35. Adhesions After Lap Ventral: Do They Matter?

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The Incidence and Consequences of Intra-abdominal Adhesions

Intra-abdominal adhesions are the cause of significant morbidity and mortality. Beyond the technical challenge posed by adhesions, they cause enormous human suffering and cost to society. In 1994, a comprehensive report based on the National Hospital Discharge Survey indicated that 303,836 patients underwent adhesiolysis [1]. These procedures were associated with 846,415 inpatient days and incurred $1.3 billion in hospital and surgeon costs. Ten years later, those numbers had increased slightly. In 2004, more than 342,000 patients underwent adhesiolysis [2]. Many other patients who did not require adhesiolysis were admitted to the hospital with either a bowel obstruction or complaints of pain caused by adhesions. Many other patients are afflicted with infertility caused by adhesions [3–5].

In addition to the human and financial cost of treating conditions that are caused by adhesions, they are commonly the cause of adverse consequences during surgery for conditions unrelated to the adhesions themselves. The presence of adhesions increases the chance of converting a laparoscopic operation to an open operation, increases the time required to enter the abdomen, and is the primary cause of bowel injury at the time of trocar insertion during laparoscopic surgery [6]. In short, adhesions are frequently the cause of a significant technical complication during an operation.

Although any condition inciting an inflammatory response may cause intra-abdominal adhesions, by far, the most common cause of adhesions is previous surgery. Until the late twentieth century, surgeons performed essentially all abdominal surgery with an open laparotomy, and up to 95% of patients who undergo a laparotomy develop adhesions [7, 8]. Depending

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on the underlying disease and the nature of the procedure at the time of the primary surgical procedure, up to 30% of patients will develop a bowel obstruction secondary to adhesions after a laparotomy. [9] After any colon resection, patients have a 5–10% chance of an adhesion-related admission within 5 years, and the incidence of adhesion-related admission within 5 years after proctocolectomy is 15.4% [10, 11].

The size and orientation of the laparotomy incision may be factors in the development of adhesions, but there is no reliable method to prevent adhesions during surgery [12]. Anecdotal experience and some initial observational studies suggested that laparoscopic surgery resulted in fewer and less severe adhesions than those caused by laparotomy [13]; however, other studies regarding adhesions after colorectal surgery suggest that the incidence of adhesions is not significantly different between open and laparoscopic colectomy [14].

Some of the important factors that increase the likelihood of extensive adhesion formation include ischemia, surgical trauma, inflammation, hemorrhage, thermal injury, and reactions to foreign bodies [15]. Although foreign bodies such as gloves, powders, sutures, sponges, and irrigating solutions all incite a response that can lead to adhesion formation, the foreign body of most concern in this discussion is hernia mesh.

Prosthetic Mesh as a Cause of Adhesions

Most surgeons have seen extensive, dense adhesions between polypropylene mesh and viscera at the time of re-exploration in patients with previously placed intraperitoneal mesh. Because these findings often led to difficult operations and sometimes caused complications, surgeons became reluctant to place mesh intraperitoneally. The occasional occurrence of these extremely difficult situations has led to attempts to develop mesh that would incite fewer adhesions. The main concern on reoperation after previous intra-abdominal mesh placement is the ingrowth that can occur between the viscera and a macroporous mesh. Adherence (adhesions) without ingrowth results in minimal to moderate effort to lyse the adhesions. But, with ingrowth, the mesh may need to be cut off of the abdominal wall, or a bowel resection may need to be performed to complete an operation. In rare cases, ingrowth may also lead to fistula or abscess formation.

There is no widely accepted method for determining the extent and density of adhesions in the peritoneal cavity short of abdominal

exploration. Because it is unethical to subject patients to repeat laparotomy or laparoscopy simply to explore for the presence of adhesions, investigators cannot conclusively determine the extent and density of adhesions formed after mesh placement. We really only know the extent of adhesion formation in the small, but significant, percent of patients who require a repeat operation after mesh placement. For this reason, to evaluate meshes that were designed to prevent adhesions, investigators have documented for several types of new meshes the extent and density of adhesion formation at either laparoscopy or necropsy in several animal studies [16–27].

These studies typically compare the extent and severity of adhesion formation after placement of a composite mesh (two layers) or coated mesh (single layer) with the extent and severity of adhesion formation after placement of a single-layer uncoated mesh, usually polypropylene. The composite mesh is designed to enable excellent tissue ingrowth into one layer while preventing adhesion formation and/or ingrowth into the other layer. The layer designed to lie against the abdominal wall is called the parietal layer, and the layer designed to lie against the omentum or viscera is called the visceral layer.

The parietal layer is usually a porous synthetic mesh with interstices into which the body can grow. The porous layer should enable firm incorporation of the mesh into the parietes. The visceral layer is microporous, usually either expanded polytetrafluoroethylene (ePTFE) or an anti-adhesive material such as a hydrophilic anti-adhesive collagen layer, a hyaluronate/carboxymethylcellulose combination, or polyvinylidene fluoride although other materials have also been tested. A coated mesh is a single-layer mesh that is coated with a material to prevent adhesions, such as a hydrogel.

Most studies in the animals documented tissue ingrowth into the parietal layer of the composite or coated mesh that was equivalent to ingrowth into plain polypropylene but with fewer and less dense adhesions to the visceral layer than to plain polypropylene. Based on the results of animal studies, surgeons often choose a composite mesh hoping that fewer serious adhesions will form. However, there are no human studies confirming this. Despite the belief that the composite meshes cause fewer intraperitoneal adhesions, there continues to be occasional anecdotal reports of serious adhesions caused by composite meshes [28] (Fig. 35.1).

Some investigators have reported successful identification and documentation of the location and density of intraperitoneal adhesions with the use of abdominal ultrasound [29]; however, not all investigators have found the use of ultrasound to accurately identify adhesions.

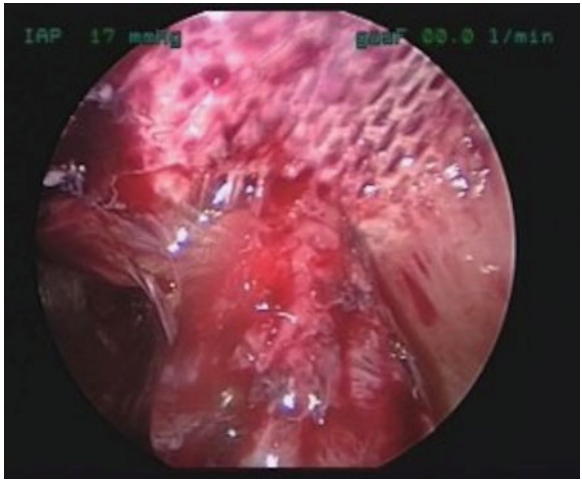

Fig. 35.1. Intraoperative photograph showing dense adhesions between a composite mesh and the small intestine.

Conclusions

There is no experimental evidence from human studies that one mesh is better than another, despite evidence in animal studies that some meshes incite fewer and less dense adhesions. However, the severity of the adhesion problem is clear, and the role of mesh in the formation of adhesions is clear. Based on the evidence from animal studies and solid theoretical reasons, the use of a composite mesh with an anti-adhesive layer seems appropriate when hernia repair requires intraperitoneal mesh [30].

Summary

Adhesions are a serious and very significant cause of morbidity and mortality in the USA. Many synthetic mesh products incite extensive and dense adhesion formation in the abdominal cavity if placed intraperitoneally. Because it is necessary to use mesh in many patients who require hernia repair, it is theoretically and experimentally desirable to use a mesh designed to reduce adhesion formation if intraperitoneal placement of mesh is necessary.

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