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Prophylactic mesh placement for prevention of incisional hernia after open bariatric surgery: a systematic review and meta-analysis

Mohini Dasari, B.S.[a,*], Charles B. Wessel, M.L.S.[b], Giselle G. Hamad, M.D.[c]

[a]*Department of Surgery, University of Pittsburgh, F1263.3, UPMC Presbyterian, 200 Lothrop Street, Pittsburgh, PA 15213, USA;* [b]*Department of Digital Library Services, Health Sciences Library System, University of Pittsburgh, Pittsburgh, PA, USA;* [c]*Department of Surgery, University of Pittsburgh, Magee-Women's Hospital of UPMC, Pittsburgh, PA, USA*

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Review

Abstract

BACKGROUND: Prophylactic mesh during laparotomy has been shown to be effective in preventing postoperative incisional hernia (IH) in high-risk patients. Since obesity is a risk factor for IH, we wished to determine whether mesh prevents IH in open and laparoscopic bariatric surgery patients.

METHODS: We conducted a systematic review of the literature with meta-analysis. Seven studies met inclusion criteria. We abstracted data regarding postoperative IH development, surgical site infection, and seroma or wound leakage and performed meta-analysis.

RESULTS: The prophylactic mesh group had significantly decreased odds of developing IH than the standard closure group (odds ratio, .30, 95% CI, .13 to .68, $P = .004$). No included studies evaluated outcomes after prophylactic mesh during laparoscopic bariatric surgery.

CONCLUSIONS: Prophylactic mesh during open bariatric surgery appears to be beneficial in reducing postoperative IH without significant increasing the odds of surgical site infection or seroma or wound leakage. Higher quality studies, including those in laparoscopic patients, and cost-utility analysis, are needed to support routine use of this intervention.

Hundreds of thousands of Americans undergo bariatric surgery annually; in 2014, an estimated 193,000 bariatric surgeries were performed.[1] Increasing body mass index is a well-known risk factor for the development of postoperative incisional hernia (IH), with rates being as high as 50% in this cohort.[2] Postoperative IH development often necessitates another operation for hernia repair, resulting in increased health care costs, potential morbidities, and patient dissatisfaction.[3]

An increasing proportion of bariatric surgeries are done laparoscopically. The minimally invasive approach accounts for almost 90% of all bariatric surgeries in the United States.[4] Despite the exponential increase in laparoscopic bariatric surgeries over recent years, there are still thousands of patients who undergo open bariatric surgery in the United States annually.[4,5] Thus, postoperative IH after bariatric surgery is a

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* Corresponding author. Tel.: +1-(617)-480-0831; fax: 412-624-0290.
E-mail address: dasari.mohini@medstudent.pitt.edu

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still a significant potential clinical and economic concern for thousands of patients annually.

Mesh placement in midline laparotomy incisions has been shown to reduce the rate of IH in high-risk patients, with decreased odds of postoperative hernia development in a subanalysis of open bariatric surgery studies.[6] In high-risk patients undergoing laparotomy, prophylactic mesh has been shown to be more cost-effective than standard primary suture closure.[7] While the clinical and cost effectiveness of mesh placement after midline laparotomy has been demonstrated, the results are not exclusive and specific to the bariatric surgery population. The goal of this systematic review was to determine whether prophylactic mesh placement in incisional wounds for patients undergoing bariatric surgery reduces rates of IH development after bariatric surgery. The secondary aims were to determine whether there is an increase in surgical site infection (SSI) or seroma or wound leakage (SWL) associated with prophylactic mesh insertion.

Methods

Eligibility criteria

For inclusion in the review, studies were required to satisfy the following predetermined criteria: (1) include a bariatric surgery only (open or laparoscopic, any type); (2) report postoperative IH rate as an end point; and (3) study design was either a randomized control trial (RCT), prospective observational study, or retrospective cohort study. Studies were excluded from the review if they: (1) compared one prophylactic mesh type to another mesh type, rather than mesh to standard primary closure and (2) included concurrent ventral hernia repair during the bariatric surgery procedure.

Data sources and search strategy

A preregistered study protocol for this review was entered within the PROSPERO database (International Prospective Register of Systematic Reviews, www.crd.york.ac.uk/prospero, record number: CRD42015027978). A health sciences librarian (C.B.W.) developed and performed the literature searches in PubMed which includes MEDLINE (1946–present), EMBASE.com (1974–present), and the Cochrane Library (John Wiley & Sons). Studies were located in the following Cochrane databases: Database of Abstracts of Reviews of Effect issue 2 of 4, April 2015; Cochrane Central Register of Controlled Trials issue 12 of 12, December 2015; and NHS Economic Evaluation Database issue 2 of 4, April 2015. Using controlled vocabulary and keywords in the appropriate search fields, comprehensive search strings were developed in each database for the concepts of bariatric surgery, IHs, and surgical or mesh closure. The 3 concepts were combined with a Boolean operator "AND" and then limited to English language only. In the EMBASE.com search conference, abstracts were removed. All searches were run, and records were downloaded on January 12, 2016 (Appendix: Database Search Strategies).

Data collection and risk of bias assessment

One author extracted data independently and extracted data were then reviewed by a second author. Discrepancies were resolved by consensus. Data extracted on study design included: randomization technique, intervention arms, and type of mesh used. The primary outcome for the meta-analysis was the pooled incidence of IH over the length of study period. Secondary outcomes assessed were SSI and SWL. Risk of bias and study quality were evaluated using the Cochrane Risk of Bias Tool for the RCTs.[8] RCTs were evaluated with the tool along the following 6 domains: selection bias, performance bias, detection bias, attrition bias, reporting bias, and other bias. A high, unclear, or low risk of bias was allotted for each of these categories and then an overall high or low risk of bias status was assigned to each study.

Statistical analysis

The meta-analyses were performed in accordance with the guidelines from the Preferred Reporting Items for Systematic reviews and Meta-Analysis group.[9] The odds ratio (OR) was used as the statistical measure for dichotomous outcomes. ORs were calculated from the original data and meta-analysis was calculated using the Mantel–Haenszel method. An OR less than 1.0 indicated reduced odds of IH occurring in the intervention group (mesh placement). A P value of less than .05 was considered statistically significant for all analyses. A priori sensitivity analysis was planned for the following groups: (1) RCTs vs non-RCTs; (2) open vs laparoscopic bariatric surgery trials.

Between-study heterogeneity was calculated using the I^2 statistic. Higher values of the I^2 statistic signify increasing levels of heterogeneity, with an I^2 greater than 50% indicating significant heterogeneity. Given the expected variation between and within included studies, a random effects model was used for the analysis. Statistical analysis was performed using Stata SE 14 (StataCorp. 2015; Stata Statistical Software; Release 14; College Station, TX: StataCorp LP.)

Results

The database search located 355 citations in PubMed, 425 citations in EMBASE.com and 30 citations in the Cochrane Library (1 Database of Abstracts of Reviews of Effect citation, 27 Cochrane Central Register of Controlled Trials citations, and 2 NHS Economic Evaluation Database citations). The total number of received citations was 810. Of these, 242 were duplicate citations, and they were removed. After applying inclusion and exclusion criteria, the final analysis included 7 studies (Fig. 1), of which 4 were RCTs[10–13] and 3 were nonrandomized prospective trials.[12–14]