



## Penetrating Injuries of the Colon: Role of a Primary Repair

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### Abstract

*This study was designed to determine the role of primary repair in Penetrating injuries of the colon and to evaluate the possibility of expanding use of one stage non-diversion primary repair of colon injuries, this is a prospective study of 100 patients with Penetrating injuries of the colon, Primary repair was the first choice except in cases of destructive colonic damage with disseminated gross peritoneal contamination requiring colostomy; Primary repair was performed in 76% with an incidence of abdominal sepsis of 11.8%. The remaining 24% of the patients had a colostomy and the incidence of abdominal sepsis was 29.2% ( $P < 0.05$ ) in our study; left-sided colonic injuries, multiple colonic perforations, shock on admission, delay  $> 6h$ , more than two associated intra-abdominal injuries, moderate Flint colonic injury Severity Score (FISS) not in themselves contraindications for primary repair.*

**Keywords:** Colon; penetrating injury; Primary repair.

### Introduction

The colon is the second most commonly injured intra-abdominal organ in cases of penetrating trauma. Colon injuries can be repaired either by fecal diversion (in a two-stage process) or with primary repair without fecal diversion. The two-stage procedure remained standard treatment for the era following the Second World War without adequate scientific evidences<sup>[1]</sup> In late 1970s, Stone and Fabian<sup>[2]</sup> defined the so-called "Stone and Fabian" exclusion criteria for primary repair of colonic injuries, as several factors that influence prognosis: site of injury, degree of tissue destruction, presence of multiple and/or multi-segmentation injuries, number of simultaneous injuries of other organs, time elapsed from injury to surgery, development of shock, fecal contamination, and bowel devitalization.<sup>1,2</sup>

These criteria have been questioned and modified by Flint and Vitale<sup>[3]</sup> in 1991, when more liberal attitude for primary repair emerged, based on substantial improvements of intensive care facilities, in 1999, Curran and Borzotta<sup>[1]</sup> Exclusion criteria were re-evaluated again, leading to the conclusion that most previous reports were based on highly subjective surgical estimation of risk factors, so primary repair could be performed in consecutive number of patients without any exclusion criteria<sup>[4,5]</sup>. Prospective randomized trials performed in period 1995-99, compared results of primary repair with two-stage procedure without using exclusion criteria<sup>[6,7]</sup>. They found that mortality and morbidity from abdominal sepsis were either similar or slightly lower in primary repair group, A primary repair has multiple advantages in the precarious

conditions of many developing countries (such as Libya) where this type of war surgery has to be performed. For social and cultural reasons, the patient much better accepts it than a colostomy. The problems of stoma care and stoma bags, which are always in short supply, disappear. There is no re-intervention so our aim in this study was to investigate the possibility of expanding indications for primary repair of colon injuries

### Methods

This was a prospective study performed at Derna Hospital over a period of 14 months (march 2018 to may 2019), candidates for inclusion in the study were all patients with Penetrating injuries of the colon, excluded from the study were patients who died within 48h of operation mostly these patients died for reasons unrelated to the colonic wounds, usually due to massive bleeding from other associated injuries, their short survival precluded assessment of the safety of the type of colonic management used. All the patients were assessed clinically resuscitated and were given prophylactic antibiotics, which were continued postoperatively. The patients were explored and hemostasis secured, the severity of colonic injuries was assessed by the Flint Colon Injury Score (FCIS)<sup>3</sup>

FCIS grade 1	isolated colon injuries with minimal contamination, minimal delay in operation, and in shock.
FCIS grade 2	through-and-through lacerations with moderate contamination and possible associated injuries
FCIS grade 3	severe tissue loss, devascularization, heavy contamination, and can have profound shock

The extent of contamination of the peritoneal cavity was established; Contamination confined to the immediate area near the colon was labeled as mild, that confined to one quadrant of the abdomen as moderate while that extending beyond one quadrant of the abdomen as major, the standard approach to the injured colon was debridement and freshening the edges, which closed by primary repair of the perforations (two layers, synthetic absorbable suture 3/0).or by

resection and primary anastomosis. Colostomy was performed depending on the judgment of the surgeon if (a) the colonic damage was so extensive, and (b) there was disseminated gross fecal contamination or pus, in this case the proximal colon was exteriorized as a colostomy the peritoneal cavity was generously washed with 4-5 liters normal saline and drains put in the pelvis and paracolic gutter., the incision wound was closed routinely, entry and exit wounds were debrided and kept open, shock on admission, multiple intra-abdominal injuries, multiple colonic perforations, the anatomical site of the colonic injury (left or right colon), delay of more than 6 h, were not taken into account when deciding primary repair or colostomy. The patient was kept fasting till the bowel sounds re- turned to normal or the patients passed stools. They were discharged from the hospital when they tolerated oral feed, became freely mobile, afebrile and their postoperative period The patients were monitored postoperatively for any evidence of abdominal sepsis, an abdominal wound was defined as infected if there was pus, exudate, or erythema, an intra-abdominal abscess was suspected clinically and echo-graphically and confirmed by operation, the patients were followed up for a minimum period of 10 days after the operation, The data was collected on a pre-prepared format and analyzed, the data was entered in SPSS version 16 and analyzed. Mean and SD was calculated for mode of injury, site of injury, grade of injury, rates of sepsis and anastomotic leakage/ repair failure. P value  $\leq 0.05$  was considered as significant

### Results

A total of 100 patients fulfilled the criteria for inclusion in the study and analysis. There were 97 males and 3 females. The mean age was 28.3 years. All patients had penetrating injuries of the abdomen; there were 17 patients in shock on admission (BP<90 systolic). The transverse colon was involved in 42 cases, the left side of the colon in 19 cases, and the right colon in 8 cases. There

was involvement of two or more colonic segments in 27 patients, and occurrence of severe intra-abdominal complications in relation to site shown in Table 1

**Table 1:** Complications in relation to sites of colon injuries

Site of injury	Complications	
	Yes	No
Transverse colon	0/42 (0%)	42/42 (100%)
Left colon	2/19(10.5%)	17/19(89.5%)
Right colon	1/9(11%)	8/9(88.9)

(P value =0.1976)

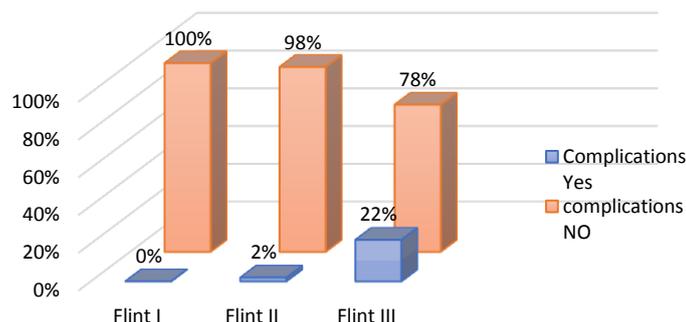
In 42 cases there were three or more intra-abdominal organ injuries, the most commonly associated injury was the small bowel in 50% of the patients, followed by the liver and stomach, as shown in (Table 2), and in 42 patients (42%) we found colon and other more than two organ from above are injured; in these Associated intra-abdominal organ injuries group, 33 (78.6%) were managed with primary repair, 6 (14.3%) with colostomy

**Table 2:** Associated intra-abdominal organ injuries

Organ	%	Organ	%
Small bowel	50%	Spleen	5%
Liver	18%	Kidney	5%
Stomach	16%	Major vessels	5%
Duodenum	7%	Biliary tract	3%
Pancreas	6%	Bladder &Ureter	3%

We use **Flint Colon Injury Score (FCIS)** to assess severity of injuries and evaluate outcome of primary repair which performed for all (FCIS) Grades I and II and patients of grade III except in presence of sever destructive colonic damage with disseminated gross peritoneal contamination requiring colostomy, Grade I injury of colon was present in 19%% patients in our study while 64%% patients presented with Grade II injury and 17%% patients presented with Grade III injury of colon and each show complications rate figure 1

**Figure 1 complications in relation to Flint grades of colonic injury**



(P =0.008)

Primary repair was performed in 76 patients (76%), a colostomy in 24 patients (24%), The overall incidence of abdominal complications was 19% (19cases). Severe intra-abdominal complications occurred in 5% (two intra-abdominal abscesses, three fistulas), one of the abscesses was managed by drainage, and all three fistulas were successfully treated conservatively, the remaining complications were superficial sepsis, the incidence of abdominal sepsis in the group of patients who had primary repair was 11.8% Compared with 29.2% in the group with a colostomy (Table 3).

**Table 3** The complications in the primary repair and colostomy groups

	No.	Intra-abdominal sepsis	Fistulas	Wound sepsis	Total
<b>Primary repair</b>	76	1	2	6	9/76 (11.8%)
<b>Colostomy</b>	24	1	1	5	7/24 (29.2%)
<b>Total</b>	100	2(2%)	3(3%)	11%	

**Discussion**

The management of colonic injuries has undergone significant change during the last few years, no clinical or experimental study has ever shown that the two sides of the colon healed differently, on the contrary there is evidence that no distinction should be made between right and

left colonic injuries<sup>(5-8)</sup>. Numerous prospective randomized trials compared primary repair to diversion procedure, and demonstrated no significant difference in complication rates between groups<sup>[9,10,11,12]</sup> Despite the new approach to colonic injuries there is still significant reluctance to perform primary repair in many cases have been described over the years Various criteria for primary repair have been described over the years: no shock on admission, no more than two associated intra-abdominal injuries, no multiple colonic injuries, no bullet injuries, no gross contamination, theatre delay less than 6h; we are convinced that almost all the above criteria are not valid, we perform primary repair in all cases except in those with severe destructive colonic damage or in the presence of severe gross fecal contamination or pus<sup>(11,12,13)</sup>.

The presence of multiple colonic perforations is not a contraindication for primary repair. Of the 78 patients with multiple colonic wounds, 59(75.6%) were managed with primary repair. Only one patient developed intra- abdominal sepsis and the site was away from any colonic suture line. Similarly the presence of multiple intra-abdominal organ injuries is not a contraindication for primary repair. Of the 42 patients with three or more organ injuries, primary repair was performed in 34 (80%). There was only one case of intra-abdominal abscess (the patient escribed above). The presence of shock on admission is not a contra- indication for primary repair. Of the 17 patients admitted in shock, 10 (58.8%) were managed with primary repair, one patient developed a fistula which closed spontaneously. Flint and Richardson<sup>(3)</sup> suggested that intra peritoneal primary repair should be reserved for patients with colonic injury grade I, our results do not support their recommendation andwe use the primary repair in most of colonic injury grade II with less complications rate Controversy remains only in cases of destructive colon injuries requiring resection, whether they should be treated with or without diversion procedure According to results of prospective

multicenter trial 11,12

Our overall incidence of intra-abdominal abscesses was 2% and the incidence of fecal fistulas was 3% these figures compare very favorably with other series especially taking into account that most of our patients were GSW victims. Colostomy is an open source of feces near a laparotomy wound and with a potential communication with the peritoneal cavity through its abdominal wall exit; theoretically it should be associated with a higher incidence of wound sepsis and intra-abdominal abscess

### Conclusion

The majority of Penetrating injuries of the colon can safely be managed by primary repair and the old dogma that primary repair is safe in the right colon but not in the left colon has been discredited, left-sided injuries, multiple colonic perforations, shock on admission, delay > 6 h, and more than two associated intra-abdominal injuries, do not appear to be contraindications for primary repair. However, there is need to assess the results of one stage management on large scale in moderate to high risk patients with traumatic colonic injuries

### Acknowledgement

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### Ethics

All patients involved in this study are pre-informed about the nature and steps of the study, and signed written consent is taken from each and attached to own patient format sheath.

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