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PROSPECTIVE STUDY OF THE SURGICAL MANAGEMENT OF PENETRATING COLON INJURIES, INDICATIONS, COMPLICATIONS AND LIMITATIONS OF THE PRIMARY REPAIR

By
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The surgical treatment of civilian penetrating colon injuries has evolved towards the primary repair instead of the staged repair with fecal diversion by a proximal colostomy. Septic complications were found equal or less with the former method and unrelated directly to colon suture line disruption. A question is raised why should a colostomy is performed for those injuries. However, certain pre- and post-operative criteria must be taken in consideration.

Aim of The Work*: Evaluation of the indications and technical factors relevant to the outcome of both the staged repair with diversion and primary repair of civilian colon injuries.*

Material and Methods: *18 patients with full thickness colon injuries were surgically treated by primary repair or by a staged repair and colostomy in a time period between 3/98 – 3/01. Patients were studied in a prospective manner for the pre- and intra-operative risk factors predisposing to septic complications. The incidence of those complications, colon sutures line integrity and the patient's risk factors were correlated.*

Results: *All of the patients have had one or more of risk factors for postoperative septic complications. 14 of the patients underwent primary repair (10 following debridment and 4 following resection). 4 of the patients underwent repair with diverting colostomy (2 following debridment and 2 following resection). Complications related to the colon operation occurred in 8 cases (7 after primary repair and 1 after colostomy). None of the patients was complicated by colon suture line disruption.*

Conclusion: *Septic complications following surgical repair of penetrating colon injuries correlates with a long elapsing time between injury and operation, the severity of that injury and the degree of fecal soiling of the peritoneum. It can occur without colon suture line disruption. Severe colon injuries that mandate a resection in patients with risk factors for postoperative abdominal sepsis deserve a diverting colostomy.*

Key words: *colon trauma, primary repair, colostomy.*

INTRODUCTION

The surgical management of penetrating colon injury has evolved in the last two decades towards the primary repair instead of the classic staged procedure with a preliminary fecal diversion by a colostomy to protect the distal suture line at the colon [2,3,19]. Septic complications were found equal or less than that in those undergoing diversion and unrelated directly to suture line disruption.[4] However, certain pre-and intra-operative criteria should be taken in consideration. The general conditions at presentation such as shock, blood loss, associated injuries and timing of diagnosis relative to the accident are detrimental. The site and extent of the colon injury, the

degree of fecal contamination of the peritoneum and associated intraabdominal injuries must be considered[12,13,17].

Aim of The Work::

Evaluation of the indications and technical factors relevant to the outcome of both staged repair with diversion and primary repair of civilian penetrating colon injuries.

MATERIALS AND METHODS

We prospectively studied eighteen cases with penetrating colon injuries due to blunt or penetrating abdomen trauma who undergone colon reparative surgery over the time period between 03 / 1998 – 03 / 2001. Sixteen male and 2 female patients with age range between 27-58 years (mean 33.7 years). The type of injuries are listed in (Table 1).

Preoperative diagnosis was made in the two cases of endoscopic injuries and in one of the patients with stab because the bowel was eviscerated. Otherwise; the injured colon was discovered at the exploratory laparotomy. A full clinical assessment and the relevant investigative studies were done. There were no associated medical illnesses. Preoperative data of the patients at presentation and intra-operative findings were documented with emphasis on the risk factors predisposing to postoperative septic abdominal complications. This included hemodynamic instability, major blood loss, the time elapsing between injury and operation, associated extra- and intra-abdominal injuries, degree of fecal contamination of the peritoeum and the severity of the colon injury.

The staged technique with diversion was performed by two methods. Either by debridment and closure of the perforation with a proximal loop colostomy as an end stoma with distal segment mucus fistula or the injured segment was exteriorized as a loop colostomy.

The primary repair was performed by either closure of the perforation in two layers after debridement or by a segmental resection and anastomosis by standard techniques. Saline irrigation of peritoneum before closure was performed to all cases. Preoperative IV 3rd generation 1.5 gm cephalosporin with mitronidazole 0.5 gm were given and continued postoperatively twice daily for 5 days increased up to 7 days according to the clinical judgement.

The outcome parameters involved the postoperative days needed at the intensive care unit, hospitalization period, and complication with a particular emphasis on major sepsis (systemic and abdominal) or anastomotic disruption. The later was assessed by a gastrografin enema study, abdominal CT whenever needed or a re-laparotomy.

Colostomy closure was performed 8 - 16 weeks after surgery. It was done by hand-sewn, end-to-end extra-peritoneal anastmosis in two patients and the other two by local excision of the colostomy site without laparotomy.

RESULTS

All of the patients have had one or more of the risk factors for postoperative abdominal sepsis. There was pre- and intra-operative hemodynamic instability in nine of the patients with requirement of more than six units of blood transfusion in five of them.

The abdominal injury was the sole injury in 14 patients, it was part of polytrauma in 3 patients of the road traffic accident victims and it was associated with a left-sided thoracic injury in one patient with gunshot injury (Table 2).

The colon injuries were found as single injury in 8 patients and the remaining 10 patients were accompanied with other intra abdominal injury. This was found during laparotomy (Table 3). Six of traffic accidents victims, three of the abdominal stabs wounds and one patient with gun shot injury . All were associated with liver, spleen, kidney and mesentery injury.

All of the injuries in the colon were characterized by full thickness injury, the sites of which are shown in (Table 4). Three of the sigmoid colon injuries were iatrogenic injury [two at colonoscopy and one intra-operative diathermy injury].

There were multiple tears of the injured colon in four of the stab wound patients. In one patient with gunshot there was compromised blood supply of the whole descending colon.

The time elapsed between injury and the operation ranged from two to twelve hours (average of 4.5 hours). The delay of the operation was more than six hours from the injury in only three patients.

At the exploratory laparotomy; fecal soiling of the peritoneum was confined to the colon injury site in six, at the same quadrant in seven and it was spreading into more than one quadrant in the other five patients.

The associated injuries were managed first after securing the injured part of the colon by non-crushing clamps. Splenectomy was performed in five of the patients. Heamostatic suturing of liver and mesenteric tears was done in three of the patients. Suture repair of two large lacerations of the right kidney was done in one and left nephrectomy was performed in another patient.

Primary repair of the colon injury without a colostomy was performed in fourteen of the patients. Closure of the colonic tear in two layers after debridment was done in ten and resection was performed in four.

The remaining four patients who had colostomy, the injured segment was exteriorized as a loop colostomy after segmental resection in two patients (One involving the transverse colon and one involving the sigmoid colon). Two of the patients were managed by repair of tears at the descending colon and proximal transverse loop colostomy. These later injuries were occupying more than one quarter of the descending colon circumference. The patients afore-mentioned risk factors were listed in (Table 5).

There was no mortality in this study. Complications related to colon surgery occurred in eight patients (Table 6). Seven patients following primary repair; in the form of pelvic abscess in (one), wound infection with partial dehiscence in (four) and fecal fistula in another two of the patients. One patient following transverse colostomy had peri-stomal abscess.

None of the primary repair patients have had anastomotic disruption proven by post operative gastrograffin enema on the 7^{th}-10^{th} post operative day.

Table (1) : ***Type of Trauma that led to colon Injuries***

Type of injury	*# of patients*
RTA; Road Traffic Accidents	9
Stab wounds	4
Iatrogenic injury during colonoscopy	2
Iatrogenic injury during laparotomy	1
Gun shoot injury (Abdomen + Chest)	1
Gun shoot injury (Abdomen)	1

Table (2) : ***The Associated extra abdominal injuries.***

Abdominal injury sole injury	*Associated Extra abdominal*
14	3 poly-trauma 1 Thorax gun shot wound

Table (3) : ***Associated intra-abdominal injuries.***

Aetiology	*Associated intra- abdominal injury (total 10)*
RTA	3 spleen, 1 mesentery, 1 liver , 1 Lt. Kidney
Stab wound	1 spleen, 1 liver / mesentery, 1 Lt. Kidney
Gun shot	1 spleen

Table (4) : ***The colon injury different sites***

Site of the colon injury	*# of patients*
Ascending + Hepatic Flexure	3
Transverse colon	4
Spleenic flexure	3
Descending colon	4
Sigmoid colon	4

Table (5) : ***Patients risk factors:***

Patients data	*Total*	*Primary repair*	*Diversion*
Shock	9	5	4
Blood transfusion (> 6 units)	6	3	3
Associated extra-abdominal injury	4	1	3
Associated intra-abdominal injury	10	6	4
Delayed surgery	3	1	2
Colon injury requiring resection	6	4	2
Fecal soiling	12	8	4

Table (6): *Data of the complication*

Complication	*Patients*	*Patient's risk factors*	*Operation*
Pelvic abscess	1	Bleeding, hemothorax, rupture spleen, fecal soiling	Primary Resection Anastomosis Descending colon
Wound infection, dehiscence	4	Shock, fecal soiling	Primary repair of tear Sigmoid colon
Fecal fistula	1	Bleeding, rupture spleen, fecal soiling	Primary Resection Anastomosis Descending colon
Fecal fistula	1	Delay surgery fecal soiling	Primary repair of a tear Sigmoid colon
Peristomal abcess	1	Shock , Delay surgery fecal soiling	Resection Anastomosis Descending colon defunctiong transverse loop colostomy

Three complications were encountered during closure of colostomy intra-operative injury to small bowel, post-operative fistulae and adhesive small bowel obstruction. The postoperative hospital stay was 10-15 days in the uncomplicated patients with average (13 days). It was at range of 22 – 30 days in the complicated cases. No significant difference in hospital stay was found between primary repair and colostomy patients without complications. The average hospital stay was 5 weeks for those who had a complicated colostomy closure.

DISCUSSION

Several prospective randomized trials were done comparing the results of primary repair of penetrating colon injuries in civilians versus the staged procedure with a fecal diversion [6,10,14,16,18]. They came to the conclusions that performing a colostomy does not decrease the incidence of septic complications and the colon suture line disruption is the least common complication of the primary repair option. Septic complications rate exceeds the rate of suture line disruption [4]. So; putting to question why a colostomy should be done [10,16]. Primary repairs for virtually all trauma patients with full thickness colon injuries were reported. However, this statement can not be applied. There is still a high-risk category in which intra-abdominal infection due to colon suture line disruption leads to multi-organ failure and mortality. Identification of those risk factors would determine the need of a staged procedure with fecal diversion [15,18]. The risk factors predicting septic abdominal complications became well documented in literature [5,9, 7, 12,13,17] They involve shock, blood loss with requirement of more than 6 units of blood transfusion, multi-system or organ injuries, fecal soiling of the peritoneum, and the time elapsed between injury and colon surgical repair of more than 6 hours. Through the limited number of patients in this study we came to several observations. Firstly; septic complications are more common with severe fecal soiling of the peritoneum and delay of surgery. In our eight cases with postoperative septic complications there was a marked fecal soiling of the peritoneum. Reversible shock, blood loss, and associated injuries of other abdominal organs are correctable risk factors particularly; when promptly diagnosed and the definitive treatment is instituted early. Nine of our cases have had shock and six of them required massive blood transfusion of > 6 units but only two of them developed sepsis postoperatively. Probably this is related to prompt liberal use of blood in polytrauma patients. This contradicts what is available in literature about the need of massive blood transfusion as independent predictor of septic complications following surgery for repair of colon injuries [13]. The extent of colon injury and its site as risk factors is reflected on the previously mentioned as important factor namely; the severity of fecal contamination of the peritoneum. In our cases; all septic complications were found following repair of the left colon. Three of them have had severe colon injuries that require a resection and other three have had injuries occupying more than 25% of the colon circumference. Secondly; out of our expectation at the start of the study septic complications are not synonymous with colon suture line disruption. This is also, what is mentioned in the recent literature. 4 None of our patients suffered colon suture line disruption despite of occurrence of postoperative intra-abdominal sepsis in one and fecal fistula in two of them. This was attributed to a leaking suture line rather than disruption. Thirdly; vascularity of the colon at the time of repair is a very important factor. In the patients in whom there is a severe damage of a segment of the colon that mandates resection; the blood supply of the repaired part of the colon may be compromised. This may be not apparent to the naked eyes of the operating surgeon. Patients who underwent colon resection because of colon injury deserve a proximal diverting colostomy to be done [4,14,18]. Colostomy as a risk factor of post traumatic infection and high morbidity of colostomy closure support the choice of primary repair option [1,8,11]. In our study 3 out of 4 cases developed complications at colostomy closure surgery (75%). The long elapsing time between initial surgery and colostomy closure and the need of re-laparotomy favour

primary repair option in low risk patients not in- need of colon resection

Conclusions :

The septic complication following surgical repair for penetrating colon injuries are related to long elapsing time between injury and the severity of the colon injury and degree of fecal contamination of the peritoneum. It may occur without colon suture line disruption. Primary repair of civil penetrating colon injuries can be performed in all patients in whom resection of the injured part of the colon is not required.

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