

Is Fecal Diversion Necessary for Nondestructive Penetrating Extraperitoneal Rectal Injuries?

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Background: Current management of penetrating extraperitoneal rectal injury includes diversion of the fecal stream. The purpose of this study is to assess whether nondestructive penetrating extraperitoneal rectal injuries can be managed successfully without diversion of the fecal stream.

Methods: This study was performed at an urban Level I trauma center during a 28-month period from February 2003 through June 2005. All patients who suffered nondestructive penetrating extraperitoneal rectal injuries were managed with a diagnosis and treatment protocol that excluded fecal stream diversion. Patients were placed in one of two management arms based upon clinical suspicion for intraperitoneal injury. In the first arm, patients with suspicion for rectal injury and a positive clinical examination for intraperitoneal injuries were delivered to the operating room for exploratory laparotomy. Proctoscopy was performed be-

fore exploratory laparotomy. Extraperitoneal rectal injuries were left to heal by secondary intention. Intraperitoneal rectal injuries were repaired primarily. Patients did not receive fecal diversion or perineal drainage. In the second management arm, patients with a negative clinical examination for intraperitoneal injury and wounding agent trajectory suspicious for rectal injury underwent diagnostic peritoneal lavage (DPL), cystography, and proctoscopy in the emergency room. Positive DPL or cystography warranted laparotomy as above. Patients with positive proctoscopy alone were admitted and placed on a clear liquid diet. Barium enema was performed 5 to 7 days postinjury for all rectal injuries with diets advanced accordingly.

A matched historic control group of rectal injury patients who underwent fecal diversion was compared with the nondiversion protocol group. Patients from both groups were matched for penetrating

abdominal trauma index (PATI), age and mechanism of injury.

Results: There were 14 consecutive patients diagnosed with penetrating rectal injury placed in the nondiversion management protocol. Of these, 9 (64%) patients in the nondiversion group required laparotomy. The average age in the diversion historical control group was 30.5 years and 29.3 years in the nondiversion group. The average PATI in the diversion group was 15.3 and 16.1 in the nondiversion protocol group. The average length of stay for the diversion and nondiversion groups was 9.8 days (range, 7–15) and 7.2 days (range, 4–10), respectively. There were no complications associated with rectal injuries in either group.

Conclusions: Nondestructive penetrating rectal injuries can be managed successfully without fecal diversion. Randomized prospective study will be necessary to assess this management method.

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C current guidelines for the management of civilian penetrating rectal injuries includes repair of the injury when easily accessible, fecal diversion and presacral drainage. Guidelines for the management of penetrating rectal injuries continue to evolve with emphasis on a more conservative approach to the operative management of these injuries. Intraperitoneal rectal injuries are managed as are most other proximal large bowel injuries with primary repair as the only maneuver necessary for an optimal outcome. Primary repair of extraperitoneal injuries is often difficult, because of the confined pelvic space, adjacent sacral venous plexus and

adjacent urogenital structures. The optimal management methodology for extraperitoneal penetrating rectal injuries remains controversial. Several authors have questioned the efficacy of presacral drainage in the management of these injuries.^{1–6} Recently a randomized prospective study that evaluated the efficacy of presacral drainage concluded that presacral drainage does not impact the incidence of infectious complications.⁶ At the University of South Alabama, presacral drainage is no longer standard therapy for penetrating extraperitoneal rectal injury. We have not seen an increased incidence of infectious complications associated with this practice. In the past, several authors have suggested that penetrating extraperitoneal rectal injuries can be managed without fecal diversion.^{7–9} The purpose of this study is to assess whether nondestructive penetrating injuries of the extraperitoneal rectum can be managed successfully without fecal diversion.

METHODS

A protocol for management of penetrating rectal injuries was implemented at the University of South Alabama Medical Center during the 28-month period from February 1, 2003

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through June 30, 2005. During this time period, all patients that sustained nondestructive penetrating extraperitoneal rectal injuries were prospectively managed with a diagnosis and treatment protocol that excluded diversion and presacral drainage. Nondestructive rectal injuries were defined as injuries of less than 25% total circumferential disruption. The University of South Alabama's Institutional Review Board approved a retrospective analysis of data collected from this management protocol and data from patients who suffered penetrating rectal injuries after implementation of the protocol.

Patients who were suspected of having sustained a penetrating extraperitoneal rectal injury were placed in one of two management arms of the nondiversion treatment protocol based upon clinical suspicion for intraperitoneal injury. In the first arm of the treatment protocol, patients who had a clinical examination consistent with intraperitoneal organ injury and suspected extraperitoneal rectal injury were delivered to the operating room for proctoscopy followed by exploratory laparotomy. Cystography was performed in the emergency room before operating room transfer. Intraperitoneal rectal injuries were repaired primarily. Extraperitoneal rectal injuries were left to heal by secondary intention with no attempt at exposure of the injury. Bladder injuries were repaired primarily during laparotomy typically by opening the dome of the bladder and repairing the injury under direct visualization. Fecal diversion and presacral drainage were not performed. Patients received intravenous antibiotics for 24 hours postinjury. Patients were allowed nothing by mouth until passing flatus. At that time (typically postoperative day 5–7), barium enema was performed and diet was advanced accordingly. Barium enema was performed at a minimum of 5 days postinjury. If the barium enema showed sign of a leak, the patient was advanced to a clear liquid diet and barium enema was repeated on postoperative day 10 (see Fig. 1). Antibiotics were not administered if the barium enema showed contrast extravasation.

In the second arm of the treatment protocol, patients with transpelvic missile trajectory and clinical examination inconsistent with intraperitoneal injury underwent diagnostic peritoneal lavage (DPL), cystography, and proctoscopy in the emergency room. Patients with a positive DPL or cystogram were delivered to the operating room for exploratory laparotomy. A DPL was considered positive and indication for exploratory laparotomy if the DPL effluent had red blood cell (RBC) count greater than 10,000 RBCs per cubic millimeter. In these patients, proctoscopy was typically performed in the operating theater and extraperitoneal rectal injuries were treated in similar fashion to extraperitoneal rectal injuries in the first management arm. If the DPL and cystogram were negative and proctoscopy identified a rectal injury, the patient was diagnosed with an isolated extraperitoneal rectal injury and was admitted and placed on a clear liquid diet. Barium enema was performed on post admission day 5. If the barium enema was negative, the patient was advanced to a regular diet and discharged home. Otherwise, the barium enema was

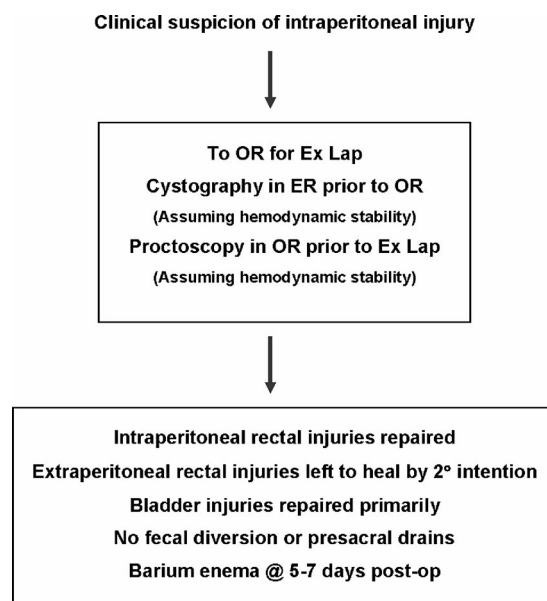


Fig. 1. First treatment arm: suspected intraperitoneal and rectal injuries.

repeated at post admission day 10. If all three emergency room studies were negative, the patient was admitted for overnight observation (see Fig. 2).

A matched historic control group was developed from the hospital's trauma registry. The matched controls were extracted from penetrating rectal injury patients during the time period from February 1995 through January 2003. Patients were matched by age, mechanism of injury and penetrating abdominal trauma index¹ (PATI). The authors were blinded to length of stay (LOS) and complications for the purposes of selecting the matched controls. Comparative analysis was performed between protocol and historical control groups utilizing the paired *t* test. Average age, PATI, length of stay and complications were compared.

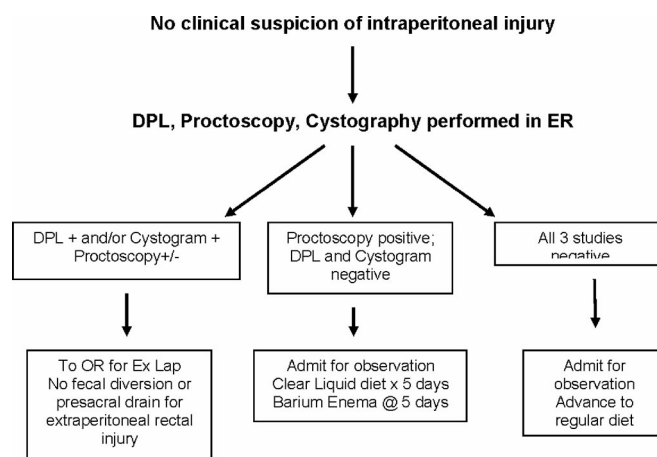


Fig. 2. Second treatment arm: transpelvic gun shot wound with unsuspected intraperitoneal injury.

1st Treatment Arm

Clinical suspicion for intraperitoneal injury

Cystography in ER prior to OR
5 patients with gross hematuria
4 patients with negative cystogram

Proctoscopy in OR prior to Ex Lap
9 rectal injuries diagnosed by proctoscopy and/or digital exam

Exploratory Laparotomy (9 patients)

Fig. 3. Protocol group patients: laparotomy required ($n = 9$).

2nd Treatment Arm

No clinical suspicion for intraperitoneal injury

Proctoscopy positive (5 patients)
DPL and Cystogram negative (5 patients)

Admit for Observation (5 patients)

Fig. 4. Protocol group patients: no laparotomy required ($n = 5$).

RESULTS

Fourteen consecutive patients (12 male, 2 female) with nondestructive penetrating extraperitoneal rectal injuries were placed in the nondiversion management protocol. None of these patients received fecal diversion or presacral drainage. There were no destructive rectal injuries ($>25\%$ circumferential injury) encountered during the study period. Nine (64%) of the protocol patients underwent exploratory laparotomy (see Fig. 3). Eight of the laparotomies performed in the protocol group were therapeutic with one patient who underwent laparotomy without intraperitoneal injury repair. Abdominal injuries encountered in the protocol group are shown in Table 1. Five (36%) patients diagnosed with extraperitoneal rectal injury underwent diagnostic studies (DPL, cystography, proctoscopy) in the emergency room and were admitted for observation of an isolated extraperitoneal rectal injury (see Fig. 4). All 14 patients in the nondiversion protocol group underwent normal barium enemas by postinjury day 10. The average time from admission of protocol patients until they underwent initial barium enema to assess rectal integrity was 6.0 days (range, 5–10 days). One patient in the protocol group had an initial barium enema at 5 days that was thought to have extravasation of rectal contrast. This patient

had a repeat barium enema on postadmission day 10 with resolution of contrast extravasation.

Fourteen patients (14 male) were matched from the trauma registry pool of 42 penetrating rectal injury patients. Thirteen of these patients received a loop colostomy and one patient underwent a Hartmann's procedure. Five (36%) of the matched control patients underwent presacral drainage. Eight match control patients had isolated rectal injuries with other abdominal injuries encountered by the match-control group described in Table 1.

The average age in the nondiversion protocol group was 29.3 years (range, 15–46) and the average in the matched control group was 30.5 years (range, 21–50) ($p > 0.05$). The average PATI in the nondiversion protocol group was 16.1 (range, 12–30) and the average PATI in the matched control group was 15.3 (range, 12–30) ($p > 0.05$). The average LOS in the nondiversion protocol group was 7.2 days (range, 4–12) and the average LOS in the matched control group was 9.8 days (range, 5–15 days) ($p > 0.05$). All patients in the control group had isolated penetrating injuries to the abdomen or pelvis. Two patients in the protocol group had penetrating injuries to other body regions. Those injuries were a soft tissue extremity injury in one patient and a gunshot wound to the face in the second patient. Neither of those injuries required operative intervention or affected hospital LOS. All patients were scheduled for follow-up at 1 week postdischarge at the University of South Alabama trauma clinic.

There was one complication in the nondiversion protocol group that was an intraperitoneal abscess associated with an intraperitoneal cecal injury. This abscess was not in the retroperitoneal space nor was it in continuity with the rectal injury. This abscess was drained percutaneously via computed tomographic guidance. The patient was discharged on postadmission day 10 with the drain in place. The drain was subsequently removed in outpatient trauma clinic. There were no complications associated with extraperitoneal rectal injuries in the nondiversion protocol group. There were no complications in the matched control rectal injury group.

One patient in the nondiversion protocol group was discharged on postadmission day 4. This patient was diagnosed

Table 1 Nonrectal Abdominal Injuries Encountered in Protocol and Control Groups

Protocol group ($n = 14$)*	
Bladder	5
Small bowel	4
Colon	2
Ureter	2
Control group ($n = 14$)†	
Bladder	4
Small bowel	3
Iliac artery/vein	1
Colon	1

* Six patients with isolated rectal injuries.

† Eight patients with isolated rectal injuries.

with an isolated extraperitoneal rectal injury that did not require exploratory laparotomy. The patient left the hospital against medical advice; however, he underwent a normal outpatient barium enema on postinjury day 9.

DISCUSSION

The management of civilian rectal injuries is primarily based upon experience from wartime conflict. The landmark paper by Lavenson and Cohen originated from the Vietnam War experience with penetrating rectal injuries.¹¹ This created the framework from which civilian penetrating rectal injuries are managed today. Lavenson and Cohen purported four basic tenets for the successful management of penetrating rectal injuries: diverting colostomy, rectal injury repair (when feasible), presacral drainage, and distal rectal washout. For years, civilian trauma surgeons have adhered to these basic tenets; however, several of these tenets have come under scrutiny as to their benefit and efficacy in the management of civilian penetrating rectal injuries.

Because of the increased prevalence of high-velocity assault weapon violence in the civilian setting, civilian penetrating rectal injuries are better defined as destructive and nondestructive injuries. High-velocity missile injuries, seen in wartime conflict, can cause destructive injuries with greater than 25% rectal circumference tissue loss. Injuries caused by assault weapons that are seen with increasing frequency in the civilian population, incur similar destructive injury as weapons from wartime conflict and were excluded from entry in the study protocol.

Many authors in the recent past have questioned the benefits and efficacy of presacral drainage.¹⁻⁷ Several authors have retrospectively evaluated the efficacy of presacral drainage and have concluded that presacral drainage was an unnecessary adjunct in the management of penetrating rectal injuries.¹⁻⁶ Gonzalez et al. recently published a randomized prospective series of nondestructive penetrating rectal injuries that were randomized to presacral drainage and nondrainage.⁷ The author's concluded that presacral drainage had no effect on infectious complication associated with rectal injuries. At the University of South Alabama we advocate nondrainage of nondestructive extraperitoneal penetrating rectal injuries and have not had any infectious complications associated with this practice during the 5-year period before institution of the current study protocol. Accordingly, the current study protocol was designed without presacral drainage as a component of rectal injury management. Of the 14 patients managed in the nondiversion protocol, infectious injuries directly related to the extraperitoneal rectal injuries were not encountered. This further supports the notion that presacral drainage is an unnecessary adjunct in the management of nondestructive penetrating rectal injuries.

In the recent past, several authors have suggested that colostomy is unnecessary for the management of penetrating rectal injury when the extraperitoneal injury is not repaired.⁸⁻¹⁰ Haas and Fox have reported successful management of extraperito-

neal rectal injuries without operative intervention.⁸ Burch has suggested that many extraperitoneal penetrating rectal injuries can heal satisfactorily without surgery, but selecting the appropriate patients may be difficult.⁹ When contemplating nondiversion of penetrating extraperitoneal rectal injuries, one must question whether the rectal defect serves as an avenue for fecal leakage into the perirectal space or is it a pathway for extraperitoneal contamination to necessitate into the rectal lumen? The time-tested management of supralelevator perirectal abscesses is transanal drainage into the lumen of the rectum without fecal diversion. Should not the fecal stream continue to seed the perirectal abscess cavity in these patients? For decades, colorectal surgeons have successfully managed full-thickness rectal tumor removal without fecal diversion or presacral drainage.¹²⁻¹⁶ As a rule, large full-thickness rectal defects caused by rectal tumor removal heal uneventfully without fecal diversion. In the present study protocol, 14 patients with nondestructive penetrating extraperitoneal rectal injuries were managed successfully without diversion or presacral drainage. Barium enema has previously been established as an excellent screen to assess the integrity of the rectum after penetrating rectal injury.^{17,18} Postinjury barium enemas in all protocol patients demonstrated that the rectum could heal successfully without fecal diversion.

Nonrepaired extraperitoneal rectal injuries heal rapidly. This was demonstrated by the fact that all 14 rectal injuries in the protocol had normal barium enemas by postinjury day 10. The numerous authors who advocate early and same admission colostomy closure for diverted, nonrepaired rectal injuries, have recognized the rapidity with which the rectum heals.¹⁸⁻²¹ More importantly, in our series, there were no infectious complications attributable to extraperitoneal rectal injuries in patients managed with our nondiversion and nondrainage protocol.

An additional issue that is often overlooked when considering the management of rectal injuries is the complication rates, and cost associated with colostomies and colostomy closure. Although mortality rates for colostomy closure have been consistently low in many series, morbidity rates range from 5 to 25% with reported LOS from 4 to 150 days.²²⁻²⁷ The most common complications associated with colostomy closure are wound infection, anastomotic leak and bowel obstruction. Clearly, nondiversion management of rectal injuries avoids the complications and cost associated with colostomies and colostomy closure.

Of the 14 patients that were treated without diversion in the protocol group, five (36%) of the patients underwent successful management without exploratory laparotomy. These patients who had negative DPL and cystography had rectal injuries diagnosed with proctoscopy. These patients were diagnosed with isolated extraperitoneal rectal injuries and were successfully managed without exploratory laparotomy, fecal diversion, or presacral drainage. Several authors advocate selective management of transpelvic gunshot

wounds in patients without clinical signs of peritonitis.^{28–30} In a retrospective series, Nagy et al., reported a DPL sensitivity of 99% for determination of peritoneal penetration.²⁸ Similar to our protocol, a threshold of 10,000 RBCs per cubic millimeter was used as criteria for peritoneal penetration in that study. Velmahos et al., published a prospective series of 37 patients in which indication for operative intervention for transpelvic gunshot wounds was based solely on clinical examination.²⁹ Clinical findings of peritonitis, hemodynamic instability, gross hematuria, and rectal bleeding were the only indications for operative intervention. They found clinical examination to have 100% sensitivity in detecting the need for exploratory laparotomy. The authors concluded a policy of selective management is safe, even for patients that have a high likelihood for intra-abdominal organ injury. In the Velmahos series, invasive testing was not used to identify rectal injuries. Thus, one can only assume extraperitoneal rectal injuries that did not manifest rectal bleeding were successfully managed without fecal diversion or presacral drainage. This supports our conclusions that isolated extraperitoneal penetrating rectal injuries can be managed successfully without operative intervention and allows for considerable cost savings because of the avoidance of operative intervention and its associated longer hospital stay.

CONCLUSIONS

The management of penetrating rectal injuries continues to evolve with emphasis on a more conservative operative approach. The management of penetrating rectal injuries in the civilian population continues to be based upon destructive injuries encountered during wartime conflict. The severity of tissue destruction in most civilian rectal injuries is minimal and the tenets of rectal injury management based upon wartime experience do not apply to nondestructive penetrating rectal injuries. This management protocol has shown that nondestructive penetrating rectal injuries can be managed successfully without fecal diversion or presacral drainage. Because of the low number of subjects in this study and the low incidence of these injuries in most trauma centers, multi-institutional randomized prospective study will be necessary to assess the nondiversion approach to the management of these injuries.

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