

Complications associated with Nuss technique for thoracoplasty

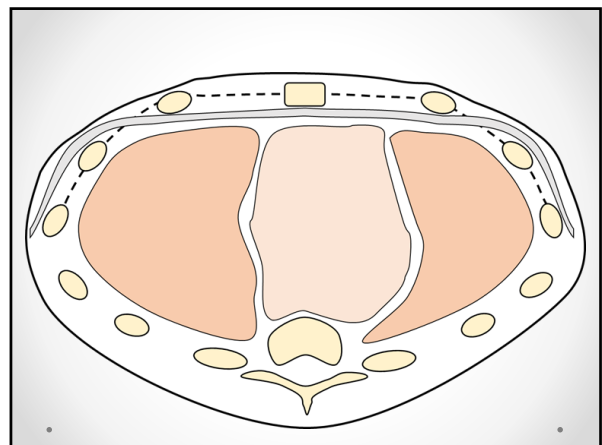
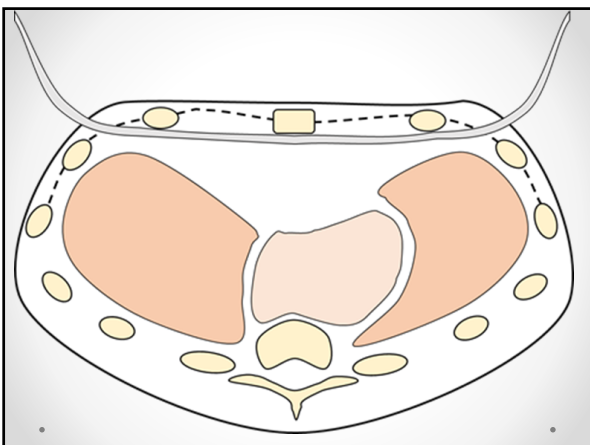
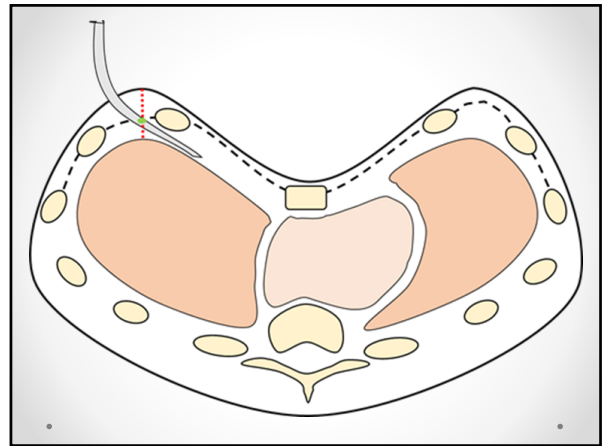
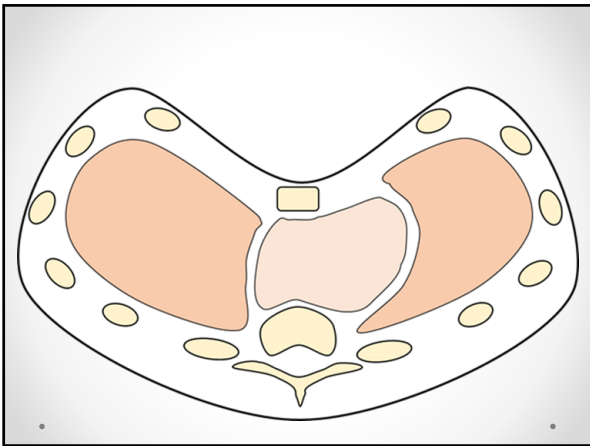
Orthopaedica Belgica
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Brice Henry



Introduction

- Performed since 1987 and introduced in 1998 by Donald Nuss.
- « Minimal invasive » surgical repair for pectus excavatum (= MIRPE).
- Use plasticity of child thoracic cage to avoid incision of rib cartilages.



A 10-Year Review of a Minimally Invasive Technique for the Correction of Pectus Excavatum

By Donald Nuss, Robert E. Kelly, Jr, Daniel P. Croitoru, and Michael E. Katz
Norfolk, Virginia

Table 5. Long-Term Results of Minimally Invasive Surgery

Result	No. of Patients
Excellent	22
Good	4
Fair	2
Poor	2
Total number of patients post bar removal	30
Number of patients with bar still in place	12
Total number of patients post minimally invasive procedure	42

NOTE. Average length of follow-up was 2.8 years (range, 6 months to 7 years) post bar removal and 4.6 years (range, 1 to 9.2 years) from corrective surgery.

Hospital stay 4.3 days [3–7]
Bloodloss 15 ml [10–25]

+ 1 overcorrection !

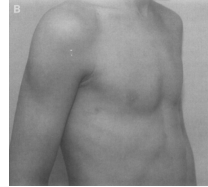


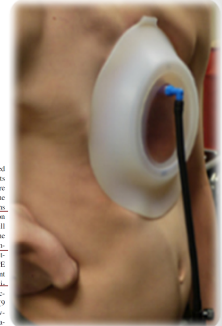
Table 4. Complications in 42 Patients Undergoing Minimally Invasive Procedure

Complication	No. of Patients
Pneumothorax (only one patient required tube thoracostomy)	4
Skin irritation	4
Bar displacement	2
Wound infection (treated with antibiotics)	1
Viral pneumonia	1

Other solutions

- Eckart-Klobe Vacuum Bell

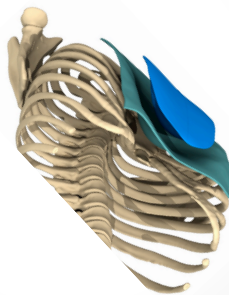
À partir du 4^e mois, le patient doit avoir beaucoup de patience : d'autres progrès sont encore continuellement atteints, mais dorénavant ils prennent plus de temps. La plupart des patients ayant bien intégré l'utilisation de la cloche d'aspiration dans leur vie quotidienne, poursuivent son utilisation ne représente donc pas une charge. À partir du 4^e mois, de nombreux patients rapportent une réduction de la profondeur de l'entonnoir d'environ 1 mm par mois.



While starting with the application, patients presented with a PE with depth from 2 to 5 cm. In 118 patients (79%), after 3 months of treatment, an elevation of more than 1 cm was documented. In 18 patients (15.5%), the sternum was lifted to a normal level after 18 months (Figs. 2 and 3). The longest follow-up after discontinuation is 5 years, and the success until today is permanent and still visible (Fig. 3). In these patients with asymptomatic PE, the depth of PE has decreased after 9 months, but the asymmetry is still visible (Fig. 4). Three patients were discontinued with the postoperative result (2 patients after MIRE and 1 patient after Ravitch procedure) and started treatment with the vacuum bell. Thirteen patients stopped the application after 18.5 months, in average due to an unsatisfactory result (4 patients) and decreasing motivation (9 patients). Twelve patients underwent MIRE. At follow-up, all patients were satisfied and expressed their motivation to continue the application, if necessary.

Other solutions

- Subcutaneous prosthesis



Other solutions

- Modified Ravitch sternochondroplasty.
- Introduced in 1949.

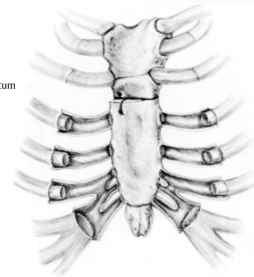
Meta-Analysis/Review Articles

Comparison of the Nuss versus Ravitch procedure for pectus excavatum repair: an updated meta-analysis

Yang Zhong Mao¹, Shan-Yao Tang, Shun Li

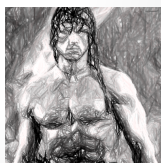
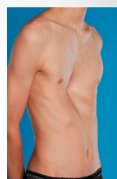
¹Department of Plastic Surgery, Xinhai Hospital, Jiangxi Medical College, Nanchang University of Science and Technology, Nanchang, China

59.88 min longer
51.26 ml more bloodloss
Same hospital stay



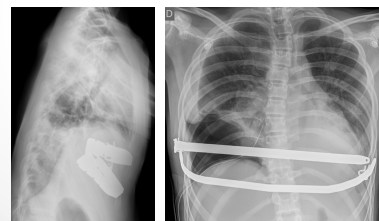
Nuss

- Routinely used
- Severe symmetrical pectus excavatum
- Good cosmetic results
- Compared to non-invasive methods & plastic surgery:
 - Correction of the rib cage deformity.
 - Potential improvement in respiratory function.
- Compared to Ravitch :
 - Less time consuming.
 - Less bloodloss.



1 year experience in Marseille

- 1 – 2 /month
- 2 major complications :
 - 1 hematoma : drainage & hemostasis
 - 1 lung entrapment : removal & failure



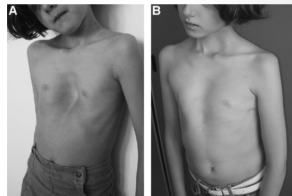
Child pectus excavatum: Correction by minimally invasive surgery

E. Felts*, J.-L. Jouve^{a*}, B. Blondel^a, F. Launay^a, F. Lacroix^b, G. Bollini^a

^a Department of Pediatric Orthopedic Surgery, Children Tinswe Hospital, rue Saint-Pierre, Boulevard Jean-Martin, Marseille, cedex 512385 France
^b Intensive Care Unit and Anesthesiology Department, Children Tinswe Hospital, Marseille, France

Accepted: 9 March 2009

- 2004 – 2007
- 25 patients
- 3 pneumothorax
- 1 early infection
- 2 aseptic collections
- 1 repositioning of the bar



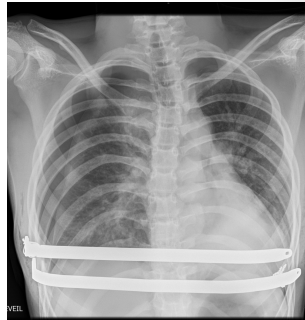
In the litterature...

- Overall complication rate is very wide !
- From 2 % to... 70 % !
- Intra-operative
- Early (< 30 days)
- Late (> 30 days)

Early : Pneumothorax

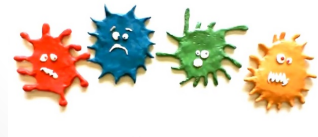


- 2 to 70 %
- Most with spontaneous resolution
- Few needing drain
- Evacuation at the end of the procedure



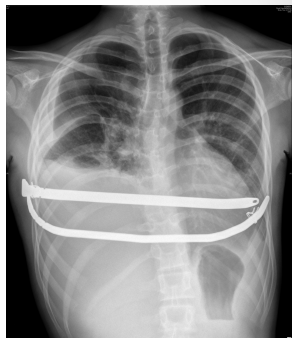
Wound infection

- 1 to 10 %
- Treated with antibiotics
- No need to remove hardware



Pleural effusion

- 0,3 to 7,5 %
- Spontaneous resolution



Other early complications

- Hemothorax : 0,3 to 2 %
- Pneumonia : 0,5 to 2 %
- Pericardial effusion : 0,5 to 1 %
- Thoracic outlet syndrome :
 - In adults with severe and high PE with one study reporting 15,2 to 33 %.
 - 0 in adolescent !
- Sterno-clavicular luxation : 1 case report !

Late complications

Table 2 Late post-operative complications

Complication	Number of Cases
A. Bar displacements requiring revision	3.7% (n=54)
B. Over-correction	3.1% (n=47)
C. Bar allergy	2.7% (n=39)
D. Wound infection	1.5% (n=22)
C. Recurrence	0.9% (n=13)

Bar displacement...

- Persistent pain
- Persistent pleural effusion
- Internal thoracic artery erosion !
- Possible cause of delayed hemothorax !
- Aortic erosion :
 - Massive hemorrhage 2 months post-operative (1)
 - Massive hemorrhage at hardware removal

Bar displacement...

- Can cause erosions or adhesions of intra-thoracic organs !
- More complications at the time of removal !
- Possible lung laceration, heart wound, aortic laceration... !
- 2 death reported following bar removal !

Sternal erosion

- Possible
- Due to pressure of the bar
- More in Marfan
- Still rare !

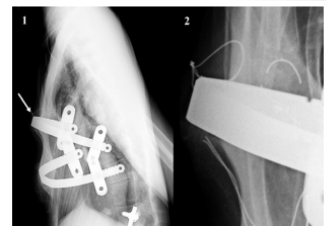


Fig 2. Nuss bar anterior to sternum (1, arrow), close-up (2).

Intra-operative

- Intra-thoracic organs lesions
- Thoracoscopy to prevent !
- Heart perforation (18)
- Lung lesion (3)
- Internal thoracic artery lesion (2)
- Parietal hemorrhage (1)

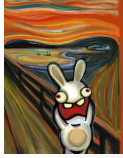


Intra-operative

- Liver injury (1)
- Inferior vena cava occlusion (3) :
 - Possibly because of anatomy modification
 - Good response to immediate hardware removal !

Conclusion

- Nuss is effective and now widely performed
- High rate of complications !
- Most are not severe : pneumothorax, pleural effusion, wound infection...
- Life-threatening lesions rare (< 0,1 %)
- Death cases at surgery = 11
- Death cases at hardware removal = 2
- Severe enough to advice the intervention to be performed by a well-trained surgeon !



Thanks !