The Use of Omental Flaps in the Protection of Anastomoses of the Unprepared Colon (An Experimental Study)

Hatem Helmy MD, Motaz Selim M.Sc., Prof. Dr Samir Galal MD.
Department of Surgery, Kasr Alaini Faculty of Medicine, Cairo University

ABSTRACT

To test the feasibility of using omental flaps for protecting primary anastomoses on the unprepared colon, a prospective experimental study was designed with two groups of rats (20 rats each) were included; an unprotected primary anastomosis was done in one, while in the other a protective omental patch was used to cover the anastomosis. Both groups were followed up 14 days post operatively for mortality and morbidity, then autopsy was done to detect any leakage and to assess the strength of the anastomosis by bursting them using the balloon of the Foley’s catheter. For the primary repair group, the morbidity rate was 30%, the average volume of saline at which bursting occurred was 4.45 cc with 80% of ruptures occurring in the anastomotic site. For the omental flap covered group morbidity was only 5%, the average volume of saline at which bursting occurred was 6.25 cc and 60% of ruptures were in extra anastomotic sites. The data generated by this study suggests that wrapping colonic anastomoses with omental patches confers them more strength and healing power.

Key Words: Unprepared colonic anastomosis - Omentum

INTRODUCTION

Surgeons face emergency abdominal surgery routinely; one of the organs that are usually encountered in such situation is the unprepared colon. The causes of emergency surgery on the unprepared colon are various; including, but not limited to colonic injuries, perforations (e.g. diverticulitis) and acute obstruction (e.g. tumors or volvulus). There has been a lot of controversy regarding the best option to deal with such situations, especially with left colon injuries and perforations. The usual concept of the use of a protective proximal diverting colostomy has been valid for long; however, the morbidity rate associated with colostomy closure (20%) has led to the development of other techniques aiming at improving the results of primary anastomoses on the unprepared colon.

Surgical options in emergency situations include: exteriorization of a colonic segment, resection anastomosis with proximal protecting colostomy, resection with colostomy and mucous fistula and primary anastomosis. Exteriorization of a lacerated segment as colostomy commits the patient to a second operation for closure of colostomy and the patient will be exposed to the complications of colostomy as ischaemia, gangrene, retraction, obstruction, prolapse and paracolostomy hernia, and to the complications of closure of colostomy viz. leakage, sepsis, evisceration and incisional hernia. It has been suggested that the injured colon be repaired and then exteriorized to avoid these complications. This would allow the exteriorized repair to be returned to the abdomen during the same hospitalization (generally at 10 to 14 days after the original repair). Lou reported such management in 50 patients. The repaired, exteriorized loop was covered with occlusive petrolatum gauze and inspected daily. In this series 60 % of the injuries healed, but 34 % leaked between the third and tenth postoperative days and required formal conversion to a colostomy. Construction of a proximal diverting loop colostomy is another technique that has been historically employed to protect a new anastomosis in patients undergoing emergency colectomy or simple closure for penetrating colon trauma or perforation. Closure of the colostomy is delayed until the patient recovers and anastomotic healing is confirmed by radiographic studies. The patient is exposed to all the complications of colostomy and the complications of the operation to close it. Clinical support for resection and anastomosis in the unprepared colon comes from a growing experience with primary repair of penetrating colon injuries in trauma patients. In those patients, considered for primary anastomosis, on-
table lavage suggested by Dudley reduces the fecal load of the colon. However, many studies have criticized the concept of on-table colonic lavage. The intracolonic shield has been described by Carpenter as a means of protection of the primary anastomosis and to avoid colostomy with successful anastomotic healing reported. However, erosion by the stiff ring of the intracolonic shield through the bowel wall has been reported too.

The omentum is a major source of the leukocyte response in bacterial peritonitis and it also has valuable angiogenic properties. Vascular omental adhesions can provide precious alternative blood supply to ischaemic tissues as stated by Ellis. Omentum wrapping of anastomoses has been proposed for colorectal surgery since 1888, in an experimental study by Senn, who concluded that the advantages of covering a sutured intestinal wound by an omental flap are self-evident. The process is simply an imitation of nature’s process in protecting the peritoneal cavity against perforation and in hastening the healing of abdominal visceral wounds.

MATERIALS & METHODS

This is a prospective experimental study, carried out in the animal lab, Kasr-Alaini Faculty of Medicine, Cairo University, designed to include two groups of rats to study the value of a protective omental patch fashioned to cover the primary anastomosis of the unprepared colon in the healing of such repairs in one group, compared to unprotected primary anastomosis done in the same setting in the other group.

Animals

40 white rats, 250-300 gm, were randomly selected. All the rats were kept under standard laboratory conditions, and were allowed food and water ad libitum.

Study Design

Rats were assigned randomly into two groups of 20 rats each; Group A (the control group) and Group B (the omental patch group).

Anaesthesia

IM Ketamine HCl 50 mg/kg + Xylasine 10 mg/kg.

Surgical Procedure

No pre-operative colon preparation methods were used in either group. Group A: Midline laparotomy was done under aseptic conditions, the left colon was identified and a complete circumferential cut was done taking care not to injure the marginal artery. Ends were anastomosed by single layer, full thickness, interrupted, inverting 6/0 polygalactin sutures (plus a single silk suture for later identification). Assessment of integrity was done by squeezing colonic contents along the anastomotic segment, then the abdomen was closed by continuous 4/0 silk after intraperitoneal instillation of 100mg cefoperazone in 1 cc saline. Skin closure was done by continuous interlocking 4/0 silk sutures. Group B: was operated upon as before, plus wrapping the anastomotic line with greater omentum and fixation in place by interrupted 6/0 polygalactin sutures.

Post operative care

No antibiotics were given. Standard food and water allowed ad libitum from day 1. To assess the two study groups, the following criteria were taken into consideration: mortality rate, morbidity rate, autopsy and the volume at which anastomotic bursting occurred.

Autopsy

All rats of both groups were sacrificed on day 10 post-operatively, autopsy was done and the abdomen was inspected for anastomotic dehiscence, peritonitis, and the formation of adhesions.

Volume of saline needed to burst the anastomotic segment to assess the strength

A segment of the colon 6 cm long was resected, centered on the anastomotic line, while care was taken not to disturb the anastomosis and adhesions. A Foley's catheter 8 Fr was introduced through the lumen centering the balloon on the anastomotic line, and then both ends of the colonic segment were ligated. The balloon was inflated with saline at a constant rate until the anastomosis ruptured. The volume of saline injected was used as an indicator of the strength of the anastomosis.
Primary anastomosis  Anastomosis with patch

10 days post operative
RESULTS

Mortality rate
No mortalities were reported in either group.

Morbidity rate
Wound infection rate was 6/20 (30%) for Group A and 1/20 (5%) for Group B.

Autopsy
No abdominal collection or gross leakage was apparent on autopsy of subjects of both groups.

Assessment of the volume at which bursting occurred
Average for group A was 4.45 cc. with most ruptures occurring at the anastomotic site 16/20 (80%), and only 4/20 (20%) occurring at normal surrounding tissue. Average for group B was 6.25 cc with most ruptures occurring at normal surrounding tissue 12/20 (60%), and 8/20 (40%) occurring at the anastomotic site.
Group statistics showed a significant difference in the mean volume of saline needed to burst the anastomosis. Regarding the site of rupture, the Chi square value was 6.7 with a statistically significant P (<0.01) and t value (6.9). The odds ratio was 6 with a confidence interval of 1.2-32.2 which shows a statistically significant probability of rupture in the extra anastomotic site in the omental patch group than it is in the primary anastomosis group.

### Group Statistics

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
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<tbody>
<tr>
<td>Saline Volume A</td>
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</tr>
<tr>
<td>Saline Volume B</td>
<td>20</td>
<td>6.2500</td>
<td>0.89590</td>
</tr>
</tbody>
</table>

**Wound infection in primary anastomosis**

**Clean wound in patch group**

**Bursting apparatus**

**Burst occurred at 7 cc saline**

**Burst in extra anastomotic site**
DISCUSSION

As regards omental wrapping, McLachlin\textsuperscript{20} has performed an experimental study on dogs, the leak rates of experimentally devascularized rectal anastomoses was significantly less in the group with omentum wrapped around the anastomosis (25\% vs. 90\%). This protective effect depends on the blood supply of the omentum. Devascularized omentum grafts led to an increase in leak rates and mortality. On the contrary, Carter\textsuperscript{21} observed no improvement in fatal leak rates in rabbits undergoing technically satisfactory, adequately perfused colonic anastomoses with an omental wrap (14\% in wrap group vs. 8\% without). The few reported case studies described low clinical leak rates (0-4\%) after anterior resection with omental wrapping.\textsuperscript{22-23-24}

Comparing our results with those of previously mentioned studies, lead to the conclusion of the importance of protecting the anastomosis and the significance of wrapping the anastomosis with omentum. The data generated by this study suggests that wrapping colonic anastomoses with omental patches confers them more regeneration ability and healing power. In contrast to anastomoses done primarily with no omental patch coverage, rats with protected anastomoses showed significantly less wound infection rates, and their anastomoses were significantly more resistant to forces trying to disrupt them. Moreover, the rupture, when occurred in this group was mostly located in normal tissue outside the vicinity of the omentum protected anastomosis, while in the unprotected anastomoses, the rupture was predominantly within the anastomosis.

REFERENCES
