

Surgical Technique

Funnel Chest: A New Technique for Repair

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Abstract

This new technique is based on the principle that the sternum is a straight bone but that in Pectus Excavatus it is deformed with a deep localized anterior depression over the median and lower part of the sternum, giving it a cup shaped appearance, so requiring multiple osteotomies and not single one to really straightening the sternum. The aim is to obtain a normal looking appearance and have an easy removal of the osteosyntheses material. (One or two Kirchner wires) Further, and particularly relevant, is the fact that it can positively be used also in asymmetric cases of Pectus Excavatus, which we believe are not solved successfully when treated with other techniques (namely the more frequently used Nuss Technique).

Keywords: Funnel chest; Congenital chest deformities; Pectus excavatus; Osteotomies

Introduction

The objective is to obtain a normal looking chest through sternal and costal osteotomies but with a simplified sternal osteo-syntheses (2 Kirschner Wires to be easily removed some months later).

We exemplify the technique with the presentation of one of the patients in which the technique was used, with excellent results, both functionally and cosmetically [1,2]. Obviously surgery is preceded by a careful pre-operative evaluation and the deformity is studied through a CT scan (always more informative than a simple 2 planes) chest X-Ray [3].

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Under general endotracheal anesthesia an undulated incision is made transversely below the nipples and a certain distance from them, thinking particularly, namely in girls, that the scar will coincide with the future sub-mammary sulcus (Figures 1 and 2) [4,5].

The incision is carried down through the skin, fat, and pectoralis muscles fascia to the periosteum of the sternum. Then the pectoralis muscles are separated from the edge of the sternum and of the lower and medial parts of the ribs in their cartilaginous area (usually from the 3rd to the 8th rib), the entire deformity becoming exposed [6-8].

Then follows longitudinal incision of the perichondrium, with extra-perichondrial condrothomy excision of the deformed cartilage (or just making multiple vertical sections at that level, just to allow preserving those short segments which have been rendered "mobile"), from just outside the sternum till near the costo-condral junction (but never involving it as it is needed for further growth) (Figures 3 and 4) [9,10].

Taking the utmost care to avoid injuring that growing zone where the bone rib starts to become cartilaginous, and essential for future ribs growth), leaving the sectioned segments of cartilage is we believe to be the preferable method) then follows detaching the xiphoid from the sternum to allow entering in the retro-sternal space. After sub-sternal digital dissection and placement of a protecting spatula, (taking particular care not to damage the internal mammary vessels or entering the pleural cavity), the sternum is cut transversely at several levels (as many as needed to straightening the bone), starting with a wedge resection where the sternum begins to depress (usually the 2nd intercostal space) [11,12].

Then separation of the attachment of the rectus muscle to the lower sternum at the xiphoid level is performed. After measuring the distance between the manubrium and the xiphoid appendix, one places one (or even two) Kirschner wires along the sternal fragments of the rectified sternum, penetrating superiorly through the anterior plate to reach the diploe, till attaining the upper portion of the manubrium but without over passing it, what is controlled by the fingers [12,13]. At this stage we aim to obtain slight over correction, knowing that there is a moderate long term tendency for recurrence of the sternal depression. At the level of the more proximal section of the bone, 2 long standing absorbable sutures are placed on either side. Then follows bending the Kirschner wire (or wires), at the entrance in the xiphoid so to avoid the eventual suprasternal displacement (due to injury or trauma), with the possibility of a tracheal lesion) (Figure 5 and 6) [14].

The Kirchner wire must be of such a diameter (1.5 mm to 2 mm in diameter) that it can easily be bent in the final stage of the operation. Then a small indentation is made on the Kirschner wire, so that a stitch may keep it joined to the bone [15,16].

If there are doubts about hemostasis, a small retro-sternal suction drain is placed through a small incision in the place where, 3 months later (or more, if one so wishes), one will remove the Kirschner wire (generally under local anesthesia and infrequently with a short General Anesthesia) [17].

Discussion

Generally the problem of the Pectus Excavatus is fundamentally of psychological importance and can be a source of unhappiness, social anxiety or even depression. It is true that the heart is usually

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Figure 1: Typical Funnel Chest in a girl.



Figure 2: Showing the skin incision.

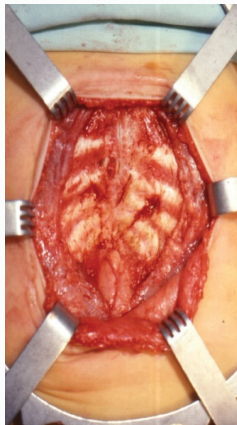


Figure 3: Exposing the sternum and ribs, using the Denis Browne's retractor.

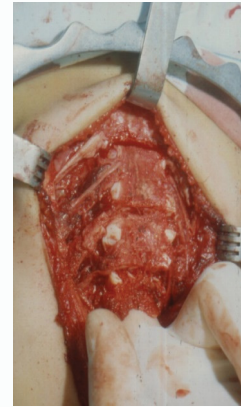


Figure 4: Sternum with multiples transverse incisions and Ribs after removal of the Cartilages.



Figure 5: Kirchner wire in place.

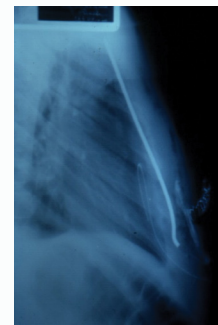


Figure 6: Kirchner wire showing the rectified Sternum.

more or less displaced to the right, but not compressed or leading to functional problems [18]. The same happens with the lungs, as pulmonary problems very rarely arrive and we believe that the eventual Jenne's Syndrome (chest wall description described by Haller defined as asphyxiating thoracic condrodystrophy) appearance is avoided. Also the danger of lesion to the internal mammary vessels is avoided and the pleural space does not need to be entered [19,20].

Considering the long term results we find the growth of the ribs proceeds normally one year after operation. Generally symmetrical,

some asymmetrical deformities can appear and which seem to be more frequent in families (although no genetic alterations have so far been recognized) (Figures 7 and 8).

The short and long term results have been excellent, even in girls, provide one has taken care in the correct placement of the undulated skin incision (leading to a sub-mammary scar). That is our choice, although some surgeons advocate a vertical incision in boys. Blood loss is usually not significant, the duration of surgery (2 or 3 hours) acceptable although not ideal, can be used preferably between 2 or 3 years of age and does not require an uncommon expertise. We also do not advise the Rehbein's approach and the use of the metal struts, the Willital/Hegamann technique with its multiple small osteosynthesis, the Shamberger-Welch procedure or even the more recent Mini Power Magnetic Procedure (3 MP) [21].



Figure 7: Chest asymmetry and sternal depression.



Figure 8: Final result at puberty.

The technique here presented is particularly valuable for asymmetrical cases, as the more commonly used Nuss Technique (a reversed curved bar introduced under the sternum through 2 small thoracic incisions and involving a thoracoscopy and the eventual use of 2 stabilizers) can't solve the asymmetry and so not attaining the expected aesthetic result. Further severe complications have been described with the Nuss technique (MIRPE), particularly with less experienced surgeons dealing with a relatively rare situation [22].

The timing for operation is controversial and opinions vary widely. As far as 1931 Sauerbruch proposed correction to be performed between 2 and 5 years of age. We believe it should preferably be performed around the 4th to the 6th year of age, particularly when the deformity is perfectly defined, and knowing that recurrence after surgery is more frequent in older children [23].

If, in older children, it is certainly appropriate to consider the patient's opinion (particularly in a generally predominantly cosmetic problem as this one), in a younger child it is mandatory to take in consideration the Parents fully informed opinions. There seems to be a tendency for a familial predominance although that is doubtful and has never been genetically proven.

Conclusion

The proposed technique, obtaining generally excellent aesthetic results both in short terms and in the long run, is particularly useful in asymmetrical cases of funnel chest, entailing only a moderate surgical risk in their corrective operation and just minor surgery 3 months later (to remove the Kirschner wires).

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