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# Repair of a wide sternal cleft in a young female☆

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ABSTRACT

Sternal clefts are rare congenital malformations of the anterior chest wall. Surgical correction is typically recommended as early as possible due to the compliance and growth potential of the infant sternum. Several operative techniques have been employed with great success. However, there is a paucity of data regarding repair in large clefts refractory to standard reparative techniques. We report the successful surgical repair in a 15-month-old female with an excessively large, superior sternal cleft.



Sternal clefts are congenital malformations of the anterior chest wall in which the left and right hemisternum fail to fuse or develop during fetal life. The malformation is rare, with less than 100 cases reported in the literature [1]. No correlation has been made with regard to nutrition or toxin exposure, but recent studies have proposed a link between the defect and the Hoxb gene [2]. Early surgical repair is recommended in order to capitalize on the compliance of the infant sternum and minimize the exposure time of vital organs. Operative technique is variable, depending on cleft size, location, and associated defects. We describe a multidisciplinary surgical approach to repair a large superior sternal cleft in a 15-month old female.

## 1. Case report

The patient was a 15 month female referred with a large superior sternal cleft. The cleft was easily visible during clinical examination (Fig. 1) and preoperative imaging revealed a large, 5.1 cm, defect in the superior half of the sternum (Fig. 2A). Given the complexity of repair, a multidisciplinary approach involved pediatric general, cardiac, and plastic surgery. Intraoperatively, the sternum was exposed through a full vertical sternotomy incision. The widest portion of the cleft measured 5 cm, and the intact inferior portion of the sternum measured 1.5 cm in length. The inferior sternum was divided longitudinally and beveled to accommodate closure. Both sternal edges were fully mobilized and an attempt to primarily oppose the two sternal edges was unsuccessful due to significant restriction superiorly by the clavicular heads and the 1st and 2nd rib attachments. The sterno-clavicular and costochondral attachments of the 1st and 2nd ribs were divided bilaterally with electrocautery, easily allowing medialization and approximation of the sternal edges. The sternum was closed using interrupted wires and a 0 Vicryl® suture at its most cephalad end (Fig. 2B). The portion of the resected inferior sternum was morcellated and placed as bone graft into the gap between the clavicular heads and the sternum (Fig. 2C). Surgicel® was used as flooring. This was placed over the pleura to prevent migration of the bone graft in this direction.

Following the sternal reconstruction, bilateral pectoralis major muscle flaps were fully mobilized and approximated to each other in the midline. This provided complete superficial coverage to the



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**Fig. 1.** Preoperative exam. Solid arrows show clavicular heads and width of the sternal cleft.

reconstructed area (Fig. 2D). Subcutaneous drains were placed and the skin was closed. The child had an abnormal skin defect above the umbilicus which was also removed. The cartoon in Fig. 3 illustrates all surgical incision sites and the operative technique used to complete this repair.

The postoperative course was uncomplicated. At three months postoperatively the patient continues to heal well with a stable sternum (Fig. 4).

## 2. Discussion

Sternal clefts can typically be repaired either primarily or via complete sternotomy with osteotomy and reapproximation. Osteochondroplasty flaps have also been successfully implemented to close smaller clefts [2,3]. However, our patient presented with such a profound superior cleft that it would have precluded typical repair. Given the complexity of repair we used a multidisciplinary surgical approach involving pediatric general, cardiothoracic and plastic surgery.

The large width of this cleft presented a difficult challenge. It is possible to close residual bone gaps with polytetrafluorethylene or mesh with methylmethachrylate. However, we felt that the best chance for normal growth and cosmesis would result from repair with native tissue. Dividing the sterno-clavicular heads and incising the 1st and 2nd costochondral junctions allowed for proper sternal approximation without tension. The morcellated bone grafts will hopefully provide more clavicular stability with ossification.

After sternal mobilization and closure, our patient was left with a large soft-tissue defect. Standard closure would have resulted in a skin closure over a complicated sternal reconstruction. In consultation with plastic surgery, we felt that bilateral pectoralis major muscle flaps would provide healthy, vascularized tissue to aid in healing. There are no long-term effects of clavicular head disarticulation reported in the orthopedic literature. Longer follow-up is required to adequately assess this type of repair and any potential sequelae.

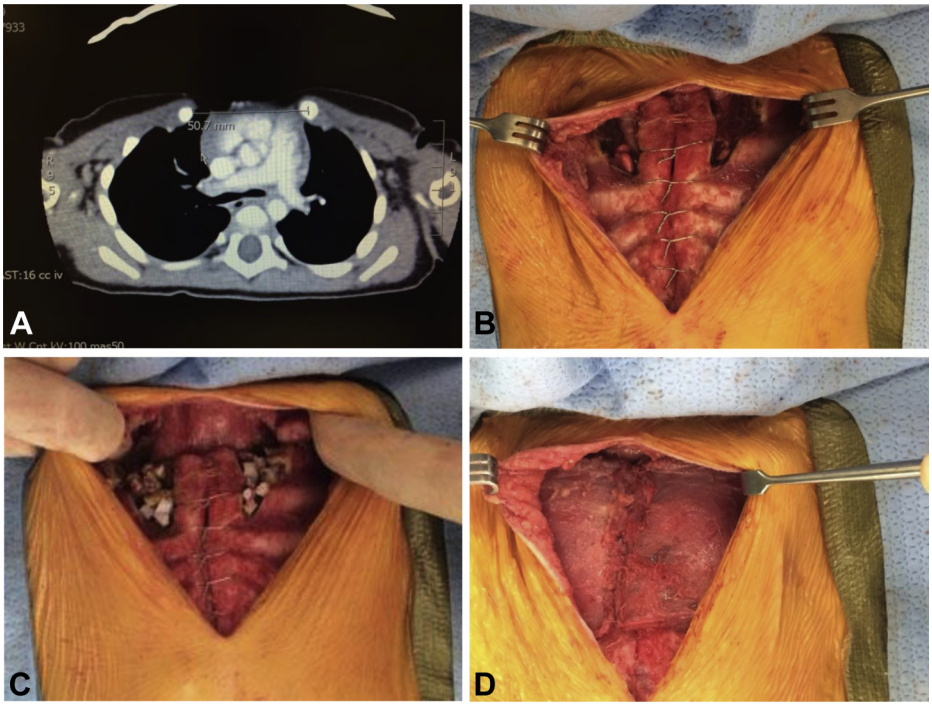


**Fig. 2.** (A) Preoperative CT demonstrating cleft (B) reapproximated sternal cleft (C) bone graft placement (D) pectoralis major flap.

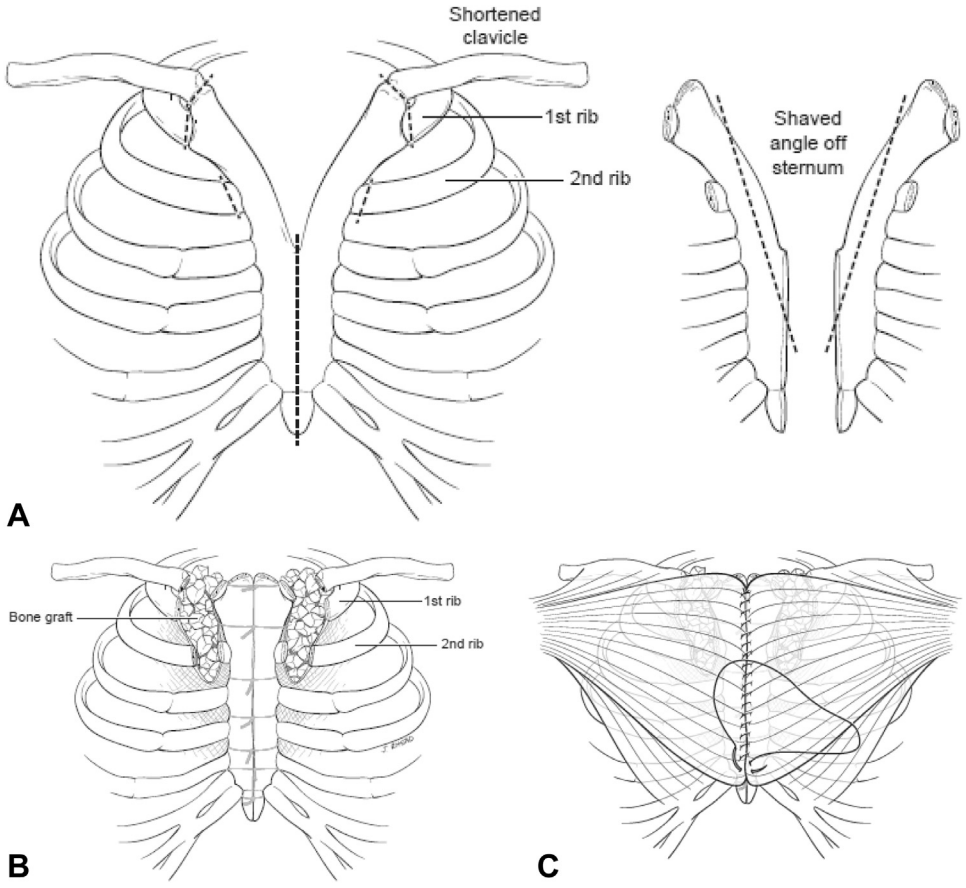


**Fig. 3.** (A) Illustration of pre-operative sternal cleft, dashed lines represent division and beveling locations (B) bone graft placement (C) reapproximation of pectoralis major muscles.

**Fig. 4.** 3 month postoperative visit.

## 3. Conclusion

In summary, large sternal clefts can present a difficult surgical challenge. Our report describes an easily reproducible technique to accomplish complete closure in a complex disease using a multi-disciplinary approach.

## Conflict of interest

The authors have no conflicts of interest to disclose.

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