial revascularization for left anterior descending artery (LAD) disease with a left internal thoracic artery (LITA) bypass. Patients were

selected for OPCAB or MIDCAB technique according to the patients' and surgeons' preference, patient anatomy and risk profile. OPCAB was generally preferred in obese and high risk patients or patients with a large distance between LITA and LAD in a thorax CT. Follow-up consisted of a written questionnaire.

RESULTS: One Patient died in the OPCAB group 3 months postoperatively related to lung cancer. MIDCAB surgery was related to increased creatine kinase levels at 6h postoperatively (95 vs. 283U/l; p<0.001), and a higher incidence of occluded (4 vs. 0; p<0.039) or stenosed (7 vs. 2; p<0.06) bypasses and immediate coronary anigography (9 vs. 1; p<0.019). During follow-up up to 5.2 years MIDCAB patients tended to need more coronary reinterventions (20% vs. 10% at 5 years; p<0.16) and develop more recurrent angina (p<0.12).

CONCLUSIONS: Small incisions in MIDCAB patients obviously lead to less precise LITA-LAD anastomoses with subsequent higher incidences of myocardial infarctions, reinterventions and recurrent angina. Indication for MIDCAB should therefore be restricted to patients explicitly demanding a small incision despite thorough patient information.

Abstract 84. A PROSPECTIVE STUDY OF THE SAFETY AND EFFICACY OF A COMBINED CLOPIDOGREL AND ASPIRIN REGIMEN FOLLOWING OFF-PUMP CABG

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OBJECTIVE: We prospectively evaluated the safety and early efficacy of a combined regimen of clopidogrel and aspirin starting immediately after off-pump CABG.

METHODS: One hundred and thirty-five consecutive off-pump CABG patients received clopidogrel (75mg/day) and aspirin (325mg/day) orally or initially through a nasogastric tube for 3 months commencing within 6 hours of surgery. Additionally, heparin (10000 IU/day) was given subcutaneously during the first 4 postoperative days. Clinical events including death, myocardial infarction (MI), reintervention, angiographically documented graft occlusion, stroke, pulmonary embolism (PE), deep vein thrombosis (DVT) and hemorrhagic events were recorded. All patients were followed up to 3 months.

RESULTS: Thirteen patients among 135 off-pump CABG patients had treatment discontinued prior to discharge due to: refractory atrial fibrillation requiring coumadin (6 patients); gastrointestinal bleeding (1 patient); DVT (1 patient); PE (1 patient) and death (4 patients). All remaining patients were followed up to 3 months. At 1 month, the following events were noted: cerebrovascular accidents 3.0% (3 strokes and 1 transient ischemic attack), MI 3.0%, DVT 0.7% and hemothorax 0.7%. At 3 months, no additional events had occurred except for 1 patient who developed DVT and 2 additional patients who developed MI. Coronary angiography was indicated in these 2 patients. All grafts were found to be patent. However, in 1 patient, a native vessel required percutaneous intervention (stenting).

CONCLUSIONS: Early administration of a combined regimen of clopidogrel and aspirin following off-pump CABG is safe and is associated with a relatively low incidence of MACE, bleeding, PE and DVT. Consequently, its routine administration post off-pump CABG is recommended.

Abstract 85. OFF-PUMP TOTAL ARTERIAL REVASCULARIZATION IN MULTIVESSEL DISEASE: MYTH OR REALITY?

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BACKGROUND: The aim of this study was to demonstrate the feasibility of off-pump coronary artery bypass (OPCAB) using exclusively arterial grafts in multi-vessel disease.

METHODS: We prospectively analyzed 238 patients who underwent total arterial OPCAB using two or more arterial grafts (group I), and compared with 87 patients who underwent OPCAB using single arterial conduit and additional saphenous vein grafts (SVG) (group II).

RESULTS: The average number of distal anastomosis was 3.2 ± 0.9 and 3.5 ± 0.8 in groups I and II, respectively ($p = 0.005$). Operative mortalities were 0.8% (2/238) and 1.1% (1/87) in groups I and II, respectively ($p = ns$). There were no differences in postoperative morbidities such as atrial fibrillation (11.8% vs. 13.8%), perioperative myocardial infarction (2.1% vs. 4.6%), stroke (0% vs. 1.1%), and mediastinitis (0.8% vs. 1.1%), between groups I and II ($p = ns$). In group I, arterial grafts used were left internal thoracic artery (ITA) in 234 patients, right ITA in 227 patients, right gastroepiploic artery in 116 patients, and radial artery in 12 patients. Postoperative angiographies were performed in 235 patients before discharge and demonstrated 98.7% (733/743) graft patency. In group II, arterial grafts used were left ITA in 84 patients, and right ITA in 3 patients. Postoperative angiographies were performed in 80 patients and demonstrated 94.4% (85/90) graft patency for ITA and 85.8% (163/190) for SVG. Although there was no difference in arterial graft patency between two groups, the patency of SVG was significantly lower than those of arterial grafts ($p < 0.001$).

CONCLUSION: Off-pump total arterial revascularization is feasible with excellent early patency rates.

Abstract 86. BEATING HEART REVASCULARIZATION WITH PURELY BILATERAL INTERNAL THORACIC ARTERIES FOR TRIPLE VESSEL DISEASE: BASED ON EARLY ANGIOGRAPHIC FINDINGS

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BACKGROUND: To know the feasibility of beating heart complete arterial revascularization with purely bilateral internal thoracic arteries (ITAs) for triple vessel disease, early postoperative coronary angiography (CAG) was performed.

MATERIAL AND METHODS: Between March 2001 to November 2002, 84 triple vessel disease patients (aged 61.1 ± 8.6 years) underwent beating heart revascularization with purely both ITAs. Left ventricular ejection fraction ranged from 23 to 78% (mean $48.6 \pm 19.2\%$). The incidence of diabetes mellitus was 45.2%. Since May 2002, early postoperative CAG follow-up has been performed in 42 patients.

RESULTS: There was no operative death. Perioperative myocardial infarction and postoperative low cardiac output occurred in one patient (1.2%) respectively. The mean number of distal anastomoses was 4.0 ± 0.8 per patient. The patency rates were 100% for the left ITA and 98.3% for the right ITA. Competitive flow patterns were present in 20 distal anastomoses sites (11.8%). Degree of stenosis ($<75\%$), extent of stenosis (focal or diffuse) of the native coronary artery, and the measurement of the intraoperative transit-time flow meter ($<10\text{ml/min}$) were the risk factors for competitive flow in multivariate analysis.

CONCLUSIONS: This surgical strategy is feasible, safe, and yields good early CAG outcomes even in beating heart revascularization. However, competitive flow patterns were relatively prevalent and it may be necessary to evaluate long-term angiographic follow-up and functional study in these patients.

Abstract 87. OFF-PUMP TOTAL ARTERIAL REVASCULARIZATION WITHOUT AORTIC MANIPULATIONS: TECHNICAL ASPECTS AND MID-TERM CLINICAL OUTCOME

S.Prapas, V. Kotsis, A. Sidiropoulos, J. Panagiotopoulos, F. Danou, E. Kouri, P. Stratigi

INTRODUCTION: The superiority of OPCAB surgery and the favorable results of arterial revascularization have been well established. In addition, avoidance of aortic manipulations offers solutions to patients in high risk of stroke from aortic atherosclerosis or carotid disease. In our practice we routinely combine the above techniques. Aim of the study: To evaluate the applicability of our method and the mid term clinical results.

MATERIALS AND METHODS: We operated on 637 patients with isolated coronary artery disease between February 2001 and October 2002. Nineteen patients who were selected to be operated on pump and 16 who underwent mini sternotomy excluded from the study. The remaining 602 patients were retrospectively studied. In all of them we intended to apply diversion of bilateral internal mammary artery flow through preconstructed conduits to the diseased coronary circulation in an off pump fashion. We used the known T,Y and II composite grafts and extension of proximal RIMA with radial artery. The patient population consisted of 528 men and 74 women aged 34 to 92 years, with a Euroscore of 0-3 in 249 pts, 4-7 in 162 pts, 8-9 in 106 pts and >9 in 85 pts. Forty-one cases were reoperations. All the patients were examined 2 weeks, 3 months and 1 year after the operation. Exercise test was performed 10-14 months after the operation.

RESULTS: Conversion to CPB was necessary in 11 pts (1.8%) at the first period of 11 months. Aorta non-touch technique was applied in 598/602 pts (99.3%) and total arterial revascularization in 92%. Use of a saphenous vein graft was required in 43 patients because of a positive Allen test. Mortality rate was 6/602 pts (1%). Eight pts suffered a major complication such as reopening for bleeding (3 pts), low cardiac output (2 pts), sternal wood infection (1 pts), eriooperative MI (2 pts). The rate of postoperative atrial fibrillation was 15%. During the postoperative period 2 pts had positive exercise test and the angiographies showed total occlusion of grafts to the right coronary system.

CONCLUSIONS: Off-pump total arterial revascularization without aortic manipulations is applicable in a great range of coronary cases, including high-risk patients and reoperations, with excellent mid-term results given that the team is dedicated to the method.

Abstract 88. IS TOTAL ARTERIAL OFF-PUMP CORONARY SURGERY THE BEST STRATEGY IN ELDERLY PATIENTS?

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Aim of the study was to evaluate the strategy of choice for myocardial revascularization in the elderly. We prospectively enrolled 180 consecutive patients aged over 70 years undergoing isolated coronary surgery and assigned them to: Group 1 (total arterial OPCAB), Group 2 (total arterial on-pump CABG), Group 3 (conventional on-pump CABG with LITA on LAD plus saphenous grafts). The presence of risk factors was higher in the off-pump group (mean Euroscore: G1 = 8.6 vs G2 = 6.3 vs G3 = 6.1). Mean number of anastomoses was similar between the groups (mean: G1 = 2.9 vs G2 = 3.1 vs G3 = 3) while mechanical ventilatory support, ICU stay and post-operative stay were significantly lower in G1 ($p < 0.05$). Post-operative complications as atrial fibrillation, bleeding and blood transfusion occurred less frequently in G1 ($p < 0.05$). Hospital mortality was 3.3% in G1 and G2 and 5% in G3. At follow-up (mean: 16 ± 5 months), G1 and G2 showed better results in terms of graft patency and survival free from late events. Total arterial OPCAB surgery offered improve short term outcome and mid-term results comparable to on-pump arterial surgery but superior to conventional CABG surgery.

Abstract 89. PRIMARY STENTING VERSUS ATRAUMATIC CORONARY ARTERY BYPASS COMPARISON OF TWO METHODS OF REVASCUARIZATION IN SINGLE LEFT ANTERIOR DESCENDING ARTERY STENOSIS

Marek Cisowski, Janusz Drzewiecki*, Andrzej Jaklik*, Agnieszka Drzewiecka-Gerber*, Wojciech Kruczak**, Włodzimierz Morawski, Andrzej Bochenek

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BACKGROUND: Percutaneous revascularization is well-accepted method of treatment in a single left anterior descending (LAD) stenosis. It has become the treatment of choice for LAD lesion with the introduction of primary stenting. For the last few years however, the introduction of minimally invasive coronary artery bypass techniques and endoscopic internal thoracic artery (ITA) harvesting - atraumatic coronary artery bypass grafting (ACAB), have risen the question whether ACAB revascularization would be competitive to percutaneous coronary interventions (PCI) in a single LAD stenosis.

METHODS: Group of 102 patients with CCS class II - IV, and angiographically confirmed single critical stenosis of LAD (type A or B), were treated with primary direct stenting, DS-group I, 50 patients, or with ACAB-group II, 52 patients.

RESULTS: All patients in a group I, have reached a very good angiographic and clinical effect. In one-month follow-up 3 patients (6%), and in six-months follow-up 6 patients (12%) developed restenosis of the LAD. In these cases successful repeated-PCI of target vessel was performed. In a group II very good results of cardiac surgeries were observed. In one- and six-months follow-up all patients remained asymptomatic. Critical stenosis of the LITA-LAD anastomosis was angiographically documented in 1 case (1.9%). That

particular patient was successfully treated with PCI. Forty eight pts (96%) from group I, and 49 pts (94%) from group II were included in 12 months follow up. In group I, one patient expired (2%), 12 pts had recurrence of angina (25%). One patient (2%) experienced MACE requiring hospitalization. In group II we did not observe such complications.

CONCLUSIONS: Prevalence of cardiac surgery (ACAB) over direct primary stenting in LAD revascularization has been documented along with slightly higher costs of surgical procedure.

Abstract 90. ATRAUMATIC MINIMALLY INVASIVE CORONARY ARTERY BYPASS. A CLINICAL AND ANGIOGRAPHIC FOLLOW-UP

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BACKGROUND: Atraumatic Coronary Artery Bypass (ACAB) technique consists of endoscopic internal mammary harvesting followed by an atraumatic chest incision through which a direct-vision anastomosis is performed using conventional instruments. ACAB is a challenging quickly developing surgical technique, resulting in a decrease the physical trauma, smaller number of in-hospital complications and better patients outcome.

METHODS: Between June 1998 and February 2002, we performed 247 ACAB procedures (185 patients (pts) with single vessel - LAD disease, and 62 pts multi-vessel disease). In all the cases the endoscopic LITA harvest was employed. The criteria of eligibility to ACAB were: type B or C lesion in proximal part of the LAD, restenosis after percutaneous coronary intervention (PCI) and multi-vessel disease were hybrid coronary revascularization is possible. A total of 200 pts from this group, with anginal symptoms of Canadian Cardiovascular Society (CCS) 2.57 + 0.7 were included to prospective follow-up study.

RESULTS: Follow-up period was 6 to 44 months (mean 2.5 years). There were one early (due to myocardial infarction) and two late no cardiogenic deaths. Major adverse coronary events were observed in 6 pts, (3%) and included: myocardial infarction (2 pts, 1%), aggravation of anginal status (4 pts, 2%). An average pts anginal status was CCS I, ECG exercise test was negative in 172 pts (86%), positive in 20 pts (10%). In eight patients (4%) were not able to perform stress test due to skeleto-muscular disorders. 196 patients (98%) stated their quality of life as very good and good. In 157 pts control coronary angiography was performed (78.5%). Patency of grafts was evaluated with use of Fitz-Gibbon scale. Angiographic studies showed patent LITA-LAD graft in 154 pts (98.1%)—only 3 pts (1.9%) had totally occluded grafts (score 0). Coronary artery disease progression was observed in 14 pts (8.9%) who were treated with PCI.

CONCLUSIONS: Excellent long term clinical and angiographic results can be achieved with ACAB technique. The ACAB is the safe and effective method of treatment proximal LAD lesions thus it may be the treatment of choice in patients with a high risk of stent restenosis. We believe that ACAB approach will have a major impact on the management of coronary patient with type B or C lesion of LAD.

Original Presentations Breakout Session V

Endovascular and Congenital Cardiovascular Surgery

Abstract 91. NEW XENOGRAFT VALVED CONDUIT (CONTEGRA™) FOR RIGHT VENTRICULAR OUTFLOW TRACT RECONSTRUCTION

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INTRODUCTION: The well known flaws of existing valved conduits for reconstruction of the right ventricular outflow tract (RVOT) continue to stim-

ulate research for the elusive "perfect conduit". We describe here our experience with a glutaraldehyde treated bovine jugular vein conduit (Contegra™). **METHODS:** From 06/1999 to 02/2002, 15 consecutive patients aged 2 months to 55 years underwent implantation of a Contegra™ conduit. Diagnoses/procedures included: Repair of truncus arteriosus (2), pulmonary atresia (3), severe pulmonary insufficiency after prior tetralogy of Fallot repair (9), and replacement of degenerated valved conduit (1).

RESULTS: No operative death occurred. One patient required early conduit replacement for unexplained valve thrombosis. Early post-operative mean transconduit pressure gradient: 7.7 ± 4.9 mmHg. At mean 18.5 ± 6.9 months follow-up, all patients are asymptomatic with no conduit/valve discernable calcification or notable valve incompetence. Mean trans-valvular gradient: 11.1 ± 4.5 mmHg.

CONCLUSION: The Contegra™ valved conduit is well suited for RVOT reconstruction, avoids usage of additional foreign material and remains well functioning during early follow-up. Nonetheless, long-term durability remains to be ascertained.

Abstract 92. A NEW CLIP DEVICE FOR CONSTRUCTION OF VASCULAR INTERRUPTED ANASTOMOSIS IN CONGENITAL CARDIAC SURGERY

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The U-clips, a new mechanical vascular anastomotic device developed for CABG surgery, allow precise quick construction of any vascular interrupted anastomosis, preserving pulsatility and growth potential. We report the first use worldwide of U-clips in 10 pediatric patients (mean age 2.4 ± 1.7 years) between July 2001 and July 2002 for coarctation repair (3), bi-directional Glenn shunt (5), Blalock-Taussig Shunt (1) and arterial switch (1). Median operation time was 207 ± 26 (105–365) min, CPB time 83 ± 19 (0–135) min, aortic cross-clamp (AXC) time 40 ± 10 (0–90) min and postoperative length of stay 8 ± 6 (6–61) days. For coarctation repair (2 end-to-end and 1 extended end-to-end anastomosis) U-clip size 50 was used and AXC was 31, 20 and 32 min, respectively. U-clip size 35 was used for the Glenn anastomosis. Device handling, primary hemostasis and patency were excellent and no device-related complication occurred. During a follow-up time of 11 ± 4.4 months the child with PAIVS and BTS died, all others are doing well. Echocardiographic assessments demonstrate excellent conditions of all anastomoses without growth restriction. We conclude, that U-clips may be a valuable alternative to conventional suturing in the construction of vascular anastomoses in congenital cardiac surgery.

Abstract 93. POSTOPERATIVE PAIN AND QUALITY OF LIFE IN PATIENTS UNDERGOING ATRIAL SEPTAL DEFECT REPAIR USING MINIMALLY INVASIVE AND ROBOTIC TECHNIQUES

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BACKGROUND: Although most studies of minimally invasive cardiac surgery have reported morbidity and mortality, few have addressed more subjective outcome measures, such as pain and quality of life (QOL).

METHODS: Over a 15 month period, 17 patients underwent atrial septal defect (ASD) repair by a totally endoscopic robotic (TE-R) approach. These patients were compared to a similar number of patients who underwent repair of their ASD by a mini-thoracotomy (MT) or sternotomy. QOL was assessed on postoperative day 30 by administering the Medical Outcomes Study Short Form Survey (SF-36). QOL endpoints included bodily pain, vitality, mental health, general health, physical function, and social function.

RESULTS: At 30 days, QOL was best for TE-R patients in all 8 categories, most pronounced in bodily pain (BP, $p = 0.014$), mental health (MH, $p = 0.034$), and vitality (VT, $p = 0.036$) (table). Patients undergoing minithoracotomy, however, did not fare better than those undergoing sternotomy.

CONCLUSION: Repair of an ASD can be performed safely and effectively via a totally endoscopic approach. The totally endoscopic robotic approach resulted in the least postoperative pain and best quality of life despite increased cross clamp and bypass times.

	Sternotomy	MT	TE-R	p
Day 30 BP	42 ± 25	52 ± 11	83 ± 25	.014
Day 30 MH	68 ± 28	56 ± 28	93 ± 10	.034
Day 30 VT	58 ± 21	48 ± 19	80 ± 16	.036
BP time (min)	39 ± 10	47 ± 25	171 ± 73	.002
XCl time (min)	14 ± 5	17 ± 16	39 ± 11	.005

Abstract 94. EARLY RESULTS OF THE BOVINE JUGULAR VEIN FOR RIGHT VENTRICULAR OUTFLOW RECONSTRUCTION DURING THE ROSS PROCEDURE

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STATEMENT OF PURPOSE: To study the early function of bovine jugular vein (BJV) when used for right ventricular outflow tract (RVOT) reconstruction during the Ross Procedure.

MATERIALS AND METHODS: 13 consecutive patients (median age 12 years, range 30 days to 39 years), who underwent a Ross procedure with RVOT reconstruction using a BJV were reviewed. 7 patients had prior balloon or surgical aortic valvotomy. Additional procedures included: Konno procedure (2), mitral valve repair/replacement (2) and reduction-plasty of the ascending aorta (5 pts). The size of the BJV ranged from 12–22 mm (median 20mm). Patients were followed up with periodic echocardiography.

RESULTS: There was no early or late death. None of the patients encountered any significant postop complication. 1 patient had moderate insufficiency of the BJV in peri-operative examination, which regressed to mild on follow-up. Overall, no patient had more than mild insufficiency at 3 months. 6 patients showed mean gradients across BJV ranging from 8–29mm Hg (median 18.5mm Hg).

CONCLUSIONS: BJV to replace the pulmonary valve in the Ross procedure showed excellent function in the early phase. The large size range and easy availability of this valve are particularly attractive.

Abstract 95. CLOSURE OF PATENT DUCTUS ARTERIOSUS BY VIDEO-ASSISTED THORACOSCOPIC SURGERY; MINIMALLY INVASIVE, MAXIMALLY EFFECTIVE: REPORT OF 550 CASES

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OBJECTIVE: In the last decade, increasing interest has focused on different applications and various aspects of minimally invasive surgery. To further determine the safety and efficacy of video-assisted thoracoscopic surgical (VATS) closure of Patent Ductus Arteriosus (PDA), we prospectively studied 550 patients treated by this new method.

METHODS: From June 1997 to October 2002, 550 consecutive patients diagnosed as PDA (mean age: 6 years old), were referred to us, all of them met our inclusion criteria eligible for VATS procedure. Recently, we have made some minor alterations in our routine methodology, which will be discussed in more detail later. After complete closure of PDA by two titanium clips the extubated patient leaves the Operating Room without a chest tube.

RESULTS: All the pertaining data were collected and analyzed. There were two cases of chylothorax, which were successfully treated by thoracotomy and ligation of the small lymphatic ducts, after one week of close observation. The procedure was changed to thoracotomy in four adult patients due to inappropriately dilated canal (greater than 9 mm), meanwhile, four additional patients developed transient recurrent laryngeal nerve dysfunction. All cases were re-assessed immediately after the procedure, and followed for more than 5 years by control echocardiography. No significant complication and residual shunt was recorded during the follow-up period. Mean procedure time was about 15 ± 2 minutes. All patients were discharged shortly after the procedure (~20 hours).

CONCLUSIONS: This experience indicate that video-assisted thoracoscopic surgery is superior to other techniques of ductal closure, as well as it is simple, rapid, cost-effective, and more comfortable for the patients, in addition to the cosmetic benefits.

Abstract 96. STENT-GRAFT TREATMENT OF THE THORACIC AORTA: EXPERIENCE OF 55 CASES

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PURPOSE: To evaluate endovascular stent-grafting as a minimally invasive approach to thoracic aortic surgery.

METHODS: Fifty-five patients (47 male and 8 female, aged 17 - 87 years, mean 58 years) underwent endovascular repair with Talent™ stent-grafts for true aneurysms in eight, penetrating atherosclerotic ulcers in 12, type-B dissections in 17, traumatic ruptures in 13, infection in one and suture aneurysm in four cases. Thirty-seven of the operations were emergency procedures.

RESULTS: Hospital mortality was 9.1% (five patients). Paraplegia occurred in one patient. Four patients required secondary extensions of the stent-graft soon after the procedure; one was converted to open repair after two weeks. At the time of discharge all aneurysms were successfully excluded. At follow-up (1-35 months) all patients are alive and well. In four cases distal endoleaks required graft extensions.

CONCLUSIONS: Endovascular repair of the descending aorta is technically feasible and provides encouraging results considering that 67 % were emergency procedures. The frequent need for graft extensions requires further technical improvements. Close surveillance after stent-grafting is necessary, especially in lengthy aneurysms and in dissections.

Abstract 97. ENDOVASCULAR REPAIR OF THORACIC AORTIC ANEURYSM: RESULTS FROM PHASE I STUDY WITH MEDTRONIC "TALENT" STENT GRAFT

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BACKGROUND: Endovascular repair of thoracic aortic aneurysms (TAA) is an evolving modality. We report our early experience with the first generation and subsequent re-design of the Talent device.

METHODS: 19 patients (6 male and 13 female) had repair of TAA with the Medtronic "Talent" stent graft from 7/1999 to 11/2002 under an FDA phase I study. The last 9 grafts were re-designed with greater flexibility to improve deployment at the aortic arch. All patients were high risk for open repair. Mean age was 74.8 + 8.4 yr (range 52-83). 2 patients had aortic dissections. 5 patients (26%) required pre-operative subclavian artery transposition to create a suitable distal arch landing zone.

RESULTS: There was one hospital death (5%) at 37 days due to small bowel infarction. There were four late deaths (21%) at 47, 62, 93 and 131 days postop, secondary to aneurysm rupture, CVA, pneumonia and cardiac respectively. Average length of stay was 10.9 + 11 days (range 3-37 days). 4 patients required infrarenal aortic access conduits because of small/tortuous iliacs. 4

patients developed early Type I endoleaks, all requiring repair with stent grafts extensions. No ruptures, late endoleaks or stent migrations were noted at one year mean follow-up. Postoperative paraplegia was not observed.

CONCLUSION: In high-risk populations, thoracic stent grafting with the Medtronic "Talent" device is feasible in most descending aortic pathology with acceptable morbidity and mortality. The re-designed "Talent" device is especially useful in the aortic arch, while the proximal and distal bare springs construction allows deployment close to the celiac or arch vessels.

Abstract 98. THORACIC AORTIC EMERGENCIES: IMPACT OF ENDOVASCULAR SURGERY

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AIM: Conventional surgery of thoracic aortic emergencies (TAE)—fissured thoracic aortic aneurysms (TAA), acute type-B dissection and traumatic rupture of the aorta at the isthmus (TRA)—is associated to an high risk of mortality and morbidity. Endovascular surgery of TAE has been considered as an alternative procedure.

MATERIALS AND METHOD: From March 2001 to July 2002, 15 patients with TAE were admitted at our department and submitted to endovascular surgery: 3 pts for TRA, 4 pts for fissured TAA, 8 pts for acute type-B dissection evolving to rupture. AngioCT scan was diagnostic in all pts.

PROCEDURE: Under general anesthesia, a stented-graft was placed by unilateral femoral arteriotomy. TAA and type-B pts were submitted to a multiple stent-graft procedure - telescope technique - to cover all the descending thoracic aorta. Endoleaks were not present at angiography and delayed CT scan showed a good sealing of the dissection. Hospital stay average was 4 + 1 days and no deaths and major complications were observed. At mean follow-up (7.6 ± 4.2 months) all pts were alive and completely asymptomatic.

CONCLUSION: Endovascular surgery is a safe and quick technique to treat TAE with an encouraging early results.

Original Presentations Breakout Session VI

Innovative Anastomotic Devices

Abstract 99. IMPLANTATION OF AN EPIMYOCARDIAL LEAD FOR BIVENTRICULAR PACING VIA LEFT LATERAL MINITHORACOTOMY

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The video shows the implantation of an epimyocardial steroid lead (Medtronic 4968) on the left ventricle. The lead is placed in the region of the first marginal branch through a 5 cm left lateral mini-thoracotomy. The patient was a 40 years young man with congestive heart failure (dilatative cardiomyopathy, ejection fraction 25%, left bundle branch block of >240 ms, NYHA III). One day prior to surgery the cardiologists tried to implant a transvenous coronary sinus (cs)-lead for 6,5 hours. The implantation of the cs-lead failed because of dissection of the coronary sinus. The dissection caused a pericardial haematoma of 500 ml. The implantation of the left ventricular epimyocardial lead needed 95 minutes. The threshold was excellent (0.3 V/0.5 msec). The amplitude of the R-wave was 17,2 mV.

The significant advantages of epimyocardial leads compared to coronary sinus leads are: 1. Nearly 100% target area reached. 2. Better long term thresholds. 3. Shorter operation time. 4. Since April 1999 no epimyocardial lead failed in biventricular pacing.

Abstract 100. TOTAL ENDOSCOPIC CORONARY ARTERY BYPASS (TECAB). INITIAL EXPERIENCE WITH TEN PATIENTS

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AIM OF STUDY: Total Endoscopic CABG (TECAB) has been performed in Europe. As part of multicenter trial, author enrolled patients at

a single institution to determine the safety and efficacy of performing Total Endoscopic Coronary Artery Bypass (TECAB) using the DaVinci Surgical System.

MATERIAL AND METHODS: From November 4, 2002 to November 23, 2002, ten patients were enrolled in the TECAB study. There were 6 male and 4 female and age range 34-72 years with a mean of 58.3 ± 14.8 years. The entire procedure was performed through three ports in the 3rd, 5th, and 7th left intercostal spaces. A small oblique incision was made in the groin for femoral artery and vein cannulation and TEE guidance was used for placement. Estech arterial cannula and Heartport venous cannula were used. Antegrade cardioplegia was used to achieve cardiac arrest. LIMA to LAD anastomosis was done using the Coalescent surgical U-clips.

RESULTS: TECAB was successfully completed on all patients. Anastomotic time ranged from 15-30 minutes with a mean of 20.9 ± 4.79 minutes. Aortic cross clamp time ranged from 39-77 minutes with a mean of 56.10 ± 12.11 minutes. CPB time ranged from 60-175 minutes with a mean of 89.70 ± 33.11 minutes. Operative time ranged from 200-368 minutes with a mean of 247 ± 74 minutes. Extubation time in the ICU ranged from 2.45-29.05 hours with a mean of 10.4 ± 8.5 hours. The average length of hospital stay was 1-3 days with a mean of 2.0 ± 0.71 days. There was no mortality, atrial fibrillation, or peri-operative MI. None required conversion or exploration for post-operative bleeding.

Abstract 101. U-CLIP ANASTOMOSES IN CORONARY ARTERY BYPASS GRAFTING—INITIAL CLINICAL EXPERIENCE

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BACKGROUND: Recent studies suggested that U-clip™ interrupted coronary artery anastomosis is superior to continuous suture. However, clinical experience with this device is limited.

AIM: To evaluate our initial clinical experience with this technology.

METHODS: Outcomes of 41 patients undergoing isolated coronary artery bypass grafting (CABG) using U-clips™ (UC) were compared to 137 patients undergoing CABG using conventional sutures (Conv).

RESULTS: Average number of distal anastomoses were similar between the groups (UC: 3.1, Conv: 3.3, $p = 0.3$). Also similar were the number of arterial grafts (1.6 vs. 1.4, $p = 0.2$), % of sequential anastomoses (10% vs. 9%, $p = 0.9$) and % performed "off-pump" (27% vs. 26%, $p = 0.9$). Cardiopulmonary bypass and aortic cross-clamp time were longer in the UC group (97 ± 24 vs. 85 ± 27 min, $p = 0.07$; 68 ± 16 vs. 57 ± 19 min, $p = 0.03$). Operative mortality (UC: 2.4%, Conv: 1.5%), postoperative MI (0% each), stroke (0% each), renal failure (0% vs. 1.5%), and blood transfusion rate (51% vs. 58%) were not statistically different. Average follow-up in 36 (90%) of UC patients was 5 ± 2 months (range 1-7 months). One patient expired from a non-cardiac-related cause. At the time of follow-up 90% of patients were in angina class I-II.

CONCLUSIONS: The U-clip interrupted anastomosis technique is versatile, safe and associated with excellent short-term outcomes.

Abstract 102. LONG-TERM PATENCY OF VEIN TO CORONARY ANASTOMOSIS FOLLOWING PLACEMENT WITH THE C-PORT AUTOMATED ANASTOMOSIS SYSTEM IN A SHEEP MODEL

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BACKGROUND: There is a clinical need for a safe and reliable automated vascular anastomosis system to facilitate minimally invasive beating heart coronary bypass procedures. This study was designed to test a novel distal anastomosis system in a chronic CABG model in sheep.

METHODS: Vein conduits were anastomosed proximally to the aorta using either standard hand-sewn techniques (HS) or the PAS-Port proximal anastomosis system. The distal anastomoses were either performed with the staple-based C-Port system (C-Port) or using standard hand-sewn techniques (HS) on the beating heart. The automated device allows the attachment of grafts to coronaries from 1 to 4 mm in diameter while maintaining intracoronary blood flow during placement. Automatically placed micro staples result in a compliant anastomosis. No antiplatelet or anticoagulant drugs were administered during the 9 week follow-up. Final evaluation included a coronary angiogram followed by macroscopic and microscopic assessment of the anastomoses.

RESULTS: A total of 14 animals were included in the study. One animal in the HS group and 2 animals in the C-Port group each deceased intraoperatively due to arrhythmias. The internal diameter of the distal targets in animals that survived the follow-up period was similar in both groups and ranged between 1.0 and 2.5 mm. Graft blood flow was 33.7 ± 21.5 ml/min in the HS group and 21.0 ± 12.8 ml/min in the C-Port group (p n.s.). Four of the 6 HS animals (67%) and 5 of the 5 C-Port animals (100%) showed angiographic patency. At the end of the follow-up a smooth endothelialized inlet into the vein graft with complete healing of the anastomotic site was observed.

CONCLUSIONS: A distal anastomosis of vein to coronary can be safely and rapidly performed with the C-Port anastomosis system using a single tool and by simple actuation of a button. The long-term patency and histology of device anastomoses was excellent. This system enables the surgeon to complete a compliant distal anastomosis virtually within seconds. These results warrant further clinical evaluation.

Abstract 103. EXPERIMENTAL RESULTS WITH AUTOMATED MAGNETIC ANASTOMOSIS DEVICE

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BACKGROUND: Experimental and clinical outcomes with the Ventrica Magnetic Vascular Positioner (MVP™) have been reported. Angiographic patency, strength of the connection, device ease of use, and hemostasis have been documented. These previous findings have been compiled with a device for vessels with internal diameters equal to or greater than 2.0 mm. We evaluated an iteration of the device suitable for a wider range of vessel diameters.

MATERIALS AND METHODS: Twenty-seven domestic white swine (45-65 kg) underwent coronary artery bypass (CABG) through a left thoracotomy. A left internal thoracic artery (LITA) was attached to the left anterior coronary

artery (LAD) with the Ventrica Series 6000 MVP™ anastomotic device. Nineteen animals received the larger size of the device intended for vessels with internal diameters equal to or greater than 2.0 mm. The remaining eight animals received the smaller size of the device intended for vessels with internal diameters less than 2.0 mm. Angiographic patency was assessed at 30 ± 10 days. Strength of connection, hemostasis and ease of use were also assessed.

RESULTS: Three of the animals with the larger size device were excluded from follow-up for non-device-related reasons. Angiographic patency was demonstrated in 24 of the remaining 24 subjects (100%). There were no leaks in or disruptions of the anastomoses formed with the device. The device was also quick and easy to use.

CONCLUSION: The MVP™ Series 6000 demonstrates functional characteristics at the 30-day interval similar to or better than earlier iterations of the design, while being suitable for a wider range of vessel sizes.

Abstract 104. VETTATH'S ANASTAMOTIC OBTURATOR—A SIMPLE PROXIMAL ANASTAMOTIC DEVICE

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BACKGROUND: Proximal anastomosis of a vein graft is usually performed with a side clamp on the aorta. But during beating heart surgery, and when there is only one island of aorta that remains normal, then, applying a side clamp has remained a cause for postoperative neurological events.

MATERIAL AND METHODS: We have fabricated this simple device to perform the proximal anastomosis. This has been used in 78 of our 90 OPCABs performed in the last five months in our new center, without any neurological complications.

RESULTS: This obturator is fabricated in different sizes, according to the size of the aortic punch. Once the aortic punch hole is made, the obturator is inserted, and the vein graft is sutured on the aorta, making sure the sutures lie loose. Once suturing is complete, the obturator is removed and the sutures tightened and knotted. Sometimes a purse string is used to prevent bleeding.

DISCUSSION: Using this device we have been able to perform all our proximal anastomosis of the vein grafts on the aorta without dropping the pressures and on calcific aortas.

Abstract 105. EXPERIMENTAL MINIMALLY INVASIVE CORONARY ARTERY BYPASS USING A BIOLOGIC GLUE SHORT AND LONG TERM RESULTS

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OBJECTIVE: Perfection of minimally invasive coronary artery anastomoses has been frustrated by the complex process of suturing. While distal, metal based anastomotic devices are in development, they offer the same disadvantages of cardiologist's stents that they are designed to compete with. We have previously reported on our early in vivo and in vitro work creating an internal mammary artery to coronary artery anastomosis using a double balloon catheter system and a biologic glue, formed from bovine albumin and glutaraldehyde (BioGlue). This report details the short and long term follow-up of these anastomoses using both stopped and beating heart techniques.

METHODS: Five yearling goats weighing from 41 to 60 kg underwent a single coronary artery bypass from either the left or right IMA to the LAD via a small left anterior thoracotomy. Three initial animals were placed on bypass and had the anastomosis constructed under cardioplegia arrest. Two angioplasty-type balloons were introduced into the distal IMA; one exited the back wall of the IMA 1 cm proximally and entered the anterior wall of the LAD; the other was positioned proximal to the anastomosis to occlude and temporarily stent the LAD. Stay sutures were placed proximally and distally at the anastomosis. Once the balloons were inflated, BioGlue was applied externally and allowed to set-up for two minutes; the balloons were deflated and removed and the distal end of the IMA was clipped, converting the side to side graft to an end to side graft. Following these initial successes, two additional animals had the same procedure using off pump techniques, using a stabilizer to control movement at the anastomotic site. All animals were recovered and followed.

RESULTS: Animals were autopsied at one day, 3 months, 10 months, 12 months, and 27 months. All anastomoses were patent. Angiograms showed patent, non-stenosed, non-aneurysmal graft sites. The 27 month animal (off pump) was allowed to grow from 41 kg to 60 kg prior to sacrifice; despite animal growth, the anastomosis was pristine. BioGlue was still present at 27

months and remained pliable and smooth. This glued anastomosis has subsequently been duplicated in a human cadaver model using robotics and port access.

CONCLUSION: We have shown that a commercially available biologic glue can be used with a catheter system to produce long term patent coronary artery anastomoses in growing large animals. No long term adverse effects of the glue have been found in this model. Further development of this technique could enable robotic or other true minimally invasive anastomoses in cardiac and other fields of surgery.

Abstract 106. NOVEL DISTAL ANASTOMOTIC DEVICE: LONG-TERM PATENCY AND HISTOLOGICAL FINDINGS

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PURPOSE: Efficacy and long-term patency of the new distal anastomotic device (DAD) for the creation of a rapid, sutureless, end-to-side venous or

arterial coronary artery bypass graft anastomoses were tested in a sheep model.

METHODS: In 34 sheep, on beating hearts, the DAD was used to create 20 anastomoses between saphenous veins (n = 9) or internal mammary arteries (IMA) (n = 11) and various coronary arteries. Fourteen conventional hand sutured anastomoses (veins = 7, IMA = 7) served as controls. Sheep were sacrificed after one day, one week, and one, three and six months.

RESULTS: Immediate patency of all anastomoses was proved by flow rates and pattern. There was no significant difference between DAD and suture anastomoses in pre-sacrifice Pulsatility-Index and occlusion rate. The histomorphometric studies showed complete intimal bridging over the DAD with no significant difference between DAD and suture anastomoses in respect to lumen diameter mural injury, inflammation or adventitial fibrosis.

CONCLUSIONS: The DAD enables the creation of rapid, efficient, sutureless, venous or arterial coronary anastomoses. Long-term results show that the DAD is comparable to conventional sutured anastomoses.

Scientific Session VI

Innovative Valve Technology

Abstract 107. EARLY RESULTS WITH A TOTALLY NEW DESIGNED EQUINE PERICARDIAL STENTLESS AORTIC VALVE

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OBJECTIVE: The 3F Aortic Bioprosthesis is a new stentless valve (currently under investigation). It has a totally new tubular design and is fabricated from three equal leaflets of equine pericardium. The valve is fixed in the annulus in standard technique either by running or interrupted sutures. There is no need for a second suture line since three commissural tabs only have to be fixed through the aortic wall. Favorable hemodynamics, durability and stress performance were proven during laboratory and animal tests. We present the early clinical results and hemodynamic performance of the 3F valve in patients undergoing aortic valve replacement.

METHODS: Between June and November 2002, 13 patients (7m/6f) underwent AVR with a 3F valve. Mean age was 70.5 ± 16.5 years (range 41-88). In 4 patients combined revascularization was performed, one patient received bi-atrial ablation therapy. Peak systolic gradient (PSG) and valve performance were investigated intra- and postoperatively by Doppler echocardiography.

RESULTS: There was one intraoperative non valve-related death. ECC time was 95 ± 26 min, aortic cross clamp time was 76 ± 20 min. Sizes for implanted 3F valves were: 3x 23mm, 5x 25mm, 4x 27mm and 1x 29mm. Postoperatively 3 patients received warfarin due to intermittent atrial fibrillation, the other patients received anti platelet medication only. No thrombotic event occurred. At 30 day follow-up PSG was 12 ± 3 mmHg. During the follow-up period trivial central aortic valve regurgitation was found in two patients.

CONCLUSION: Excellent preliminary results with the 3 F aortic valve encourage us to continue the investigation of this prosthesis. Due to the new valve design, implantation technique is simplified comparing with other stentless valves. Long-term evaluation and follow-up is mandatory to assess hemodynamic performance and durability.

Abstract 108. CLINICAL OUTCOMES OF THE FIRST 100 CONSECUTIVE IMPLANTATIONS OF SELF-ASSEMBLED COMPOSITE GRAFTS

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AIM: The aim of the study was to evaluate the clinical outcome of the first 100 consecutive implantations of our self-assembled composite grafts for

replacement of the ascending aorta and aortic valve. The valve prostheses are placed within a Dacron tube leaving a small rim of Dacron underneath the valve for fixation at the aortic annulus.

METHODS: For the composite grafts commercially available biological stentless valves (SPV To-ronto) were used in 53 patients with a mean age of 69.4 years (Group A). In 47 patients with a mean age of 54.1 years (Group B) mechanical valves offering improved hemodynamic performance (St. Jude Regent or ATS AP) were used. The surgical indication was a true aneurysm in 90 and type A aortic dissection in 10 patients.

RESULTS: There was no perioperative (30-day) mortality. Echocardiographic examinations prior to discharge revealed excellent hemodynamic characteristics with low transvalvular gradients in both groups. There were 4 deaths during the follow-up period (one cardiac and three non cardiac deaths). All of them occurred in the elderly patients Group (A).

CONCLUSIONS: The modified self-assembled composite graft is an excellent alternative to commercially available standard conduits. The use of biological stentless or low profile mechanical valve prostheses in connection with supraannular valve placement improves hemodynamic and hemostatic characteristics. In addition the stentless composite grafts are suitable for those patients, in whom anticoagulation should be avoided.

Abstract 109. EARLY RESULTS ON A SERIES OF 117 PATIENTS OPERATED ON FOR ACUTE TYPE A AORTIC DISSECTION BETWEEN 1992 AND JUNE 2002

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METHODS: 75 pts. (64% men and 42 (36%) women aged 28 to 82 years (mean 58.8 + 12 years). Eighteen patients (15.3%) had Marfan syndrome. There were three groups: in group A operations were performed under deep hypothermic circulatory arrest (18 C), in group B patients operated with deep hypothermic circulatory arrest and retrograde cerebral perfusion and group C operated with selective antegrade cerebral perfusion with moderate hypothermic circulatory arrest (28 C).

RESULTS: The overall early mortality (30-day) was 23 % (27 patients) group A: 14 p (25%) group B 7 patients (23%) group C 6 patients (21%). In the last three years early mortality has leveled down to 18%. There was no statistical significant difference in early mortality among the different groups. On univariate analysis the following factors had a significant influence on 30-day mortality: postoperative renal failure (p = 0.0051), repeat sternotomy for bleeding (p = 0.0096), permanent neurologic deficit (p = 0.0059), preoperative low cardiac output (0.0108).

CONCLUSION: Antegrade selective perfusion allows for a longer "safe" circulatory arrest time that translates into more complete arch replacement in the presence of complex primary arch tears.

Abstract 110. BIOGLUE WITH ACUTE TYPE A AORTIC DISSECTION: RESULTS FROM 87 CONSECUTIVE REPAIRS

Alberto Pochettino, Thomas G. Gleason, Robert C. Gorman, G. William Moser, Joseph E. Bavaria

BACKGROUND: Surgery for acute type A aortic dissection requires repair of the aortic wall at the proximal extent below the sinotubular ridge or the aortic root must be replaced. Various tissue adhesives have been used to create a neomedia in dissected sinus segments. This series reports the largest experience using BioGlue (for neomedia reconstruction at the proximal- and distal-most extents of acute type A dissection).

METHODS: Between 3/2000 and 10/2002 87 consecutive patients underwent repair of acute type A dissection (67 root repairs, 20 root replacements). An integrated approach with rapid delivery to the OR, continuous EEG monitoring, and intraoperative TEE was used exclusively. Operative technique uniformly included: valve repair/resuspension, repair of the aortic media using BioGlue with or without Teflon felt in the sinuses and the arch, ascending aortic replacement and hemiarch reconstruction using hypothermic circulatory arrest [HCA] with retrograde cerebral perfusion [RCP].

RESULTS: Among the root repairs, the mean age was 64 (range 25-86). Cardiopulmonary bypass time, cross-clamp time, and HCA time averaged 199 (45), 143 (45), and 39 (11) min, respectively. Length of stay averaged 12.6 (2 days [range 3-70]). Three patients required reoperation for bleeding, and there were two post operative strokes. Thirty-day and in-hospital mortality rates were 4.9% and 6.6%, respectively. 12-month follow-up yielded no additional deaths and no reoperations.

CONCLUSION: Use of BioGlue is a safe and effective adjunct for repair of acute type A dissection. The mortality rate is low when an integrated approach is used. Intermediate durability (2.5 years) of the proximal and distal neomedia repair remains very satisfactory.

Abstract 112. OPTIMUM ORIENTATION LEADS TO INCREASED CORONARY FLOW FOLLOWING MECHANICAL AORTIC VALVE REPLACEMENT

Peter Klein

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OBJECTIVE: Optimum orientation of mechanical aortic valves was defined in previous studies regarding systolic performance. The tilting disc valve matched flow dynamics in the proximal aorta almost physiologically, when its major orifice faced the noncoronary sinus, the area of highest velocities during ejection. Optimum orientation for the bileaflet design was achieved with one leaflet opening towards the right coronary sinus. The present study investigates the influence of valve orientation on coronary flow for both valve designs in an animal setup.

METHODS: A rotation device designed to hold either a Medtronic Hall tilting disc or St. Jude Medical bileaflet aortic valve was implanted into 8 pigs. The device allowed rotation of the implanted valve without reopening the aorta. Coronary blood flow in the left anterior descending artery (LAD) was measured at a constant cardiac output preoperatively and in different orientations of the valves (best and worst position as defined previously) using a perivascular ultrasound device.

RESULTS: The coronary flow rates are summarized in the Table.

	Tilting disc (n = 4)	Bileaflet (n = 4)
Preoperatively	24.5 (\pm 4.7) ml	25 (\pm 3.3) ml
Best orientation	64 (\pm 8.7) ml	46 (\pm 9.7) ml
Worst orientation	37.5 (\pm 1.3) ml	34 (\pm 9) ml

CONCLUSIONS: Coronary blood flow was significantly influenced by mechanical aortic valve implantation ($p < 0.01$) and by the orientation of the implanted valves ($p < 0.05$). For both valve designs the previously defined optimum orientation demonstrated the highest LAD flow rates with significantly higher LAD flow in the tilting disc valves ($p < 0.02$).

Abstract 113. CARDIAC AUTOTRANSPLANTATION: A SALVAGE TECHNIQUE FOR MITRAL VALVE REPLACEMENT

Dimitri Novitzky, MD

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BACKGROUND: Adequate exposure is a fundamental requirement in mitral valve (MV) surgery. Occasionally seeking adequate exposure may be technically demanding and often challenging to the surgeon. In 1995, a 69-year-old male required MV replacement and concomitant coronary artery bypass grafting (CABG). Distal coronary grafts were performed initially followed by exposure of the MV through a transatrial-septal approach. Adequate exposure was unable to be achieved and the heart was explanted. The MV was replaced ex vivo and autotransplantation of the heart was subsequently performed. Proximal coronary anastomoses were completed and a permanent pacemaker was implanted. The patient had an uneventful recovery and was discharged from the hospital.

METHODS: To assess the incident of inadequate MV exposure, a survey was forwarded to 3,000 cardiac surgeons. A total of 1,120 responses were received. This represents a 37.3% response rate.

RESULTS: Seven hundred eighty-four respondents (70.0%) indicated they had experienced difficulty in achieving adequate exposure of the MV at one time or another. To achieve adequate exposure, 392 (50.0%) indicated they would extend the initial atriotomy perpendicular to the incision in the atrial groove and into the right atrium and then subsequently divide the atrial septum. Using these techniques, 213 respondents (19.0%) reported similar problems. In those cases, 190 respondents (17.0%) proceeded to divide the superior vena cava (SVC) and 11 (1.0%) divided the inferior vena cava (IVC) and 11 (1.0%) separated both the SVC and the IVC. Forty-four respondents (3.9%) indicated they had been forced at one time or another to abort the MV procedure and discontinue cardiopulmonary bypass without performing the indicated MV surgery. This action was reported in 71 patients. In the experience of this group of 1,120 cardiac surgeons it was reported that 320 operative deaths could be directly attributed in one way or another to incomplete MV surgery as a result of inadequate exposure and access to the MV annulus.

CONCLUSIONS: While technically demanding, in experienced hands, cardiac autotransplantation may be a viable alternative for MV replacement when difficulty is encountered with adequate exposure. This approach may reduce the incidence of incomplete operation and provide enhanced clinical outcomes.

Abstract 114. A NEW STENTLESS BOVINE PERICARDIAL PROSTHESIS FOR MITRAL VALVE REPLACEMENT: PRELIMINARY EXPERIENCE

Zohair Al Halees, MD

Saudi Arabia

OBJECTIVE: The SJM Quattro Mitral Valve is manufactured from bovine pericardium that has been cross-linked using a glutaraldehyde solution. This is a quadrileaflet stentless bovine pericardial bioprosthesis (QMV), with anticalcification treatment is indicated for the replacement of malfunctioning native or prosthetic mitral valves.

METHODS: From March 1998–September 2002, 40 SJM QMV were used to replace the MV in 39 patients (pts) (one patient had two valves). Mean age 35 \pm 15, range 16-76. Mean NYHA functional class 2.5 \pm 1.5. Severe mitral regurgitation (MR), in 20 patients, 7 severe mitral stenosis, 12 mixed lesions, 16 had previous surgery with previous prosthesis. Etiology: 22 patients rheumatic, 6 degenerative, 9 degenerated bioprosthesis 1 mechanical valve thrombosis and 2 endocarditis.

RESULTS: Hospital mortality 1/39 (2.5%), 2 late deaths. One patient developed minor stroke and recovered. Four patients developed endocarditis requiring reoperation. A fifth patient who had a Ross procedure and QMV replacement died of septic shock with prosthetic mitral valve endocarditis prior to reoperation. Freedom from endocarditis is 74% \pm 10%. Mean follow up 20 \pm 14 months, range 4-48. Mean MV area 2.1 \pm 0.06cm². MR trivial to mild in all pts except 4 who have mild to moderate MR. One of those 4 had the QMV explanted and replaced somewhere else 3 years later. All surviving patients are asymptomatic.

CONCLUSION: It is feasible to implant this valve for various MV pathologies even after previous prosthesis. Hemodynamics are acceptable. Longer follow-up awaited.

Abstract 181. THE NEW EDWARDS PERIMOUNT MAGNA VALVE

E. Wolner, N. Simon-Kupilik, P. Simon

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The PERIMOUNT Magna valve is a new generation pericardial valve designed for improved durability and hemodynamics. New tissue selection and valve construction methods have been introduced to enhance durability, and to prevent calcification the XenoLogiX treatment is applied. The valve has a supraannular design and a scalloped shape of the sewing ring to provide an optimal anatomic fit. A smaller sewing ring diameter should allow for a larger valve in a given patient's annulus compared with the stan-

dard PERIMOUNT valve. Since September 2002, 200 valves were implanted in 26 centers in Canada and Europe. Our own experience consists of 20 valve implants in patients over the age of 70 years. We were able in 12 patients to use a bigger valve as measured with a standard PERIMOUNT sizer. The gradients and hemolysis were low. There were no postoperative complications.

CONCLUSION: The hemodynamic performance of the PERIMOUNT Magna valve is superior to other stented valves, and with its implant ease and reproducible results, the availability of this new valve obviates the need for stentless valves and aortic root enlargement procedures. Further observation will prove the effectiveness of the XenoLogiX anticalcification treatment and the other design enhancements aimed at improving durability.

Scientific Session VII

Featured Abstracts

Abstract 115. ENDOVASCULAR TREATMENT OF THE THORACIC AORTA: PROSPECTIVE STUDY

A.S. Bortone, D. D'Agostino, E. De Cillis, G. Mannatrizio, V. Paradiso, G. Dialetto*, M. Cotrufo*, L. de Luca Tuppiti Schinosa.

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METHODS: From March 1999 to November 2002, 71 pts underwent to our observation: 20 with atherosclerotic aneurysms, 17 post-traumatic and 22 type B dissections. 12 pts with chronic type B dissection were not suitable of endovascular and therefore medical treatment was implemented.

RESULTS: There were two hospital deaths (3.4%) respectively due to multiorgan failure and rupture of ascending aorta owing to device dislodgement. An optimal sealing of the graft was reached in 98, 3%. However, one pt required open surgical conversion while seven underwent left carotid-subclavian bypass. In two pts iliac fenestration was performed. No spinal cord injuries were observed. At the follow-up by angio-CT scan within 72 hrs and after 6, 12 months and once a year, no stent-graft related complications have been detected. In two pts with chronic dissection an asymptomatic type II endoleak was found. On the other hand 41.6% of medical treatment pts died.

CONCLUSION: Endoluminal stent-graft treatment represents a valid option by itself especially if compared to medical therapy.

Abstract 116. PROSPECTIVE ANALYSIS OF OFF-PUMP CABG IN ACUTE MYOCARDIAL INFARCTION

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PURPOSE: Conventional CABG using cardiopulmonary bypass (CPB) carries higher mortality and morbidity for patients operated upon acute myocardial infarction (AMI) and acute coronary syndrome (ACS). Aim of this prospective study was to evaluate risk factors for off-pump CABG (OPCAB) in ACS and AMI.

METHODS: Since December 1999 till August 2002, 165 consecutive urgent and emergency CABG patients due to AMI referred to one surgeon were operated without CPB. All of those 165 ACS were troponine positive (by definition), among them there were 46 AMI operated during first 72 hours- group named "AMI early". Sixteen preoperative and operative discrete variables (age, sex, ejection fraction, myocardial infarction, acute myocardial infarct (<1 week), myocardial infarct (>1 week), acute coronary syndrome, CCS class, NYHA class, hypertension, diabetes mellitus, renal failure, chronic obstructive pulmonary disease, redo, atheroscleromathosis, LV aneurysm) were tested, with end-points being 30-day hospital mortality.

RESULTS: Overall 30-day mortality was 4.24% (n = 7) for ACS group and 10, 9% (n = 5) for "AMI early" group. Univariate analysis revealed operation in AMI <72 hours ("AMI early") as only predictor (p = 0,022, OR- 7, 07, CI- 1, 3- 37,5). Multivariate logistic regression analysis for overall 165 patients revealed "AMI early" (p = 0, 03, OR-8,6), female gender (p = 0,01, OR-15,7), LV aneurysm (p = 0,03, OR-13,8), perioperative IABP (p = 0,03, OR-12) and renal failure

(p = 0,05, OR-2) as independent risk factors for 30-day mortality. In "AMI early" group female gender (p = 0.001, OR- 32, 5), perioperative IABP (p = 0, 03, OR- 12, 1) and diabetes (p = 0,05, OR-2,1) appeared to be the risk factors.

CONCLUSIONS: OPCAB is a valuable approach in AMI; however it carries significant mortality and morbidity when performed within 72 hours of myocardial infarction. Careful preselection, early preoperative IABP support and timing of intervention warrant optimal results.

Abstract 117. EPICARDIAL LEADS ARE SUPERIOR TO CORONARY SINUS LEADS IN BIVENTRICULAR PACING

H. Mair, A. Schütz, K. Warncke, M. Schmöckel, G. Nollert, S. Däbritz

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OBJECTIVE: Biventricular pacing has shown improvements in cardiac function and congestive heart failure (CHF). We aimed to evaluate different operative techniques.

METHODS: Since April 1999 58 patients (pts, age: 67 ± 11 years) with depressed ejection fraction (23 ± 9%), left bundle-branch-bloc (QRS 171 ± 32 ms) and NYHA III or higher were enrolled. For biventricular stimulation we used coronary sinus (cs) leads in 46 pts (Medtronic2187 and Guidant-Easytrek). In 12 pts epicardial steroid leads (Medtronic 4968) were placed through a small left-lateral thoracotomy (7 ± 3cm). 21 pts needed a defibrillator. Follow up time was 9-44 month (median: 24,3 month).

RESULTS: In biventricular mode patients had significant improvement of NYHA-class (p<0.0001), QRS decreased to 144 ± 22ms (p<0.001) and the 6-min-walk-test improved from 320 ± 110m preoperatively to 480 ± 82m after 12 month and 496 ± 105m after 36 month (p<0.001) in both groups. After 12 month the stimulation-threshold of the cs-leads were significantly higher compared to epicardial leads (2,2 ± 0,8V/0,5ms vs. 1,0 ± 0,3V/0,5ms) and increased in the follow-up (2,6 ± 0,7V/0,5ms) vs. threshold of epicardial leads did not increase (p<0.001). At 12 month follow up, 8 cs-leads had a threshold of >4V/0,5ms vs. epicardial leads were all under 2V/0,5ms. After cs-lead implantation 7 devices failed and needed conversion to epicardial leads (loss of pacing capture, diaphragm stimulation or lead dislodgment), vs. epimyocardial leads needed no reoperation. There were no severe intraoperative complications in any group. 2 pts died due to ventricular fibrillation and one for non cardiac reason.

CONCLUSION: Epicardial leads revealed excellent long-term results. Therefore epicardial implantation is a safe and reliable technique and should be offered to patients.

Abstract 118. CONCOMITANT MICROWAVE ABLATION—A SUPERIOR CONCEPT FOR CURATIVE TREATMENT OF PERMANENT ATRIAL FIBRILLATION IN COMPARISON TO CARDIOSURGICAL PROCEDURES ALONE

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INTRODUCTION: Microwave ablation (MW) is a safe and efficient procedure for the treatment of permanent atrial fibrillation (pAF). Restoring of sinus rhythm (SR) is of major importance due to the co-morbidity and co-mortality associated with pAF.

METHODS: Two patient groups with mitral valve disease (MVD), coronary artery disease (CAD) and aortic valve disease (AVD) were compared retrospectively. Group A includes 62 patients (pts) (age 72 ± 9 years, ejection fraction 25-74%, left atrial diameter 53 ± 9 mm, MVD in 34 pts, CAD in 53 pts, AVD in 40 pts, pAF for 6.9 ± 5.5 years) and group B 88 pts (age 67 ± 4 years, ejection fraction 26-76%, left atrial diameter 52 ± 6 mm, MVD in 82 pts, CAD in 60 pts, AVD in 18 pts, pAF for 6.4 ± 4 years). In group B concomitant MW was performed.

RESULTS: Survival rate was 94.2% (group A) vs. 98% (group B). In the 1-year follow-up in group A 7% of pts with MVD, 9% with CAD, and 5% of pts with AVD were in SR. In group B 62% of pts with MVD, 72% with CAD, and 83% of pts with AVD were in SR.

CONCLUSIONS: MW is efficient and safe in pts with pAF and concomitant cardio-surgical procedures, independently from the nature of cardiac disease in comparison to isolated cardio-surgical procedures. We have extended this approach to most pts with pAF and cardio-surgical disease.

Poster Presentations

Abstract 22. A NOVEL APPROACH TO ACHIEVE BEATING HEART MAZE PROCEDURE

Gianluca Bonanomi, David Schwartzman, Marco Zenati

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AIM: To investigate the feasibility of a novel approach to achieve a lesion pattern similar to the left atrium component of the Maze III procedure in the beating heart using a bipolar clamping device and a purse string technique.

METHODS: Five healthy adult pigs (35-45 kg) underwent beating heart left atrium ablation through a median sternotomy. Ablation lesions were performed using radiofrequency energy delivered via a bipolar clamping hand piece. The design of the device enabled the complete encirclement of left and right pulmonary veins. The interconnecting lesions between the pulmonary veins and towards the mitral valve annulus were performed by introducing one jaw of the device into the heart through small purse strings. Appendectomy was performed utilizing a commercial stapling device.

RESULTS: A lesion pattern similar to the left atrium component of the Maze III procedure was deployed. The purse string technique could be performed safely and enabled the completion of the interconnecting lesions. All lesions produced conduction block. Pathological analysis revealed uniform, transmural lesions with no evidence of charring or barotrauma.

CONCLUSIONS: The use of a bipolar clamping device associated with the purse string technique enables a safe and effective left atrium Maze-like ablation on the beating heart.

Abstract 119. DISTRACTION ANGIOGENESIS

Jack C. Griffis

AIM: Distraction angiogenesis was evaluated as a potential means for generating an autologous arterial vascular graft. A distraction device was designed and implanted in swine. The gastroepiploic artery was distended successfully at rates averaging approximately 10mm/day with minimal effects on the normal histology of the artery.

METHODS: A mechanical means of producing axial arterial distraction was developed and evaluated in-vivo. Juvenile swine were utilized for the study. Seven pigs were entered in the study. The gastroepiploic artery of each animal was utilized to assess the effects of mechanical stimuli, and the gastroepiploic artery segments proximal and distal to the implant were designated as the control. Upon completion of device actuation, the mechanism was removed and designated artery segments evaluated using gross visual histological examination.

RESULTS: Axial arterial length change occurred without significant adverse histomorphometric changes. Significant changes in arterial length did not result in elastic recoil upon removal from the mechanism and examination. Patency was maintained in vessels that incurred up to 7.8mm/day distraction, or 42% per day increased length. Results are summarized based upon two distinct distraction subgroups (Standard and Hyper). Mean graft length changes for the total artery segment were 8.25mm (33%) and 11.27mm (45%) per day, respectively.

Abstract 120. HEART VALVE REPAIR

Jeffrey H. Shuhaiber

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Heart valve repair is biomaterial dependent. Autogenous tissue for valvular reconstruction is limited to pericardium and fascia lata. More clinical studies

recommend valve repair to replacement. I forward a potential hypothesis for valve repair using the plantaris tendon extrapolated from hand surgery. This provides a new foundation to increase the autogenous donor tissue for valve repair and enhance the surgeon's armamentarium. The poster will address a novel and unique approach in harvesting, on table reconstruction of the atrioventricular annulus, chordae and papillary muscle complex. The poster will exhibit these techniques diagrammatically. The intention is to improve the art and science of surgery for future clinical development.

Abstract 121. QUALITY OF LIFE AFTER MIDCAB AND OPCAB PROCEDURES

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Heart Institute Ludwigshafen, Ludwigshafen, Germany

BACKGROUND: The beneficial aspects of minimal invasive procedures are still in discussion. To evaluate the quality of life, we performed a follow up questionnaire after MIDCAB and OPCAB operations.

METHODS: From 01/06/2000 to 31/05/2002, in 125 patients (mean age 61.9 ± 10.4 years; 75.1% male) a follow up, using a standardized catalogue of questions concerning quality of life and operation related complication. Majority of patients referred to OPCAB (59.5%), MIDCAB without ECC (25.5%) and with ECC (15%). The Barthel mobility index and geriatric depression scale were used in order to evaluate physical ability and mood disturbances.

RESULTS: The in-hospital mortality reached 0.6%. 6.1% patients died between hospital discharge and follow-up. Rehospitalisation due to various clinical diagnoses was necessary in 12.8%. Without any group differences, patients had a normal geriatric depression scale in 98.1% and a regular Barthel index in 97.2. Wound healing disturbances were higher in the MIDCAB group.

CONCLUSION: Compare to follow up examinations in patients with full sternotomy and ECC, your results show a better outcome in the postoperative course. However, the patient selection for an OPCAB or MIDCAB procedure is still different in our institution.

Abstract 122. BEATING-HEART VALVE SURGERY IN PATIENTS WITH RENAL FAILURE REQUIRING HEMODIALYSIS

Saqib Masroor, MD, Pierluca Lombardi, MD, Hassan Tehrani, MD, Kushagra Katariya, MD, Tomas Salerno, MD

BACKGROUND: We evaluated the safety and efficacy of beating-heart valve surgery as a myocardial protection strategy in patients with renal failure requiring hemodialysis.

METHODS: This is a retrospective review of 8 patients with renal failure requiring hemodialysis, who underwent beating-heart valve surgery at our institution between April 2000 and December 2001.

RESULTS: There were 4 males in the group. Mean age was 45.8 (13.8) years, with a mean duration of hemodialysis of 49 (48) months. The procedures included MVR (4), AVR (1), AVR/MVR (1), AVR/CABG (1) and mitral and tricuspid valve repair (1). The etiology was infectious endocarditis in 4 and degenerative disease in the rest. Mean cardiopulmonary bypass time was 78.6 (8.17) minutes. One patient was extubated in the operating room while the rest were extubated 4-24 hours postoperatively. Two patients died in the entire group. One of these patients was septic for two weeks requiring inotropes preoperatively, who died on the 79th postoperative day from uncontrolled yeast and bacterial sepsis and multi-organ failure. The other patient died from a large hemorrhagic stroke during anticoagulation on the

5th postoperative day. Average length of hospital ICU stay was 15.3 (32.5) days and hospital stay was 18.8 (28.8) days. Excluding the septic patient who was moribund preoperatively as mentioned above, the average length of ICU stay was 2.8 (2) days and hospital stay was 8.4 (2.9) days. Other complications included re-intubation for <24 hours (1), AV graft thrombosis (1) and stroke (1, same patient mentioned above). There were no new cardiac (including arrhythmia and low cardiac output syndrome) or metabolic complications (including hyperkalemia, fluid overload).

CONCLUSIONS: Beating-heart valve surgery can be performed safely in patients with renal failure requiring hemodialysis. Although this is a small study, the results suggest a low incidence of complications and short ICU and hospital stay.

Abstract 123. NORMOTHERMIA AFFECTS IMMUNE RESPONSE REGULATION AND ATTENUATES MYOCARDIAL DAMAGE DURING OFF-PUMP CORONARY ARTERY BYPASS (OPCAB) SURGERY

Nahum Neshet,* Steven Insler,** Ina Froilkis,* Gil Bolotin,* Josef Paz,* Amir Kramer,* Dimitry Pevni,* Menahem Matza,* Oren Lev-Ran,* Ram Sharony,* Gideon Uretzky*

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BACKGROUND: Perioperative hypothermia is associated with impaired immune function. We assessed the effects of maintaining normothermia on immune function and on myocardial performance during OPCAB surgery in two medical centers.

METHODS: Eighty patients undergoing OPCAB surgery were randomized into two groups and warmed perioperatively with Allon thermoregulation (AT, n = 40) or with other routine thermal care (RTC, n = 40). AT used patients' urinary bladder (core) temperature values to maintain water temperature in a circulating garment at 37°C. Patient temperature, hemodynamics, cardiac Troponin I (cTnI) and interleukin (IL)-6, -8 and -10 levels were uninterruptedly assessed perioperatively.

RESULTS: Cardiac index (CI; L/min) tested at 5 time points was higher in AT patients compared to RTC patients (P<0.05). Systemic vascular resistance (SVR, [dyne*sec]/cm⁵) was lower in AT patients during the entire perioperative period (P<0.05). IL levels were higher than baseline levels in both groups at the end of surgery: from 1-10 pg/ml at baseline and up to 25: 88 pg/ml at the end of surgery (P<0.001). IL levels were higher in the RTC group (P<0.005). Cardiac troponin I (cTnI) levels were elevated during the entire perioperative period, suggesting some degree of myocardial damage, but was lower in AT group. cTnI levels correlated with IL-6, IL-8 and IL-10 values.

CONCLUSIONS: OPCAB surgery was associated with clear alternation of the immune regulation as expressed by different elevations of the investigated cytokines. The clear and significant correlation between IL-6 and cTnI suggests a direct damaging effect of IL-6 on the myocardium. Maintenance of normothermia throughout the entire perioperative period showed reduced levels of IL-6 and IL-10, suggesting enhanced immune response to stress.

Abstract 125. BIOMECHANICAL COMPARISON OF TWO STERNAL CLOSURE METHODS

David H. Song, MD

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BACKGROUND: Previous stress tests performed on a cadaver sternal model have shown significant separation (2mm or greater) with circlage closure under normal physiologic forces. A validated foam model (density 20 lbs./ft³) is used to compare circlage wire closure to titanium plate closure.

METHODS: Ten sternal models were closed with 2 different techniques: half with 6 circlage wires and half with 6 titanium 2.4mm plates and screws. Models were mounted on a traction device delivering lateral pull forces at increments of 20 N up to 400 N (90 lbs). Separation was measured in mm.

RESULTS: Significant differences between the two closure techniques were noted upon comparison at the mid-sternum at 40 N and greater and the xyphoid at 80 N and greater (p<0.05 T-test). Significant separation of 2mm or greater was seen in all models closed with wire, no significant separation was seen in any models closed with plates.

CONCLUSIONS: Normal physiologic forces can disrupt sternal closure performed with wire. This disruption is believed by many to be an

antecedent event to sternal breakdown and post-operative mediastinitis. Sternal closure using titanium plates and screws is shown to be significantly superior to wire closure in this validated polyurethane foam model

Abstract 126. THREE YEARS OF OPCAB PROGRAM: WHAT WE LEARN AFTER MORE THEN EIGHT HUNDRED CASES

Milani R., Bofman P., Varela A., Giffhorn H., Guimarães M., Souza J. A., Pantarolli R., Maia F., Zytyski L.A., Silveira A.

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OBJECTIVES: This retrospective study was designed to analyze our experience with more than eight hundred cases of OPCAB myocardial revascularization, the difficult and pitfalls.

METHODS: From June 1999 to October 2002, 882 patients were submitted to OPCAB myocardial revascularization, corresponding to more than 80% (81.9%) of our total coronary surgery. Since we started an OPCAB program on 1999 we had an increase in our coronary surgery without extracorporeal circulation. On 1999 we did 103 cases, corresponding to 50.2% of our coronary surgery. On 2000, we did 139 cases corresponding to 67.1%. On 2001, 291 cases were done, corresponding to 92.9%, and on 2002, we have done 99.1% of our coronary surgery off-pump. The great majority of the patients were male, 595 patients (67.5%), with a mean age of 67.7 years. The patients were operated off-pump, with 2mg/kg of heparin and the operations techniques consisted of proximal coronary artery snared, LIMA'S suture and coronary stabilization. Sometimes we used intracoronary shunt, especially for right coronary artery. The distal anastomosis was done first as routine. After finished all the anastomosis the heparin was reverted in 75% of the initial dose.

RESULTS: The total number of distal anastomosis were 2629, with 2.98 grafts per patient. Eighty four percent of the patients received LIMA and forty four percent received only arterial grafts. The average time for intensive care unit stay was 25.3 hours and for hospital stay was 5.2 days. Regarding complications, 2.64% of the patients presented acute myocardial infarction. Mediastinitis, acute renal insufficiency, stroke, reintervention for bleeding and on-pump crossover showed rates lower than 1%. The global mortality were 3.62%, with 689 elective patients presented 2.03% of mortality, 93 reoperations patients presented 6.45% of mortality and 56 emergency patients, with cardiogenic shock, presented a mortality rate of 21.4%. The majority of the deaths were caused by acute myocardial infarction, followed by metabolic disorders, stroke, bleeding and mediastinitis respectively.

CONCLUSION: At the present moment, we are doing OPCAB in more than 99% of the patients submitted to myocardial revascularization. After this series, we conclude that all patients needing myocardial revascularization can receive OPCAB surgery, even patients in whom you have to do five or six anastomosis, patients with a poor left ventricle function and patients with important other disease than cardiac. OPCAB can reach benefits for low and high risk patients. In conclusion, OPCAB is a safety procedure, with low risk of complications and great benefits, specially for high risk patients. The three major objectives of this technique are: good heart stabilization leading to a good exposure of the target vessel and finally a perfect anastomosis. This is possible.

Abstract 127. PROBLEMS IN AN OBJECTIVE EVALUATION OF THE GRAFT PATENCY AFTER MIDCAB AND OPCAB SURGERY

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OBJECTIVE: We wanted to evaluate the graft patency in all patients that have undergone MIDCAB (29 patients) and OPCAB (60 patients) surgery in our department.

METHODS: All surviving patients (n = 87) were invited for a follow-up examination. An angiographic control was recommended.

RESULTS: 19 patients had already received an angiographic control due to clinical problems. Out of the remaining 68 patients 27 angiographic controls could be performed. 18 patients did not show up for follow-up examination, 20 patients did not agree to the angiography. In three cases the primary

physician opposed the suggested control. In total angiographic controls were performed in 46/89 patients (52%) and 53 anastomoses revealing a graft patency rate of 89% (Table). In those 27 patients without symptoms we found a patency rate of 97%. In the group of 19 patients with symptoms the graft patency was 78%. This group showed a significantly higher proportion of stenoses or occlusion. Table shows angiographic results from 46 patients divided into patients with and without symptoms.

	total	without symptoms	with symptoms	
No. of patients	46	27	19	
months after CABG (mean)	17.7	21.7	12.2	
patients without occlusion	40 (87%)	26 (96%)	14 (74%)	not significant
patients without stenosis	35 (76%)	24 (89%)	11 (58%)	p < 0.05
No. of anastomoses	53	30	23	
anastomoses not occluded	47 (89%)	29 (97%)	18 (78%)	not significant
anastomoses without stenosis	42 (79%)	27 (90%)	15 (65%)	p < 0.05
stenosis 51-75%	3 (6%)	2 (7%)	1 (4%)	
stenosis >75%	2 (4%)	0 (0%)	2 (9%)	

CONCLUSIONS: Not all patients and primary physicians could be convinced of the necessity of the angiographic control when no clinical complaints were present. Those patients with symptoms had angiographies in 100%. Therefore we have a negative bias in our results. The difficulty to gain unbiased and complete data remains.

Abstract 128. THE USE OF HETEROTOPIC HEART TRANSPLANTATION IN EXPERIMENTAL SURGERY

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INTRODUCTION: The use of heterotopic heart transplantation (HHT) in experimental surgery is an extended method to evaluate cardiac graft viability. To study endothelial injury after ischemia-reperfusion, the technique described by Matsui et al for HHT was chosen. With the purpose of using this technique in small pigs, a modification, which consists of replacing the atrium-to-atrium anastomosis for the tip of a venous cannula 30F, was developed. Both techniques were compared.

METHODS: Twenty-seven consecutive HHT in 15-20 kg pigs using Matsui's original technique and the modified technique were performed. Ischemia time, bleeding volume, mean gradient and anastomosis complications were measured to compare both techniques.

RESULTS: Statistical significant decreases in ischemia time, bleeding volume and mean gradient with the modified technique were found. Furthermore, there were two cases of suture dehiscence with the original technique.

CONCLUSIONS: The replacement of the atrium-to-atrium anastomosis for the venous cannula is a modification that statically decreases the ischemia time, blood loss and avoids suture complications. This modification makes Matsui's technique easier, faster and safer in small pigs and it may be used in bigger animals and in any kind of non-permanent anastomosis.

Abstract 130. PERI-OPERATIVE ASSESSMENT OF LEFT VENTRICULAR FUNCTION BY PRESSURE-VOLUME LOOPS USING THE CONDUCTANCE CATHETER METHOD

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Peri-operative quantification of LV function by pressure-volume relations is advantageous, since load-independent indices are obtained. In 8 CABG patients we obtained pressure-volume loops using the conductance catheter. Measurements, at paced heart rate of 80 beats/minute, were obtained before and after CPB at steady state and during preload reduction by temporary occlusion of the inferior caval vein. Complete data were acquired within 15 minutes before cannulation and after decannulation. CO (5.2 ± 1.3 to 6.0 ± 1.4 L/min, p = NS) and EF (46 ± 17 to $48 \pm 19\%$, p = NS) did not change, however end-diastolic pressure increased significantly (8 ± 2 to 16 ± 7 , p < 0.05). Load-independent systolic indices remained constant (elastance: 1.31 ± 1.20 to 1.13 ± 0.59 mmHg/mL, p = NS). Diastolic function changed significantly as tau decreased from 64 ± 6 to 52 ± 5 ms (p < 0.05)

and chamber stiffness increased from 0.016 ± 0.014 to 0.038 ± 0.016 1/ml (p < 0.05). All patients remained hemodynamically stable and no complications occurred.

CONCLUSION: The conductance catheter provides accurate data on peri-operative LV function and is an important tool to evaluate the effects of new surgical and anesthetic procedures.

Abstract 132. EXPERIENCE WITH AN ALBUMIN-GLUTARALDEHYDE TISSUE ADHESIVE IN SEALING AIR LEAKS AFTER BULLECTOMY

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OBJECTIVE: To evaluate the efficacy of an albumin-glutaraldehyde tissue adhesive (BioGlue®, CryoLife Inc., Kennesaw, GA) in preventing air leaks after bullectomy. Between January 1999 and June 2002 BioGlue® was applied in 21 consecutive patients, who underwent resection of bullae for persistent or recurrent pneumothorax. A control group of 19 patients matched for age and sex was used to compare results.

RESULTS: In the treatment group duration of air leak ranged from 0 to 2 days, with a mean of 0.42 days. Chest-tube drainage ranged from 2 to 4 days, with a mean of 2.33 days. In the control group duration of air leak ranged from 2 to 11 days, with a mean of 3.68 days. The chest tube drainage ranged from 3 to 12 days, with a mean of 5.42 days. There was no mortality and morbidity was less in the treatment group.

CONCLUSIONS: The use of BioGlue® as a surgical lung sealant decreased significantly postoperative air leak (p < 0.001) and time to chest tube removal (p < 0.05).

Abstract 133. 54-YEARS-OLD PATIENT PASSED AN OPEN MITRAL VALVE REPLACEMENT

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54-years-old patient passed an open mitral valve replacement. Left pleural effusion appeared a month after the surgery, it was drained, whereas lymphothorax was diagnosed. MCT diet was used, and the lymphatic drainage has alleviated. A month later breathlessness occurred, the patient was admitted for evaluation, and a large amount of pericardial effusion was found. In general anesthesia, VATS pericardial window was performed. Thick milky fluid was gained, and lymphopericardium was verified by biochemical examination of the fluid. Again, MCT diet was initialized, and the lymphatic discharge has ceased. The video tape shows the VATS performance of the pericardial window. As through the scope a small incision made on the pericardium, the milky discharge fountain-like breaks out from the pressurized pericardial cavity.

Abstract 134. 47-YEARS-OLD PATIENT PREVIOUSLY PASSED A MITRAL VALVE REPLACEMENT SURGERY

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47-years-old patient previously passed a mitral valve replacement surgery, he remained with a moderately reduced left ventricular function. He was seeking medical attention 2 months after the surgical operation due to breathlessness, in the chest X-ray and CT scans a moderate amount right pleural fluid was found. He was admitted to the chest surgery department for chest drainage, and a 32 Fr. tube was inserted into his right chest cavity, 2800 cc bloody stained exudate was drained, but the patient immediately started to expectorate very large amount of serous airway discharge consistent with pulmonary edema. In the X-ray no more pleural fluid was seen, but the entire right lung was opacified, whereas, the left was clean. Post-expansion pulmonary edema was diagnosed. Urgent intubation and mechanical ventilation was required. Forced diuresis was employed in the ICU, and during the next two days the right lung cleared up fully, and the patient was extubated. The case is an excellent example of post-expansion pulmonary edema, which can be expected, if rapid fluid evacuation is done from chest cavity. Fluid evacuation through a chest drain should be gradual.

Abstract 135. LEFT VENTRICULAR PSEUDOANEURYSM SECONDARY TO LEFT VENTRICULAR APICAL VENTING

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A 79-year-old man suffered cardiac tamponade secondary to ruptured chronic type A aortic dissecting aneurysm 3 week ago, and he received patch repair of the chronic dissecting aneurysm under deep hypothermic circulatory arrest and left ventricular apical venting through a site more anterior to the true anatomic left ventricular apex. The venting site was repaired by means of 3-O polypropylene sutures with Teflon felt pledgets after pump-off. Ecchymosis of the epicardium around the apex was found, but hemostasis was achieved easily following manual compression. The postoperative course was uneventful, and he was discharged 7 days later. He received the computed tomographic (CT) scan of the chest to evaluate the post-repair ascending aorta during the outpatient visit, and the CT scan revealed a 3 × 4 cm pseudoaneurysm over the apex of left ventricle. The reoperation was performed through a repeat sternotomy by means of femoro-femoral bypass. A 3 × 4 cm pseudoaneurysm was found around the apex, and the pseudoaneurysm was entered under ventricular fibrillation due to the huge thrombotic ascending aortic aneurysm precluding cross-clamp. The perforation of the left ventricle communicating with the pseudoaneurysm was about 7 mm in diameter, which was coinciding to the 18 Fr. left ventricular venting catheter. The perforation was repaired with 3-O pledgeted polypropylene suture, and the pseudoaneurysm was closed with linear repair. The patient was recovery well, and discharged 7 days postoperatively.

Abstract 136. CORONARY PSEUDOANEURYSM AFTER FREESTYLE AORTIC ROOT REPLACEMENT

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A 65-year-old man had underwent total root replacement using a Freestyle stentless aortic root bioprosthesis (Medtronic, Minneapolis, MN, USA) with a Dacron tube graft extension for the type A aortic dissection associating aortic root aneurysm and severe aortic insufficiency 6 weeks ago. The postoperative course was uneventful, and he was scheduled for resection of the cholangiocarcinoma. On examination, the patient was mildly febrile (37.8°C) and hemodynamically stable. Hemogram showed decreased hemoglobin 9.6g/dL, and other blood chemistry results were within normal limits. The roentgenogram of the chest showed widening of the mediastinum. The computed tomographic scan revealed abnormal contrast material between the neo-aorta and the left coronary artery, and some blood clots around the neo-aorta. Upon reoperation, a 2 × 1 cm pseudoaneurysm was found between the Freestyle bioprosthesis and the left coronary button, and the disruption of the suture line was, about 4 mm in length, located at the upper part of the coronary anastomosis. The aortic wall was grossly free of infection, and the perforation was repaired with continuous 7-O polypropylene suture. The postoperative course was complicated with *Escherichia coli* sepsis secondary to obstructive cholangitis, and the patient died 2 weeks later.

Abstract 137. TOWARDS TOTALLY GLUE CORONARY BYPASS

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OBJECTIVE: The glue technique for CABG could be of interest especially for endoscopic and robotic surgery.

MATERIAL AND METHODS: We studied 78 different versions of end-to-side free arterial grafting to in situ coronary arteries made in vitro (cat hearts) with cyanacrilic glue. The connections simulated IMA or A.radialis CABG.

Mean diameters of the vessels used:

grafts 1.84 mm (the least 1.2 mm)

coronaries 2.03 mm (the least 1.3 mm)

The major demands for the techniques were:

intima-to-intima adaptation

prevention of the glue penetration

The technique searching is continuing and the progress could be illustrated: in the whole group successful anastomosis was created in 88.4%, failed in 11.6%; in the last 21 experiments corresponding figures are 95.2% and 4.8%.

CONCLUSIONS: Despite the technique is still to be improved and tested in vivo it is clear that construction of totally glue vascular (IMA, A.radialis) anastomosis with the coronary arteries of less than 2 mm in diameter is feasible. Comparative study for the best suitable modern glue is to be done.

Abstract 138. A NOVEL WAY TO PROTECT HEARTS FROM RE-PERFUSION INJURY

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PURPOSE: The aim of this study was to assess the efficacy of green tea polyphenol against cardioplegic re-perfusion injury.

METHODS: Sixteen rats were divided into two groups. Group A had 0.001M/l green tea polyphenol in oral uptake for 2 weeks (35ml/day in average). Group B had no medication. Isolated hearts were perfused with a Langendorff's apparatus. After equilibration, the hearts were arrested by St. Thomas solution. After 90 minutes' arrest with intermittent infusion of the cardioplegia every 30 minutes, the hearts were reperfused. Left ventricular (LV) function was measured just before arrest and after reperfusion. Then the hearts were evaluated with the immunohistochemical studies by 8-hydroxy-2'-deoxyguanosine (8-OHdG) as oxidative stress marker. For Group A, distribution of polyphenol was examined with FITC.

RESULTS: After reperfusion, in Group A the LV size became smaller. The heart weight ratio was lighter. The LV end systolic pressure volume relationship was higher. And also, the 8-OHdG index was lower in Group A. Labeled polyphenol was located in the cell membrane of cardiomyocyte.

CONCLUSIONS: Green tea polyphenol given orally before the surgery protected hearts effectively. This simple and safe method may be applied to various treatments which require transient ischemia of the heart (e.g., off-pump CABG).

Abstract 139. HEART TRANSPLANTATION IN A PATIENT WITH ISOLATED COMPACTION OF THE VENTRICULAR MYOCARDIUM

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We describe an 18 year old patient with isolated non-compaction syndrome of the left ventricle, who presented to our institution with worsening congestive heart failure and was successfully treated with heart transplantation. The patient received an orthotopic heart transplant 5 months after symptom onset. Postoperative recovery after heart transplantation was uneventful. Only 6 cases of patients with non-compaction of the ventricular myocardium treated with heart transplantation have been described so far. Isolated non-compaction of the left ventricle is a rare entity that affect both sexes, age of presentation may vary and the clinical course is complicated by a worsening heart failure, serious arrhythmias and cardioembolic phenomena. Prompt recognition and diagnosis with echocardiogram and optimization of medical treatment is warranted. Unrelented cases are treated with cardiac transplantation. Prognosis of these patients is poor and main causes of death include arrhythmias, cardioembolic events and cardiac failure.

Abstract 140. HEMORRHAGE-RELATED REEXPLORATION AFTER CONVENTIONAL VERSUS MINIMALLY INVASIVE CORONARY ARTERY BYPASS

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BACKGROUND: Early results of coronary artery bypass without cardiopulmonary bypass (off-pump CABG) have demonstrated comparable outcomes over the conventional On-pump approach. It is unknown however, whether off-pump CABG may yield similar improvements in the hemorrhage-related reexploration rates.

METHODS: Between January 1998 and June 2002, 5,208 patients had Off-pump CABG and compared with a contemporaneous control group of 3,653 who underwent On-pump CABG, at the Washington Hospital Center. The patients undergoing Off-pump CABG were matched to on-pump patients by propensity score. A logistic regression model was used to test the difference in the postoperative hemorrhage-related reexploration rates and need for postoperative blood transfusions between groups, controlling for preoperative risk factors.

RESULTS: Patients undergoing Off-pump CABG had a lower trend of hemorrhage-related reexploration (Odds-Ratio [OR] = 0.69, 95% Confidence Intervals [CI] = 0.46-1.04, $p = 0.08$) and decreased need for postoperative blood transfusions (OR = 0.56, CI = 0.5-0.63, $p < 0.01$) compared to On-pump CABG patients.

CONCLUSION: Off-pump CABG avoids the risks of cardiopulmonary bypass and the systemic inflammatory response it elicits. A substantially lower need for postoperative blood transfusions and a trend towards a lower hemorrhage-related re-exploration rate suggests that Off-pump CABG is a safe revascularization option.

Abstract 141. OUTCOME OF PATCH ANGIOPLASTY FOR ISOLATED LEFT CORONARY OSTIAL STENOSIS

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BACKGROUND: Patch angioplasty for coronary ostial stenosis is assumed to be an alternative approach to coronary artery bypass grafting (CABG). The clinical features of isolated coronary ostial stenosis, postoperative complications and follow-up angiographic results have not been well studied.

METHODS: We retrospectively studied 29 patients (male: female = 6: 23, age = 33-79 year (mean = 50.0 year) who underwent surgical angioplasty for isolated left coronary ostial stenosis using patch (26 fresh autopericardium, 2 saphenous vein, and 1 bovine pericardium) during the period of March 1990 and October 2002. Repeat coronary angiography (17 patients) and echocardiography (29 patients) were performed. Aortic regurgitation (AR) was evaluated semiquantitatively (Grade I-Grade IV).

RESULTS: There were 2 deaths after surgical angioplasty. One death was due to acute coronary artery dissection perioperatively, and the second was due to traumatic pancreatitis at postoperative 10 months. Follow-up was completed in all patients (1-134 months, mean = 53 months). Angina occurred in 5 patients and the remaining 24 patients were symptom-free. Repeat coronary angiography in 5 symptomatic patients showed that 3 patients had 1 distal patch stenosis, 1 ostial stenosis in Takayasu's arteritis, 1 left main stenosis and 2 patients had widely patent ostium with excellent run-off. First distal patch stenosed patient was received percutaneous coronary angioplasty. Second symptomatic Takayasu's arteritis patient was managed with steroid. Third left main stenosis patient received off-pump CABG at postoperative 6 months. Fourth symptomatic patient was proven to have coronary spasm by ergonovine test, and AR increased in the fifth symptomatic patient (Grade II-III) with patent ostium.

CONCLUSION: Surgical angioplasty may be feasible and alternative operative method to CABG for isolated left coronary ostial stenosis. It should, however, be noted that postoperative AR develop and/or increase. Further investigation is need to evaluate the clinical significance of AR.

Abstract 142. CABROL TECHNIQUE APPLICATION IN CORONARY ARTERY BYPASS GRAFTING USING RADIAL ARTERY

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INTRODUCTION: In coronary artery bypass grafting (CABG), multiple proximal anastomosis may increase the risk of cerebral embolism (air, debris) and aortic injury (dissection, pseudoaneurysm). Radial artery (RA) was no intraluminal valve such as saphenous vein (SV). Cabrol technique using RA graft can reduce the number of proximal anastomosis in CABG. We report

Cabrol technique for proximal anastomosis in CABG with RA graft.

Technique:

1. Left coronary artery -distal anastomosis with RA graft.
2. Cabrol type proximal anastomosis with RA graft (side to side).
3. Removal of air and debris through proximal end of RA graft and clamping.
4. Right coronary artery - distal anastomosis with SV graft
5. RA graft to SV graft anastomosis (end to end).

Advantages:

1. Effective use of graft length.
2. Effective removal of air and debris through proximal end of RA graft (reduce cerebral embolism)
3. Reduce number of ascending aorta manipulation.

Abstract 143. COSMETIC INCISION FOR SIMPLE CONGENITAL HEART DEFECTS IN FEMALE PATIENTS

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Among the cosmetic approaches for correction of simple congenital cardiac, the most popular one is small vertical skin incision and a partial lower sternotomy. Our concern is that the vertical skin incision for female, even the small one, is still visible while wearing the bra. We used the limited transverse incision, Mt. Fuji-like incision, with lower sternotomy for juvenile and adult female patients. Cases: Two female patients, one with atrial septal defect (ASD) and one with ventricular septal defect (VSD), underwent the operation through this incision. Small transverse horizontal line was made at the height of bra on the sternum. Then the both end of line was directed caudal gradually about 4 cm each, making a small mountain-like shape. Partial lower sternotomy was made to approach the heart. Operative scar was visible only 4 cm at the mid portion on the sternum and even that portion can be covered by the bra. Other portion of incision line was covered by the breast when it was well developed, being cosmetically appealing.

Abstract 144. A SELF RETAINING ATRIAL SPREADER FOR MINIMALLY INVASIVE AND ROBOTICALLY-ASSISTED INTRACARDIAC OPERATIONS

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OBJECTIVE: To develop a low-profile self retaining atrial spreader to facilitate minimally invasive and robotically-assisted ASD closure.

METHODS: A device was created using two 10 mm broad strips of malleable stainless steel which were connected on both sides by simple hinges. Multiple pairs of broad blunt hooks were made on one edge of the device, as to allow better grip of the tissue. The device, which is completely collapsible, can be introduced into the thorax through a 12 mm standard port. In the non-compressed state the device opens to around 5 cm. Various lengths of the device from 11 cm to 4 cm were created. The device positioning was performed on an explanted pig heart and in a closed chest pig model.

RESULTS: The spreader was successfully introduced through 12 mm ports and could spread and self-retain the standard right atriotomy, giving good exposure of all intra-atrial landmarks. The atrial spreading was adequate and secure to allow free movement of minimally invasive instruments.

CONCLUSION: This device is a useful tool for spreading the right atriotomy, thus obviating the need for stay sutures which can be cumbersome to place in minimally invasive and robotically-assisted approaches. Its use simplifies and expedites procedures like ASD closure.

Abstract 145. COMPUTATIONAL CORONARY FLOW DYNAMICS

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STATEMENT OF PURPOSE: Modern paradigm of surgical planning involves use of computational tools to construct and evaluate combined

anatomic/physiologic models, thus improving the accuracy and the consistency of therapy. We simulated coronary flow using computational haemodynamic models.

MATERIALS & METHODS: The coronaries of explanted porcine hearts were perfused with 4% formaldehyde at physiological pressures. Omnipaque dye added to lead/rubber solution (Ratio 1:25), was used to cast the coronary arterial tree. CT sections of this model were used to reconstruct the 3-D coronary arterial geometry; which in turn was used to generate a volumetric tetrahedral mesh of approximately 600,000 elements. The unsteady equations of momentum and mass conservation were numerically solved.

RESULTS: The computational simulations yielded a wealth of quantitative information, including pressure and wall shear stress distributions, bifurcation mass flow rates and detailed velocity profiles. The variability of these quantities within the heart cycle was investigated at a temporal resolution of 1/100 second.

CONCLUSION: Such computational tools along with the possibility of having MDCT or MR based noninvasive coronary images could enable objective quantification of the effects of stenosis on the distal flow and pressure and thus aid in effective surgical/interventional planning. Additionally, it could also enhance our insight into coronary pathogenesis.

Abstract 146. MITRAL AND TRICUSPIDAL VALVES SURGERY THROUGH AN ANTERIOR MINI THORACOTOMY

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OBJECTIVE: This report outlines the procedures and technical aids used performing mini thoracotomy in a series of 87 patients.

METHODS: Right anterior mini thoracotomy incision (to 10 cm) is made, using the inframammary groove in female patients. The chest is entered in the 4 (63) or 3 (24) intercostals space. The pericardium is then opened longitudinally. The aorta (52) or the left femoral artery (35) is cannulated, followed by the vena cava separately (58) or the dextra atrium of one cannules (27). CPB with mild hypothermia (32 C) is instituted. Access to the mitral valve it is carried out through the right atrium and the atrioseptal a partition at 58 and through a wall of the left auricle at 27 patients.

RESULTS: Mean CPB and ACC time were 78, 5-9, 5 and 53, 5-8, 5 minutes respectively. By all patients undergoing MV replacement and 20 patients TV annuloplastics. Removal of a thromb in the left auricle 13 and radio-frequency isolation pulmonary veins 23 patient. Extubation was carried out within the fifth hour. All patients were written out home during 7-10 days without complications.

CONCLUSIONS: We suggest that the technique of mitral and tricuspidal valve repair through the right anterior mini thoracotomy is a suitable alternative to that through a median sternotomy. The thoracotomy approach is safe and efficacious, and offers good exposure. The cosmetic result is superior to that of median sternotomy.

Abstract 147. SURGICAL TECHNIQUE FOR THE CORONARY ANEURYSM

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Two successful cases of the surgical treatment for the coronary aneurysm (non-Kawasaki disease) were reported. Our preferred technique is ligation of the coronary aneurysm and coronary arterial bypass grafting (CABG) to the distal portion of the aneurysm. The first case had a stenosis on the left anterior descending artery (LAD) and had an aneurysm on the left circumflex artery (Cx). Ligation of the Cx. aneurysm was done subsequent to the double vessel CABG (LITA-LAD and SVG-Cx.) under the cardioplegic cardiac arrest. The second case had aneurysms on both the LAD and the Cx. After CABG (LITA-LAD and SVG-Cx.) were performed, ligations were done under the on-pump beating heart. Postoperative course has been uneventful in both cases, now at 5 and 2 years after operation, respectively. With these experiences, we are now confident that this technique has an excel-

lent mid-term durability and may be done in the most of cases under off pump beating heart using currently available devices.

Abstract 148. DOES ROBOTIC TECHNOLOGY MAKE MINIMALLY INVASIVE CARDIAC SURGERY TOO EXPENSIVE? A HOSPITAL COST ANALYSIS OF ROBOTIC AND CONVENTIONAL TECHNIQUES

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OBJECTIVE: While potential benefits of robotically assisted cardiac surgery include decreased morbidity and improved recovery, some have suggested a prohibitively high cost. This study was undertaken to compare the actual hospital costs of open and robotically assisted cardiac procedures.

METHODS: Atrial septal defect (ASD) or mitral valve repair (MVR) were performed by sternotomy or minithoracotomy (OPEN, n = 68), or with robotic assistance (ROBO, n = 30) using the Da Vinci system (Intuitive Surgical, Mountain View, CA).

RESULTS: Intraoperative cost was higher for robotic ASD (p = 0.054) and robotic MVR (p = 0.025) as compared to open. However, there was no significant difference in total cost of robotic versus open procedures (Table).

	Total Cost	Operative Cost	Postoperative Cost
ASD OPEN	28625 +/- 15694	12444 +/- 5747	12367 +/- 8571
ASD ROBO	27400 +/- 10221	16264 +/- 5780	11358 +/- 6430
p	0.794	0.054	0.707
MVR OPEN	37351 +/- 22066	16611 +/- 5540	13019 +/- 6818
MVR ROBO	34800 +/- 12313	20549 +/- 4079	11539 +/- 10619
p	0.681	0.025	0.594

CONCLUSIONS: Beyond the initial capital investment associated with robotic technology, robotic surgery does not increase total hospital cost. While intraoperative costs are higher for robotic procedures, these are offset by a less costly postoperative course. This may be secondary to a trend toward decreased ICU and hospital stay for robotic patients. Thus, it is possible that the benefits of minimally invasive surgery may justify investment in this technology.

Abstract 149. SUTURELESS MITRAL VALVE REPAIR USING NITINOL CLIP TECHNOLOGY

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OBJECTIVE: Technical challenges continue to limit minimally-invasive mitral valve repair (MVP). We hypothesized that nitinol clip (NC) technology could facilitate various components of MVP.

METHODS: MVP was performed using self-closing NCs (Coalescent Surgical, Sunnyvale, CA) in isolated porcine hearts (n = 14), chronic sheep (n = 33) and calves (n = 10). NCs were compared to suture for anterior leaflet (AL) repairs in the isolated hearts at 250 mm Hg. AL repair (n = 10) or prosthetic annuloplasty (PA) (13 open, 10 robotic) was then performed in sheep to assess clip utilization and optimize clip design. Finally, MVP was performed in 10 calves (45-65 kg), using a stable clip design, including isolated PA (n = 2), bileaflet repair (n = 2) and combined posterior leaflet repair and PA (n = 6). Follow-up included serial echocardiography, radiographic and histologic analysis at 1 (n = 7), 3 (n = 7) and 6 (n = 6) months.

RESULTS: In bench testing, all clips and AL repairs remained intact. All repairs were intact and all PAs were securely attached at sacrifice. Gross and histologic evidence of leaflet healing and neointimal coverage of prosthetic material was confirmed in all animals. Echocardiography revealed no more than mild central regurgitation in any animal.

CONCLUSION: Sutureless MVP using nitinol clip technology can be performed expeditiously with good functional and histologic results. By eliminating knot-tying and suture management, this technology has the potential to facilitate MVP.

Abstract 150. INTEGRATED HYBRID CORONARY REVASCLARISATION: A COST AND RESOURCE OUTCOME ANALYSIS IN HIGH-RISK PATIENTS

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BACKGROUND: Integrated Hybrid Coronary Revascularisation (ICR) combines minimally invasive coronary bypass and angioplasty for patients with multivessel coronary artery disease. Encouraging clinical outcomes of the ICR approach have been reported, but little on the resource utilization (RU) outcome. Our goal was to evaluate the cost of ICR compared to conventional coronary artery surgery (CABG) in high-risk patients.

METHODS AND RESULTS: A retrospective cohort study design was used. Index hospital, one month, six month and twelve month post hospital follow up RU and costs between high risk patients undergoing ICR (N = 28) and a matched CABG control group (N = 41) were analyzed. RU included length of stay (LOS), readmission, outpatient visits and cost. Groups were comparable on demographic and clinical variables, but different regarding: age (69.6 vs 59.4 years; $p = .0001$), ejection fraction (44.4% vs 53.2%, $p = .002$), Parsonnet scores (14 vs 6.2; $p = .001$), preoperative cerebrovascular accidents (35.7% vs 7.3%; $p = .003$) and chronic obstructive pulmonary disease (46.4% vs 7.3%, $p = .0001$). LOS was shorter for ICR and no differences found in readmissions or costs throughout the first postoperative year. At one year aggregated costs of ICR and CABG were comparable (19934\$ vs. 21481\$, $p = 0.12$).

CONCLUSION: ICR, although a 2-stage procedure requiring costly coronary stents, is a cost-effective or at least not a more costly procedure than conventional CABG for high risk patients.

Abstract 151. VALIDATION OF THE BUTTERFLY TRANSIT TIME FLOW METER

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INTRODUCTION: The Transit Time Flow Meter (TTFM) probe uses ultrasound to measure the time difference between waves traveling against the normal flow and in the same direction of normal flow. Our objective was to validate the TTFM by comparing its results to postoperative angiograms.

METHODS: The TTFM was applied to all off-pump coronary grafts performed by a single surgeon. All patients had a coronary angiogram before discharge. The surgeon was blinded to TTFM results intra-operatively.

RESULTS: Forty-seven grafts were measured in 19 patients between 8/01 and 10/02. Six of 47 grafts (12.8%) were compromised according to the angiograms and all were identified by the TTFM. Four of six grafts had an anastomotic stenosis less than 50%. The TTFM showed patency in 35 grafts and the angiogram correlated for all 35. The TTFM contended that six grafts were compromised but the postoperative angiogram demonstrated patency. Overall, the sensitivity was 85% (35/41), specificity was 100% (6/6), positive predictive value was 100% (35/35) and the negative predictive value was 50% (6/12).

CONCLUSION: The Butterfly Transit Time Flow Meter is extremely sensitive for identifying compromised bypass grafts intra-operatively.

Abstract 152. CONGENITAL FISTULA BETWEEN LEFT INTERNAL MAMMARY ARTERY (LIMA) AND PULMONARY ARTERY: CAUSE OF LIMA BYPASS OCCLUSION?

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OBJECTIVES: Angiography of the internal mammary arteries (IMA) prior to coronary artery bypass grafting (CABG) in order to assess suitability of the vessel as graft is not a standard procedure during diagnostic heart catheterization.

MATERIAL AND METHODS: We report on a 49 years old patient with severe aortic valve regurgitation and coronary artery disease. PTCA and LAD stenting had been performed because of a significant proximal LAD lesion. Repeated coronary angiogram 3 months later revealed a patent stent, but severe sclerosis up to a 40% stenosis of the LAD prior to the area of stenting. The patient was operated with standard cardiopulmonary bypass (CPB). A mechanical aortic valve was implanted. Despite of the non significant stenosis the LAD was bypassed with a LIMA-graft for prophylactic reasons.

RESULTS: Operation and postoperative course was uneventful. However, two years after surgery a control angiogram revealed a LIMA-bypass occlusion and a large congenital fistula deriving from the proximal part of the left IMA to the pulmonary artery. Diminished flow in the IMA-bypass due to the fistula in combination with a non significant proximal LAD stenosis might be the reasons for IMA-bypass occlusion. The fistula was occluded by coils during an interventional cardiological procedure.

CONCLUSIONS: A fistula between IMA and pulmonary artery is a seldom congenital defect but may be one reason for IMA-bypass occlusion. Therefore, angiography of the IMA should be mandatory in all cases of arterial coronary revascularization using IMA bypasses in order to detect malformations preoperatively.

Abstract 153. LESS ADHESION FORMATION AFTER CARDIAC SURGERY BY CHYMASE INHIBITOR—A NEW STRATEGY TOWARD SAFER REOPERATIONS

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OBJECTIVE: Chymase is released from mast cells, which are associated with adhesion formation. Chymase activates transforming growth factor-beta1 (TGF-beta1), which promotes tissue fibrosis. We studied whether a chymase inhibitor prevents postoperative cardiac adhesions.

METHODS: In sixty-six hamsters the epicardium was abraded, and either chymase inhibitor (C-Group) or placebo (P-Group) was injected into the left thoracic cavity.

RESULTS: The cardiac chymase activity and TGF-beta1 level 3 days post-operatively were lower in C-Group than P-Group (45.8 +/- 18.7 vs. 79.7 +/- 13.7 microU/mg protein, $p < 0.025$, 15.6 +/- 6.5 vs. 33.2 +/- 9.8 microgram/ml, $p < 0.01$, respectively). The density of mast cells was higher in P-Group, and this value was suppressed for 60% in C-Group. The adhesion scores (macro- and micro-scopic, 2 weeks postoperatively) were lower in C-Group than P-Group (1.3 +/- 1.3 vs. 3.0 +/- 1.1, $p < 0.01$).

CONCLUSION: Chymase inhibitor may be useful to attenuate postoperative adhesions.

Abstract 154. THE BENEFITS OF SKELETONIZED BILATERAL INTRAL THORACIC ARTERY IN CORONARY ARTERY BYPASS GRAFTING

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BACKGROUND: The purpose of this study is to evaluate the advantages of skeletonized bilateral internal thoracic artery (ITA) over the pedicled bilateral ITA in coronary artery bypass grafting (CABG).

METHODS: One hundred and seven patients underwent CABG using bilateral ITA. In Group-I (n = 32), the ITAs were harvested with the skeletonization technique. In Group-II (n = 75), they were harvested with pedicle. On-pump CABG was performed in this study.

RESULTS: There were no events of operative death or wound infection. The average number of grafts and aortic cross-clamp time were similar in both groups. Total operation time was shorter in Group-I than in Group-II (295±51 minutes vs 326±51 minutes, $p < 0.01$). Postoperative first 12-hour blood accumulation from the chest tubes was less in Group-I than in Group-II (248±159ml vs 479±255ml, $p < 0.01$). The ratio of freedom from blood transfusion was lower in Group-I than in Group-II (53% vs 72%, $p < 0.01$).

CONCLUSION: The use of skeletonized bilateral ITAs was more beneficial and less invasive than that of pedicled bilateral ITAs in CABG.

Abstract 155. CAN LEFT VENTRICULAR ASSIST DEVICES BE SAFELY IMPLANTED WITHOUT CARDIOPULMONARY BYPASS SUPPORT?

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Given the encouraging results of the R.E.M.A.T.C.H. Trial, LVADs now hold the potential for great advances in treatment of end-stage HF. How-

ever, early mortality remains high, and improvement of implantation techniques and post-operative management are critical for LVADs to realize their true potential as life-saving devices. Until now, implantation of LVADs has required cardiopulmonary bypass (CPB), which may exacerbate multi-organ dysfunction and RV failure. Our goal was to determine (1) whether LVADs could be safely implanted without CPB support and (2) any potential benefit in intraoperative blood product usage. Eight patients (mean age, 57 years) received either a Thoratec or Heartmate LVAD with [OnPump, (n = 4)] or without [OffPump, (n = 4)] intraoperative CPB. All patients were inotrope-dependent in end-stage HF. There were no intraoperative deaths. Intraoperative blood product requirements for OffPump were significantly less ($p < 0.05$) than OnPump (1.7 ± 0.6 vs. 3.6 ± 0.7 units packed red cells). These preliminary results prove that implantation of LVADs without CPB support is safe. This refinement in implantation technique may further broaden the successful application of LVADs to older and sicker patients with HF. Furthermore, the decreased blood products usage may be advantageous to patients receiving a LVAD as a bridge to cardiac transplantation.

Abstract 156. HYBRID SURGICAL REVASCULARIZATION: "CABG" OF THE FUTURE

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The treatment of coronary artery disease is changing at an exponential pace. Increasingly, the surgeon is asked to perform standard coronary artery bypass grafting (CABG) only after all percutaneous interventions have been exhausted. Short of those patients with left main disease, few patients are referred for CABG who have not already had previous coronary percutaneous intervention (often multiple times). By then however, the native CAD has usually progressed to the point that complete revascularization is often technically impossible or exceedingly risky. Alternative surgical revascularization strategies must be developed for these increasingly challenging situations. Hybrid CABG must encompass more than just LIMA to LAD plus angioplasty. We believe transmyocardial laser revascularization (TMR) offers the surgeon such a technique. Our experience with TMR in 218 patients supports this approach. Holmium:YAG laser (CardioGenesis Corp., Foothill Ranch, CA) was used alone or in conjunction with standard CABG to obtain complete revascularization despite extensive native CAD. Careful patient and target vessel selection optimized outcomes with low operative mortality (2.2%: CABG+TMR off pump. Follow-up (0.1-3.2 years, mean 1.2 years) revealed sustained angina relief (82%—Class I) and excellent intermediate term survival. TMR allowed complete revascularization to be achieved at low risk with excellent results. In addition, we believe TMR will serve as a primer or scaffolding for future surgical techniques such as gene therapy, growth/angiogenesis factor application and cell transplantation.

Abstract 157. AVOIDING AIR EMBOLISM WITH CARDIO-PULMONARY BYPASS

David Jayakar MD, Jack Copeland DM

OBJECTIVE: Delayed air embolism is common after open heart surgery. Air embolism after open heart surgery are due to immediate causes (<20 mins from cross-clamp removal—due to retained intra-cardiac air) and delayed causes (>20 mins from cross-clamp removal—due to air entrapped in pulmonary veins). Delayed air embolism is of grave clinical consequence. Right ventricular dysfunction and neurological problems have been linked to delayed air embolism. We eliminated delayed air embolism by compressing the apex of both lungs while on cardio-pulmonary bypass during open cardiac surgeries.

METHODS: We open the chest using a midline sternotomy and for any open cardiac (non-CABG) procedure. We then proceed to open the pleura on both sides of the chest. Once we initiate bypass and the ventilation had stopped, we place two wet laparotomy pads on the superior and anterior aspect of both lungs to compress the parenchyma posteriorly. By collapsing the lung we squeeze the parenchyma so no air can get into the pulmonary venous system. We remove the sponges when the cross clamp is removed and do the standard de-airing procedure.

RESULTS: Using the sponge lung compression technique, 20 consecutive patients were studied. 19 patients did not have any significant delayed air

embolism. In comparison to data presented by Tingleff [1] 13 of 15 patients studied had significant air by TEE and the total duration of air embolism lasted as much as 28 minutes after terminating bypass.

CONCLUSIONS: The sponge compression technique has completely abolished the incidence of delayed air embolism. This would entail in improving right ventricular and cerebral function post-bypass.

Reference:

1. Tingleff J, Joyce FS, Pettersson G.: Intraoperative Echocardiographic Study of Air Embolism during cardiac operations. *Ann. Thorac. Surg* 1995;60: 673-77.

Abstract 158. CORONARY REVASCULARIZATION IN HIGH RISK PATIENTS—DRAMATIC IMPROVEMENT IN NEUROLOGICAL OUTCOMES USING OPCABG

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BACKGROUND: The benefits of off-pump coronary artery bypass (OPCAB) remain undefined. We sought to identify a patient population that might benefit from this technique.

METHODS: All 225 patients undergoing CABG (on and off pump) between 3/2000 and 3/2001 were reviewed. Analyzed risk factors included recent CVA, EF<30%, acute MI, COPD, active smoking, obesity, renal dysfunction, age >75 years, liver dysfunction and hemodynamic instability. One point was assigned per factor. Only patients with a score of 2 or higher were included in the study.

RESULTS: 85 OPCABG (risk score 3.4) and 83 pump CABG (3.3) were done during this time period. The numbers of grafts, incidence of perioperative MI and completeness of revascularization were similar in both groups. Length of hospital and ICU stay, use of inotropes and IABP, and time to extubation were better in the OPCABG group. We had one death (1.1% early mortality), and no major neurological events in the OPCABG group vs (4.8% early mortality, $p < 0.01$), and 4 (5%, $p < 0.05$) major neurological event in the pump CABG group. Four patients (4.7%) were converted to pump CABG due to hemodynamic instability.

CONCLUSIONS: Avoiding cardiopulmonary bypass significantly decreases neurological morbidity and mortality in this group of patients without affecting the quality of revascularization. Hence, OPCAB is the optimal method of surgical revascularization for high risk patients.

Abstract 159. OFF-PUMP EPICARDIAL ATRIAL FIBRILLATION SURGERY UTILIZING A NOVEL BIPOLAR RADIOFREQUENCY SYSTEM

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BACKGROUND: The current standard for surgical treatment of atrial fibrillation involves endocardial ablation with cardiopulmonary bypass and atriotomy. This study was undertaken to evaluate a novel radiofrequency (RF)-enabled clamp system designed to create transmural lesions on the beating heart epicardially using bipolar RF.

METHODS: A set of differently shaped clamps modified to deliver bipolar RF energy (Boston Scientific Corporation) were used to create a series of lesions in a beating heart canine model. The pulmonary veins and atrial appendages of six dogs were electrically isolated using bipolar RF energy. The right and left atrial appendages served as controls for the right and left pulmonary veins, respectively. Temperature controlled RF energy was delivered to maintain a tissue temperature of 80°C for 15 seconds. Electrical isolation was assessed acutely and after 4 weeks by a bipolar pacing protocol.

RESULTS: A total of 24 circumferential lesions were created. By pacing analysis, 100% of these lesions were electrically isolated acutely and 95% four weeks later. At four weeks, 92% of lesions were transmural by histologic analysis, and 96% demonstrated endocardial continuity.

CONCLUSION: Bipolar radiofrequency ablation utilizing a novel bipolar RF clamp device results in electrical isolation and histologic transmural injury in an off-pump epicardial model.

Abstract 160. BIPOLAR RF ABLATION WITH TRANSMURALITY FEEDBACK FOR THE SURGICAL MAZE PROCEDURE

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BACKGROUND: Radiofrequency ablation (RFA) has been used to replicate surgical scars of the Maze procedure. This study aimed to demonstrate an irrigated, bipolar RFA device could effectively create Maze scars using a transmural feedback program.

METHODS: A complete Maze-III lesion pattern was created ex vivo on eleven fresh porcine hearts with the Medtronic Cardioblate BP Surgical Ablation System. Adequate jaw-closure force was applied to ensure tissue/electrode contact. A proprietary feedback and control algorithm monitored tissue impedance in real-time for all lesions, and ablation was terminated when lesions were deemed transmural by the algorithm. After hearts were stained with 1% TTC, lesions were cross-sectioned at 5mm intervals and grossly examined for transmurality. **RESULTS:** A total of 137 lesions, 24.1 ± 8.4 mm in length, were created on porcine atrial tissue. Average tissue thickness was 3.0 ± 1.7 mm (range 0.5-9.9mm). Cross-sectional examination revealed that 100% of lesions were transmural (n = 718).

CONCLUSIONS: These results indicate the Medtronic Cardioblate BP Surgical Ablation System reliably replicated the full Maze-III lesion pattern ex vivo on intact porcine atria with a 95% confidence that at least 98% of lesions are transmural. Additional in vivo studies are underway to further demonstrate efficacy and safety of this system.

Abstract 161. TREATMENT OF INTERRUPTED AORTIC ARCH WITH EXTRAANATOMICAL BYPASS SIMULTANEOUS TO CORONARY ARTERY BYPASS GRAFTING AND AORTIC VALVE REPLACEMENT

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OBJECTIVE: We describe simultaneous treatment of an interrupted aortic arch, coronary artery bypass grafting (CABG), and aortic valve replacement (AVR) through median sternotomy.

MATERIAL AND METHODS: A 64 year old man (75 kg) showed pre-gradient stress dyspnea and angina due to severe aortic valve regurgitation and coronary artery 3-vessel disease. Beside upper body arterial hypertension the patient showed pulseless extremities and hypoplasia of the legs. Preoperative MRT demonstrated an interrupted aortic arch directly after the origin of the left subclavian artery, and a calcified bicuspid aortic valve with severe regurgitation. The patient was operated using standard cardiopulmonary bypass (CPB) with cannulation of the ascending aorta and the right atrium, hypothermia (24.6°C), and blood cardioplegic arrest. Four aortocoronary vein grafts and pericardial aortic valve replacement were performed. Finally the posterior pericardium was opened and a 16 mm vascular prosthesis was anastomosed to the descending aorta during side clamping. The prosthesis was guided to the ascending aorta laterally to the right atrium passing between inferior vena cava and right inferior lung vein in order to obtain optimal placement.

RESULTS: The operation was carried out without complications, and the postoperative course was uneventful. MRT showed a competent aortic valve prosthesis, unobstructed flow through the extraanatomical bypass, and highly decreased collateral flow via the internal mammary arteries. Postoperatively both inguinal pulses were present and the patient was free of angina.

CONCLUSIONS: In the presence of an interrupted aortic arch an extraanatomical bypass between ascending and descending aorta can be performed safely and easily in addition to CABG and AVR through median sternotomy.

Abstract 162. TOTAL ARTERIAL REVASCLARIZATION WITH AND WITHOUT CARDIOPULMONARY BYPASS

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AIM: To compare the early results of total arterial revascularization for multiple vessel disease performed with and without the use of CPB.

METHODS: Retrospective analysis of perioperative data of patients in who total arterial revascularization for multiple vessel coronary artery disease was performed with the use of CPB (92pts) and without CPB (55pts). Patient characteristics:

	OPCAB (n = 55)	(n = 92)	p
Age	57±9	56±8	NS
Sex	47males (85%)	76males (83%)	NS
Unstable angina	2 (3.6%)	5 (5.4%)	NS
Acute MI	3 (5.5%)	3 (3.3%)	NS
EF	55±11%	52±13%	NS
Diabetes	10 (18%)	16 (21%)	NS
Previous stroke	3 (5.5%)	1 (1.1%)	NS

RESULTS: Perioperative data are presented in the table:

	OPCAB (n = 55)	(n = 92)	P
No of grafts	2.4±0.7	2.9±0.9	P = 0.005
LITA	53 (96.4%)	92 (100%)	NS
RITA	22 (40%)	42 (46%)	NS
RA	42 (76%)	76 (83%)	NS
GEA	0 (0%)	2 (2.2%)	NS
Sequential grafts	14 (25%)	48 (52%)	P = 0.024
CPB time		67±21min	
X clamp time		48±17min	
Conversion to CPB	1 (1.8%)		
Death (early/late)	0/0	0/1	NS
MI	2 (3.6%)	5 (5.4%)	NS
Low CO	1 (1.8%)	5 (5.4%)	NS
IABP	1 (1.8%)	6 (6.5%)	NS
Dopamine	10 (18%)	90 (97.8%)	P = 0.001
Adrenaline	1 (1.8%)	12 (13%)	P = 0.043
IPPV time	7.0±3.8h	9.5±4.4h	NS
Stroke	1 (TIA) (1.8%)	3 (3.3%)	NS

CONCLUSION: Total arterial revascularization for multiple vessel coronary artery disease is possible without CPB. We observe tendency to smoother postoperative course in patients operated without CPB. However they have on average less grafts placed and the lower number of sequential anastomoses performed.

Abstract 163. EXCLUSIVE ARTERIAL OFF-PUMP REVASCLARISATION IN MULTIVESSEL DISEASE

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BACKGROUND: Arterial grafting is expected to decrease the rate of cardiac events after myocardial revascularisation. Anyway, few authors report the use of complex arterial procedures in off pump surgery.

METHODS: Between 4/2000 and 8/2002, all patients referred for myocardial revascularisation were operated on the beating heart including unstable patients. From those 392 patients, 200 (51%) underwent exclusive arterial revascularisation with use of bilateral internal mammary arteries (IMA), gastroepiploic arteries or radial arteries.

RESULTS: Sternotomy was used in 192 patients while MIDCAB in 8. Mean number of distal anastomoses was 3.5/pt (2-6). Conversion to cardiopulmonary bypass occurred in only 2 patients. Perioperative infarction rate reached 0.5% and hospital mortality 0.5% for an expected predicted mortality of 3.5% with the Euroscore. No patient suffered perioperative stroke. 1 patient underwent temporary mechanical assistance (6 days) for right ventricular failure. Follow up was 100% complete. 80% of the patients consented to a maximal stress test. At 1 year, actuarial survival was 96.4% and freedom from recurrent angina was 99.1%.

CONCLUSIONS: Complete revascularisation with complex arterial grafting is feasible on the beating heart with excellent immediate results and a very low rate of recurrent angina at 1 year.

Abstract 164. THE USE OF SKELETONIZED INTERNAL THORACIC ARTERY (ITA)

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BACKGROUND: The use of skeletonized internal thoracic artery (ITA) was reported to be technically and hemodynamically beneficial in coronary artery bypass grafting (CABG). The purpose of this study was to evaluate the impact of use of skeletonized ITA harvested by ultrasound scalpel compared with conventional pedicle ITA.

MATERIAL AND METHODS: Between January 2001 and October 2002, a total of 107 consecutive patients underwent CABG using bilateral ITA. These patients were divided into two groups according to the ITA harvesting method. Group-I (N = 32) IMA was harvested as skeletonized was compared with Group-II (n = 75) conventional harvest in early operative result.

RESULTS: There was no operative death and wound infection in this series. There was no significant difference between two groups in preoperative patients' characteristics. There was no significant difference in average number of grafts (3.3 ± 1.1 in Group-I, 3.4 ± 0.6 in Group-II,) and aortic cross clamp time (74 ± 27 in group-I, 86 ± 28 in Group-II). Total operative time was significantly shorter in Group-I, 295 ± 51 minutes compared with Group-II, 326 ± 51 minutes ($P < 0.01$). Bleeding 12 hours after operation was significant lower in Group-I, 248 ± 159 ml compared with Group-II, 479 ± 255 ml ($P < 0.01$). Freedom from homologous blood transfusion was significant lower in Group-I, 53% compared with Group-II, 72% ($P < 0.01$).

CONCLUSION: The use of skeletonized ITA harvested by ultrasound scalpel was beneficial and less invasive to the patient by shorter operative time and lower postoperative bleeding.

Abstract 165. VALVE SPARING RESECTION OF TWO TRICUSPID VALVE MYXOMAS

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OBJECTIVE: Myxomas of the tricuspid valve are extremely rare. We report on two papillary myxomas, located at the anterior leaflet and the tricuspid annulus of the tricuspid valve.

MATERIAL AND METHODS: A 67 years old man was scheduled for coronary artery bypass grafting (CABG) because of angina due to a severe 2-vessel coronary artery disease. Preoperative MRT revealed two tumors (size: 2-3 cm each) at the anterior leaflet of the tricuspid valve, which was prolapsing into the right ventricle during diastole. Minor tricuspid valve regurgitation was detected. The patient was operated using standard cardiopulmonary bypass (CPB) with cardioplegic arrest and mild hypothermia (34°C). A left internal mammary artery jump bypass to LAD and diagonal branch was performed as well as a venous bypass to the marginal branch. The tumors were excised from the anterior leaflet of the tricuspid valve and the tricuspid annulus. The defect was closed with a continuous 5-0 monofilic suture of the anterior leaflet and creating a plicature of the tricuspid annulus.

RESULTS: Operative procedures were performed without complications. CBP time was 98 min and aortic cross clamp time 75 min. Postoperative MRT showed no tricuspid valve regurgitation, mean delta p of 1.0 mmHg and max delta p of 3.3 mmHg. Postoperative course was uneventful. The patient was discharged from hospital on the 10th postoperative day in good condition and was free of any recurrence during a follow up of 21 months. Histological examination revealed two papillary myxomas.

CONCLUSION: Two papillary myxomas of the anterior tricuspid leaflet and the tricuspid annulus were successfully removed and the tricuspid valve was preserved by valve reconstruction.

Abstract 166. SURVIVAL AFTER SEVEN HOURS OF SUSTAINED VENTRICULAR FIBRILLATION WITH THE MICROMED DEBAKEY LVAD: A CASE REPORT

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Patients with terminal heart failure are prone to develop malignant ventricular arrhythmias causing death if not treated immediately. We describe

the case of a 61 year old patient on mechanical circulatory support as bridge to heart transplantation (MicroMed DeBakey LVAD, Houston, USA) following terminal heart failure due to valvular cardiomyopathy. After 52 days of LVAD support the patient was taken ill during his stay in a specialised rehabilitation clinic. After transfer to our clinic electrocardiography showed ventricular fibrillation in an ambulating, conscious and oligosymptomatic patient. Furthermore the patient's pacemaker auto-diagnosis function (MedTronic InSync III, Minneapolis, USA) revealed a continuous pattern of ventricular fibrillation exceeding 7 hours. Absence of flow through the native left heart and impactment of the right ventricle were documented by echocardiography. After external defibrillation regular sequential paced heart rhythm with stable hemodynamics was restored. Left ventricular ejection and flow through the aortic valve was confirmed by echocardiography. Ventricular unloading through non pulstaile mechanical support seems to be enough for adequate pulmonary blood flow. This report demonstrates that the MicoMed DeBakey LVAD is able to generate sufficient blood flow for viable end-organ function and pulmonary perfusion in the absence of cardiac output.

Abstract 167. THE CLAP CLASSIFICATION: AN INNOVATIVE METHOD FOR CLASSIFYING MITRAL VALVE PATHOLOGY AND REPAIR

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OBJECTIVES: (1) To develop a universal classification in mitral valve surgery than currently available to all heart surgeons at any level of training. (2) to provide professionals with a valid and systematic method for describing the mitral valve morphology surgically and mode of repair.

METHODS: Review and critical analysis of the all published classifications for mitral valve disease and surgery exhibit many disadvantages and lack practical definition and usage. As more evidence that some of the inherent abnormalities of the mitral valve and mode of repair can be significant predictors of outcome in cardiac surgery the CLAP Classification becomes necessary. Each of the four valve structures (chordae, leaflets, annulus and papillary muscles) is substituted with a mathematical binary system for each structure.

RESULTS: The Clap classification is reliable. Examples of how classification works includes two equations and tables transforming the published data for valve repair in a simplified manner. Mitral morphology score is CLAP- X denotes:

$$\text{CLAP} = \sum_{f=0,1}^6 \{C+L+A+P\} \times \epsilon \{0, 6\}$$

CLAP - \sum (binary numbers of each C, L, A and P) $\times \epsilon \{0 - 6\}$, Mitral repair score is CLAP X/Y where X denotes annuloplasty size and Y the summative score for the types of repair involved.

CONCLUSIONS: The CLAP classification is a simple, accurate and comprehensive mitral valve pathology and mode of repair. It has a severity score that is proportional to the number ranging from 0 to 6. The classification allows better documentation valve pathology and repair together with prospect for future universalization of tabulating mitral valve repair data.

Abstract 168. A NEW DOPPLER DEVICE FOR OPTIMIZED VESSEL PUNCTURE

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INTRODUCTION: Central venous catheters are mainly placed by the landmark method (LM) and complication rate can be up to 20%. A new doppler device was developed allowing for doppler guided vessel puncture (DGP).

MATERIAL AND METHODS: We prospectively studied 132 patients (age 51 ± 14 years, 87m/41f) who required a central venous catheter at our institution. The doppler puncture set includes a doppler device (4MHz) providing an acoustic and optical signal allowing for differentiation of venous and arterial flow pattern.

RESULTS: Doppler guided central venous catheterization was performed in 39 routine cases (50%), 17 teaching cases, and 18 emergency cases w(23%) compared to 47 routine cases (87%), 4 teaching cases (7%) and 3 emergency cases (6%) in the LM group. Success rate was 68% (n = 58) with the DGP versus 61% (n = 33) by using LM. No complications were studied in 92, 3% of the doppler device performed cases versus 81% of the LMM group. A lower overall complication rate was observed in DGP group (7.7%) compared to the conventional LM group (19%), including hematoma (1.3% vs 3.7%), arterial puncture (0% vs 3.7%), hemothorax (0% vs 1.9%), and pneumothorax (2.6% vs 1.8%).

CONCLUSION: The new doppler vessel catheterization device was safe and simple to apply with superior results and less complications compared to the conventional landmark method.

Abstract 169. OFF-PUMP CORONARY BYPASS WITH RIGHT HEART SUPPORT FOR HEMODYNAMIC STABILITY PROVIDES A SAFE METHOD FOR ANASTOMOTIC ACCESS

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BACKGROUND: Off-pump coronary artery bypass (OPCAB) decreases complications of cardiopulmonary bypass (CPB). Positioning the heart for anastomotic access may compromise hemodynamic stability and limit patient eligibility. Right heart support (RHS) augments left ventricle preload and provides stability, particularly for lateral and posterior target vessels. This study evaluated adverse outcomes of OPCAB utilizing RHS.

METHODS: Retrospective analysis of data between 2000 and 2002 compared Group 1 (n = 106) OPCAB with RHS (A-Med Systems, Inc., West Sacramento, CA) and Group 2 (n = 1482) OPCAB without RHS or Group 3 (n = 106) computer-matched OPCAB without RHS. Demographic, preoperative, and outcome data including cardiac, neurologic, renal, pulmonary, and infection were compared.

RESULTS: Groups 1 and 2 showed no differences for mortality, overall complications, or any of 19 adverse outcomes. There were significant differences in preoperative variables. Comparing Group 1 with Group 3 showed no preoperative variable differences except NYHA class (p = 0.01) and no significant differences in mortality (2/106, 1.9% versus 4/106, 3.8%), overall complication rate (18/106, 17.0% versus 33/206, 20.8%), or other adverse outcomes. Group 1 had a decreased length of stay (4.0±3.2 days versus 5.7±6.8; p = 0.02) and ICU days (1.1±1.5 versus 2.2±3.9; p = 0.007).

CONCLUSIONS: OPCAB with RHS is safe, with equivalent outcomes to OPCAB without RHS.

Abstract 170. EXTRACORPOREAL MEMBRANE OXYGENATION PROVES EFFICIENT CIRCULATORY SUPPORT AFTER CARDIAC SURGERY IN INFANTS AND CHILDREN

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OBJECTIVE: Evaluation of postoperative extracorporeal membrane oxygenation (ECMO) support following procedures in children with congenital heart disease (CHD).

METHODS: Over a 5-year period (11/1997-11/2002) 10 patients age 5 days to 28.5 months (median 3 months) who underwent surgical procedures for CHD received postoperative mechanical support for failing cardiac function despite optimal medical therapy. In 3 patients ECMO was instituted in the operating room and in 7 this was introduced in the ICU 2-48 (median 20) hrs postoperatively. The circuit setup included right atrial venous drainage and left atrial decompression cannulae, with arterial return to the aortic root.

RESULTS: Three patients (30%) survived after 70 ±36 hrs, while in the remaining 7 the procedure was abandoned after 109 ±58 hrs of circulatory support. One of the survivors died 4 months later, unable to wean off from mechanical ventilation. The other two, remain well in NYHA class II.

CONCLUSIONS: In spite of the adverse effects of ECMO, the methodology provided the necessary support and allowed the failing heart to recover in a number of patients where inotropic support alone proved inadequate.

Abstract 171. SINGLE BICAVAL VENOUS CANNULA AND ATRIAL SPREADER FACILITATE TOTALLY ENDOSCOPIC ROBOTICALLY-ASSISTED ATRIAL SEPTAL DEFECT CLOSURE

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OBJECTIVE: We report of our initial experience with a newly designed atrial spreader and a peripherally inserted single bicaval venous cannula for totally endoscopic atrial septal defect closure.

METHODS: A computer-enhanced surgical telemanipulation system (DaVinci, Intuitive Surgical, USA) was used to perform totally endoscopic atrial septal defect closure in a sheep model (n = 4, 60-92kg). A single 32F bicaval cannula (Aotec AG, Baar, Switzerland) was introduced through jugular vein and placed in venae cavae. Arterial cannula was inserted into carotid artery. Three robotic arms and two additional ports were placed. Heart was fibrillated, right atrium opened and atrial septum exposed with atrial spreader inserted through 12mm port. After intentional opening of septum, defect was sutured, atrium closed and heart externally defibrillated.

RESULTS: Mean CPB and fibrillation times were 207 ± 18 and 78 ± 12 minutes, respectively. Mean CPB flow was 3.87 ± 0.39l/min or 97.7% ± 4.5% of theoretical flow (3.97 ± 0.42 l/min) with snared venae cavae and vacuum assisted venous drainage of 0-20mmHg and mean central venous pressure of 9.5 ± 5.7mmHg. Exposure and consecutive suturing of atrial septum defect was achieved in all animals. One animal could not be weaned from CPB.

CONCLUSION: A peripherally inserted single bicaval venous cannula demonstrates safe and efficient CPB flow patterns without obstructing surgical view. Exposure with atrial spreader allows for comfortable robotically-assisted suturing of atrial septal defects.

Abstract 172. CHARACTERIZATION OF REMAINING CORONARY ARTERY MOTION AFTER OCTOPUS STABILIZATION

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OBJECTIVE: To characterize remnant coronary artery motion observed in a pig beating heart after Octopus stabilization.

MATERIAL AND METHODS: A progressive scan B/W-camera (X/Y-plane) and a laser distance sensor (Z-plane) were positioned 10 cm above the LAD of a pig beating heart. Several ECG and blood pressure synchronized video sequences (10sec each; 50 frames/sec) of successive heart beats were acquired. Dopamine was used to modulate blood pressure.

RESULTS: Motion analysis of a LAD branching point, showed significant reduction of maximal excursion, speed of excursion and motion trajectory after Octopus stabilization.

LAD	Excursion	mean BP	HR
Unstabilized	7.2mm±0.3mm	55mmHg	83
with octopus	300µm±6.4µm	55mmHg	82
with octopus	318µm±8.4µm	78mmHg	86
with octopus	330µm±8µm	88mmHg	116

The excursion variability between consecutive cardiac cycles was 8.8µm±7µm. Variability between cycles minutes apart was 18µm±12µm. This technique enabled us to track in-plane movement of a surface landmark, over the entire cardiac cycle with a spatial resolution of ~10µm.

CONCLUSION: Negligible variability in motion between consecutive cardiac cycles and characterization of the trajectory of the anastomotic site after stabilization could help in developing a motion cancellation method for a surgical robot.

Abstract 173. PROGRAM DEVELOPMENT AND LEARNING CURVES IN ROBOTIC TOTALLY ENDOSCOPIC CORONARY ARTERY BYPASS GRAFTING

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BACKGROUND: Totally endoscopic coronary artery bypass grafting (TECAB) using robotic techniques is an innovative procedure the introduction of which, may include increased mortality or morbidity. The aim of this report is to demonstrate the safe introduction of TECAB using a stepwise and modular approach.

METHODS: From 6/2001 to 10/2002 44 procedures were performed using the da Vinci™ system. The following procedure modules were carried out in a stepwise manner: robotically assisted endoscopic LIMA harvesting and conventional CABG, MIDCAB, or OPCAB (n = 18), robotically assisted LIMA to LAD anastomosis during conventional CABG (n = 13), TECAB (n = 12).

RESULTS: A significant learning curve was observed for LIMA take down time (65 (35-300) min), and total operative time in TECAB (435 (270-690) min.) The conversion rate in TECAB was 2/12. Intraoperative graft angiography showed a patent anastomosis in all cases of robotically assisted LIMA-anastomosis. Postoperative ventilation time and ICU stay were 13 (0-278) h and 24 (12-282) h respectively. There was no hospital mortality.

CONCLUSION: TECAB can be safely implemented into a heart surgery program. Learning curves are steep for LIMA harvesting and operative time in TECAB but less pronounced for anastomotic suturing. Long operative times translate into prolonged ICU stay but not into increased mortality.

Abstract 174. INTRAOPERATIVE GRAFT ANGIOGRAPHY FOR QUALITY CONTROL OF ROBOTICALLY SUTURED LIMA GRAFTS

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BACKGROUND: Only few cases of totally endoscopic coronary artery bypass grafting have been performed worldwide and little is reported on the quality of the anastomoses. The aim of this study to investigate the quality of robotically sutured LIMA to LAD grafts by intraoperative angiography.

METHODS: LIMA to LAD bypass grafts were performed in 21 patients using the da Vinci™ telemanipulation system. 11 anastomoses were performed via sternotomy and 10 endoscopically (median anastomotic time 35 (23-50) min). Graft angiography was conducted through femoral access with a 6F Judkins LIMA catheter using Visipaque™.

RESULTS: All anastomoses were patent on first inspection. Target vessel spasm was noted in 10 cases but it resolved after intraluminal injection of nitroglycerine. One anastomotic leak, one bleeding LIMA side branch and a local dissection of the LIMA caused by electrocautery were diagnosed. In all cases surgical repair was performed immediately. There was no perioperative myocardial ischemia and no hospital mortality.

CONCLUSION: The quality of LIMA to LAD grafts using robotic techniques is satisfying. Suturing of the anastomoses frequently leads to target vessel spasm but anastomotic patency is adequate. Bleeding from the anastomosis or graft can be detected by intraoperative angiography and repaired immediately.