

Penetrating Colorectal Injuries

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ABSTRACT

Introduction: Abdominal trauma especially the penetrating type has increased in Iraq with many patients requiring surgical intervention, among those, colo-rectal injury. **Patients and Methods:** In the period from January 2005 – January 2006, 232 patients sustaining penetrating abdominal trauma were managed in, and submitted to laparotomy at Al-Yarmouk Teaching Hospital, Baghdad – Iraq. **Results:** 86 patients (37%) had colorectal injuries. Primary repair 22 patients (25.58%), exteriorization of the injured segment is an alternative which was done in 37 patients (43.02%), and 1 repair with proximal diversion as colostomy 23 patients (26.74%), Hartmann's procedure 4 cases only (4.65%). **Conclusion:** Primary repair (one stage surgery) is preferred if conditions for it's performance are satisfied. Colostomy creation and closure is associated with a significant morbidity. Morbidity and mortality is high in colo-rectal injury.

Introduction:

Penetrating abdominal injuries have increased in Iraq, most requiring surgical intervention⁽¹⁾. A significant reduction in mortality from penetrating Colorectal injury occurred from 100% during the American Civil War to less than 5% at the present day⁽²⁾.

Experience in Bowel surgery till the later part of 19th century was limited to dealing with protruding intestine following abdominal injury usually sustained during wars.⁽²⁾

In colorectal surgery, every effort should be made to have a completely empty colorectum before surgery, indeed it is a criterion of excellence that it should be so⁽³⁾.

Urgent evaluation and resuscitation when receiving the patients, intra-venous fluids, blood sampling for cross-matching, urinary catheter and central – venous line insertion, antibiotics as prophylactic, wound debridements of back and buttock, surgery without delay is necessary for uncontrolled suspected intra-abdominal bleeding^(4,5,6,7).

Midline incisions are preferred^(1,8), abdominal exploration may take priority over stable intrathoracic injury and stable head injury⁽⁷⁾. Removing all free blood and clots⁽⁷⁾. Control of major hemorrhage⁽⁹⁾, colonic wounds should be next⁽¹⁰⁾, the whole GIT should be thoroughly inspected and examination of the fixed portions of the colon is done^(7,8,9) bowel viability must be evaluated⁽⁷⁾.

In severely injured and rapidly deteriorating patients (Damage Control Surgery) is practiced to terminate the operative procedure quickly^(9,11).

The aim of surgery remains unchanged, but timing is changed.

Hypothermia + Coagulopathy + Metabolic Acidosis = Damage Control Surgery

Two main subjects have been found to be associated with and contributing to the post-operative complications in mangement of colorectal injury^(4,9,11,12,13,14,15,16).

1 - Influence of risk factors.

2 - Method of repair.

These risk factors and methods of repair, will be discussed later on in details. Among the risk factors is **Injury Severity Score I.S.S.:** Penetrating Abdominal Trauma Index = PATI is a method of quantifying the risk of complications following the trauma. The PATI is calculated by scoring⁽⁹⁾:

Severity of each intra-abdominal organ x a coefficient = complications arises following trauma. A scor of > 25 have a high incidence of complications.

Nelken and Lewis, 1998⁽¹²⁾ found PATI is important for:

- 1 - Primary repair or colostomy decision.
- 2 - Predicting complications.
- 3 - Predicting cost.

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Patients & Methods:

This is a prospective study on 86 patients admitted to the General Surgical Wards of Al-Yarmouk Teaching Hospital, Baghdad – Iraq with colo-rectal injury who had surgical treatment from a total of 232 cases of penetrating abdominal trauma submitted for laparotomy during a period of one year from January 2005 – January 2006.

For the diagnosis, we depended mainly on clinical examination and evaluation and assessment of the wound tracks aided by plain chest and abdominal x-ray, peritoneal tapping in selected cases, sometimes abdominal ultrasonography was done according to availability.

One case of iatrogenic colo-rectal injury in the caecum following caesarean section with delay diagnosis was included in the study.

Results:

- Age and Sex Distribution

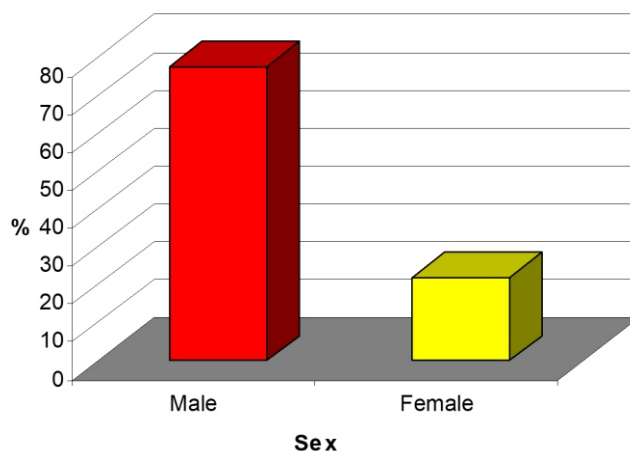
All major post-operative complications (those that prolong the patients hospital stay or significantly alter subsequent treatment) were categorized by site: intra – abdominal - wound infection - extra-abdominal.

During this study 42 patients underwent closure of colostomy that had been done for diversion purposes during the course of an operation to manage traumatic colo-rectal injury. The records of these patients were reviewed to detect the time – interval between creation and closure of colostomy (within 3 months or more than 3 months). Regarding follow-up of the patients, for those of primary repair we followed them for 14 days after removal of the stitches, those with colostomies, most of them underwent closure and we followed them for 24 days after the 2nd operation.

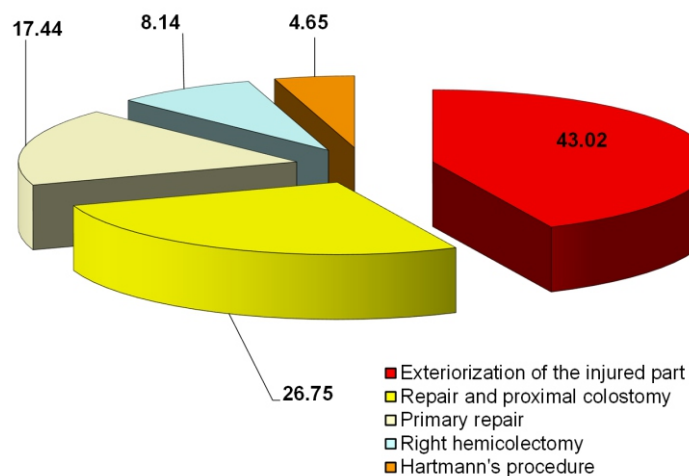
Table (1): The distribution of cases in respect to age.

Age in years	No.	%
10 – 20	16	18.60
21 – 30	30	34.88
31 – 40	23	26.75
41 – 50	9	10.47
> 50	8	9.30
Total	86	100

Figure (1): The distribution of cases in respect to sex



- **Mode of colonic injury management: Figure (2): Modes of Colonic Injury Management.**



- **The sites of colonic injury:**

Table (2): Distribution of the site of colonic injury.

Site	Repair group		Other group	
	No.	%	No.	%
Caecum	9	40.91	3	4.69
Ascending colon	1	4.55	--	--
Hepatic flexure	--	--	9	14.06
Transverse colon	8	36.36	30	46.88
Splenic flexure	2	9.09	6	9.38
Descending colon	2	9.09	5	7.81
Sigmoid colon	--	--	5	7.81
Rectum	--	--	6	9.37
Total	22	100	64	100

- Mechanisms of injury:

Table (3): Type of management according to the mechanism of injury

Mechanism	Total no.	1 st Repair group		Other groups	
		No.	%	No.	%
Bullets	55	11	20	44	80
Shells	24	8	33.33	16	66.66
Stab wound	5	3	60	2	40
Iatrogenic	1	--	--	1	100
Sharp object	1	--	--	1	100
Total	86	22	--	64	

- Time Interval between injury and surgery:

Table (4): Time between injury and surgery

Time in hours	1 st Repair group		Other group		Total no.
	No.	%	No.	%	
< 3	19	86.36	42	65.63	61
3 – 8	3	13.64	14	21.87	17
8 – 24	--	--	6	9.30	6
> 24	--	--	2	3.12	2

- Severity of injury : Grading the injury:

Flint's Grading system of penetrating colonic injury was applied on all the 86 cases as in following table:

Table (5): Grading of colonic injury : Flint's Grading.

Flint	1 st Repair	Other groups	Total
I	18	--	20.93
II	3	11	16.28
III	1	53	62.79
Total	22	64	100

- Degree of peritoneal contamination:

Table (6): Degree of peritoneal contamination according to the mechanism of injury

Mechanism	Total No.	Severe contamination	
		No.	%
Bullet	55	38	69.09
Shells	24	11	45.83
Stab	5	1	20.0
Iatrogenic	1	1	100
Sharp object	1	--	--
Total	86	51	59.30

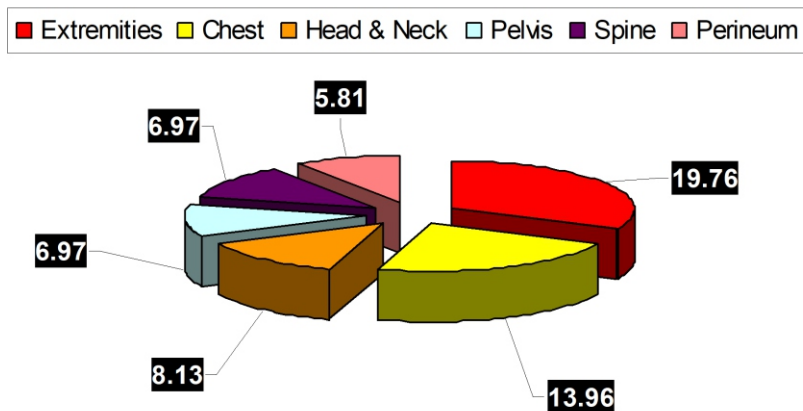
-Associated intra-abdominal injuries:

Table (7): Associated intra-abdominal Injuries.

Organs	No.	%
Small bowel	38	44.18
Mesentery	16	18.60
Liver	11	12.79
Spleen	10	12.79
Stomach	10	11.62
Major vessels	6	6.97
Diaphragm	5	5.81
Left kidney	5	5.81
Right kidney	4	4.65
Duodenum	4	4.65
Pancreas	4	4.65
Gall bladder	3	3.48
Urinary bladder	3	3.48
Ureters	2	2.32

- Associated Extra-abdominal injuries:

Figure (3): Associated Extra-abdominal Injuries



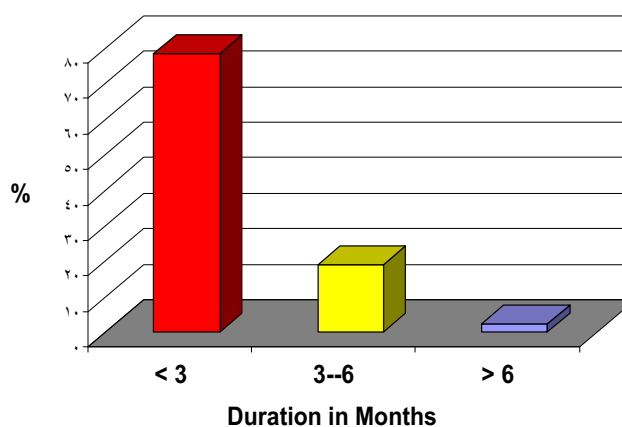
- Duration of Hospital Stay:

Table (8): Total hospital stay according to the mode of management

Hospitalization in weeks	Repair group		Other groups	
	No.	%	No.	%
< 2	21	95.45	49	76.56
2-3	--	--	12	18.75
> 3	1	4.55	3	4.69
Total	22	100	64	100

- Closure of colostomy:

Table (9): Colostomy closure interval



- The morbidity:

Table (10): Morbidity related to primary operation

	Complications	Repair group		Other groups	
		No.	%	No.	%
I	Septic complications				
	A- Directly – by colon injury				
	1. Septicemia	--	--	2	3.27
	2. Intra-abdominal Abscesses	--	--	2	3.27
	3. Wound infection:				
	a) simple infection	1	4.54	7	11.48
	b) significant infection	--	--	4	6.56
	c) dehiscence	1	4.54	3	4.92
	B- Related to GA + laparotomy				
	1) respiratory infection	1	4.54	6	9.83
	2) urinary tract infection	--	--	2	3.27
	3) renal failure	--	--	1	1.66
	4) D.V.T	--	--	1	1.64
II	Partial intestinal obstruction	--	--	2	3.27
III	Faecal fistula	--	--	3	4.92
IV	Incisional hernia	1	4/54	4	6.56
V	Massive transfusion complications	1	4.54	2	3.27
	Total	5/22		39/61	

2 - Morbidity related to colostomy

Table (11): Morbidity related to colostomies.

Morbidity	No.	%
Prolapse	3	4.68
Stomal wound infection = simple	3	4.68
Bleeding	1	1.56
Stenosis of the stoma	1	1.56
Colostomy associated diarrhea	1	1.56
Delayed functioning	1	1.56

3 - Morbidity related to the 2nd operation.

Table (12): Morbidity related to 2nd operation.

Morbidity	Colostomies gr.		Other groups	
	No.	%	No.	%
Wound infection	6	14.28	1	9.09
Faecal fistula	1	2.38	--	--
Respiratory infection	2	4.76	--	--
Urinary tract infection	1	2.38	--	-

The 3rd group is related to indications for the 2nd operation, mostly closure of colostomy 42 cases were the indications.

Table (13): Indications for the 2nd operation

Indication	Primary repair group		Other groups	
	No.	%	No.	%
Closure of colostomy	--	--	42	65.62
Abscess drainage	--	-	2	3.12
Dehiscence	1	4.54	3	4.68
Faecal fistula	--	--	1	1.56
Incisional hernia	--	--	2	3.12
Total	1	50		

The mortality: Table (14): Time of death from injury

Time	No.	%
On table	3	23.08
< 24	8	61.54
> 24	2	15.38
Total	13	100

Table (15): Mortality rate according to the mode of management

Mode of management	No.	%
Primary repair group	1	7.69
Other groups	12	92.31
Total	13	100

Discussion:

Diagnosis of colo-rectal injury is commonly reached on laparotomy⁽⁴⁾. The majority of colonic injury are Diagnosis intraoperatively following a penetrating abdominal Injury Rectal injury are usually Diagnosis preoperatively with high index of suspicion based upon the woundy missile trajectory⁽⁵⁾, and digital rectal examination is recommended in all patients^(5,6). Available diagnostic modalities are not highly reliable in detecting isolated colonic injury, although Ross-1992⁽¹⁷⁾ said that it's unreliable. Digital Rectal Examination "DRE", Proctoscopy and Cystography have been recommended in all patients with penetrating wounds of the buttock^(5,6), but in our study and practice we do only D.R.E.

Most patients. of penetrating gunshot wounds of abdominal need thorough exploration of abdominal without any delay⁽⁴⁾, as with cases in our study, those with stab wounds need urgent laparotomy if in shock, with evisceration or peritonitis; otherwise stab wounds should be managed selectively⁽⁴⁾. Ultrasound, plain x-ray for pneumoperitoneum, paracentesis, contrast enhancement, C-T scan and laparoscopy through the tract can help in decision making in more stable patients.^(1,4,5), in our study clinical examination was the pillar in Diagnosis as imaging studies weren't available commonly or the patient was shocked.

For purposes of comparison, we divided our patients. from the start into 2 patients:

- 1st: those who underwent primary repair including 1 resection and anastomosis (right hemicolectomy).
- 2nd: those belonging to other groups of surgical treatment.

Primary repair for traumatic colo-rectal injury was reported as early as 1951 by Woodhall and Oschner⁽¹⁸⁾ who discussed the feasibility of this technique for civilian traumatic Colorectal inj's, however, colostomy remained as a treatment choice⁽²⁾.

Orsay *et al.*, (1989)⁽¹⁹⁾ reviewed their experience using colostomy and reported a mortality rate of 2.5%, morbidity under 10%, they cautioned that **any new approaches to the mangement of traumatic colo-rectal injury must have the same low risk of complications**⁽¹⁹⁾.

Furthermore, colostomy closure is recognized as a reasonably safe procedure⁽²⁰⁾ but is that True!!? Colostomy, delays return to work, with physical, psychological and financial stress of caring for and closing the stoma, in addition closure has its own complications as any operation^(21,22,23) some of which may be fatal⁽⁶⁾.

There have been numerous reports of successful Mx. of colonic injuries with primary repair without a colostomy, thus emerged the recent trend away from colostomy^(15,16,24,25,26,27).

Technique of Primary Repair^(7,9): Excision of devitalized tissue, repair is with a single layer continuous suture, extramucosal, monofilament suture material. Another study prefers using a simple interrupted suture most commonly with non-absorbable silk suture⁽¹⁵⁾. In our study, the age of the patients. ranged from 10-62 years, with a high incidence in the age of the 21-38 ys. (53 patients.).

The age distribution injury does not significantly differ from other studies, like Abdu-Razzak's study – 1997⁽²⁸⁾ and Other⁽²⁹⁾.

The age is not a major risk factor in determining the type of repair and outcome, but mortality increase in elderly patients.⁽⁴⁾ The male : female ratio was 3.5:1 in our study with slight difference from other studies which give a ratio of 2:1^(28,30).

The most viable explanation is that male, young age groups are usually involved in outdoor activities and they are liable to terrorist attacks.

What about the Mechanism of Injury: Colo-rectal injuries result from a variety of mechanisms. Blunt and Iatrogenic trauma are relatively uncommon, whereas penetrating trauma is responsible for the majority of injuries⁽¹⁰⁾.

Firearm injury are classified according to the Muzzle velocity. High velocity injury are defined as those caused by a Muzzle V. of greater than 600 m/s. The destructive force of an individual missile depends on 2 factors: It's wound energy and creation of temporary cavitation, both these depend on missile shape, and each component contributes a variable amount to the severity of an individual injury.

Low V-Missiles which dissipate all their energy in the body, can be equally as destructive as high V. Missiles⁽¹⁰⁾.

By convention, missile wounds are now described in terms of energy transfer, recognizing that V. is merely one factor determining energy available and its transfer to tissues⁽¹⁾. Blunt Colorectal injury Occurs in 3-5% of patients. having a laparotomy for blunt abdominal trauma^(10,31,32).

The transverse colon is the most frequent site and usually associated with liver and splenic injury and of rectum are more common than colon⁽⁹⁾, while Colorectal injury occur in 1/3 of patients. with penetrating abdominal injury, and 50% in transverse and sigmoid colon, and about 70% presented with associated intra-abdominal organ injury: small bowel, mesentery, liver, spleen, stomach, major vessels and kidney⁽⁹⁾.

Regarding the mechanism of injury, all of our cases were penetrating type, with a highest % in bullet injury 55 patients. (63.95%), the least common cause of injury was Iatrogenic, only one case (1.16%), stab wound account for 5.81% only.

Our results are similar to Abdul-R's study⁽²⁸⁾, and higher in comparison to Costa-1989⁽³⁰⁾ which was (72%) and (40%) respectively. In Satish & Rajeev's study⁽⁴⁾ done in Pakistan, the % was only 10.93% of bullet injury while stab wounds accounted for 78.12% which highly differs from that of our study. Also many other studies have results similar to our study^(33,34).

In a period of one year, we discovered only one case of colo-rectal in patients. with blunt abdominal trauma after R.T.A., and this is totally different from Satish & Rajeev's study = 28.9% in 3 years⁽⁴⁾.

Still stab wounds are more amenable to primary repair, while 57% of gunshot wounds can be repaired primarily. In our study primary repair was done in 24% of all gunshot wound = 79 patients. Many recent papers report that the mechanism of injury per say is not a risk factor⁽⁴⁾.

The commonest logical explanation to that is the frequent use of weapons and increase no. of killing teams, in addition to increase incidence of explosion

injuries as a result of the deteriorated security status in Iraq.

The most common sites of colonic injury were in the transverse colon (44.19%) similar to Abdul-R's study (50% for both transverse colon and sigmoid colon); in our study the left colon injury was only 23.25% which was less than the right side while in other studies like Abdul-R's and Costa^(28,30) reached 65%.

As we expected, right sided colon has been considered more suitable for primary repair due to liquid contents and less bacterial load, in addition to more possibility for right hemicolectomy procedures but recent papers show no significant difference in the outcome^(4,35,36).

In the multiply – injured patients the most common extra-abdominal associated injury is that of the extremities (19.7%), then the chest (13.96%), and these are the same findings in Abdul-R's study, while in Kunin's – 1994⁽³⁷⁾ paper the most common organ injured is the chest (40%).

In this study, isolated colonic injury in penetrating abdominal trauma was in 8 patients (9.30%), occurred commonly in patients with stab wounds, Iatrogenic colonic injury and in one patients that presented with rectal injury by a sharp object, while in other studies^(28,29) no isolated traumatic colonic injury is reported; whereas in Dokucu, 2000⁽³⁸⁾ report, 7 cases of 34 patients (21%) within a period of 12 years.

The commonest associated intra-abdominal organ injury in our study was small bowel (44.18%), followed by mesentery (18.60%) and liver (12.79%) and these results are the same as for others^(29,38).

Isolated colonic injury offer the best opportunity for primary repair. In the presence of multiple-associated injury, faecal diversion is safer⁽⁹⁾.

Fifty three patients (61.63%) presented to the Emergency Room with shock, which is defined as systolic blood pressure <90 mmHg, mainly due to hypovolaemia due to severe loss of blood, and this high % does not differ from other studies^(28,29,39) and this is mainly explained by the severity of injury, associated injury and delayed presentation.

Prolonged hypotension contributes to adverse effects and increases mortality by diversion of blood from the GIT, so the incidence of anastomotic breakdown^(4,9) however, there is a good evidence in both retrospective and prospective studies that shock is not the only factor in choosing the type of repair and outcome of colo-rectal injuries^(8,12,13).

In our study, we did primary repair in 3 shocked patients. successfully without any increase morbidity or mortality.

Severe Peritoneal Faecal Contamination was found in 51 patients.(59.30%), the majority was associated with bullet injury, this is not significantly different

from other studies^(34,35). A significant increase in septic complication occur following severely contaminated Colorectal wound, but minimal contaminations poses little risk for primary repair.

Gross (severe) faecal contamination is the strongest contra-indication to primary repair⁽¹⁷⁾ so diversion is favored. 70.93% of our patients. (61 out of 86 patients.) were treated surgically within 3 hrs. from the time of injury; 19 patients. (86.36%) out of 22 patients. were treated by primary repair. Only 2 patients. from the total of 86 patients. were treated after 24 hrs. from the time of injury by colostomy due to delay in receiving these patients.

Any delay leads to increase in faecal contamination and blood loss and hence increase complications. The risk is significantly increases when the delay exceeds 6-8 hrs⁽⁴⁾, but delay from time of penetrating colonic injury is not an absolute contra-indication to primary repair⁽¹⁶⁾.

Classifications of Penetrating Colonic Injury:

1 - Flint *et al.*, (1981) proposed a classification to grade the severity of colonic injury in relation to mortality⁽⁴⁰⁾.

Flint's Grade	Severity of injury of colon	Mortality %
I	- Isolated colonic injury - Minimal contamination	4
II	- Moderate contamination - > 2 organ damage - Minimal shock - Little delay in operation	20
III	- Severe tissue loss - Profound shock - Multiple organ damage - Extensive contamination	> 25

All colo-rectal injuries in our study were graded using Flint's-system to detect the severity of the injury and how it can influence the type of surgical Mx.; primary repair was performed in all patients. (18 of 86) found with grade I = (20.93%) without any morbidity.

Three patients. presented with grade II injury were treated by primary repair including Resection / Anastomosis, although there were a moderate degree of contamination, more than 2 organ injury and minimal shock.

The majority of patients. of colonic injury presented with grade III. 54 patients. (62.79%). Only one case of grade III underwent 10 repair by right hemicolectomy and another 53 patients were treated by diversion, either primary repair and proximal diversion or exteriorization of the injured part.

Recent prospective studies have recommended primary repair for all penetrating colonic injury, and the morbidity was equal in both groups, also there is no significant differences in demographics or injury severity found to account for the increased rate of primary repair⁽²⁵⁾.

In our study, we did Right Hemicolectomy with Ileotransvers Anastomosis primarily for 7 patients. successfully, actually we did limited Right Hemicolectomy for 3 patients. of them. Khayat *et al.*, (1994)⁽³⁵⁾, study proved that Right Hemicolectomy with primary anastomosis and preoperative antibiotic and peritoneal lavage is a safe one – stage method in managing missile injury of the right colon with peritoneal faecal soiling.

In our study, the selection of patients. for primary repair was guided by the factors previously discussed.

The advantage of primary repair is that definitive treatment is carried out at the initial operation, the disadvantage is that suture lines are created in suboptimal conditions and leakage may occur⁽⁵⁾.

Gonzalez-1996⁽⁴¹⁾ in his study concluded that; all penetrating colonic injury in the civilian population should be primarily repaired. This suggestion is questionable and colostomy is still appropriate in a few patients, specially those with rectal injuries^(5,42).

Some authors recommend resection with intraoperative colonic lavage and primary

anastomosis^(43,44); this was not done in our patients.

Exteriorization of the injured part of colon were applied in 37 patients. (43.02%) in our study, according to the anatomical site of injuries and it was very successful, while in Abdul-R's study it was done only in 15%. Mobilization of the colon to exteriorize the injury part on correct anatomical sites is still a feasible choice in contrast to primary repair and proximal colostomy diversion.

Also primary repair and proximal colostomy was carried out in 23 patients. (26.75%); we still have a high rate of colostomy diversion and these are mostly related to the primary presentation of our patients in association with a high incidence of risk factors mentioned before.

Hartmann's procedure = end colostomy, carried out in 4 patients. (4.65%), all of them with rectal injury; using of a defunctioning loop colostomies with a subcutaneous bridge support is an alternative⁽⁴⁵⁾.

Exteriorized repair not applied in patients. of our study; it's used in some centers⁽⁴⁶⁾ but is no longer indicated because most patients who were once candidates for this treatment are successfully managed by primary repair⁽⁵⁾.

Fifty percent of these repairs fail to heal and have to be converted to colostomies^(40,37).

In our study, during the period of one year, 42 cases of colostomy were closed, 33 patients. were closed within the 1st 3 months of it's creation and 9 patients. were closed within the 2nd 3 months, this is not significantly different from other studies^(28,48).

During this study, 51 patients. needed a 2nd operation, 42 of them for colostomy closure, 11 patients. for Mx of other complications related to the 1st operation, 4 patients. of them for wound dehiscence, this is different from Abdul-R's-study which found that septic complications is a common complication that needed a 2nd operation after colostomy closure⁽²⁸⁾.

Patients with primary repair with low rates of hospital stay than the colostomy group, in Primary Repair 95.45% had a hospital stay of <2 wks, while in the colostomy group is 76.56%, these results approximate that of Abdul-R.'S study; this factor should be taken into account in comparison between primary repair and colostomy in financial costs and to decrease the period of patient illness.

Miller-1996⁽⁴⁹⁾ in his series concluded that for Iatrogenic injury, when seen early, primary repair is the treatment of choice; in our study we faced one case and was diagnosed late and was treated by caecostomy.

The risk of complication related to colon injury is related to a variety of clinical parameters which was previously discussed such as shock, large transfusion requirements, peritoneal contamination, multiple injuries, elderly patients, grade of colonic injury, and delayed presentation; our study supports these

observations, although recent studies considered some of these parameters not so important for deciding the type of procedure but contribute to the final outcome of the patient's condition^(4,9,17,18,27).

We compared morbidity rate in our study between the primary repair group and other management groups, the morbidity categorized into 3 groups : patients.⁽⁵⁰⁾.

In 1st group:

Five patients of 22 (22.72%) in the primary repair group developed complications including one dead patient, and morbidity occurred in 39 patients out of 53 survivors more than 24 hr (73.58%), the overall morbidity occurred in 44 patients out of 75 survived patients (58.66%), and these are similar to other studies^(28,37,51) but are very high when compared to other studies^(8,18,30,36).

Infection is the major problem in patients with colonic injury⁽²⁹⁾ this is supported by our study and in other studies^(4,28).

Overall septic complications occurred in 28 patients (45.90%) of 61 patients that survived in the colostomy group, 18 of them are directly related to the colonic injury and another 10 are related to G.A and laparotomy in general, while overall septic complications occurred in 3 patients with the primary repair group (13.63%).

Septicemia occurred in two patients in the colostomy group, treated conservatively. Intraabdominal abscesses occurred in two patients in the colostomy group, one of them was subphrenic and another one was pelvic, both of them required a 2nd operation.

Simple wound infection occurred in 8 patients, one in the primary repair group, and 7 in other groups, all of them were treated with antibiotics and wound care.

Four patients in the colostomy group developed significant wound infection with pus discharge and required early removal of the stitches in between each other and then open wound treatment and secondary suturing was done after healing.

Wound dehiscence occurred in 4 patients, one in primary repair group and other 3 patients in the colostomy group, all of them occurred during the 1st admission and treated by suturing of the burst abdominal wall. This morbidity is high when compared with other studies^(18,36).

Respiratory complications occurred in 7 patients, one in primary repair group and the other 6 in the colostomy group, 4 of the 7 that died, the three of them died within 24 hrs all of them were admitted to the I.C.U. Urinary tract infection occurred in 2 patients belonging to the colostomy group, and both of them had urethral catheterization. Renal failure, occurred in one patient with associated right renal injury, and right nephrectomy was done for him and died after 3 weeks although he was on dialysis.

D.V.T. developed in one patient in the colostomy group in the left sided lower limb due to spinal cord injury and fracture pelvis as associated injuries.

Faecal fistula occurred in 3 patients, 2 of them with a caecostomy tube as a treatment of caecal injury, and another one in patients with Hartmann's procedure which is treated surgically at the time of colostomy closure and the other 2 were treated conservatively.

Incisional hernia occurred in 5 patients, one in primary repair group and another 4 in the colostomy group, two of them were treated surgically during this study.

But still the most common morbidity we faced in our study and in others is the colostomy itself, with its risks and cost of their own 2nd admission for closure, increased care in the period between colostomy and closure, training of the patients in the management, and psychological problems, so closure of colostomy as an operation has complications but less frequent and without mortality. 10 patients out of 42 (23.8%) who underwent closure of colostomy developed complications in our study and its similar to other studies^(8,28).

In addition we have 10 patients (23.80%) in our study that had complications related to their stoma, this concur with many studies about stoma morbidity^(33,48).

We had 3 patients with stoma prolapse, 3 with stomal simple wound infection, one mild bleeding in the 1st two postoperative days treated conservatively, one patient developed stenosis of the stoma.

The overall mortality rate was 13 patients of 86 cases (15.12%). This is acceptable and near other studies^(29,30).

Most of the deaths (8 of 13) occurred within less than 24 hrs. from the injury, 3 of 13 occurred on table due to severely injured patients and major vascular injury, and other 2 of 13 due to renal complications and pulmonary complications within 3 wk post-operatively.

In Baker's – 1990 study⁽⁴³⁾, (9%) of deaths occurred in the 1st 24 hrs. In Tanovic's study – 2003⁽⁵²⁾, the overall mortality rate was (6%). In Satish and Rajeev's study⁽⁴⁾, the overall mortality rate was (6.67%), 6 deaths out of 90 patients, 4 of them were due to associated injuries, and other 2 deaths were due to chest infection.

In all the above studies, we noted that the mortality rate is less than in our study, and this may be due to modern trauma center facilities and expert staff, increase in the incidence of mass – injury in our study and high percent of multiple organ injuries.

One patient died in primary repair group due to associated severe bilateral chest injury complicated by left sided chest empyema and died at the 8th postoperative day.

Conclusions:

Penetrating abdominal trauma have increased in our country and colo-rectal injury is one of the most common injuries at any age group. Clinical assessment is the main pillar aided when available by imaging. Primary repair is preferred if conditions for its performance are satisfied. Primary repair technique: debridement of the wound, repair with single layer continuous, extramucosal monofilament suture material, Or Full-thickness one layer interrupted non-absorbable suture. Still hemodynamic instability, and gross faecal contamination are the strongest contra-indications for primary repair. Delay from the time of penetrating colo-rectal injury, is not an absolute contraindication for primary repair by itself. For iatrogenic injury when discovered intraoperatively, primary repair is the treatment of choice.

The proximal colostomy is still an appropriate alternative in those patients unsuitable for primary repair, more so in rectal injury. Colostomy creation and closure is associated with a significant morbidity. Morbidity and mortality is high in colo-rectal injury and correlates with the severity of associated injuries.

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