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Review Article

Management of Rectal Injury

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Abstract Rectal injury is also challenging for surgeons regarding diagnosis and treatment planning. Delayed diagnosis and treatment can lead to severe complications and fatality. The diagnosis should be distinguished between the intraperitoneal or extraperitoneal type. Treatment of intraperitoneal rectal injury is mimicking to colon trauma. Proximal diversion is less required, except in unfavorable situations. Although current evidence suggests proximal diversion as a mainstay treatment of the extraperitoneal rectal injury. Primary repair should be attempted if the injured site can be visualized and accessible.

Keywords: Rectal injury, Rectal trauma, Management of rectal injury

Introduction

Management of acute rectal injury is currently a challenging issue in trauma surgery. There was a high mortality rate of 60-75% in World War I,[1] and after launching diverting colostomy in the World War II era, the mortality rate declined to 53-59%.[2] In the Vietnam War, the development of **"4D"**, which included **D**irected primary repair, proximal **D**iversion, **D**istal rectal washout, and presacral **D**rainage, was a famous treatment method for acute rectal injury. The mortality rate decreased to less than 30% after this era. However, many evidences suggest that not every rectal injury requires 4D and treating rectal injury should be personalized.

Incidence of rectal injuries is approximately 1-3% of all injuries in a developed country.[1] The most common mechanism is gunshot (71-85%), followed by blunt injury, which usually refers to pelvic fractures (5-10%), and stab injury (< 5%).[3] Another mechanism that increases in incidence is the rectal foreign body.[4] Associated injuries include urogenital trauma (43%) and pelvic vascular injury (50%) in penetrating rectal injury, and pelvic fracture especially anteroposterior compression type (75%) in blunt rectal trauma.[1] The current mortality rate is 3-10%,[5] with a morbidity rate of 18-21%.[5,6]

The rectum is located in the pelvic cavity, with 12-15 cm in length, and is divided into two portions, intraperitoneal and extraperitoneal rectum. The intraperitoneal rectum refers to 2/3 upper anterior portion and 1/3 upper posterior portion of the whole rectum, which is covered with the peritoneum. In contrast, the extraperitoneal rectum locates deep down out of the peritoneal cavity. The distal rectum connects with the anus

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at the dentate line. The location of the injury is essential to define appropriate treatment in terms of peritoneal contaminations, developing deep abscesses, and difficult accessibility and repairable.[7] The American Association for the Surgery of Trauma (AAST) launched a rectal injury scale as in Table 1.[8]

Table 1 Rectum injury scale

Grade	Type of injury	Description of injury
I	Hematoma	Contusion or hematoma without devascularization
	Laceration	Partial-thickness laceration
II	Laceration	Laceration < 50% of circumference
III	Laceration	Laceration ≥ 50% of circumference
IV	Laceration	Full-thickness laceration with extension into the peritoneum
V	Vascular	Devascularized segment

Advance one grade for multiple injuries up to grade III

Diagnosis

Diagnosing rectal injury is challenging because the rectum lies within the deepest part of the pelvic cavity, especially the extraperitoneal rectum, which usually has no significant abdominal signs. The rectal injury usually occurs with high-risk mechanisms, such as a high-speed motor vehicle accident with a pelvic injury, pelvic gunshot, or stab wound of the pelvic and perineum. Aihara et al. reported a 2.2% incidence of rectal injury in fractured pelvic patients and three times increasing incidence in the presence of widened pubic symphysis.[9] Patients with urethral injury, bladder injury, anterior-posterior compression types pelvic fractures, or pelvic vascular injuries are highly concerned about rectal injury.[1,9]

1. Digital rectal examination (DRE) has a 33-53% sensitivity with a high false negative rate of 63-67% for diagnosing rectal injury.[10] DRE is operator-dependent and may have confounding factors, such as perineal hematoma or wound. The presence of rectal bleeding is most often used to diagnose rectal trauma. However, the blood may come from the colon without injury to the rectum.[10-12]

2. Proctoscopy has a sensitivity of 71% for diagnosing rectal trauma and 88% for extraperitoneal rectal injury. Intraperitoneal rectal injury may not visualize in a proctoscope examination.[13]

3. Computed tomography (CT scan) can be utilized in a stable hemodynamic patient with suspicious rectal trauma. CT scan may have a role in trajectory identification in penetrating injury. Signs of rectal injury are extravasation of intraluminal contrast, full-thickness rectal wall defect, symmetrical extraluminal free air foci, or hemorrhage within the rectal wall.[1,14] However, in case of no suspicious signs in the CT scan with highly concerned clinical signs of rectal injury, it may require further investigation, such as proctosigmoidoscopy, which is usually done in the operating room as a double set-up.[4] CT scan has a false negative rate of 20%. There is no sufficient evidence support routine use of intraluminal contrast to enhance diagnostic value of CT scan.[1,14]

4. Proctosigmoidoscopy should be performed in the operating room after adequate anesthesia, and the patient should be placed in the lithotomy position. With this method, the sensitivity for diagnosing rectal trauma increases to more than 90%.[4,13] Endoscopic sign of rectal injury is the presence of a rectal wound or blood in the rectum. The previous study showed a higher sensitivity for diagnosing rectal injury at 78% in rigid endoscopy compared to 51% in DRE, and rigid proctosigmoidoscopy can detect 58% of intraperitoneal rectal traumas with the 88% detection rate for extraperitoneal injuries.[13] No current study compares rigid and flexible proctosigmoidoscopy in rectal traumas. Some previous studies in low rectum cancer showed no significant difference in detection, diagnosis, and post-procedure complications between rigid and flexible proctosigmoidoscopy, but more patient's comfortable and more accessible biopsy in flexible proctosigmoidoscopy.[15-17]

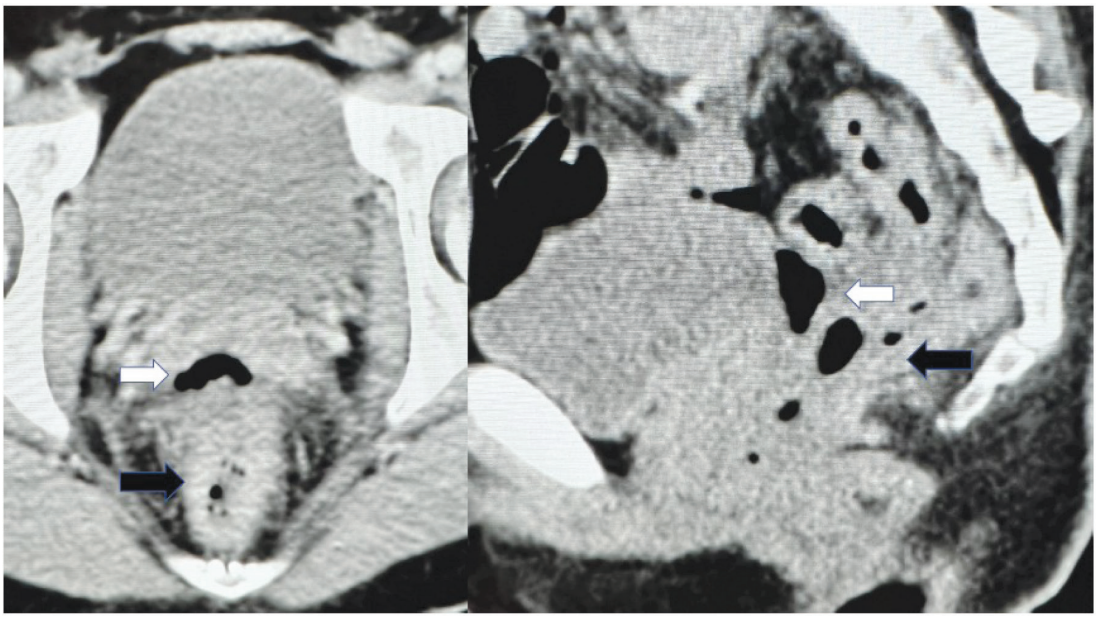

Figure 1 Contrast-enhanced CT scan without intraluminal contrast of extraperitoneal rectal injury (left; axial view, right; sagittal view)
White arrow – extraluminal free air within anterior mesorectal space
Black arrow – non-enhancing anterior lower rectal wall, likely injured site

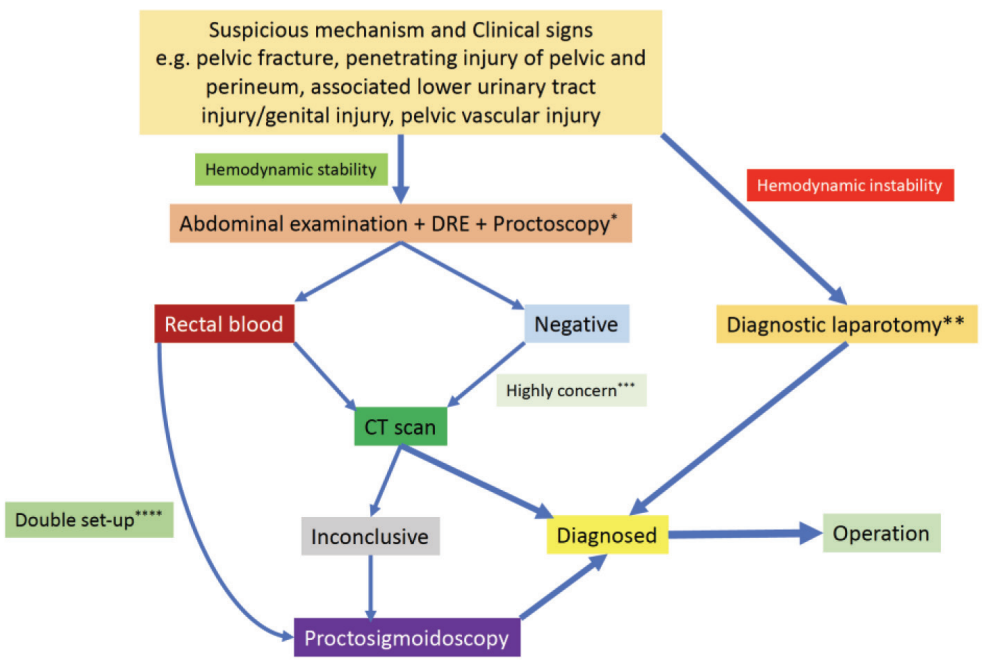

Figure 2 Diagnostic workup of rectal injury
*Bedside diagnostic tool, false positive in GI tract trauma and false negative in intraperitoneal rectal injury or low-grade injury
**Intraperitoneal rectal injury can be found, and may require proctoscopy/proctosigmoidoscopy if suspicious extraperitoneal injury
*** Highly concern in suspicious mechanism, trajectory identification
**** Intraoperative evaluation included proctoscopy under anesthesia

Management

1. Intraperitoneal rectal injury

Current management of the intraperitoneal rectal injury is mimicking to colon trauma. In hemodynamically unstable, the patient must be treated with damage control surgery (DCS), including perforated site closure, bleeding control, temporary abdominal closure, and physiologic restoration in the intensive care unit. The definitive repair should be performed after achieving optimal patient conditions.[18] However, the study in 2017 reported lower ischemic changes after primary bowel repair and anastomosis in DCS compared to conventional DCS, with a mortality rate of 8.3% in primary anastomosis group compared to 16.9% in primary discontinuity ($p = 0.096$).[19] The Eastern Association for the Surgery of Trauma (EAST) reported a meta-analysis of penetrating rectal traumas, which showed a high anastomosis leakage rate in the patient with delayed repair (> 12 h), hypotension, multiple injuries, requiring > 6 units of packed red cells (PRC) transfusion, or concomitant left-sided colon injury. EAST preferred to avoid proximal diversion in the first operation of DCS because it may increase the risk of surgical site infections (SSI) and cause difficult subsequent fascial closure. Additionally, the proximal diversion has no mortality benefit in patients who require DCS. They also suggested resection and primary anastomosis in the exemplary operation rather than proximal diversion.[20] The Western Trauma Association (WTA) also suggested primary repair or resection with primary anastomosis in definitive operation. However, WTA advised proximal diversion in the patient with ongoing shock or unexplained acidosis, concomitant pancreatic or genitourinary injuries, major chronic illness, receiving immunosuppressant, suboptimal perfusion, or inability to fascial closure at the second laparotomy.[18]

In hemodynamic stability intraperitoneal rectal trauma, the patient should be classified into two groups, destructive or non-destructive injury. The non-destructive injury refers to < 50% circumferential bowel wall laceration with no vascular injury. Another hand, destructive injury means severe laceration of the rectal wall with devascularization, which mostly requires resection and anastomosis.[1,4,18] Stone et al. compared primary repair with a proximal diversion in colorectal injuries and found a statistically signific ant lower SSI rate in the primary repair group with ten times increased postoperative complications in the proximal diversion group.[21] Vertree et al. conducted a one-year follow-up on treating soldiers with colorectal traumas from the war in 2003-2006. They reported that the primary repair or anastomosis was the safest choice in isolated colorectal injury. There was no significant difference in postoperative complications compared to the proximal diversion. However, the proximal diversion group may lead to complications after the closure ostomy operation.[22] The prospective trial in 2002-2008 compared stable colorectal traumas, which required < 4 units of PRC and performed the primary repair within eight hours, and the unstable group performed proximal diversion. This study showed lower SSI and ventral hernia rates in the primary repair group compared with proximal diversion.[23]

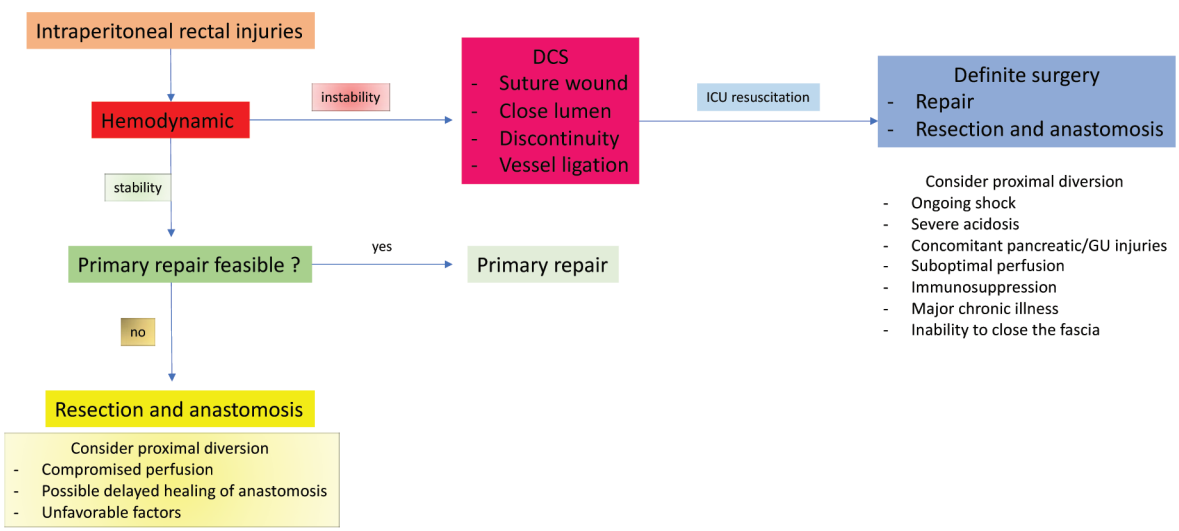

Figure 3 Management of intraperitoneal rectal injury

The systematic reviews of blast colorectal traumas showed no statistically significant difference in treatment outcome of the primary repair and proximal diversion.[24] Current studies showed no difference in outcome between primary repair and proximal diversion.[25-27] EAST suggested primary repair or resection with primary anastomosis in stable intraperitoneal rectal injury.[20] However, WTA still recommended proximal diversion in stable intraperitoneal rectal injury with compromised rectal wall perfusion, risk of compromised anastomosis healing, and unfavorable local environment.[18] The management algorithm of intraperitoneal rectal injury is shown in Figure 3.

2. Extraperitoneal rectal injury

Extraperitoneal rectal injury is challenging to repair because it lies out of the peritoneal cavity, which may be complexly accessible. The current 4D treatment is a famous and widely accepted option among surgeons. This treatment option has details and supporting evidence as follows.

1) Proximal diversion

Proximal diversion primarily aims to prevent further fecal contamination and decrease the risk of intraabdominal infections (IAI). Burch et al. conducted a retrospective study of extraperitoneal rectal traumas in soldiers and reported an IAI rate of 11% with a mortality of 4% in the proximal diversion. They suggested proximal diversion as the essential procedure in extraperitoneal rectal injuries.[26] Proximal diversion was also beneficial in civilian extraperitoneal rectal injuries.[4,28-31] EAST conducted a meta-analysis of 14 studies and reported that proximal diversion reduced the IAI rate from 18.2% to 8.8%. They recommended proximal diversion as the essential procedure for treating extraperitoneal rectal traumas.[32] Recommended proximal diversion methods are;[33]

1. Loop colostomy
2. Loop colostomy with the distal limb closure
3. End colostomy with mucous fistula (double-barrel colostomy)
4. Hartmann's procedure; destructive rectal wall injury
5. Abdominoperineal resection; combined with destructive anal sphincter injury

A comparison study between loop and end colostomy revealed no significant difference in postoperative complications and mortality rate.[34] Mattox et al. suggested loop colostomy rather than others due to rapid and low complication rates. The reversal timing typically occurs after 6-8 weeks, but there was no consensus.[4]

Laparoscopic surgery is increasingly utilized in trauma patients. Studies of diagnostic laparoscopy with diverting loop sigmoid colostomy showed no significant difference in postoperative complications rate compared with open loop sigmoid colostomy. This method would be an appropriate option in an experienced center.[35-38] The advantage of laparoscopic surgery is less invasive, less pain, rapid return to regular activity, and decreased hospital length of stays.

2) Presacral drainage

The purpose of presacral drainage is to contaminate drainage from the presacral space and prevent perineal abscess.[28] The procedure begins with a curve transverse incision at the pre-coccygeal area (1-2 cm anterior to the coccygeal tip). The anococcygeal ligament must be cut to enter the presacral space, and then a soft flat tubular drain must be inserted and fixed.[39] Jon M. Burch indicated proximal diversion could reduce infection rate and suggested proximal diversion rather than presacral drainage.[33] Steinig et al. reported no different infection rate between presacral drainage and no drainage.[40] Gonzalez et al. demonstrated an increased infection rate in presacral drainage compared to no drainage (8% vs 4%).[41] EAST also indicated increased complications and mortality rates in presacral drainage. They against advised to perform presacral drainage in extraperitoneal rectal traumas routinely.[32] However, some studies still suggested presacral drainage in the presence of retro-rectal fluid collection.[5,32]

3) Distal rectal washout

Lavenson et al. proposed distal rectal washout in the Vietnam war, including saline wash to remove feces in the rectum. They demonstrated 0% mortality in the distal rectal washout group compared to 22% in no washout with a lower complication rate (10% vs. 72%).[42] Shannon et al. compared distal rectal washout and no washout in rectal traumas and reported lower complications in the distal rectal washout group, such as pelvic infection, abscess, or fistula.[43] Different from the later retrospective study, which was conducted in penetrating rectal injuries, found no significant difference in developing a pelvic abscess in distal rectal washout compared to no washout (4.7% vs. 4.5%).[44] However, a retrospective study in the Iraq and Afghanistan war showed no statistically significant correlation between distal rectal washout and postoperative complications.[45] Current EAST guidelines showed no significant difference in infectious complications in non-destructive penetrating extraperitoneal rectal inju-

ries performing distal rectal washout compared with no washout (10.3% vs. 9.99%) and mortality rate (1.37% vs. 0.99%). They recommended no required distal rectal washout in non-destructive penetrating extraperitoneal rectal injuries.[32] However, the distal rectal washout may potentially benefit in selected patients, such as proximity to pelvic fractures or large tissue defect (destructive injury).[1,45]

4) Primary repair

Levine et al. conducted a retrospective study of 6 extraperitoneal rectal injuries, 5 cases underwent transanal repair, and one underwent laparotomy with primary repair. All patients were discharged home with no significant complications.[46] Recent studies supported primary repair in non-destructive extraperitoneal rectal injuries, which can be easily visualized and accessible.[4,30,47] The management algorithm of extraperitoneal rectal injury is shown in Figure 4.

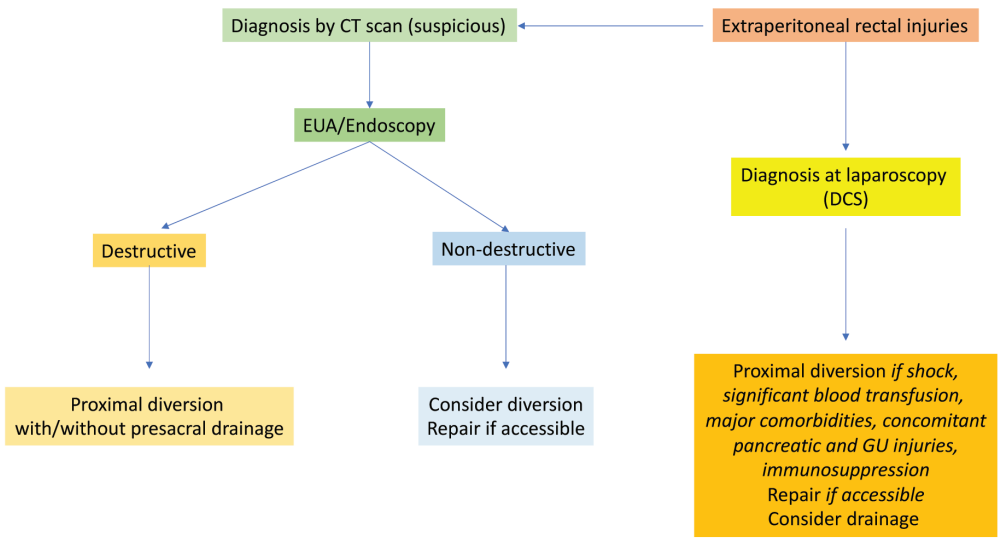

Figure 4 Management of extraperitoneal rectal injury
Non-destructive injury: AAST grade I-II, selected grade III injury (typically do not require significant debridement)
Destructive injury: AAST grade III-V (typically require resection)

Conclusion

Rectal injury is also challenging for surgeons regarding diagnosis and treatment planning. Delayed diagnosis and treatment can lead to severe complications and fatality. The diagnosis should be distinguished between the intraperitoneal or extraperitoneal type. Treatment of intraperitoneal rectal injury is mimicking to colon trauma. Proximal diversion is less required, except in unfavorable situations. Although current evidence suggests proximal diversion as a mainstay treatment of extraperitoneal rectal injury. Primary repair should be attempted if the injured site can be visualized and accessible.

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บทคัดย่อ การรักษาการบาดเจ็บของไส้ตรง

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ไส้ตรงเป็นอวัยวะที่ได้รับบาดเจ็บแล้ววินิจฉัยพลาดได้บ่อย สิ่งสำคัญในการรักษาการบาดเจ็บของไส้ตรงคือ “การตรวจหาให้พบ” และ “ให้การรักษาที่เหมาะสม” เพื่อลดภาวะแทรกซ้อนและการเสียชีวิต เมื่อวินิจฉัยการบาดเจ็บของไส้ตรงได้แล้วต้องทราบให้ได้ว่าการบาดเจ็บเกิดขึ้นกับส่วนที่อยู่ในเยื่อบุช่องท้อง หรือนอกเยื่อบุช่องท้อง ไส้ตรงในเยื่อบุช่องท้องให้การรักษาเหมือนการบาดเจ็บของลำไส้ใหญ่ส่วนอื่น โดยส่วนใหญ่ไม่จำเป็นต้องยกลำไส้เปิดที่หน้าท้อง ตรงกันข้ามกับการบาดเจ็บของไส้ตรงที่อยู่นอกช่องท้องแนะนำให้รักษาด้วยวิธีการยกลำไส้เปิดที่หน้าท้อง และหากจุดที่ได้รับบาดเจ็บอยู่ต่ำใกล้ทวารหนักมากสามารถทำการเย็บซ่อมผ่านทางทวารหนักได้