



PRIMARY ANASTOMOSIS VERSUS DIVERTING COLOSTOMY AN EXPERIMENTAL STUDY IN RATS

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ABSTRACT

Anastomotic dehiscence, following colorectal surgery is a significant cause of morbidity and mortality and is responsible for one-third of deaths following colorectal surgery. Primary repair in a contaminated field was thought to be associated with leakage from bowel anastomosis but peritoneal contamination did not have any effect on hydroxyproline levels or the tensile strength of primary anastomosis in either the large or small bowel 4 days after surgery. In the present study we are aiming to assess the value of the covering colostomy. All surgical maneuvers were conducted in the special laboratory of department of surgery, faculty of veterinary medicine, Suez-Canal University, Egypt. 40 male Sprague-Dawley rats were used and divided into two groups. Surgical procedure in Group A was done as end-to-end single layer extramucosal anastomotic construction. Colostomy fashioning was performed as a loop colostomy in Group B. Our data as regard to mortality rate, anastomotic failure and manometric study suggested that diverting colostomy had no beneficial effect on operative outcome than primary anastomosis and we concluded that primary anastomosis could be performed in most left colonic anastomosis with satisfying results.

INTRODUCTION

Anastomotic dehiscence, following colorectal surgery is a significant cause of morbidity and mortality and at least one-third of deaths were attributed to anastomotic leakage (Egger et al, 2001). Healing of intestinal anastomoses and in particular the development of early postoperative anastomotic strength may be compromised by numerous technical, local and systemic factors (Ender, et al.2001). Primary repair in a contaminated field was thought to be associated with leakage from bowel anastomosis. For this reason, major surgical textbooks have stated that primary repair has a very limited or no role in the face of peritoneal contamination (Makela, et al .2003) . Novel findings suggest that a diverting colostomy may increase intestinal leakage after anastomosis formation in the rat colon. Thus, the role of proximal colostomy in the protection of colorectal anastomosis needs to be reevaluated and further investigations are required to resolve the influence of surgical defunctioning on intestinal healing (Mansson et al.2000) .

To investigate the appropriate surgical method that should be selected in the localized fecal peritonitis due to colonic injuries, colonic injuries were performed in rats and the repairs were carried out after 24 hours. If the injured or perforated colon is surrounded by the organs and so the generalized peritonitis is avoided, primary anastomosis would have similar results with colostomy despite fecal contamination and prolonged intervention time (Kayaalp, et al.2003). In the present study, the author is aiming to assess the value of the covering colostomy.

MATERIALS AND METHODS

In the present study 40 male Sprague Dawley rats were used and housed five animals to a cage with the appropriate diet and water provided ad libitum Rats were observed for several days to ascertain health before operations and divided into two groups for study [20 rats for each]

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All surgical maneuvers were conducted in the special laboratory of Department of Surgery & Anaesthesiology in the Faculty of Veterinary Medicine, Suez-Canal University, Egypt. Male rats having an average weight 250-300 grams of Sprague-Dawley species, obtained from the documented animal house of the Faculty of Veterinary Medicine,, Suez-Canal University.

Local ethics committee for the use of laboratory animals approved all experimental procedures. Appropriate animal care and use were performed according to implementation and compliance with the Animal Welfare Act.

Rats were divided randomly into two groups group A n colonic anastomosis with defunctioning colostomy and group B n colonic anastomosis without colostomy

Anesthesia

The anesthesia was induced with i.m. Ketamine (50 mg/kg), and xylazine (6 mg/kg), and conducted by a specialized teamwork of the Department of Surgery & Anaesthesiology in the Faculty of Veterinary Medicine, Sues-Canal University (Saber,2010).

Anastomotic construction was done as end to end single layer extramucosal technique with eight interrupted sutures using prolene as described by Saber figures and colostomy fashioning was performed a loop colostomy figure

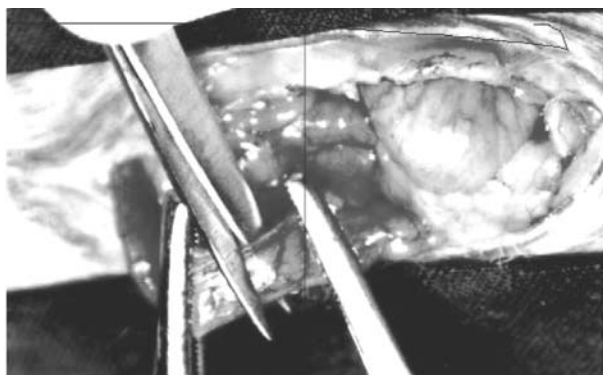


Figure An intraoperative photograph showing division of the colon prior to anastomosis

All rats were observed in the postoperative period and data were collected day by day and saved as software files for later evaluation In the present study

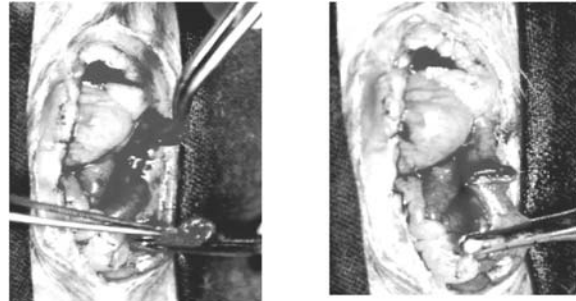


Figure An intraoperative photograph showing the start and the finish of anastomosis

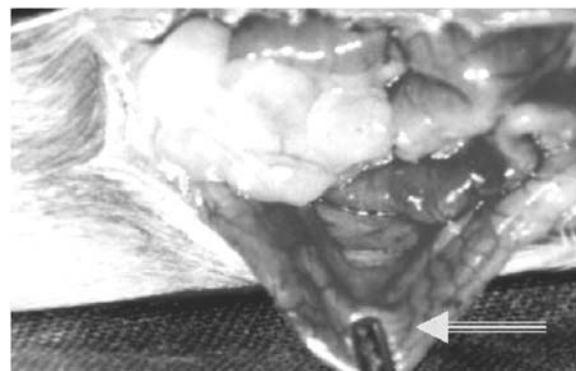


Figure An intraoperative photograph showing the fashioning of loop colostomy

no anti biotic was administered to rats in neither the pre operative intraoperative nor the postoperative periods Also no parenteral feeding was allowed and early oral feeding was started

After the scheduled two week post operative period all survived rats were reopened for second look laparotomy through a left sided curvilinear laparotomy incision to detect anastomotic leakage and for manometric study by measuring both bursting pressure and breaking strength which are the minimal force exerted to cause anastomotic perforation and it was measured as described previously (Saber,2010. Ikeuchi et al) and the maximal force needed to disrupt the anastomosis .Previous experiments have demonstrated that measurement of the bursting pressure does not interfere with measurement of breaking strength of the same anastomosis (Saber,2010. Ikeuchi et al).(figure

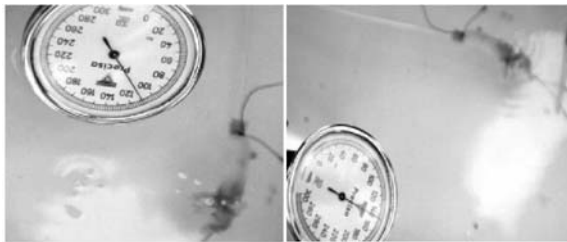


Figure 1 A postoperative photograph showing the bursting pressure breaking strength values air bubbles denote colonic segment perforation

RESULTS

No operative deaths were noted in either group. Two rats belonged to the colostomy group. A died prematurely by the day of experiment while three died of group B and the latter were excluded from the study. The overall mortality was of rats of group A and of group B. In group A mortality rate was $P \geq$ while in group B it was $P \geq$.

All rats with excessive leak or fecal peritonitis showed clinical signs of toxemia and pictures of intra abdominal sepsis as lethargy with diminished motor power, loss of appetite, loss of eye luster and piloerection. Those passed the two week postoperative period experienced rather normal attitude and activity. No intra abdominal leak could be found during the second look laparotomy.

DISCUSSION

An interesting experimental work found that anastomotic leakage was markedly increased in rats with diverting colostomy and was associated with a higher mortality rate compared to control animals (Mansson et al. 2002). This means that leakage from colorectal anastomosis is a major concern for surgeons. It is a fact that the rate of clinically apparent anastomotic leakage as reported in many studies was as high as 10 percent (Ender, et al. 2001 and Makela, 2003). The overall mortality in the present study was 10 percent in group A and 10 percent in group B. In group A mortality rate was 10 percent while in group B it was 10 percent.

Our data came in concordance with data of studies of similar interest as well as clinical aspect (Abete

All rats, with excessive leak or fecal peritonitis, showed clinical signs of toxemia and pictures of intra-abdominal sepsis as lethargy with diminished motor power, loss of appetite, loss of eye luster and piloerection. Those passed the two-week postoperative period, experienced rather normal attitude and activity. Severe abdominal infections are accompanied with a high level of endotoxin production, resulting in the so-called systemic inflammatory response syndrome (SIRS), which is often complicated by multiple organ failure (Parc, et al. 2000). Our observational data met with those reported in rats of sepsis induced experimentally by caecal ligation and puncture, exhibited symptoms and signs of sepsis, including lethargy, piloerection, decreased grooming, and diarrhea (Yang, et al. 2003).

No intra abdominal leak could be detected at the second look laparotomy but we could not exclude the occurrence of leak before re laparotomy. As leak may be clinically evident or suspected clinical anastomotic leakage was confirmed by laparotomy and clinically suspected anastomotic leakage was confirmed only by contrast radiography. In patients with anastomotic leakage death occurred in 10 percent of patients (Parc et al. 2000 and Alves et al. 2003).

Dehiscence of intestinal anastomoses is mostly seen during the first week after operation. Immediate postoperative wound strength mainly depended on the ability of extracellular matrix components, particularly collagen fibers, to retain sutures. After this initial period, wound strength should be restored to the levels of uninjured tissue by deposition of new collagen fibers, produced by fibroblasts under direction of both the cellular and humoral immune system. Consequently, disturbed connective tissue metabolism may induce poor wound strength (Mansson, et al. 2002 and Makela, et al. 2003).

Until now, we couldn't find any data comparing the manometric values in general, and colonic anastomotic healing depends on the balance between collagen synthesis and degradation; however, the role of collagen breakdown in wound healing is still not well understood (Ender, et al. 2001. Kiyama, et al. 2001).

In colostomy group, rats showed lower values of both bursting pressure and breaking strength [16712.04 and 1944.18] than those of primary



anastomosis [17313.03 and 2078.37]. Despite being different, these values were not significant $p=1$ in case of bursting pressure and in breaking strength measurement.

Our data were in concordance with that reported by Tornqvist and colleagues Tornqvist, et al. (1990) as they said that after a week their control group showed a significant increase in both anastomotic strength and collagen content that was not observed in the colostomy group. The absence of increase in anastomotic strength in the colostomy group had no adverse effect on anastomotic healing as judged by complications.

We would suggest that the low values of both bursting pressure and anastomotic strength may be due to decreased collagen content in the excluded colonic segments. Kissmeyer Nielsen et al. found that hydroxyproline content of excluded colon as well as the breaking strength of the defunctioned colon decreased. Also they reported that proximal to the colostomy site there was no difference in the hydroxyproline content or biomechanical strength and they concluded that defunctioning of the left colon in rats leads to deterioration in the biomechanical properties caused by a lesser content and a decreased quality in the collagen of the excluded colon.

CONCLUSION

The main dilemma of colonic surgery remains appropriate patient selection for primary anastomosis. The author found no benefit for diverting colostomy over primary anastomosis as regard to mortality, anastomotic integrity or manometric values. Primary repair may be a safe method of managing unprepared colon presentations in carefully selected patients.

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