

REVIEW

Prophylactic Mesh Reinforcement versus Sutured Closure to Prevent Incisional Hernias after Open Abdominal Aortic Aneurysm Repair via Midline Laparotomy: A Systematic Review and Meta-Analysis

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WHAT THIS PAPER ADDS

Prophylactic mesh reinforcement reduces the risk of incisional hernia after open AAA repair, and can be considered for clinical practice. Nevertheless, it is unclear whether prophylactic mesh reinforcement actually prevents additional re-operations for incisional hernia or improves quality of life.

Objective/Background: Incisional hernia is a frequent late complication after open abdominal aortic aneurysm (AAA) repair. We aimed to determine whether prophylactic mesh reinforcement of the abdominal wall at open AAA repair via midline laparotomy reduces the rate of incisional hernia compared to standard sutured closure.

Methods: A systematic review and meta-analysis was carried out in accordance with the PRISMA statement (PROSPERO registration CRD42017072508). Randomised controlled trials (RCTs) comparing prophylactic mesh reinforcement with standard sutured closure were eligible for inclusion. MEDLINE, Embase, and the Cochrane Library were searched. A meta-analysis with a random effects model was carried out to estimate pooled risk ratios (RR) with 95% confidence intervals (CIs) for the incidence of, and re-operation rate for, incisional hernias. Assessments of methodological quality, quality of evidence, and strength of recommendations were done with the Cochrane Collaboration's tool for assessing risk of bias and the GRADE approach.

Results: Four RCTs with a total of 388 patients were included in the meta-analysis. Pooled analysis showed that mesh reinforcement significantly reduced the risk of incisional hernia after AAA repair compared with standard sutured closure (RR 0.27, 95% CI 0.11–0.66). The pooled rate of re-operations was not different between groups (RR 0.23, 95% CI 0.11–1.05). Mesh reinforcement did not cause more intra-operative or post-operative complications than sutured closure. The risk of bias in studies was low and the quality of evidence was rated as moderate.

Conclusion: Prophylactic mesh reinforcement of the abdominal wall after open AAA repair via midline laparotomy significantly reduces the risk of incisional hernia. However, no significant difference in re-operation for incisional hernia was found.

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INTRODUCTION

Incisional hernia is a late complication of abdominal surgery and of open abdominal aortic aneurysm (AAA) repair, in particular. Twenty-one per cent of patients undergoing AAA repair develop an incisional hernia, and some studies have shown incidences of up to 38%.¹

Although no common biological or genetic mechanism has yet been discovered, the association between AAA and abdominal wall hernia development has been established.^{1,2} The risk of developing incisional hernias is also higher for patients with AAA than for patients with similar medical morbidities. For example, the risk of developing incisional hernias is three times higher after surgery for AAA than after surgery for aortoiliac occlusive disease.¹

Incisional hernias can cause pain, may have a negative impact on quality of life and body image, and rarely cause bowel obstruction or strangulation.³ Studies with long-term follow up have reported re-operation rates of 8% and 11% for incisional hernias after open AAA repair.^{4,5} However,

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because of the operative risks, patients may not be offered corrective operation.

Several techniques such as improvement in incision directions, suture techniques, and mesh reinforcement have been studied to prevent incisional hernias.^{6–8} Randomised controlled trials (RCTs) have demonstrated that prophylactic mesh reinforcement after abdominal surgery, in general, is effective and safe.⁸ Pooled data from before 2015 demonstrated the benefit of prophylactic mesh reinforcement over sutured closure after abdominal surgery (relative risk [RR] 0.17, 95% confidence interval [CI] 0.08–0.37).⁹ However, because of the small number of studies with patients with AAA, prophylactic mesh reinforcement after open AAA repair has not yet been recommended. After 2015, new RCTs have investigated the effect of mesh reinforcement after AAA repair, with the largest RCT published only recently.^{10,11} These trials all showed a significant reduction of incisional hernias in favour of prophylactic mesh reinforcement, which is already suggestive of its benefit.

The primary objective of this systematic review was to determine whether prophylactic mesh reinforcement of the abdominal wall after open AAA repair via midline laparotomy reduces the rate of incisional hernias compared with sutured closure. Secondary objectives were to determine differences in the rate of re-operations for incisional hernias, differences in operation duration, and post-operative complications.

METHODS

This systematic review was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.¹² The review protocol was prospectively registered in the PROSPERO database (CRD42017072508) and was written in accordance with the PRISMA-P statement.¹³

Study selection

Studies were eligible for inclusion if they were RCTs comparing prophylactic mesh reinforcement after open AAA repair with a control arm of standard sutured closure, with a minimum follow up of 1 year. Studies that included multiple surgical procedures were only included if AAA cases were reported separately. Conference papers were excluded.

The MEDLINE and Pubmed Central (via PubMed), Embase (via Ovid), and Cochrane Library databases were searched for published studies. The World Health Organization (WHO) International Clinical Trials Registry Platform was searched for ongoing or unpublished trials.

The Patient, Intervention, Comparison and Outcome framework was used to construct the electronic search (provided in [Table S1](#); see [Supplementary Material](#)). The search consisted of three domain sets (AAA, hernia, mesh) and was carried out with the assistance of an experienced clinical librarian. The search included free text words, as well as medical subject heading terms to search Pubmed and the Cochrane Library, and subject headings to search Embase. No language or date restrictions were applied. The last

search was performed on 19 July 2017. The reference lists of the included articles were searched for other eligible articles.

Data extraction

Two reviewers (R.I., H.J.) independently assessed all titles and abstracts for eligibility. They also independently assessed the full text of potentially eligible articles and independently extracted the data from the included articles. A standard form was used for data extraction. Disagreements were resolved by re-examination of the papers in consensus.

Extracted data included study design, study period, patient characteristics, follow up period, inclusion and exclusion criteria, type and method of the meshes and sutures used, operation duration, complications, incidence of incisional hernia, diagnosis of incisional hernia, and hernia re-operation.

METHODOLOGICAL QUALITY ASSESSMENT

The risk of bias in individual studies was assessed by the same two reviewers using the Cochrane Collaboration's tool for assessing risk of bias in randomised trials.¹⁴

Outcomes

The primary outcome assessed for meta-analysis was the incidence of incisional hernias. Secondary outcome measures for meta-analysis were the rate of incisional hernia re-operations and operation duration. Complications were reported separately per study.

Analysis

A meta-analysis was carried out for quantitative outcomes reported in two or more studies. To evaluate the difference between categorical outcomes following mesh reinforcement or sutured closure, a random effects model was used to estimate pooled RR with 95% CI. In addition, absolute risk reduction (ARR) with 95% CI, and the number needed to treat (NNT), were reported for the primary outcome. Differences in continuous variables were expressed as the weighted mean difference. For studies reporting median and range, a previously published formula was used to estimate mean and SD to allow for inclusion in the meta-analysis.¹⁵ The random effects model was purposefully chosen prior to the analysis because of clinical heterogeneity between studies (e.g., variation in surgeons, mesh types and placement of the mesh). Statistical heterogeneity among studies was expressed with the I^2 statistic. The analyses were carried out using Review Manager (RevMan, version 5.3; The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, 2014).

Sensitivity analysis

The sample size of the randomised and actually operated on patients was selected for meta-analysis. The patients lost to follow up were considered as having no incisional hernia. This method was also performed by the two largest studies

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