






# Penetrating rectal trauma: a comprehensive review

## Trauma de recto penetrante: revisión de tema

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### Abstract

**Introduction.** Currently, rectal trauma continues to be a complex clinical and potentially fatal situation. Its early detection and management is the cornerstone to avoid both mortality and morbidity of patients. Today there is still debate about the ideal surgical approach in rectal trauma, and intraoperative management decisions are greatly affected by the experience and preferences of the surgeon.

**Methods.** A literature search was performed in the PubMed, Clinical Key, Google Scholar and SciELO databases using the keywords described. The most relevant articles published in the last 20 years were selected. Articles written in English and Spanish were considered.

**Discussion.** The rectum is the organ less frequently injured in trauma; however, the clinical implications of overlooking this injury can be devastating for the patient. Options for diagnosis include digital rectal examination, computed tomography and rectosigmoidoscopy. Surgical management will depend on the location, degree of the injury and the associated injuries.

**Conclusion.** Knowledge of the anatomy, the mechanism of trauma and the associated injuries will allow the surgeon to make an adequate clinical-surgical approach that leads to optimal clinical outcomes in patients presenting with rectal trauma.

**Keywords:** rectum; wounds and injuries; multiple trauma; diagnosis; sigmoidoscopy; computed tomography; colorectal surgery

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## Resumen

**Introducción.** En la actualidad, el trauma de recto continúa siendo una situación clínica compleja y temida por ser potencialmente mortal. Su detección y manejo temprano es la piedra angular para impactar tanto en la mortalidad como en la morbilidad de los pacientes. Hoy en día, aún existe debate sobre la aproximación quirúrgica ideal en el trauma de recto y las decisiones de manejo intraoperatorias se ven enormemente afectadas por la experiencia y preferencias del cirujano.

**Métodos.** Se realizó una búsqueda de la literatura en las bases de datos de PubMed, Clinical Key, Google Scholar y SciELO utilizando las palabras claves descritas y se seleccionaron los artículos más relevantes publicados en los últimos 20 años; se tuvieron en cuenta los artículos escritos en inglés y español.

**Discusión.** El recto es el órgano menos frecuentemente lesionado en trauma, sin embargo, las implicaciones clínicas que conlleva pasar por alto este tipo de lesiones pueden ser devastadoras para el paciente. Las opciones para el diagnóstico incluyen el tacto rectal, la tomografía computarizada y la rectosigmoidoscopia. El manejo quirúrgico va a depender de la localización, el grado de la lesión y las lesiones asociadas.

**Conclusión.** El conocimiento de la anatomía, el mecanismo de trauma y las lesiones asociadas permitirán al cirujano realizar una aproximación clínico-quirúrgica adecuada que lleve a desenlaces clínicos óptimos de los pacientes que se presentan con trauma de recto.

**Palabras claves:** recto; heridas y traumatismos; traumatismo múltiple; diagnóstico; sigmoidoscopia; tomografía computarizada; cirugía colorrectal.

## Introduction

Rectal trauma is a complex and life-threatening clinical entity. Early detection and management are essential to impact the morbidity and mortality that it entails. An adequate understanding of the anatomy is crucial to perform a correct surgical approximation of the critical structures in the colon and rectum, in order to reduce the risk of complications such as hemorrhage, ischemia or nerve injury <sup>1,2</sup>.

The greatest knowledge of the management of this entity is derived from war trauma. With the establishment of the management dogma based on the 4 Ds (Debridement, Diversion, Presacral Drainage and Distal Lavage) the outcomes of patients have been significantly impacted <sup>3-5</sup>. The vast majority of civilian rectal injuries are caused by gunshot wounds, followed by blunt force trauma and sharp injuries <sup>3,6</sup>.

There is still controversy about the ideal surgical approach in rectal trauma, and intraoperative management decisions are affected by the experience and preferences of the surgeon <sup>4</sup>. The anatomical location of the rectal injury, intrape-

ritoneal versus extraperitoneal, also has a great influence <sup>5</sup>.

The purpose of this article is to review the current available literature on the epidemiology, clinical presentation, diagnosis and management of rectal trauma and is illustrated with photographs of diagnostic studies performed on a patient successfully treated at our institution.

## Methods

A search of the literature was performed in PubMed, Clinical Key, Google Scholar and SciELO databases using the keywords described, and the most relevant articles published in the last 20 years were selected, in order to be able to evaluate the evolution in the management of rectal trauma. Articles that were written in Spanish and English were included for the review of the topic.

## Anatomy

The rectum is a tubular structure 15-17 cm long, which begins at the level of the sacral promontory, at the point where the sigmoid colon loses its mesentery and the colonic teniae come

together to form a longitudinal muscle layer, extending caudally to the anus. Its lower anatomical limit is the pectineal (or dentate) line, where the rectal mucosa joins the anal mucosa and changes from columnar epithelium to stratified squamous epithelium, and its upper limit is at the level of the levator ani (2 cm above the the pectineal line).

Anatomically, it is divided into three portions based on its relationship to the peritoneum. The upper third is covered by peritoneum in its anterior and lateral portion; the middle third is covered only anteriorly, and the lower third is entirely extraperitoneal.

There are structures adjacent to the rectum of clinical importance, which in case of trauma can be injured. In men, the prostate, seminal vesicles, vas deferens, ureters, and bladder; in women, the extraperitoneal posterior vaginal wall and cervix, and the intraperitoneal upper posterior vaginal wall, uterus, tubes, and ovaries. Additionally, the rectum has a great vascularization, coming from the superior, middle and inferior rectal arteries, which in case of injury generate significant bleeding<sup>1,2</sup>.

## Epidemiology

Given its location and protection by pelvic bones, the rectum is the least frequently injured organ in the context of trauma, with an incidence of 0.1 to 0.5%<sup>7</sup>. In civil trauma, rectal injuries are mainly caused by gunshot wounds in approximately 46 to 85% of all cases, while blunt trauma and penetrating sharp trauma only account for 10% and 5% of cases, respectively<sup>3,5,8</sup>. The rest correspond to trauma due to impalement and perforation secondary to diagnostic and therapeutic procedures. In contrast, most rectal trauma in the context of war is due to explosions and high-velocity projectiles<sup>4,9</sup>.

Despite advances in trauma response systems and surgical management, mortality continues to be close to 10% and can increase significantly when there are delays greater than 8 hours in management, mainly in extraperitoneal trauma<sup>10</sup>, with a rate of additional complications between 18 to 21%<sup>3</sup>. Mortality and complication rates may vary depending on clinical experience, surgeon

confidence in rectal trauma, and the fact that rectal trauma rarely occurs in isolation: injury to other organs and pelvic blood vessels is common, which make its management challenging.

Rectal trauma, similar to other traumas, occurs mainly in middle-aged male patients, with no reports in the literature of race prevalence<sup>8</sup>.

## Clinical presentation

The clinical presentation will depend on the mechanism of trauma and the associated injuries. Closed high-energy pelvic trauma with separation of the pubic symphysis, urogenital trauma, and pelvic fractures (particularly anteroposterior compression fractures) are prone to associated rectal trauma<sup>11</sup>. Any patient presenting with a combination of pelvic fractures and perineal injuries should be considered a rectal injury patient until proven otherwise. The suspicion of a rectal injury due to the mechanism of trauma or associated injuries requires investigation, as in the case of penetrating gunshot wounds with pelvic fractures and impalement<sup>3,12</sup>.

The most common clinical findings are shock, abdominal pain, wound near the anorectal area, and macroscopic rectal bleeding<sup>9,12</sup>. Rectal trauma is usually recognized and diagnosed during the secondary review of polytraumatized patients. Inquire about the mechanism of trauma and related conditions (for example, acceleration/deceleration or direct impact in blunt trauma and the type of weapon used in penetrating firearm trauma), and associated injuries evidenced during the primary assessment in the scene.

Blunt trauma most commonly occurs with concomitant injuries to pelvic structures such as the bladder, urethra, and vascular structures, which implies morbidity and a mortality rate up to three times higher compared to penetrating trauma. Both penetrating and blunt injuries can cause anal sphincter injuries<sup>12</sup>.

## Diagnosis

Although rectal trauma represents a small percentage of all injuries that occur in trauma patients, the clinical implications of ignoring this injury can

be devastating. That is why the finding of wounds near the anal region, pelvic fractures, urinary tract injuries, or pain and tenderness in the lower abdomen should increase the suspicion of a possible anorectal injury<sup>9</sup>.

There is no clear evidence to show which is the most appropriate diagnostic strategy. Options include digital rectal examination, computed tomography (CT), and rectosigmoidoscopy. In the context of polytrauma, digital rectal examination is widely used and recommended in guidelines and texts to evaluate signs of rectal trauma; however, there are reports of its low sensitivity for detecting lesions at the level of the rectum, which is close to 33%<sup>13</sup>.

CT is a widely available examination in our environment, which has a sensitivity and specificity close to 95% for intra-abdominal injuries, although the sensitivity reported for hollow viscus injuries is lower (53-86%), both in penetrating trauma and in blunt trauma<sup>14-16</sup>.

Tomographic findings suggestive of anorectal injury are divided according to the mechanism of trauma. In penetrating trauma, the most sensitive and specific finding is the presence of a wound with a trajectory extending directly into the rectum, which is identifiable by the presence of focal areas of tissue and air striation along the trajectory, although its sensitivity may decrease in the case of multiple pathways<sup>12,17</sup>. More specific findings, although not commonly identified, include direct evidence of a transmural injury, seen as extravasation of oral or rectal contrast, and the presence of active bleeding from the bowel wall, evidenced by active extravasation of intravenous contrast. There are also indirect signs of anorectal trauma on CT that, although they do not confirm the diagnosis and are not specific, increase clinical suspicion. These signs are wall thickening, striation and infiltration of the perirectal/anal tissue, and the presence of free peritoneal fluid, although the latter finding is less important in the setting of penetrating trauma due to violation of the peritoneum.

As patients with blunt rectal trauma usually have associated pelvic bone injuries, it is prudent to perform an angiographic phase in the tomogra-

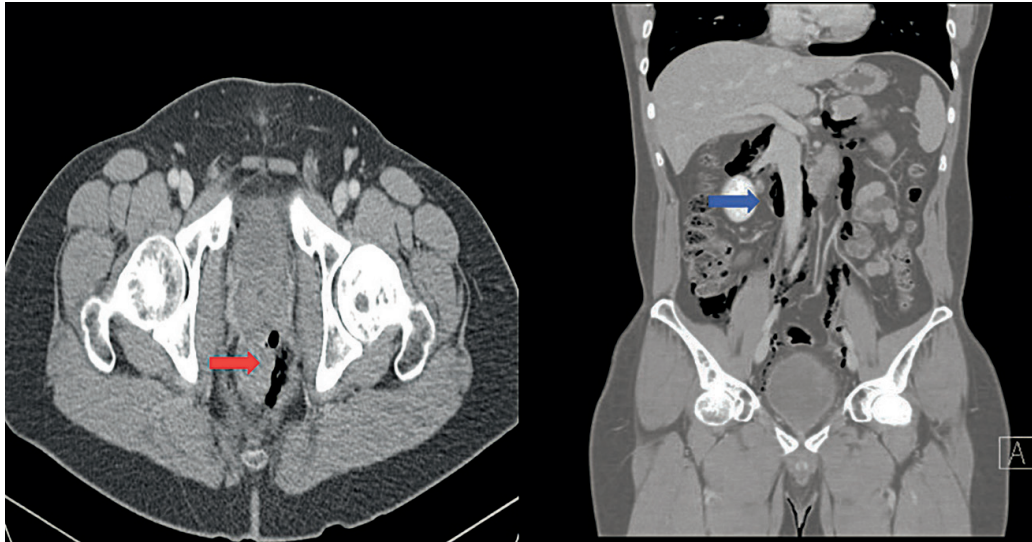
phy, in addition to the portal and late phase, to rule out relevant active bleeding<sup>12</sup>. The most specific injuries in blunt trauma are evidence of transmural injury to the rectum and active bleeding. Unlike penetrating trauma, where the presence of free air in the peritoneal cavity, in the perirectal retroperitoneum and/or the perineal area may be due to the introduction of air through the penetrating wound, in blunt trauma the presence of air in these locations it is highly specific for hollow viscus injury<sup>12,14,15</sup>. It is important to bear in mind that the presence of asymmetric and focal gas collections in the rectum should alert us to the possibility of rectal trauma, even in penetrating trauma<sup>12</sup> (Figure 1). The indirect tomographic signs of injury in blunt trauma are the same as those described for penetrating trauma, understanding that the presence of free fluid, in the context of blunt trauma and in the absence of solid visceral injury to explain it, may be due to an intestinal injury, including the intraperitoneal segment of the rectum, a finding that is very sensitive for this type of injury but with very low specificity<sup>18</sup>.

On the other hand, rectosigmoidoscopy allows direct evaluation of the rectal mucosa, looking for bruising, contusion, lacerations or bleeding (Figures 2 and 3); however, poor bowel preparation (a very common scenario in trauma patients) can limit its evaluation diagnostic yield<sup>12,19</sup>. A study of 106 patients demonstrated an even lower sensitivity (34%) of CT for evidencing rectal injuries; in contrast, found a sensitivity of 94% for rectosigmoidoscopy alone and a sensitivity of 97% when the two diagnostic strategies are combined<sup>19</sup>.

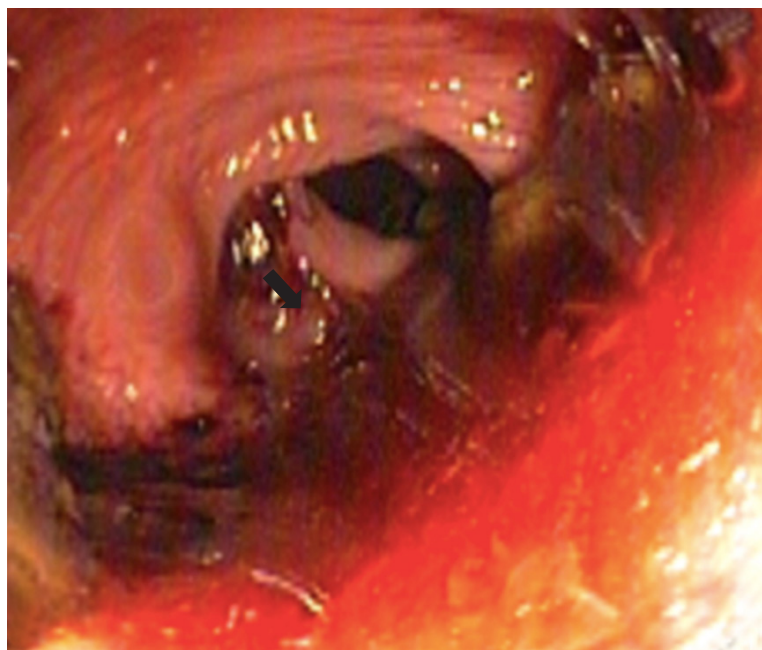
## Surgical management

The evolution of rectal trauma management has been associated with the history of the military conflict. This is how it went from managing rectal injuries expectantly in the American Civil War (with usually fatal results), to performing proximal diversions (ostomies), debridement of injuries, presacral drainage and distal rectal lavage (a strategy known as the 4 Ds) in World War II, with a greater impact on the clinical results of patients<sup>3,5,7</sup>.

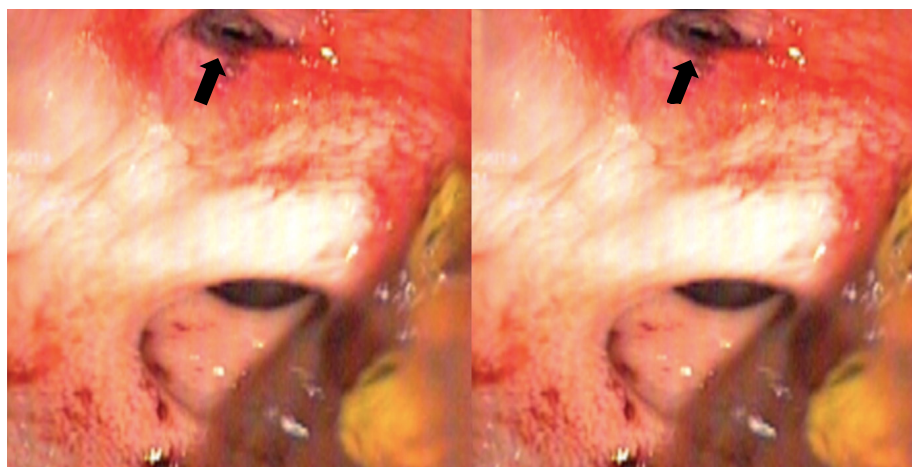




**Figure 1.** Contrast-enhanced computed tomography (CT) of the abdomen and pelvis showing multiple atypical air bubbles in the pararectal fat on the anterior and left lateral sides. On the anterior side, a small mural bubble (red arrow) suggestive of perforation is observed, in addition, thickening of the surrounding soft tissues, with air dissecting the entire retroperitoneal cavity (blue arrow) around the psoas muscles, the space of Retzius, the perivascular spaces of the cava and aorta up to the esophageal hiatus, with atypical air bubbles in the peritoneal cavity, which is dissected by the right paracolic gutter and the central region. Free intraperitoneal fluid is not identified. Source: images taken from a patient's clinical history.



**Figure 2.** Intraoperative rectosigmoidoscopy where old blood remnants were identified (black arrow) 30 cm from the anal verge, up to the anorectal region. Source: images taken from a patient's clinical history.



**Figure 3.** The photograph shows the traumatic lesion (black arrow) with irregular, necrotic borders and discharge of hemopurulent material in the distal rectum, 5 cm from the anal verge, immediately below the distal valve of Houston. Presence of traumatic lesion with necrotic borders; no other perforations identified. Source: images taken from a patient's clinical history.

### *Ostomies*

Some studies have advocated performing ostomies in military trauma mainly due to the unknown effects of energy dissipation from high-velocity projectiles that could potentially compromise the viability of an anastomosis<sup>20-22</sup>; the latter supported by a review of colorectal injuries during the conflicts in Afghanistan and Iraq, with rates of anastomosis failure and conversion to ostomy of 13%<sup>23,24</sup>.

In recent years, there has been a differentiation in the management of these injuries in the context of civil trauma, taking into account the differences that exist between these two scenarios, mainly with regard to the mechanism of trauma, available resources, and costs. There are series and case reports in the literature that seek to challenge the dogma of the 4 Ds, reducing proximal diversion as the gold standard in treatment and replacing it with primary repair in many cases. This has led to continued practice variation and controversy regarding optimal management strategies for traumatic rectal injuries, especially in the civil field<sup>7</sup>.

Although there is currently no consensus on the optimal management of these injuries, multiple case series and clinical trials have been tried

to elucidate the appropriate surgical approach according to the specific characteristics of each patient<sup>8</sup>. This is how the introduction of the damage control technique has allowed “second look” surgeries and with it the possibility of adjusting surgical decisions according to the clinical characteristics and the appearance of the intestine in each patient; this is especially important in those unstable, coagulopathic and/or hypothermic patients, who would hardly tolerate a definitive repair in the initial surgery<sup>3</sup>.

Surgical management of rectal trauma will depend on the site of the injury and its anatomical relationship, whether intraperitoneal or extraperitoneal (Figure 4).

### *Intraperitoneal injuries:*

Its incidence, although not well established, can be inferred to be very low due to the low incidence of rectal trauma in the civil context (<1%) and the fact that most rectal injuries are extraperitoneal. In a general context, intraperitoneal injuries can be managed similar to colon injuries<sup>25</sup>, however the type of repair will depend on the degree of tissue destruction. “Non-destructive” injuries, defined as those involving less than 25% of the circumference of the rectum, can be

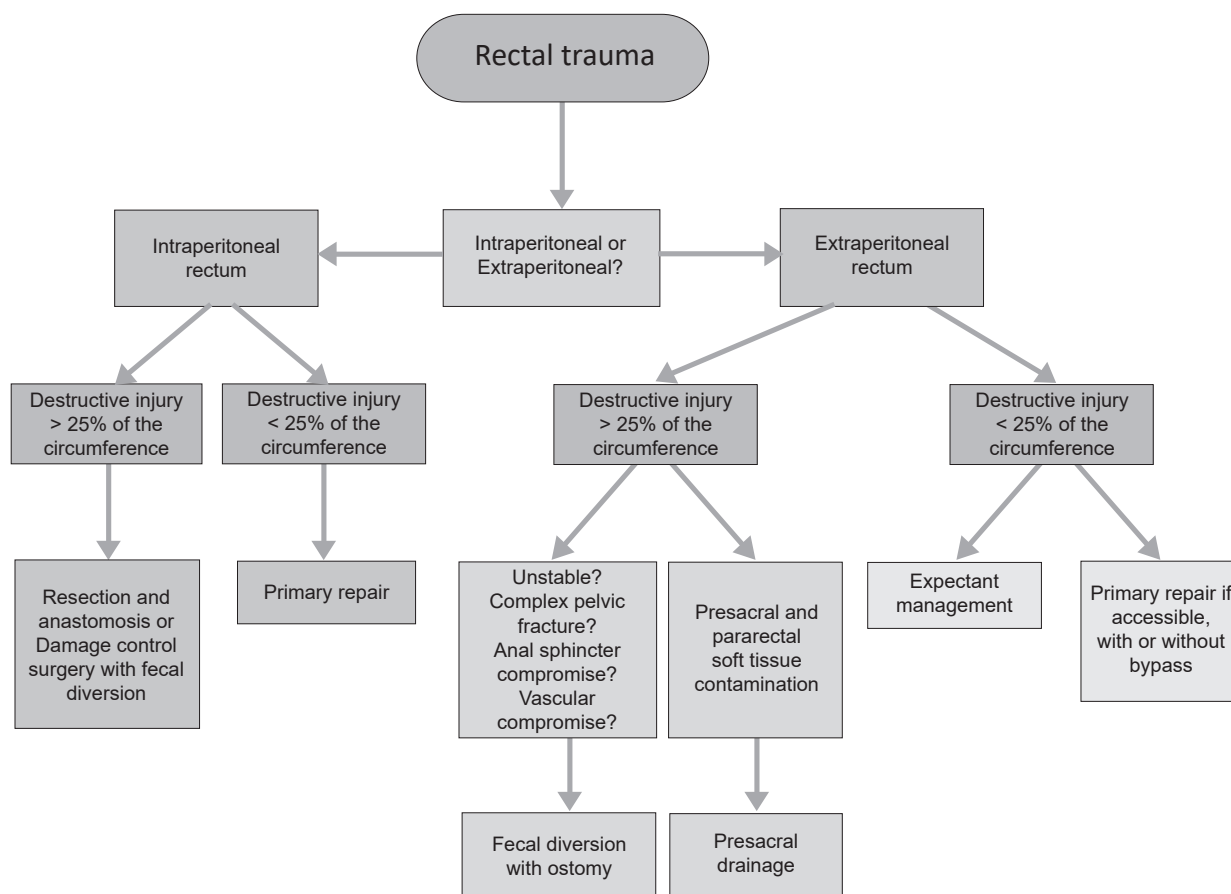
repaired primarily, while “destructive” injuries, defined as those involving more than 25% of the circumference of the organ, require resection of the devitalized tissue and anastomosis.

In these patients, it has been shown that diversion through a colostomy does not offer additional benefits, although this decision may be reasonable in those patients with persistent hypotension, coagulopathy, and high transfusion requirements (3). A prospective trial involving 19 trauma centers, comparing patients who underwent primary repair (n=197) versus those who underwent fecal diversion (n=100), demonstrated a lower mortality rate in primary repair (0 vs 1.3%), with comparable rates of abdominal complications between the two groups, identifying three independent risk factors: severe fecal contamination, requirement of more than 4 units of blood in 24

hours, and antibiotic prophylaxis with a single agent <sup>26</sup>.

*Extraperitoneal injuries:*

A recent case series reported that 93% of rectal injuries are extraperitoneal and of these, most occur in the lower third <sup>27</sup>. In extraperitoneal injuries, the use or not of a fecal diversion is a matter of debate. Diversion via a loop ileostomy or a Hartmann-type loop or end colostomy may be more appropriate in patients with extraperitoneal “destructive” rectal injuries or associated pelvic fractures, due to concern of an open fracture leading to sepsis of pelvic origin. Patients with isolated, “nondestructive” lesions could be managed without fecal diversion, thus avoiding multiple surgeries and the morbidity of a stoma <sup>3</sup>. The 2015 EAST guidelines make a conditional recommenda-



**Figure 4.** Surgical management algorithm for intraperitoneal and extraperitoneal rectal injuries. Source: own authorship.

tion regarding the decision to perform an ostomy or not in these patients, in favor of performing it, taking into account the low level of evidence due to the lack of availability of appropriate literature regarding this topic and the high value for patients to avoid infectious complications (fecal diversion 8.8% vs no diversion 18.2%), with no evidence of associated mortality in the group of patients managed without fecal diversion<sup>3,6</sup>.

In recent years, several authors have begun to put on the table other considerations regarding the performance of fecal diversion in these patients, taking into account the frequency of complications associated with the stoma itself, which reaches 35 to 50%, including parastomal hernias, prolapse, stenosis, retraction and metabolic alterations, and 5 to 25% of complications associated with stoma closure. This is how the extrapolation of concepts applied in non-traumatic anorectal surgeries arises, successfully treated without the need for fecal diversion, such as transanal management of supralelevator abscesses (considered by some authors as an injury analogous to penetrating trauma) and resection transanal full-thickness rectal tumors<sup>3</sup>.

Some authors consider it mandatory to perform an ostomy in those patients with unrepaired extraperitoneal injuries and in case of compromise of the anal sphincter<sup>28</sup>. Although this may be necessary in most of these cases, the decision to perform fecal diversion or not should be based on adequate clinical judgment, taking into account the magnitude of the injury, associated injuries, the hemodynamic status of the patient, the available resources and the experience of the surgeon.

Vascular injuries associated with rectal trauma are common due to the proximity of these structures. A vascular injury could compromise the blood supply to the rectum and thus cause a failure to repair it, so in these specific cases the use of a fecal diversion is recommended to prevent increased mortality associated with bleeding and concomitant sepsis.

### ***Presacral drainage***

Regarding the role of presacral drainage in this type of injury, it is generally advised that it be performed only in those patients with destruc-

tive rectal injuries, which communicate with and contaminate presacral and pararectal soft tissues<sup>29</sup>, injuries usually seen in trauma with high-speed mechanisms. Otherwise, it is not recommended to perform dissection and mobilization of intact tissues in order to position a presacral drain<sup>30</sup>.

### ***Distal lavage***

Distal rectal lavage has not shown relevant clinical utility in patients with low-velocity extraperitoneal rectal injuries<sup>3</sup>; however, some authors give it a role in the context of injuries with large soft tissue defects or in close proximity to pelvic fractures<sup>24,29,31</sup>.

### ***Primary repair***

In the current literature, no clinical benefit is found with primary repair when it is not possible to access the lesion, since the mobilization of intact tissues to access retroperitoneal lesions is not recommended<sup>31</sup>; however, if tissue mobilization is performed to access a concomitant injury or the injury is accessible transanally, a primary repair may be performed, if so decided by the surgeon<sup>32</sup>.

Minimally invasive surgery has gained importance in recent years, both in its diagnostic role to rule out intraperitoneal lesions and in its therapeutic role to correct some lesions and to perform ostomies through this route, with adequate clinical results, reducing the time of postoperative recovery and complications associated with open surgery<sup>33</sup>.

## **Conclusion**

The rectum is an organ with important anatomical considerations, both due to its location and its relationship with multiple adjacent structures of clinical relevance, especially the peritoneum. Adequate knowledge of the anatomy, the mechanism of trauma and associated injuries will allow the surgeon to carry out an adequate clinical-surgical approach to improve the clinical outcomes of patients who present with rectal trauma, taking into account the value of diagnostic aids available and the differences between rectal trauma in civil and war settings. All polytrauma patients



should be evaluated and treated according to ATLS principles, initially to recognize and correct life-threatening injuries, since rectal injuries are rarely the cause of death in the first hours after polytrauma.

### Compliance with ethical standards

**Informed consent:** Being an article that contains the presentation of images taken from a clinical case treated at our institution, we have the written authorization of the patient for the publication of the photographs. This work is a review of the literature, so it did not require approval by the Ethics Committee.

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### Author's contributions:

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Acquisition of articles: Santiago Salazar-Ochoa, Pablo Posada-Moreno, Mariana Llano-Herrera.

Review, analysis and summary of synthesis of articles: Cristina Martínez-Hincapié, Jorge Iván Sierra-Jaramillo, Alejandro Carvajal-López, Santiago Salazar-Ochoa, Pablo Posada-Moreno, Mariana Llano-Herrera.

Drafting the manuscript: Cristina Martínez-Hincapié, Jorge Iván Sierra-Jaramillo, Alejandro Carvajal-López, Santiago Salazar-Ochoa, Pablo Posada-Moreno, Mariana Llano-Herrera.

Critical review: Cristina Martínez-Hincapié, Jorge Iván Sierra-Jaramillo, Alejandro Carvajal-López.

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