Inferior Partial Sternotomy for Surgical Closure of Isolated Ventricular Septal Defects in Children

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ABSTRACT

Background: Surgical closure of isolated ventricular septal defect (VSD) through partial inferior sternotomy offers the advantages of a much shorter, cosmetically superior skin incision, potentially improved sternal stability, a lower rate of infection, and less postoperative pain. We report our technique and results of use of inferior partial sternotomy for closure of isolated VSD in children.

Patients and Methods: From July 2002 to July 2003, 24 consecutive patients with a median age of 4.5 months (range, 1 month–4.5 years) underwent partial inferior sternotomy for isolated VSD closure. The length of the incision ranged from 4 to 6 cm. Special features of the approach included T incision of the lower sternum (from the fourth intercostal space to the xiphoid), establishment of cardiopulmonary bypass with central cannulation, aortic cross-clamping, and cardioplegic arrest. All VSDs were approached through right atriotomy. Perimembranous VSDs were exposed after detachment of the anterior leaflet of the tricuspid valve and were closed with a continuous suture. Muscular VSDs were approached directly. Perioperative and postoperative echocardiographic findings were available for all patients. Follow-up was complete.

Results: There was no mortality or significant surgical morbidity. Median cross-clamping and cardiopulmonary bypass times were 43 and 103 minutes, respectively. All patients were in sinus rhythm. Perioperative and postoperative echocardiography confirmed the absence of any residual defects in perimembranous VSDs and the presence of a trace residual VSD in 4 patients with muscular VSDs. Optimal healing of the partial sternotomy was obtained in all patients.

Conclusions: Inferior partial sternotomy is less invasive than and cosmetically superior to full sternotomy. It provides excellent results when applied to isolated VSD with standard surgical techniques.


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With this approach, the patch was exactly tailored to fit the septum with a running stitch of 7-0 polypropylene (Figure 2). A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003]. A patch of Gore-Tex or xenopericard material was sutured on the right side of the perimembranous VSD [Maile 2003].
Several alternative minimally invasive approaches have been described for closure of VSD. These approaches include anterolateral thoracotomy, left parasternal minithoracotomy, full sternotomy with limited skin incision, and the transxiphoid approach. It appears that inferior partial sternotomy, as used for VSD closure in this study, presents several advantages [Gundry 1998, del Nido 1998, van de Wal 1998, Wu 1998, Bauer 2000, Hagl 2001]. This approach allows institution of cardiopulmonary bypass through the sternotomy. This method of bypass avoids additional groin incisions and subsequent potential peripheral vascular complications, such as malperfusion, infection, and lymph fistula. Exposure, especially of the great vessels, is not compromised and does not impair aortic cross-clamping or the application of cardioplegia, which may be encountered with the transxiphoid approach [van de Wal 1998].

Somewhat surprisingly, inferior partial sternotomy allows de-airing of the left ventricle through the left apex, a maneuver we have routinely performed. TEE enables additional control of residual air in the left chambers. All of our patients readily regained consciousness, and no neurological complications occurred.

Only partial splitting of the sternum may result in reduced sternal instability and subsequent infection. Given the very low rate of postoperative sternal instability observed in our pediatric patients, however, comparison with a group receiving full sternotomy does not appear reasonable.

Another advantage of using a midline approach is avoidance of the long-term complications following anterolateral and posterolateral thoracotomy, such as breast and pectoral muscle maldevelopment and scoliosis [Cherup 1986, Van

Figure 2. Perimembranous ventricular septal defect closure. The anterior leaflet of the tricuspid valve is detached from its annulus (A, B). A Gore-Tex patch is inserted with a continuous 7-0 polypropylene (Prolene) suture starting at the posterior limb of the septomarginal band (C). Along the ventriculoinferior fold, the patch is frequently sandwiched between the anterior tricuspid valve leaflet and the annulus. The anterior leaflet is reanastomosed by use of a continuous suture (D).

Figure 3. Postoperative result of ventricular septal defect closure through inferior partial sternotomy.
Studies in adult cardiothoracic surgery have shown that midline sternotomy and ministernotomy are less painful than lateral thoracotomy and that respiratory discomfort is decreased in relation to that following lateral thoracotomy [Izat 1998, Hagl 1999]. Until now, however, a significant difference between lateral and midline access for congenital cardiac surgery had not been shown in terms of postoperative pain, length of intensive care unit, in-hospital stay, and costs [Laussen 2000].

The anterior leaflet of the tricuspid valve was routinely detached to fully expose the perimembranous VSD. We prefer this approach to detachment of the septal leaflet because of the excellent exposure of the periaortic annulus and the reduced risk of generating dysfunction of the atrioventricular node. Echocardiograms demonstrated perfect closure of the VSDs, good function of the tricuspid valve, and absence of left ventricular outflow tract obstruction in all patients.

In summary, inferior partial sternotomy can be safely performed for closure of isolated VSD in small children. The cosmetic results are excellent and superior to those of standard full sternotomy (Figure 3).

REFERENCES


