Subxiphoid incisional hernias post median sternotomy: A Literature review

Jeremy Chan[1], James O'Hanlon[2], Joshua McKenna[2], and Shwe Oo[3]

[1]Bristol Medical School
[2]Swansea University Medical School
[3]Bristol Royal Infirmary

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Abstract

Background: Subxiphoid incisional hernias are one of the complications following a median sternotomy, a surgical procedure to provide access to the mediastinum. Incidence has been reported between 1-4%, although the true incidence is not well known due to its asymptomatic nature. Method: A comprehensive search was performed on multiple sites. Keywords included "incisional hernia OR Subxiphoid hernia" AND "Median sternotomy OR Cardiac Surgery OR Coronary artery bypass graft OR Transplant OR Valve replacement". Articles up to 1st of August 2020 were included in this study. Results: 8 articles were included in the study, with a total number of 132 patient identified. The incidence ranged from 0.81% to 3.44%. There was a mixture of repair method and follow up period reported. Recurrence post-repair ranged from 10% to 43%. Conclusion: Subxiphoid incisional hernias remains challenging to manage. We have discussed the incidence, risk factors, preventions, and management of subxiphoid incisional hernias including both the open and laparoscopic technique.

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Jeremy Chan[1], James O'Hanlon[2], Joshua McKenna[3], Shwe Oo[4]

1: MB BCh BAO, PgDip (ClinEd), Bristol Medical School, University of Bristol, Bristol, United Kingdom

2: MSci, Swansea University Medical School, Swansea University, Swansea, United Kingdom

3. BSc (Hons), Swansea University Medical School, Swansea University, Swansea, United Kingdom

4. MRCS, PgCert (ClinEd), Department of Cardiothoracic Surgery, Bristol Royal Infirmary, Bristol, United Kingdom

Corresponding author

Dr Jeremy Chan MB BCh BAO, PgDip (ClinEd) Bristol Medical School University of Bristol, Bristol, United Kingdom Email:*jeremychan@doctors.org.uk*

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Conclusion: Subxiphoid incisional hernias remain\souts challenging to manage. We have discussed the incidence, risk factors, preventions, and management of subxiphoid incisional hernias including both the open and laparoscopic technique.

Introduction

Subxiphoid incisional hernias (SIH) are a recognised complication following a median sternotomy. SIH is known to be difficult to repair and therefore associated with a high rate of recurrence. (1-3) SIH occurs due to a defect created during median sternotomy. The defect mainly occurs in the caudal part of the sternotomy that allows protrusion of tissue such as fat or bowel. While the reported incidence of SIH is relatively low, at 1-4.2%,(4) the true incidence is not fully understood due to their asymptomatic nature, and the tendency to recur post repair. (5) Several articles have been reported their experiences of minimising the risk of developing SIH as well as open and laparoscopic repair of SIH. We, therefore, aim to perform a literature review to summarise the existing shreds of evidence available in the research field.

Method

A comprehensive search was performed on PubMed, Ovid, SCOPUS, EMBASE, Cochrane library and Google Scholar. The search terms included "incisional hernia OR Subxiphoid hernia" AND "Median sternotomy OR Cardiac Surgery OR Coronary artery bypass graft". Articles published prior 1st of August 2020 were included in this study. All types of publication were included for review. The references of the identified articles were then searched for any potential articles that can be included. A literature search was performed by two reviewers (JM and JOH) independently. A further review was performed by the third reviewer (JC). Articles that discussed the incidence and the management of SIH were included. Case reports, expert opinion, editorials, duplicates studies, and conference abstracts were excluded.

Results

8 articles were included in the study. The incidence of SIH, number of patients included, repair method, recurrence rate and follow up data were summarised in table 1. All studies were performed retrospectively, with a total number of 132 patients included. (ranged 4-45) All 132 patients underwent median sternotomy for coronary artery bypass grafting, valve replacement or cardiac transplant. The incidence reported in 3 out of 8 articles, ranged from 0.81% to 3.44%. There was a mixture of repair method and follow up period reported. Recurrence post-repair ranged from 10% to 43%, this is likely due to small sample size included in the study.

Discussion

Anatomy and Challenges in repairing

Subxiphoid hernias generally occur in the midline and are inferior to the tip of the xiphoid. According to the European Hernia Society classification, SIH occurs within 3 cm of the xiphoid and are terms midline (M)1 hernias. (6) Subxiphoid incisional hernias can occur either on or off the midline although in the midline is more common. (7)

SIH repair presents several challenges. Firstly, the shearing forces generated by the muscular attachments results in high intra-abdominal pressures. (2) This tension is further enhanced by an anatomical variant bifid xiphoid process or by dividing the xiphisternum surgically. The high pressure in the subxiphoid region makes repair under minimal tension and approximation of the medial borders of the anterior sheath difficult and increases the risk of dehiscence. (8, 9) Secondly, the close proximity of the ribs, diaphragm and central tendon make securing a mesh more difficult compared with other types of hernia repair. (10) This is made more challenging if a hypoplastic xiphoid process is present as there is only a small retro-xiphoid space available. (11) Lastly, the xiphoid process has vascular supply from the xiphoid artery, a terminal branch of the internal thoracic artery, and from a branch of the superior epigastric artery. Blood supply may be compromised to this area if damage occurs to the internal thoracic or superior epigastric arteries so care must be taken during surgery. (7)

Incidence

An incisional hernia is a common complication of abdominal operations, affecting 10–26% of patients. (2) However, incisional hernias following a median sternotomy are less well reported than their abdominal counterparts. The incidence of subxiphoid incisional hernias has been reported ranged between 1% to 4.2%, (1, 2, 4, 12) although most agreed that the true incidence is unknown due to the asymptomatic nature. (5)

Risk Factors

There is a variety in the reported risk factors for developing incisional hernias following a median sternotomy. The most commonly reported are obesity, wound infection, male sex, left-sided heart failure, long incisions (specifically >18cm), and repeat operations. (5, 10, 12-14) Other, less reported, suggestions include a history of chronic obstructive pulmonary disease (COPD), diabetes mellitus, a positive smoking history, and postoperative bleeding (1, 13, 14) - specifically, a transfusion requirement within 24 hours of cardiac procedure was identified as an independent risk factor specifically for subxiphoid incisional hernia development. (3) A retrospective review suggested that a history of hernias could be a risk factor for developing further hernias, claiming that “hernias beget hernias”, so there is potentially cause for caution when operating on patients with a history of hernias. (3)

Prevention of Incisional Hernias

Barner reported a technical modification of median sternotomy to reduce the incidence of SIH. It emphasises a slightly shorter incision and avoids opening the linea alba by diverting the midline incision at the tip of the xiphoid process and connecting it with a stab wound made in the left xiphoidcostal angle, shown in Figure 1.(15) Barner reported his experience in 2,500 operations with no recorded incidence of subxiphoid or paraxiphoid incisional hernias.

Barner’s technical modification has been acknowledged and developed by multiple studies, suggesting that paraxiphoid extension of the sternotomy, reinforcement near the xiphoid end of the incision, optimizing closure of the distal sternotomy and the linea alba, and non-absorbable aponeurotic suturing of the epigastrium may further improve the closure’s stability. (3, 11, 15)

Management of subxiphoid incisional hernias

Several approaches have been reported to manage SIH. The treatment of the hernia follows basic principles that emphasise tension-free repair and all methods were performed under general anaesthetic using appropriate prophylactic antibiotics.

Open, suture repair with tissue approximation

Davidson and Bailey reported their experience in managing SIH in 1987. Their management was based on the size of the defect. For large subxiphoid hernias (>10cm in diameter), Davidson and Bailey reported their experience using a double door flap, \soutand applied to the subxiphoid defect area. His method was a modification of the Wells procedures. (16) After the hernia sac was reduced, the flap was created based on the linea alba. The left flap created was mobilised and sutured to the right margin of the defect and vice versa, give a double-layered repair. On the other hand, for small defects (<4cm in diameter), a standard direct closure of the defect with non-absorbable sutures were used instead.

Open repair with mesh

Cohen *et al* reported the first open repair of a subxiphoid hernia with a mesh in 1985. (9) Dissection was done entirely extra-peritoneal, to develop a plane between the posterior surface of the musculofascial layer and the peritoneum. It is worth noting that the peritoneum was only entered to free adhesions if necessary. The bifid xiphoid process was excised in the majority of patients. A polypropylene mesh was then placed and secured with sutures on the posterior rectus sheath deep to the rectus abdominus. The anterior sheath was then closed over the mesh with absorbable continuous sutures. A similar technique has been reported by Boulliout *et al.* (15)

De Mesquita reported a new repair technique in 2017. (5) Instead of suturing the mesh between the posterior rectus sheath and the rectus abdominus muscle, they closed the rectus sheath using a continuous, non-absorbable suture. The mesh was then applied was applied anteriorly with continuous suture around the edge.

Laparoscopic Repair

Laparoscopic approach for SIH repair has been reported on three occasions. (2, 3, 10) Landau et al. reported the first laparoscopic repair of subxiphoid hernia in 2001. A similar technique was reported by Mackey et al and Eisenberg et al. After adhesiolysis, the mesh was fixated \souteither using sutures into the peritoneal cavity.

Comparisons of repair techniques and outcomes

The consistent outcome measure reported from the various methods for subxiphoid is the recurrence rate.

Recurrence of subxiphoid incisional hernias following surgical repair have been reported at various incidences, ranging from 0%-80%. (5, 9) Multiple factors can influence the risk of recurrence, particularly the surgical technique used for the primary repair; the recurrence in techniques using exclusively sutures for a repair ranged from 0%-80%, whereas the use of mesh lowered the recurrence rate to 0%-33%. (5, 12, 17). A laparoscopic approach yields very similar results for the rate of recurrence 0 - 30%. (2, 3, 10)

In addition to a lower recurrence rate, laparoscopic repair reported a reduced post-operative stay, and need for pain control. (2) This is likely due to the advantage in subfascial visualisation of the epigastrium and edges of the defect, enabling the surgeon to circumferentially cover the defect, avoidance of the previous incision and minimal tissue trauma. (3, 10) A major disadvantage of the laparoscopic approach is the

steep learning curve that it presents which may attribute to a higher rate of recurrence prior mastering the technique. (10)

Risk Factors for Recurrence

Aside from surgical technique, other risk factors for a hernia recurrence include sternal wound infections, with reports of 75% of patients developing recurrent hernias (3) \soutBesides, reference has also been made to patients who are immunocompromised - notably transplant patients - due to their reduced capacity for wound healing and therefore increased risk of infection (3)

Limitations

There are several limitations to this literature study. First and most important, the available literature in the research field on SIH remains limited. This is most likely due to its asymptomatic nature and, hence underreporting. In addition to small sample size, all 8 studies included limited pre, intra and post-operative variables. For example, the post-operative follow-up period varies leading to a variation of recurrence rate. outcome measured cannot be compared directly.

Conclusion

In conclusion, SIH post median sternotomy are rare, however, difficult to repair and have a high risk of reoccurring. (1-3) The true incidence remains poorly understood due to their asymptomatic nature (17) Risk factors, preventions, and several management techniques were discussed in this article.

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