The Heart Surgery Forum #1999-81212
2 (2):169–171, 1999

Online address: www.hsforum.com/vol2/issue2/1999-81212.html

Non Steroidal Anti-Inflammatory Drug-Based Pain Control for Minimally Invasive Direct Coronary Artery Bypass Surgery

(#1999-81212 … May 31, 1999)

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ABSTRACT

Minimally invasive direct coronary artery bypass (MIDCAB) surgery has become an attractive alternative technique to treat coronary artery insufficiency. Changes in surgical and anesthesia techniques have led to reduced pulmonary morbidity associated with the operation. Early extubation is typically expected. However, postoperative pain management becomes even more important with early extubation. We describe our technique of a NSAID-based protocol with indomethicin and Torodal that has been safe and effective in over 175 patients following MIDCAB.

INTRODUCTION

The need to reduce peri-operative morbidity in cardiac surgery has led to changes in surgical and anesthesia techniques, including the emergence of MIDCAB techniques. In MIDCAB, the avoidance of cardiopulmonary bypass has resulted in decreased postoperative pulmonary dysfunction, and anesthesia management for MIDCAB has evolved towards using significantly reduced dosages of narcotics as compared to conventional cardiac surgery. Unfortunately, narcotic-based postoperative pain control strategies that are the mainstay for conventional cardiac surgery are inadequate for the MIDCAB population due to excessive sedation and somnolence. Immediate extubation can be achieved in most MIDCAB patients, but early postoperative pain can be severe and may interfere with effective pulmonary toileting if additional measures are not taken. We describe our experience with a high-dose NSAID-based protocol for post-MIDCAB pain control.

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MATERIALS AND METHODS

Our operative approach to MIDCAB (LIMA to LAD) is through a limited (6-8 cm) anterior thoracotomy in the fourth interspace. The internal mammary artery pedicle is mobilized from the fifth interspace to its origin at the subclavian artery. An epicardial stabilizing device is routinely utilized to facilitate the performance of the anastomosis. The anesthesia protocol has been previously described [Heres 1998]. Short-acting narcotics at low-to-moderate doses are utilized. Peri-operative pain control is augmented by the routine use of a field block by intercostal rib blocks (ribs 2-6) with 20 mL of 0.25% Marcaine (bupivicaine hydrochloride) before wound closure is started. The initial dose of Toradol (Hoffman-LaRoche, Inc., Nutley, NJ) (ketarolac tromethamine), 30 mg, is given intravenously prior to completion of the operation. Patients are generally extubated in the operating room and receive indomethacin, 100 mg PR, upon arrival to the Intensive Care Unit, and 50 mg PR 8 hours later. During the first 24 hours after surgery, Toradol is given (30 mg IV q 6 hr). Mediastinal chest tube drains are removed the day after surgery. For severe "breakthrough" pain, patients may receive parenteral narcotics (morphine sulfate) by bolus injection or by patient controlled pumps. Oral acetaminophen/narcotic analgesics are taken as necessary starting on postoperative day 2.

RESULTS

Over 85% of our MIDCAB patients were successfully extubated in the operating room or within two postoperative hours. No patient required re-exploration for mediastinal bleeding. Mean mediastinal drainage for the first 12-18 hours postoperative is 220 ml ± 58 in patients receiving the indomethicin/Torodal protocol. Mean total postoperative narcotic requirement is 8.8 ± 3.2 mg. No incidence of upper gastrointestinal hemorrhage was noted, and no patient suffered renal failure requiring hemodialysis.

DISCUSSION

Our experience with MIDCAB procedures began in November 1995, and we have performed over 250 cases to date. Our techniques reflect the evolution of surgical, anesthesia, and postoperative analgesic experience gained [Magovern 1998]. Early in our experience, patient controlled analgesia (PCA) with parental narcotics was commonly utilized for postoperative pain management. Although this was usually effective, we were dissatisfied with the increased somnolence and occasional dysphoria in this patient group whom we wanted early mobilization and aggressive pulmonary toileting. With the current protocol of I.V. Toradol and P.R. indomethacin, PCA use has become unnecessary. Morphine is given for severe breakthrough pain by IV bolus, and total postoperative morphine requirement has averaged less than 10 mg.

The liberal use of non-steroidal anti-inflammatory agents (NSAIDs) provide excellent perioperative musculoskeletal pain control, but without the respiratory depression and sedation associated with narcotics. Previous reports have suggested that NSAIDs, including ketorolac and indomethacin, may potentiate the analgesic effects of narcotics, resulting in a decreased need for narcotics and prolongation of the postoperative pain free interval [Pavy 1990, Pavy 1995, Singh 1997]. Concerns associated with the perioperative use of NSAIDs have included increased postoperative surgical bleeding, gastrointestinal irritation, and potentiating renal insufficiency. However, with our protocol of high dose indomethicin and Toradol, we limit its use only to the first 24 hours postoperative. To date, we have experienced no complications related to its use. No upper gastrointestinal bleeding, no incidence of renal insufficiency (i.e., postoperative serum creatinine increase more than 1.0 mg/dL over baseline), renal failure, or need for hemodialysis was encountered. Postoperative mediastinal drainage was unchanged compared to the earlier population with narcotic analgesia alone. Furthermore, the patients were subjectively more awake and lucid as compared to previous patients treated with narcotics alone. Pain was well controlled, evidenced by the minimal need for additional narcotics, and the patients were able to actively participate in pulmonary toileting exercises and incentive spirometry within several hours following surgery.

Because we achieve extubation in the operating room or within two hours postoperative in over 85% of our patients, adequate pain control is paramount for effective pulmonary toileting in the immediate postoperative period. Our NSAID-based postoperative analgesia protocol for our MIDCAB population has been safe and successful in alleviating postoperative pain, while avoiding the undesired sedative effects of narcotics.

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REVIEW AND COMMENTARY

1. Editorial Board Member MB134 writes:

This is a very timely report that many surgeons need to be aware of since the primary cause of dissatisfaction with MICS is early thoracotomy pain.

The main weakness is there is no comparison with any other group, such as a blinded placebo group or historical control, and no semiquantitative pain scale to assess patient perceptions of pain.

I am intrigued that no patient had a single complication of the use of high dose NSAIDS. This has not been my own experience. I began using Toradol as soon as it was released, and had immediate experiences with renal insufficiency. I switched to ibuprofen and had several gastro-duodenal ulcerations.

The risk of renal failure with Toradol is low, but idiosynchratic. I gave a single dose of ketorolac to an elderly patient after pulmonary wedge resection and she was anuric by the following morning and died several weeks after beginning hemodialysis. Her pre-Toradol createnine was normal.

I would like the authors to comment on any contraindications to the high dose NSAID protocol. Do they withhold this protocol in patients with a history of peptic ulcer, gastritis, gi bleeding, diabetes, elevated createnine (above 2.0), extreme elderly, or in patients with low cardiac output?

According to the protocol, NSAIDs are stopped 24 hours postop. What do the patients receive for pain after that time? Are the patients allowed to restart either Toradol or Indomethecin if pain is still severe after 24 hours?

Authors' Response by Jeffrey C. Lin, MD:

We do not institute this NSAID protocol for patients with a documented recent history or active peptic ulcer disease, gastritis, or gastro-intestinal bleeding. A remote history of PUD or diabetes is not contraindications. Patients with chronic renal insufficiency with creatinine above 2.0 are excluded. Patients 80 years or older receive 15 mg of I.V. Toradol instead of 30 mg. Patients in cardiogenic shock or low output states were not included for MIDCAB.

2. Editorial Board Member SC389 writes:

1. Were any patients reintubated?
2. Were any patients excluded from this regime and what are the exclusion criteria?
3. Can the authors provide more description of the patient population: age, sex, and obesity.
4. What was the average length of stay?
5. Specifically what kind of pain control was required after 24 - 48 hrs?
6. Was this regime stopped on patients for any reason?
7. Were there any complications or deaths?

Authors' Response by Jeffrey C. Lin, MD:

Re-intubation was required in less than 5% of the patients that underwent MIDCAB despite extubation of 85% of the patients within the operating room or within two hours following operation. Contraindications to this NSAID regime include active or recent history of PUD and renal insufficiency (Cr >2.0). The average age of patients in this series was 63 ± 11.7 years, and 27% were female. The average total post-operative hospital length of stay for "routine or low risk" patients was 3 days. The average length of stay for "high-risk" patients was 4 to 5 days. (Low risk is defined by a clinical risk score of 0-2, and high risk is defined as a clinical risk score of 6 or higher. The mean risk score of patients in this series was 3.6 ± 2.9. [Magovern 1996].

After the initial 24 hours post op, the patients are given oral acetaminophen/narcotic analgesics (Vicodin, Percocet, or Wygesic) for pain control. For severe breakthrough pain, Toradol 30mg, can be given on an "as needed" basis. We find that only a small number of patients require additional Toradol on the second post operative day and Toradol is discontinued by the third post operative day. We did not encounter any patient where the short-term/high-dose NSAID protocol had to be held. There were no complications attributable to the use of NSAIDs, i.e. no increase in post operative bleeding, no gastrointestinal hemorrhage, and no renal failure.

We had two mortalities in our series. Because of associated co-morbidities, both patients embarked upon MIDCAB as an alternative to conventional CABG. The first patient was a 70-year-old man with hepatic cirrhosis and pulmonary fibrosis. Although his cardiac operation was uneventful, his post-operative course was complicated by hepatic insufficiency and he ultimately succumbed to multi-system organ failure. The second patient was a 65-year-old man who had COPD and previous saphenous vein grafts to the LAD and ramus that presented with unstable angina. The MIDCAB was performed uneventfully, but he succumbed to respiratory failure afterwards. Both patients had normal intraoperative doppler flow and angiographic studies, and had no evidence of ischemic cardiac dysfunction during or following surgery.

3. Editorial Board Member AX44 writes:

How many had MEDS stopped because of renal function? As we gained experience with the incision, our patients hurt less. I would like a comment from the authors. I think there should be more documentation about how much and what types of pain medicines their patients got. I like this medicine plan and believe in it.

Authors' Response by Jeffrey C. Lin, MD:

No patient had to have this regimen discontinued secondary to renal insufficiency. Although the first reviewer noted that this could be an idiosyncratic reaction to the use of Toradol, we have not encountered this complication. We strongly believe that this strategy of employing high-dose NSAIDs achieve adequate postoperative analgesia, while the short duration of use at high doses avoid the potential complications associated with the chronic use of NSAIDs. Our surgical approach has also evolved with increased experience with this operation. Our limited thoracotomy is made directly over the fourth interspace, avoiding the subpectoral flap created in the inframammary incision. Furthermore, we no longer divide or remove the rib or costal cartilage. Lastly, an intercostal block with a local anesthetic is utilized. We have found these refinements for MIDCAB have decreased perioperative pain and improved patient satisfaction.

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