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Mesh Location in Ventral Hernia Repair: A Systematic Review and Network Meta-Analysis of Open, Laparoscopic and Robotic Techniques.

JOHNS HOPKINS MEDICINE

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INTRODUCTION

Ventral hernia repair with mesh reduces the risk of recurrence. Common planes for mesh placement include onlay, inlay (interposition), sublay-retromuscular, sublay-preperitoneal, and intraperitoneal underlay mesh (IPUM). A previous systematic review and meta-analysis from 2018 suggested that the retromuscular plane has a lower recurrence rate. With advances in technology, particularly in minimally invasive surgery (MIS), mesh placement may influence outcomes differently. This systematic review and network meta-analysis compares the outcomes of different mesh planes in open, laparoscopic, and robotic ventral hernia repairs, focusing on hernia recurrence, surgical site infection (SSI), seroma formation, and hematoma occurrence.

METHODS AND PROCEDURES

Relevant articles published before August 2024 were identified through searches in PubMed, EMBASE, Cochrane, and Ovid. Studies reporting recurrence, SSI, seroma, and hematoma following open, laparoscopic, or robotic ventral hernia repairs with mesh were included. A Bayesian network meta-analysis was conducted using R, and the MetaInsight tool was employed for statistical analysis, comparing outcomes of different mesh planes.

RESULTS

Eighty-seven studies (31,070 patients) were included. Overall, 41.53% (12,903 patients) underwent intraperitoneal underlay placement, 41.49% (12,892 patients) underwent sublay-retromuscular placement, 8.95% (2,781 patients) underwent onlay placement, 7.89% (2,450 patients) underwent sublay-preperitoneal placement, and 0.14% (44 patients) underwent inlay placement. The mean follow-up period for recurrence was 27.1 months. The sublay-retromuscular group had significantly lower recurrence rates compared to the intraperitoneal underlay group (RR 0.501, 95% CI: 0.316–0.789), while the onlay group had a higher recurrence rate (RR 2.24, 95% CI: 1.31–4.16). The onlay group also demonstrated higher rates of SSI (RR 2.36, 95% CI: 1.65–3.45) and seroma formation (RR 2.28, 95% CI: 1.54–3.51). Hematoma occurrence did not significantly differ between groups (Figure 1). Additionally, comparing open and MIS procedures, the recurrence rate was significantly lower in the MIS sublay-retromuscular group (RR 0.190, 95% CI: 0.0463–0.788) compared to the open intraperitoneal underlay group, while open onlay placement has the highest recurrence risk of all locations for mesh placement (RR 2.61, 95% CI: 1.13–6.97) (Figure 2).

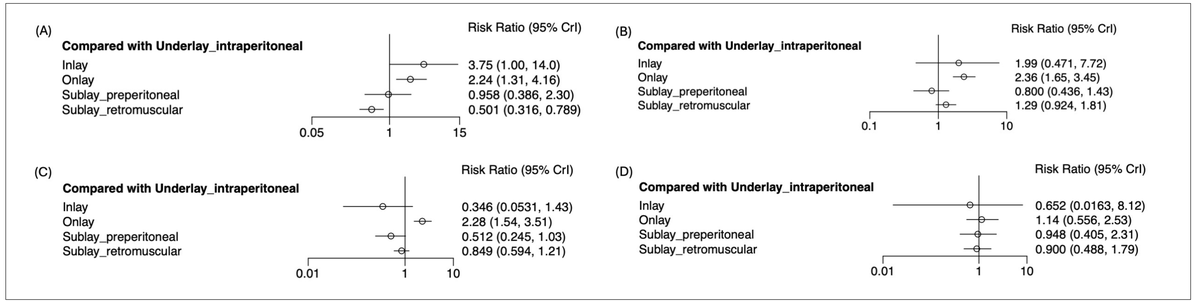


Figure 1. Forest plot representing the random-effects network meta-analysis of the included outcomes: A: Hernua recurrence, B: Surgical site infection, C: Sernoma formation, D: Hematoma occurrence.

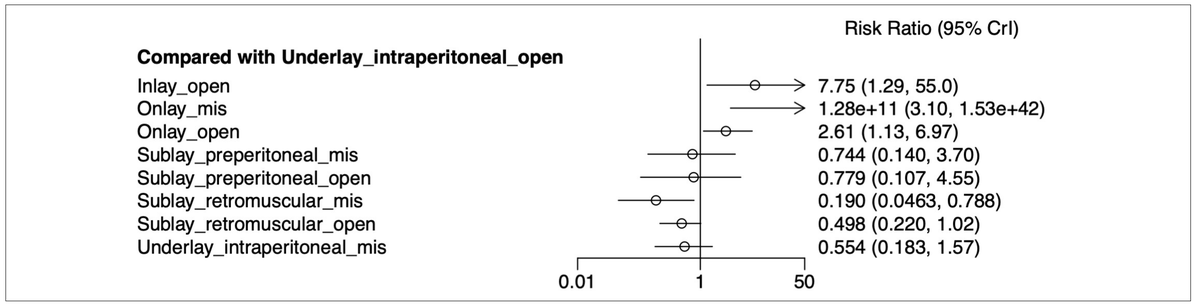


Figure 2. Forest plot representing the random-effects network meta-analysis of hernia recurrence comparing open and minimally invasive surgery procedures across each surgical approach.

CONCLUSION

Mesh placement significantly affects outcomes. The sublay-retromuscular plane may be superior for hernia recurrence compared to the intraperitoneal underlay plane. The onlay plane appears to carry a higher risk of recurrence, SSI, and seroma formation. Additionally, the MIS sublay-retromuscular group had a lower recurrence risk compared to the open intraperitoneal underlay group, while the open onlay placement group showed a higher risk. Further research is needed to confirm these associations and guide optimal mesh placement strategies.