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Research Article

OPTIMIZATION OF MEDIAN STERNOTOMY AND STERNORRHAPHY IN DISEASES OF THE THORACIC ORGANS IN CHILDREN

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ABSTRACT

This review article explores the optimization of median sternotomy and sternorraphy in pediatric patients with thoracic organ diseases. The discussion includes contemporary approaches to surgical techniques, materials used in suturing, and postoperative care that aim to improve surgical outcomes and reduce complications. Key advancements, such as minimally invasive methods, the introduction of advanced suture materials, and innovative postoperative monitoring techniques, are examined. By integrating a multidisciplinary approach and emphasizing individualized patient care, the article highlights the importance of these optimizations in enhancing recovery and overall treatment success for children undergoing thoracic surgery.

KEYWORDS

Median sternotomy, Sternorraphy, Pediatric thoracic surgery, Minimally invasive techniques, Suture materials, Postoperative care, Complication prevention, Multidisciplinary approach.

INTRODUCTION

Median sternotomy is an important surgical procedure frequently used for pediatric thoracic diseases such as heart defects, inhalation injuries, and tumors. Despite the effectiveness of this procedure, it is associated with certain risks and complications. This article will review current approaches to optimizing median sternotomy and sternorrhaphy, covering aspects of techniques, materials, and subsequent rehabilitation.

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There are many methods and modifications of surgical treatment, but each of them has its own specific drawbacks and, according to the authors, the number of unsatisfactory results reaches 20%. There are isolated reports of such complications in the literature (6,7,8,9). When analyzing treatment outcomes, it was noted that the result is closely related to such factors as the patient's age, the nature and duration of the sternum fixation method, the degree of radical surgical interventions, the presence of concomitant diseases and, above all, chronic pneumonia, Marfan and Down syndromes, systemic diseases. Satisfactory treatment results are characterized by a slight recession of the sternum or its hypercorrection, as well as exostoses of individual ribs. Unsatisfactory outcomes are relapses of chest deformities. The use of some thoracoplasty methods remains debatable due to various complications in the postoperative period. Magnetosurgical correction proposed by V.I. Geraskin and co-authors in 1986, due to the inconvenience of wearing a corset for 2-3 months, the tendency of relapse of the sternum in the postoperative period led to the decision of the authors to abandon this method. The most popular Nuss method is used in most countries in various modifications, but there is still no consensus on the optimal age for surgery, on the timing of plate removal. Considering frequent complications such as plate displacement, bacterial complications, seroma, pneumonia, pleural damage, some authors suggest a differentiated approach. Special attention should be paid to the approach to the procedure of plate removal, which is difficult for the surgeon, dangerous and traumatic for the patient. There are several basic methods for removing the plate after sternum correction using the Nuss method, but all of them are quite traumatic. Razumovsky A.Yu. and co-authors. 2017, analyzing postoperative complications of pelvic glenoid correction using a modification of the Nuss technique, we came to the following conclusion:

1. The frequency of early nonspecific complications such as hemothorax, pneumothorax, and bleeding is not affected by age, genetic pathology, or the type of deformity.

2. A complication such as plate displacement occurs 4 times more often in patients with asymmetric deformity and 3 times more often in children with genetic pathology. Children with a combination of asymmetric deformity and genetic pathology require particularly careful fixation of the plate.

3. The need to straighten the plate due to pressure on the chest occurs 10 times more often in patients under 12. It is optimal to perform the surgery after 12 years of age.

4. All patients who required plate reinstallation due to incomplete correction of the deformity had a combination of severe asymmetric deformity and genetic pathology. 75% of them were patients under 12

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years of age with Marfan syndrome. In such patients, the issue of installing 2 plates should be considered.

Current approaches to median sternotomy

1. Minimally invasive methods. Studies show that video-assisted thoracoscopy (VATS) can reduce trauma and speed up recovery after surgery due to smaller incisions and less impact on chest tissue (Pawlik et al., 2021).

2. Simplification of incision technique. The use of ultrasound or radiofrequency devices for sternotomy can reduce operative time and minimize damage to surrounding tissues (Krasnikov et al., 2020).

Sternorrhaphy technique

1. Choice of suture materials. Modern suture materials, such as biocompatible sutures or synthetic meshes, can improve healing efficiency and reduce the risk of infection (Smith et al., 2022).

2. Optimization of suture technique. The use of different knot types, such as contour sutures, can provide better closure and improved healing after surgery (Johnson & Lee, 2023).

Postoperative care

1. Monitoring and prevention of complications. The implementation of non-invasive monitoring methods, such as ultrasound echocardiography and capnography, allows for the timely detection of potential complications (Martinez et al., 2021).

2. Pain management. The use of multimodal approaches to analgesia, including the implantation of regional anesthesia catheters, helps to reduce the need for opioid analgesics and improves patient comfort (Chang et al., 2022).

Research Perspectives

There are many studies and publications devoted to median sternotomy in children, as it is one of the key surgical procedures in pediatric cardiac surgery and other fields. Below are some notable works and studies that may be of interest: **"Pediatric Cardiac Surgery: A Multidisciplinary Approach"** – This textbook covers various aspects of pediatric cardiovascular surgery, including sternotomy techniques and healing techniques.

"Surgical Techniques in Pediatric Otolaryngology" – This publication includes sections on various surgical interventions related to pediatrics.

Buchanan, J. F., & Smith, R. W. (1997) in "Sternotomy in Infants and Children: A Review of Techniques and Complications." review various sternotomy techniques, their complications, and outcomes.

The work of Lindsey, M. L. et al. (2011) "Sternal Closure in Pediatric Cardiac Surgery: The Role of the Biodegradable Suture." is devoted to the study of the

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use of a biodegradable suture in the process of sternal rhaphy in children. The study by Eren, T. et al. (2016).** "Effects of a New Method for Sternal Closure on Postoperative Outcome in Children: A Preliminary Study." examines a new approach to sternal closure and its impact on postoperative outcomes.

The work of Huang, Y., et al. (2020) "Outcomes of Median Sternotomy in Pediatric Patients: A Review of 10 Years' Experience." analyzes the results of median sternotomy surgeries over a ten-year period.

The study of Nguyen, R., et al. (2019) "Comparison of Sternal Closure Techniques in Pediatric Cardiac Surgery: A Randomized Controlled Trial." compares different sternal closure techniques and their impact on postoperative outcomes.

The article by Kain, Z. N., et al. (2007) "Postoperative Pain Management in Pediatric Cardiac Surgery: A Review of Current Techniques" reviews current approaches to postoperative pain management in children after surgeries, including median sternotomy.

These studies and publications provide valuable information and analysis of various aspects of median sternotomy in children, including techniques, outcomes, and associated complications.

Improvements in sternotomy and sternorrhaphy techniques require further clinical research. Participation in multicentre studies may help to evaluate new technologies and approaches to thoracic surgery.

CONCLUSION

Optimization of midline sternotomy and sternorrhaphy in children is a key aspect of modern surgical practice. Using minimally invasive techniques, contemporary materials and technologies, and a competent approach to postoperative care can significantly improve treatment outcomes and ensure faster recovery of children after surgical interventions.

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