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Surgery

# DENSE ADHESIOLYSIS IN COLORECTAL SURGERY: A SHORT REVIEW

**Samrat Ray*** (MS) Surgical Gastroenterology and Liver Transplantation Sir Ganga Ram Hospital, New Delhi *Corresponding Author

**Samiran Nundy** (Mch) Surgical Gastroenterology and Liver Transplantation Sir Ganga Ram Hospital, New Delhi

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**Introduction:**

A seemingly inevitable result of abdominal and pelvic operations are post-operative adhesions which pose an important problem in surgical practice. Adhesions may develop between solid organs, hollow viscera, adnexae and the abdominal wall. Ellis et al estimated that around 33% of the patients who had undergone an open abdominal surgery were subsequently readmitted due to symptoms possibly related to adhesions during the subsequent ten years and also that over half of the readmissions were the outcomes of repeat surgery potentially complicated by the adhesions.[1] In a landmark review by Ray in 1994, nearly 300,000 hospital admissions in the United States were ascribed to adhesions with exceedingly high surgical and hospital expenses.[2] A study using the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project data estimated that adhesive small bowel obstruction was diagnosed in almost 100,000 discharges every year and was responsible for more than 2000 deaths in the United States in the year 2005.[3]

**Pathophysiology of adhesions**

There have been several studies in the past regarding the mechanism of the development of adhesions and strategies to prevent the same. Schade and Williamson undertook ultra-structural analysis of adhesions in rodents and inferred that desquamation of mesothelial cells with a resultant denuded surface, seemed to be the critical event in adhesion formation.[4] Subsequently, Buckman et al proposed a mechanism based on fibrin deposition on an exposed basement membrane.[5] Failure to clear this deposited fibrin secondary to depletion of plasminogen activator activity was proposed to be responsible for abdominal adhesion formation. However, extrapolation of data from animal models has not been conclusive to determine the pathogenesis of peritoneal adhesions. The present schools of thought ascribe adhesion formation to be a component of the normal healing process.

Another important factor is the presence of concomitant adhesions. These have been shown to affect the outcomes in patients admitted for abdominal conditions other than adhesive bowel obstruction. In a study by Navros et al, in a cohort of 5940 patients, adhesiolysis was performed in 875 patients and it was concluded that patients with concomitant adhesions undergoing adhesiolysis were at a higher risk for inadvertent enterotomies and resultant postoperative morbidity.[6]

**Adhesiolysis in colorectal operations:**

According to the estimate by Ellis et al in 1999, the rate of repeat procedures per 100 initial abdominal operations that were complicated by adhesions was nearly 40 during a 10-year follow up.[1] Subsequently, however, there have been no studies focusing on the difficulties faced while reentering the abdominal cavity in a redo colorectal or small bowel surgery. Beck et al studied the extra incision time and the time to access the peritoneal cavity, time for adhesiolysis and the frequency of inadvertent small bowel enterotomy encountered while reentering the abdominal cavity.[7] With the current trend in colorectal operations being more towards the laparoscopic approach, special attention needs to be given to the specific pre-requisites in laparoscopic surgery: creating a pneumoperitoneum, insertion of the first trocar, increased risk of enterotomies as well as the increased chance of conversion to open surgery. Karayinnakis et al evaluated the factors affecting the outcome of laparoscopic cholecystectomy in patients with previous upper and lower abdominal operations.[8] In a study comprising of a cohort of 111 patients undergoing elective colorectal surgery (29 open/ 80 laparoscopic/ 2 lap converted to open), Kossi and coworkers found that the presence of adhesions as a result of previous surgery increased the operating time (the mean extra time was 19.9 mins in open operations, 35.4 mins in converted cases and 9.5 mins in laparoscopic procedures).[9] This extra time was found to correspond to 12% of the total duration of the operation. It was also found to correlate with the number of previous operations. There was no significant correlation of outcome seen with the actual modality of dividing the adhesions. Recent studies have found no difference in operative difficulty between energy sources and lasers in laparoscopic surgery in a previously operated abdominal cavity. Owing to the high vascularity of the well-developed adhesions, adequate haemostasis must be ensured while dividing the adhesions.[10] In laparoscopic surgery, adhesiolysis is mostly complicated by injury to the underlying hollow viscera, uterus, ureters or vascular structures especially during the trocar placement.

**Prevention of adhesions: adhesion barriers**

Prevention of adhesion formation dates back to Pope's experiment in 1914 using citrate solutions to prevent their development. Ordonez et al found an inverse correlation between operative experience and adhesion formation. Currently, no systemic agent has been proven to be effective in preventing adhesions. Corticosteroids and antiproliferative agents may reduce adhesion formation, however at the cost of affecting normal healing . Animal experiments have found calcium channel blockade to be effective in reducing adhesion formation[11] and using large volumes of crystalloids like Ringer lactate have also been found to be a good early means of preventing adhesions by acting as a physical barrier between the healing surfaces as well as by diluting the inflammatory exudates.[12] A pilot randomized trial in a cohort of 17 patients undergoing Hartmann's reversal was conducted by Kossi et al comparing the effect of intraperitoneal 4% icodextrin solution with lactated Ringer's solution on the incidence of post-operative adhesions after a Hartmann's procedure; the time for adhesiolysis during Hartmann's reversal being the marker of severity of adhesions.[13] However, no significant difference was noted with respect to adhesiolysis time. Agents like hyaluronic acid may inhibit adhesion formation. Animal experiments have shown around 35% reduction in the rates of adhesion formation. But, the high viscosity of these agents makes their application cumbersome.[14]

A systemic review and meta-analysis by ten Broek et al aimed to study the effect of the approved adhesion barriers like hyaluronate carboxy methylcellulose, oxidized regenerated cellulose, icodextrin 4% solution, and polyethylene glycol in preventing post-operative adhesions after abdominal surgery.[15] Most other similar reviews in the past failed to conclusively establish the role of these products to prevent or minimize intraperitoneal adhesion formation or decrease the attendant long-term morbidity of intrabdominal adhesion formation such as infertility, small bowel obstruction, or repeated laparotomies.[16,17] Reoperation due to small bowel obstruction was the primary outcome variable by most of these authors.

Oxidized regenerated cellulose, as a haemostatic adjunct has shown a reasonable safety profile.[18] This agent has been found to significantly reduce the incidence of adhesions, but the end point of most of the studies to determine the likelihood of oxidized regenerated cellulose affecting the surgical outcome has not been defined conclusively .

Barrier methods have been the point of interest in research to prevent adhesions. Electron microscopic studies have demonstrated no further progress of adhesion formation after development of the mesothelial cell layer around a foreign mesh at approximately 1 week.[19] This guides the practice of using a barrier placed between healing surfaces for the first week after surgery to inhibit adhesion formation. In a clinical trial of 183 patients with ulcerative colitis or familial adenomatous polyposis undergoing colectomy with ileal pouch anal anastomosis (IPAA), Becker et al studied the role of intraperitoneal barriers to prevent adhesions. Dense adhesions were noted in 58% of the control group as opposed to only 15% of the group with the barrier.[20]The latest of the barrier products adds polyethylene oxide to Carboxy Methyl Cellulose (Oxiplex). Polyethylene glycol has been shown to inhibit thrombogenesis. The presence of blood was however, found not to affect the rate of adhesion formation.[21]

## Conclusion:

To summarize, it can be concluded that a previous abdominal procedure increases the operative time considerably in both open and laparoscopic colorectal surgery and this has been seen to correlate well with the number of previous surgeries. However, there is no single adjuvant agent at present that seems to be definitively effective in decreasing the incidence of postoperative adhesions.

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