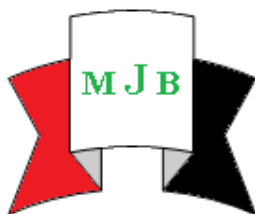


War Colonic Injuries-Management and Complication

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Abstract

This prospective study comprises (64) patients with preoperative diagnosis as colonic injuries. These cases were collected over a period of 3 years at Baghdad teaching hospital. In our study all caused by bullet and blast injuries. The Right colonic injuries were (32) cases, transverse colon (6) cases & left colon and rectum (26) cases. Intraoperative assessment and grading were done. (13) Cases were Grad I (40) cases Grad II & (11) Cases III. Out of (64) cases (55) cases had associated abdominal organs injuries all assessed and reported in (55) cases. (40) Cases admitted with hypovolemic shock. Other (24) patients were maintaining normal Blood pressure. Treatment was either Diverting colostomy (DC) in (44) cases. And primary repair (PR) in (20) cases. Mortality rate was in (4) 6.25% patients all presented with irreversible shock. Morbidity was in (44) 68% cases. (10) Cases developed complication like (fistula, Intraperitoneal sepsis....etc) and (18) cases developed (mild wound infection).

الخلاصة

هذه دراسة مستقبلية أجريت على أربعة وستون مصاباً قد شخصوا قبل وإنشاء عملية استكشاف البطن كحالات إصابة للأعضاء الغليظة. هذه الحالات تم جمعها خلال فترة سنتين في مستشفى بغداد التعليمي للفترة من ٢٠٠٣ لغاية ٢٠٠٥. في دراستنا كل الحالات كانت ضحية إصابات حرب مثل الاطلاقات النارية وحوادث الانفجارات. كانت إصابات القولون الصاعد اثنان وثلاثون إصابة (٥٠%)، القولون المستعرض ست حالات (٩.٣٧%) وعدد الحالات لإصابات القولون النازل والمستقيم ستة وعشرون حالة (٤٠.٦٢%). التقييم للإصابات القولون أثناء العمليات تم حسب نظام فلنت لتقييم إصابات القولون أجريت لجميع الحالات وكانت ثلاثة عشر حالة من الدرجة الأولى، أربعون إصابة من الدرجة الثانية و إحدى عشر حالة من الدرجة الثالثة. من العدد الكلي خمسة وخمسون إصابة (٨٥.٩٣%) تصاحبت بإصابات أخرى للأعضاء في التجويف البطني. أربعون حالة (٦٢.٥%) استقبلت والمرضى في حالة صدمة، وأربع وعشرون حالة (٣٧.٥%) كانت بفعاليات حيوية طبيعية. الإجراءات الجراحية كانت إما تقوية القولون في أربعة وأربعون حالة (٦٨.٧٢%) أو خياطة القولون الابتدائية في عشرون حالة (٣١.٢٥%). نسبة الوفيات كانت في أربعة حالات (٦.٢٥%) فقط كانت كلها استقبلت في حالة صدمة متقدمة. اثنا عشر حالة (١٨.٧٥%) عانت من مضاعفات شديدة بعد العملية مثل ناسور الأمعاء الغليظة أو خراجات تجويف البطن.. الخ، واثنان عشر حالة (١٨.٧٥%) عانت من مضاعفات بسيطة مثل التهابات بسيطة في جروح العملية.

Introduction

The large intestine extends from the end of the ileum to the anus. It is about 1.5 meters long, being one-fifth of the whole extent of the intestinal canal. Its caliber is largest at its commencement at the cecum, and gradually diminishes as far as the rectum, where there is a dilatation of considerable size just above the anal canal. It differs from the small intestine in its greater caliber, its more fixed position, its sacculated form,

and in possessing certain appendages to its external coat, the appendices epiploicae. Further, its longitudinal muscular fibers do not form a continuous layer around the gut, but are arranged in three longitudinal bands or tæniæ [1].

The lessons learned by surgeons during war time have served to advances of proper care of colonic injuries. In the era after World War II, an impressive improvement in the mortality from colonic injuries was noted.

This was due to several factors including improved method of triage and transport, effective replacement of blood and fluid and early surgical intervention combined with ancillary use of antibiotics. The old principle surgical mile stone in colonic injury that treatment of traumatic perforation of the colon mandated faecal diversion rather than primary repair had, with few exceptions.

Wartime series were slower to mimic the civilian trauma experience, but similarly demonstrated not all colorectal injuries required a colostomy, with equivalent morbidity and mortality rates following primary repair [2].

Two problems associated with colonic injury, First is that the bacterial colonies carry high risk of infection .Because Of the high bacterial content, a relatively minor leakage of faeces in the peritoneal cavity may result in a large inoculums of pathogenic bacteria. Second problem is that breakdown of the colonic suture line is more common than that seen with other hollow viscous injuries.

The exact mechanism of such disruption not fully explained. But some workers have shown experimentally that there is greater concentration of collagenase in the colon than elsewhere in the bowel [8].

Others demonstrated a grater increase in collagenolytic activity in the colon wall after injuries than after colonic anaestomoses. Penicillinase and penicillamine are produced in variable concentration by the colonic bacteria and could contribute to the weakening of cross – linking of collagen which is necessary for the healing of anaestomoses [9].

Classification of colonic Injuries:

Many systems have been devised to classify the degree of colonic injuries both qualitatively and quantitatively. Grading system become important in determining the appropriate type of surgical management.

In this study The colon wounds were classified by the Flint colon grading system[3]:

Grade 1: minimal contamination, absence of associated injuries, minimal shock, and no significant delay between injury and operation;

Grade 2: through-and-through perforation, laceration, and associated injuries.

Grade 3: severe tissue loss, heavy contamination, and deep shock.

Methodology

This prospective study includes 64 patients with documented colonic injuries admitted to the surgical words at Baghdad Teaching Hospital over a period of 2 years from June 2003 to June 2005.

The parameters used in this study include: age, sex mechanism of injuries, injury site, time from injury to arrival to hospital, presence or absence off shock.. An intravenous line had been set up for all patients, blood drawn for P.C.V, blood grouping and cross matching And antibiotic administered preoperatively for most patients (60 out of 64 ,93.75%) the 4 patient whom had no these measures were urgently taken to the operative theatre.

The anatomical location of the colonic injuries was classified, with the: 1- caecum through hepatic flexure defined as the (right colon). 2- hepatic flexure till splenic flexure as transverses colon. 3- The remaining of the abdominal colon considered left colon (descending and pelvic colon).

For purpose of comparison, patients divided into 2 groups according to the surgical procedure done to the colonic injuries:

A- primary repair (PR) with or without resection, or :

B- diverting colostomy (DC).

The term Diverting Colostomy including the following procedures:

1- Exteriorization of the injured site as a colostomy.

2- Repair of the injured site with a proximal colostomy.

3- Resection of the injured site with a proximal colostomy and a distal mucous fistula.

All major post-operative complications (e.g., those that prolonged a hospital stay or significantly altered subsequent treatments) were categorized by site: intra – peritoneal, wound infection, or extra–peritoneal (fistula and wound dehiscence).

The diagnosis of wound infection was given on clinical grounds to any patient whose skin erythema or pus discharge from the wound.

Results

64 patients with colonic injuries included in this study, 60 patients (95%) were males and 4 patients (5 %) were females. The age of the patients ranges from 7 years to 65 with highest percentage found around age of 28. The mechanism of injury in the majority of patients was bullet injury and blast injury.

The patients were divided into 2 groups; 44 patients (68.75%) had their colonic injuries treated by diverting colostomy (DC) and the remaining 20 patients (31.25%) underwent primary repair (PR).

Injuries of left side of colon (40 out of 64 patients, 62.5%) while the right side (16 of 64 patients, 25%), and 8 cases as transverse colonic injury (12.5%). The presence of hypotension on admission was also documented and it was found in 40 (62.5%) (Tables 1, 2).

According to Flint et al classifications of colonic injuries [3], ten patients were found to have Grade 1 injury 10 patients (15.62%) and were all managed by, PR with no mortality and only 2 patients developed wound infection. 40(62.5%) patients had Grade 2 injury, 30 of them were managed by DC and 10 patients by PR, 10 patients had complications, 3 of them were treated conservatively and 1 of the patients died, 4 (6.2%) patients had Grade 3 injury, all of them were managed by DC 3 patients were died. As can be seen in Table (3) the morbidity and mortality rates were directly related to the grade of colonic injuries.

The two groups of PR and DC were subsequently contrasted in terms of their rates of developing significant postoperative intra – peritoneal complications (like subphrenic abscess) and extra – peritoneal complication. 95% (19 of 20) of primary repair (PR) patients and 54.54% (24 patient out of 44) of diverting colostomy (DC) patients had no major complications.

A total of 4 complications occurred in PR patient; 3 patients in the DC group experienced a total of 10 complications (Table4). When the 2 groups were compared, the morbidity was higher in DC patients (20%) than PR patients (6%).

Mainly in the presence of at least one other organ injury, in addition to the colon, most complications happened irrespective of the manner in which the colon injury was managed (Table5).

The wound infection rate (Table 4) was slightly higher when DC 9 patients of 44 (20.45%) was used to manage the colon injury rather than PR 3 patients of 20 (15%). Associated organ injuries found at exploration shown in (Table-5). The small intestine and retroperitoneum was the most common organ injured, in association with the colon and the least injured organ was the pancreas.

The average time from accident till operation was 4 hours; the shortest period was 2 hour, while the longest was 12 hours. The relationship between hypotension on admission and the mortality and morbidity rate was also correlated (Table6). 18 patients out of 40 (45%) had complications in hypotensive patients, higher than in normotensive patients (4 out of 24, 16%).

Mortality and morbidity rate was the same in DC patients (3 of 44, 6%) and PR patients (1 of 20, 5%). As we can see in (Table6), the cause of death was readily attributed to the magnitude of injury rather than to the manner in which the colon injury managed, since all patients who died had at least one organ injury in addition to the colon. And 3 patients had sever shock.

Table 1: Distribution of cases by characteristics.

Parameter		Total no. of cases	Primary repair (PR)	Diverting colostomy (DC)
Sex	male	60 (93.75%)	20	40
	Female	4(6.25%)	-	4
Age		Main 24 years	24 years	27 years
B.P.	Hypotensive	45(70.31%)	5	40
	Normotensive	19(29.68)	15	4
Injury site				
Right colon		16(25%)	14	2
Transverse colon		8(12.5%)	4	4
Left colon		40(62.5%)	2	38

Table 2: Age and sex distribution of cases

Age group	No. of cases	male	Female
Pediatric age 1- 18 years	5(7.81%)	4	1
Young age 18 – 40 years	51(79.68%)	49	2
Old age more than 40 years	8(12.5%)	7	1
Total	64	60	4

Table 3: Grade of injury versus morbidity and mortality

Grade	No. of cases	Primary Repair(PR)	Diverting Colostomy (DC)	Morbidity	Mortality
Grade1	13(20.31%)	10	3	3	-
Grade2	40(62.5%)	10	30	10	1
Grade3	11(17.18%)	-	11	4	3

Table 4: Distribution by complications

Complication	No.	PR	DC
Intra-abdominal Abscess	2(3.12%)	-	2
External-Fistula	6(9.37%)	2	3
Wound dehiscence	4(6.25%)	1	3
Wound infection	12(18.75%)	5	7

Table 5: Associated organ injuries

Organ	No. of cases in association
Small intestine	40(62.5%)
liver	8(12.5%)
Retroperitoneal	20(31.25%)
stomach	8(12.5%)
spleen	8(12.5%)
kidney	4(6.25%)
Pancreas	1(1.56%)
Urinary bladder	4(6.25%)
diaphragm	10(15.62%)

Table 6: Mortality of all cases

Age/Years	Type of repair	Associated injuries	Possible cause of death
65	Diverting colostomy	Liver –stomach-small bowel Retro peritoneum	Shock and no recovery from anesthesia
18	Diverting colostomy	small bowel major Iliac vessels and retroperitoneum	Shock
40	Diverting colostomy	Liver –stomach-small bowel	Shock
35	Diverting colostomy	Stomach–chest diaphragm	Shock and chest injury

Discussion

It wasn't until World War I that larger scale outcome data was first available for these

injuries, demonstrating mortality rates between 60-75% depending on injury location [5]. However, the principles of

managing the perforated colon were altered by military experiences especially that obtained in World War II, with dramatic improvement in survival [6].

Reports by clinicians like Ogilvie documented that morbidity and mortality from colon injury could be reduced several folds if the principle of faecal stream diversion was applied by any of several techniques: (1) exteriorization of the injury as a stoma, (2) resection of the injury with colostomy, and (3) repair of the injury with proximal colostomy [6].

Subsequent to the war experience, these data were readily applied to civilian injuries [15], such that diversion became the surgical standard of care in the management of penetrating colon injuries primary repair was reported as early as 1951 by Woodhall and Ochsner [7], who discussed the feasibility of this technique for civilian colonic injuries under certain criteria.

However, colostomy remained the treatment of choice because it was safe and effective[35]. An alternative or compromise between colostomy and primary repair was developed to manage colonic injuries. This alternative involves exteriorization of the primary repaired colon, with return of the colon to the abdomen several days later if the repaired segment maintained its integrity [16,18]. However, this method has fallen into disfavour, due primarily to the high rate of suture – line breakdown when the colon is in the exteriorized position [17].

In general the greatest number of injuries to the colon is the result of penetrating or perforating trauma and minority of injuries are caused by blunt trauma. The amount of force required to damage the colon is considerable and as such the colon is relatively refractory to blunt injury [18].

In stab wounds the diagnostic peritoneal lavage (DPL) is of value intraperitoneal colonic injury is present and may return fluid with blood or contamination. If the injury is confined to the extra peritoneal colon and rectum, lavage is of no value [18].

All patients who sustain penetrating trauma to the abdomen who are at risk for a colon injury should receive preoperative

antibiotics in the emergency department. Several studies have demonstrated an 11% infection rate when patients received appropriate preoperative antibiotics within 1 hour of injury [17].

It is generally believed that right and left colonic injuries should be treated differently [10]. Most authors suggest that primary repair with or without resection and anastomosis is safe in the majority of right colon injuries because of its lower bacterial count and more liquid content, while they have strict criteria for primary repair in the transverse and left colon [20,23]. Some authors even recommended routine colostomy in all left colon injuries [22,24]. In this study, 14 of 16 patients (80%) with right colon injuries treated by primary repair with or without resection and anastomosis, while only 4 out of 8 patients (50%) with transverse colon injuries treated by primary repair and none of left colonic injury treated by PR.

Thompson et al [25] found the same morbidity in right and left colonic injuries in two similar groups with respect to the various complication risk factors. Dang et al [28] and Bartzial et al reported similar results.

In our study, injuries of right colon had an overall similar morbidity of those of left colon (30% for right and 28% for the left colon). Injuries of the right colon treated by primary repair had less morbidity than the ones in the left colon, while in the colostomy group, they had higher morbidity.

Most authors recommended primary repair of colonic injuries, especially the left, only under strict criteria: minimal tissue damage, no major devascularization of the colon, minimal faecal contamination, less than two associated intra – abdominal organ injuries, no massive intra peritoneal hemorrhage (less than a liter), no shock on admission and minimal delay (less than 6 hours) [30,31].

Hypotension on admission is generally considered a contraindication to primary repair, especially in left colonic injuries [21,30,31]. In our study, 19% (4 of 20) of

patients who underwent primary repair had hypotension on admission, one developed intra- abdominal complication and 4 patients developed wound infection. 68% (30 patients of 44) of patients with colostomies had preoperative hypotension, 20 of them developed complications. In comparison, there was significant difference in the incidence of colon – related complications in patients admitted in hypotension with those in normotensive patients (20 of 40) patients with hypotension (50%) developed complications.

Some authors, like Demetreads [12] et al and Shannon et al [33] found that the incidence of colon – related complications in shocked and normotensive patients was the same, irrespective to the modality of treatment or location of the colon injury.

Most authors advice against primary repair in the presence of more than two associated intra-abdominal injuries. [21,27,30,31].

Our study supported this finding and we found that both morbidity and mortality were directly related to the number of associated organ injuries. As we can see in table (4), 12 patients with wound infection had at least one associated organ injury, in addition to the colon. Mainly small bowel (40 patients) and retroperitoneum (20 patients) because they are the largest associated organs in relation with the colonic anatomical coarse (Table 5). Some authors like Taheri et al [11] and Ddemetrades et al [12], do not support this, and they said: the presence of associated intra – abdominal injuries was not associated with a higher incidence of colon – related abdominal complications, irrespective of the modality of treatment.

The risks of complications related to colon injury is related to a variety of clinical parameters such as shock, large transfusion requirement, contamination, multiple injuries, advanced age, extent of the colon injury and delay in presentation. The type of repair dose not increases the risk [13,32].

It seems that the most important risk factor for the development of abdominal

complication is the presence of gross faecal contamination at the time of operation. Under such circumstances, a colostomy should be performed irrespective of left or right sided location of the injury [12].

The reported morbidity rates (intra-abdominal complications and wound infections) for colonic injuries average about 20% [13].

In this study, the morbidity of patients with primary repair was 20% (5/20), and that of patients with colostomies was 23% (9/44), and an overall morbidity rate of 23% which is higher than average and this, in part, was due probably to inadequate preoperative administration of antibiotics in some patients and prolonged time interval between injury and operation which resulted in high incidence of wound infection (14-64). The intra abdominal complication occurred in 13 patients (20%) who include: intestinal obstruction, abscesses faecal fistula and dehiscence of abdominal wound. Only 2 patient treated by primary repair developed faecal fistula. The patients had been sustained bullet injury to the abdomen. one resulted in lacerated injury of the inferior border of the transverse colon, about 2cm in size with minimal soilage, associated with injury of transverse mesocolon, about 3cm in diameter and also there was multiple perforations of small intestine. 2nd with right hemicolectomy and end – end Anastomosis both treated by primary repair. The faecal fistula in these patients started on the 4th postoperative day as minimal leakage gradually increasing in amount. Both treated successively conservatively and fistula closed.

The important point in these patients is that there were a delay in the surgical intervention more than 6 hours, and this probably was the cause of colonic disruption.

The mortality rates in colon injuries are reported in most series around 10% or less. This applies to penetrating trauma, but in blunt trauma, the figure may be even higher because of the possibility of more serious extra- abdominal injuries

In this study, the mortality rate for primary repair was 4% (1/20) and that for colostomies was 6 % (3/44), and an overall mortality of 10% was reported. Most of deaths occurred due to causes unrelated to the colon injury, like shock respiratory failure and cardiac arrest. This high mortality in our study might be due to lack of ideal surgical intensive care unit for postoperative management of severely injured patients as well.

The use of resection and anastomosis for colonic injuries has been controversial. Stone and Fabian [6] and others initially felt that their use of this technique. Certainly, there is little hesitancy to resect and anastomose the right or even the transverse colon. There is still controversy about this technique for the left colon. Frame et al suggest that the right and left side may be managed similarly, whereas Burch et al advice a colostomy for left side if resection is required [34].

Generally, colostomy is considered as the safest method of treatment of a colonic injury, but we must realized that it is an open source of contamination, very close to an incision and with a possible communication with the abdominal cavity through its abdominal wall exit [12].

Theoretically it should be associated with a higher incidence of wound infection and intraperitoneal abscess [11]. Furthermore it is associated with a larger hospital stay than after primary and the patients have to be subjected to the inconvenience and risk of another operation for colostomy closure, a procedure with significant morbidity, most studies reported a morbidity rate of about 10–12% associated with a colostomy closure. Although some authors hold that complications could be minimized by performing the colostomy closure within a 6 to 12 weeks interval from its creation, others like Thai and Yeary found no clear – cut benefit in (timing) a colostomy closure with the expectation that a reduction in morbidity would be realized [37].

Conclusion

1- Colonic injury is a common finding in penetrating abdominal trauma, while it is rare in blunt trauma.

2- The preferred method for management of penetrating colonic injuries has become controversial in the last several years.

3- The most important risk factors for the development of abdominal complications are the presence of gross fecal contamination, extensive damage with devascularization of the colon and late presentation (delay) of colonic injuries.

4- Complications are rare in isolated colon injury, most of them occurred in patients who experienced injury to at least one associated organ.

5- Majority of deaths occurred in severely injured patients, reserved in state of shock rather than the colon injury.

6- The morbidity and mortality rates are lower in patients treated by primary repair than those treated by a colostomy, and this probably related to the fact that the more seriously injured patients had a colostomy rather than a primary repair.

7- A colostomy is considered as the safest method of treatment of colonic injuries, but closure of the colostomy is associated with an appreciable number of complications, ones that should be taken into account when a primary repair is compared to a colostomy.

8- This study points out the need for several prospective studies to more clearly define the place of primary repair in the management of colonic injuries.

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