Injury, Int. J. Care Injured 41 (2010) 58–63

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

# Current management of large bowel injuries and factors influencing outcome☆

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ARTICLE INFO

*Article history:*
Accepted 19 January 2009

*Keywords:*
Large bowel
Colon
Rectum
Trauma
Injuries

ABSTRACT

*Background:* Colonic and intra-peritoneal rectal injuries may be managed by primary repair and extra-peritoneal rectal injuries by diverting colostomy. This study was undertaken to document our experience with this approach and to identify factors which might impact on outcome.
*Patients and methods:* Prospective study of all patients treated for colon and rectal injuries in one surgical ward at King Edward VIII hospital, Durban, over a 7-year period (1998–2004). Demographic data, clinical presentation, findings at laparotomy and outcome were documented.
*Results:* Of 488 patients undergoing laparotomy, 177 (36%) had injuries to the colon and rectum with age 29.8 ± 10.9 years. Injury mechanisms were firearms (118) stabs (54) and blunt trauma (5). Delay before laparotomy was 10 ± 9.3 h. Complication and mortality rates were 36% and 17%, respectively. 68 patients (38%) required ICU management. Shock on admission and increased transfusion requirements were associated with a significantly increased mortality. Patients with delay ≤12 h before laparotomy had a higher mortality rate than those with delay >12 h. The mortality rate increased with the number of associated injuries and it was higher the higher the Injury Severity Score (ISS); it was similar for stabs, firearms and blunt trauma. Hospital stay was 9.5 ± 9.2 days.
*Conclusion:* We reaffirm that primary repair is appropriate for colonic and intra-peritoneal rectal injuries and that extra-peritoneal rectal injuries require diverting colostomy. Shock on admission, increased blood transfusion requirements, associated organ injury and severity of the injury were associated with high mortality.



## Introduction

Most colonic and rectal injuries occur following penetrating trauma and injury from blunt trauma is uncommon.[12,38] Mortality for penetrating colorectal injuries has decreased from 16 to 35% during the Korean War to the current levels of 3–13%[12] and that for rectal injuries has decreased from 90% before World War I to current levels of 15%.[12] In recent years the role of distal rectal washout and pre-sacral drainage in the management of extra-peritoneal rectal injuries has been hotly debated. The high incidence of trauma seen in South Africa[35] allows a unique opportunity to study these injuries in depth. This study was therefore undertaken to document our local experience with this approach and identify factors which might impact on management and 30-day outcome. Ethical approval for the conduction of this study was obtained from the Biomedical Research Ethics Committee of the University of KwaZulu-Natal.

## Patients and methods

A prospective analysis was carried out of all patients treated for abdominal trauma in a single surgical ward at King Edward VIII Hospital, Durban, South Africa, over a 7-year period (1998–2004). All patients found at laparotomy to have colon and/or rectal injuries form the basis of this study.

Delay before laparotomy included pre-hospital and in-hospital delay. Shock on admission was defined as a systolic blood pressure of ≤90 mmHg. Patients were resuscitated prior to laparotomy and those in whom resuscitation was not successful underwent laparotomy as part of resuscitation. Patients who were haemodynamically unstable at the commencement of laparotomy and those who developed haemodynamic instability at surgery were subjected to damage control laparotomy, the main indications being a triad of coagulopathy, acidosis and hypothermia.[48] A prophylactic antibiotic policy was applied with the antibiotic given at induction of anaesthesia followed by directed antibiotics depending on intra-operative findings. Following evaluation, each patient was accorded an Injury Severity Score (ISS).[3] Demographic data, mechanism of injury, clinical presentation, findings at laparotomy and 30-day outcome (morbidity and mortality), management strategies for the various complications, and potential predisposing factors were all recorded on a detailed proforma.

☆ Presented at the Annual Meeting of the Surgical Research Society of Southern Africa, Bloemfontein, South Africa, 27–28 June 2007.

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doi:10.1016/j.injury.2009.01.128

Lacerations and perforations involving less than 50% of the wall circumference were defined as non-destructive wounds and those involving 50% or more and those causing segmental devascularisation were defined as destructive injuries as described by others.[12,33]

Non-destructive injuries were managed by primary repair and destructive injuries required resection and anastomosis. Repair was by a single absorbable suture using polyglactin, polyglycolic acid or polydiaxanone which was continuous or interrupted, depending on the preference of the surgeon. For patients requiring damage control the procedure entailed either the use of a stapling device or abdominal tapes to close off the bowel ends thus limiting contamination.

Rectal injuries were suspected in patients with injuries traversing the pelvis. These patients were subjected to proctosigmoidoscopy prior to laparotomy and the presence of blood was regarded as signifying extra-peritoneal rectal injury until proven otherwise. Local policy for the management of extra-peritoneal rectal injuries involves diverting loop colostomy with repair if the injury is accessible and no repair if it is not accessible. Pre-sacral drainage and distal rectal washout are not part of our current policy.

A Chi square test (or Fisher's exact where numbers were very small) was used for comparison of factors affecting outcome and the one way ANOVA test was used for comparisons of injury mechanisms and ISS. A $p$-value of $<0.05$ was taken as significant.

## Results

Of 488 patients undergoing laparotomy, 177 (36%) were found to have injuries of the large bowel. One hundred and sixty-five patients were male with a male to female ratio of 15:1. The mean age was $29.8 \pm 10.9$ (range 12–68) years; only 4 were $\geq$60 years and only 14 were $\geq$50 years of age. The injury mechanisms were firearms (118) stabs (54) and blunt trauma (5). The mean pre-hospital delay was $6.8 \pm 8$ h and total delay before laparotomy was $10 \pm 9.3$ h. Twenty-six patients were shocked on presentation; all except four responded well to resuscitation prior to laparotomy. There were 159 colonic injuries (33% of abdominal injuries) and 21 rectal injuries (4% of abdominal injuries). Of the 21 rectal injuries, 11 were intra-peritoneal and 10 were extra-peritoneal. Excluding the three patients with combined colon and rectal injuries leaves 156 with colon injuries and 18 with rectal injuries. Of 156 colon injuries 77 (49.7%) were left-sided, 21 (13.5%) were right-sided and transverse colon injuries accounted for 36.8%. The mean ISS was $12.5 \pm 6.3$. The median ISS for colonic injuries, rectal injuries and combined injuries was 9, 16 and 12.5, respectively.

The most common associated organ injury was small intestine (54%) followed by liver (21%) stomach (18%) and diaphragm (12%). Of the 156 colonic injuries, 134 were managed with primary repair and 13 underwent resection and anastomosis. Five patients either remained haemodynamically unstable despite resuscitation or developed haemodynamic instability on the operating table; they underwent damage control laparotomy and finally had re-anastomosis of the resected segments (resection and anastomosis). Isolated intramural haematoma of the colon was noted in three patients and these were managed conservatively. Colostomy and mucous fistula was used in one patient with a shattered descending colon and extensive soiling following inappropriate observation in another hospital. One further patient underwent a combination of primary anastomosis for one wound and resection and anastomosis for multiple small lacerations (Table 1).

The eight patients with intra-peritoneal rectal injury were managed by primary repair, and the ten extra-peritoneal injuries were treated by colostomy without repair. Of the three patients with combined colon and intra-peritoneal rectal injuries, two had primary repair and, in the third patient the colonic injury was primarily repaired and the rectal injury was managed with colostomy without repair.

Sixty-eight patients (38%) required management in the intensive care unit (ICU) with the mean ICU stay being $4.9 \pm 4.7$ days. Sixty-three patients (36%) developed complications, the most common being multiple organ dysfunction syndrome [MODS (29, 16%)], wound infection (17, 10%), chest infection (15, 9%), peritonitis (11, 6%), and peritonitis (11, 6%). Seven fistulae developed (4%), namely, colo-cutaneous (3), entero-cutaneous (1) recto-vesical (1), colo-uretero-cutaneous (1) and pancreatic (1); all from firearms. The complication rate was 29, 47 and 50% for colonic, rectal and combined injuries respectively and it was similar for intra-peritoneal and extra-peritoneal rectal injuries (57 and 55%, respectively). Colon-related complications occurred in five patients (3%) namely colonic fistula (4, one of which developed following peritonitis due to anastomotic dehiscence) and recto-vesical fistula in one patient with extra-peritoneal rectal injury (Table 1).

Twenty patients (11%) required re-laparotomy, the reasons being peritonitis (11), removal of packs (5), unexplained pyrexia (1), bleeding from a missed inferior vena cava injury (1), intestinal obstruction (1), and for a high velocity colonic injury (1). The 11 patients with peritonitis were found at laparotomy to have sero-sanguinous fluid (5), abdominal abscess, (2) purulent peritonitis, (2), anastomotic dehiscence (1) and a necrotic liver segment (1). The injury mechanisms for patients requiring re-look laparotomy were firearms (18), stabs (1) and blunt trauma (1).

Twenty-nine patients (17%) died, the causes of death being MODS (26) and hypovolaemic shock (3). Twenty-seven out of 159 patients with colonic injuries (17%) and two out of 21 patients with rectal injuries (10%) died, both from the group with intra-peritoneal rectal injuries. Table 2 shows the influence of various factors on outcome. Increased transfusion requirements were associated with a significantly higher morbidity. The mortality rate

**Table 1**
Management of large bowel injuries in 177 patients.

| Management | $n$ | Colon-related morbidity (%) |
|---|---|---|
| Colonic and intra-peritoneal rectal injury ($n$ = 167) | | |
| Primary repair | 144 (86%) | 4 (3%) |
| Resection an anastomosis | 18 (11%)[a] | 1 (7%) |
| Damage control laparotomy | 5 (3%)[b] | 0 |
| Conservative treatment | 3 (1.6%) | 0 |
| Resection and colostomy for colonic injury | 1 (0.5%) | 0 |
| Primary repair and resection + anastomosis | 1 (0.5%) | 0 |
| Extra-peritoneal rectal injury ($n$ = 10) | | |
| Colostomy (and no repair) for rectal injury | 9 (90%) | 1 (10%) |
| Primary repair (colonic injury) & colostomy (rectal injury) | 1 (10%) | |

[a] Includes the five patients who initially underwent damage control laparotomy.
[b] Eventually had re-anastomosis of resected segments.