Rectal Trauma: Evidence-Based Practices

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Abstract

The management of rectal trauma has often been lumped in with colon trauma when, in fact, it is a unique entity. The anatomic nature of the rectum (with its intra- and extraperitoneal segments) lends itself to unique circumstances when it comes to management and treatment. From the four Ds (debridement, drainage, diversion, and distal irrigation), the management of rectal trauma has made some strides in light of the experiences coming out of the recent conflicts overseas as well as some rethinking of dogma. This article will serve to review the anatomy and types of injuries associated with rectal trauma. A treatment algorithm will also be presented based on our current literature review. We will also address controversial points and attempt to give our opinion in an effort to provide an update on an age-old problem.

Keywords

- rectum
- rectal trauma
- trauma
- diversion
- drainage

Brief History and Current Epidemiology

Rectal trauma has a reported incidence of approximately 1 to 3% in civilian trauma centers and 5.1% from recent wartime data.[1] The vast majority of injuries are caused by gunshot wounds (71–85%), while blunt trauma (5–10%) and stab wounds (3–5%) comprise the remainder.[1] Up to 23% of war-related rectal injuries are due to explosive trauma.[1] Despite advances in trauma systems and surgical management, mortality rates remain between 3 and 10% with an additional complication rate of 18 to 21%.[2–4] This may in part be related to varied levels of experience and comfort regarding complex rectal injuries among surgeons and the continued evolution of their management. In addition, rectal injuries are rarely seen in isolation given the close proximity of other pelvic organs and vasculature which can make management more difficult.[1]

The evolution in the management of rectal injuries is intimately tied to military conflict, beginning with the Civil War and progressing through modern battlefields. In the 1860s, patients with colorectal injuries were managed expectantly and the wounds were almost universally fatal. During World War I, surgical management became the norm with a subsequent drop in mortality to between 60 and 75%.[1] During World War II, Sir William Ogilvie directed British surgeons to perform fecal diversion for colorectal injuries and soon after the United States Surgeon General mandated colostomy or "exteriorization."[5,6] Early reported mortality rates were 53 and 59%, though this combined with advances in perioperative care decrease mortality to 22 to 35%.[1,5] In Vietnam, Lavenson and Cohen introduced distal rectal washout, which was credited for further declines in the mortality rate.[7] Through experience gained in these conflicts, the dogma of the "four Ds" (debridement, diversion, drainage, and distal washout) became the standard treatment of rectal injuries.

However, there has been a realization of distinct differences between military and civilian data based on mechanisms of injury, availability of resources, and the burden of combat medical evacuation through multiple sites and surgeons.[8] These challenges are reflected in the high rates of damage control operations and reported modern mortality of 14% for rectal trauma.[9] Complications have been reported in up to half of wartime rectal injuries.[10] It was wartime data that drove adoption of the "four Ds" and may uniquely continue to benefit from these principles. Shannon et al noted the greatest benefit of distal rectal washout in patients with high-energy pelvic crush or gunshot injuries.[11] Additionally, Welling et al advocated for diversion in military trauma due to the unknown effects of energy dissipation from high-velocity mechanisms potentially confounding the viability of an anastomosis.[8] This is supported by a review of

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colorectal injuries from Iraq and Afghanistan that noted a 13% failure rate for primary anastomosis requiring conversion to an ostomy.[9] A retrospective analysis of 251 wartime rectal injuries noted a 56.2% diversion rate and significantly lower mortality in patients with any colorectal injury who underwent diversion (3.7 vs. 10.8%).[3] A review of 57 patients with extraperitoneal rectal injuries from combat noted a 7% adherence to the full "four Ds" but 100% rate of diversion, distal washout in 26%, and presacral drainage in 21%.[2] Like civilian trauma, optimal management remains controversial, but it is important to recognize the different burden placed on the combat surgeon that may affect the extrapolation of data between civilian and wartime studies. As stated by Dr. Michael DeBakey with regard to lessons learned in World War II, "All the circumstances of war surgery thus do violence to civilian concepts of traumatic surgery."[12]

Civilian studies began to question these central tenets of the "four Ds." Stone and Fabian performed a randomized trial demonstrating a lower mortality in patients with primary colon repair.[13] This preceded several small series evaluating the efficacy of each aspect of surgical management for rectal trauma. The introduction of damage control techniques has allowed second-look operations and multiple opportunities to adjust operative decision-making. In their landmark article, Stone and Fabian suggested that the decision to perform primary repair versus diversion be based on the appearance of the bowel in each individual case and a second-look operation can allow better assessment of tissues. Additionally, damage control operations can allow stabilization of an unstable, coagulopathic or hypothermic patient who would not otherwise tolerate definitive repair at the initial operation. Here we present an algorithm for the diagnosis and management of rectal trauma based on recent literature and current practice (►**Fig. 1**).

Current Diagnostic Workup of Injury

Unlike many of the other intracavitary organs of the body, the rectum's protected anatomic location deep within the pelvis makes diagnosis difficult. The suspicion for rectal trauma is typically raised by the patient's mechanism of injury or other associated injuries. High-velocity pelvic trauma, trans-pelvic gunshot wounds, and mechanisms of impalement have a high propensity for rectal trauma, while a lower risk is incurred with stab wounds. In the setting of high-velocity blunt trauma, a widened pubic symphysis, urogenital trauma, and pelvic fractures (particularly anteroposterior compression fractures) should prompt further evaluation for

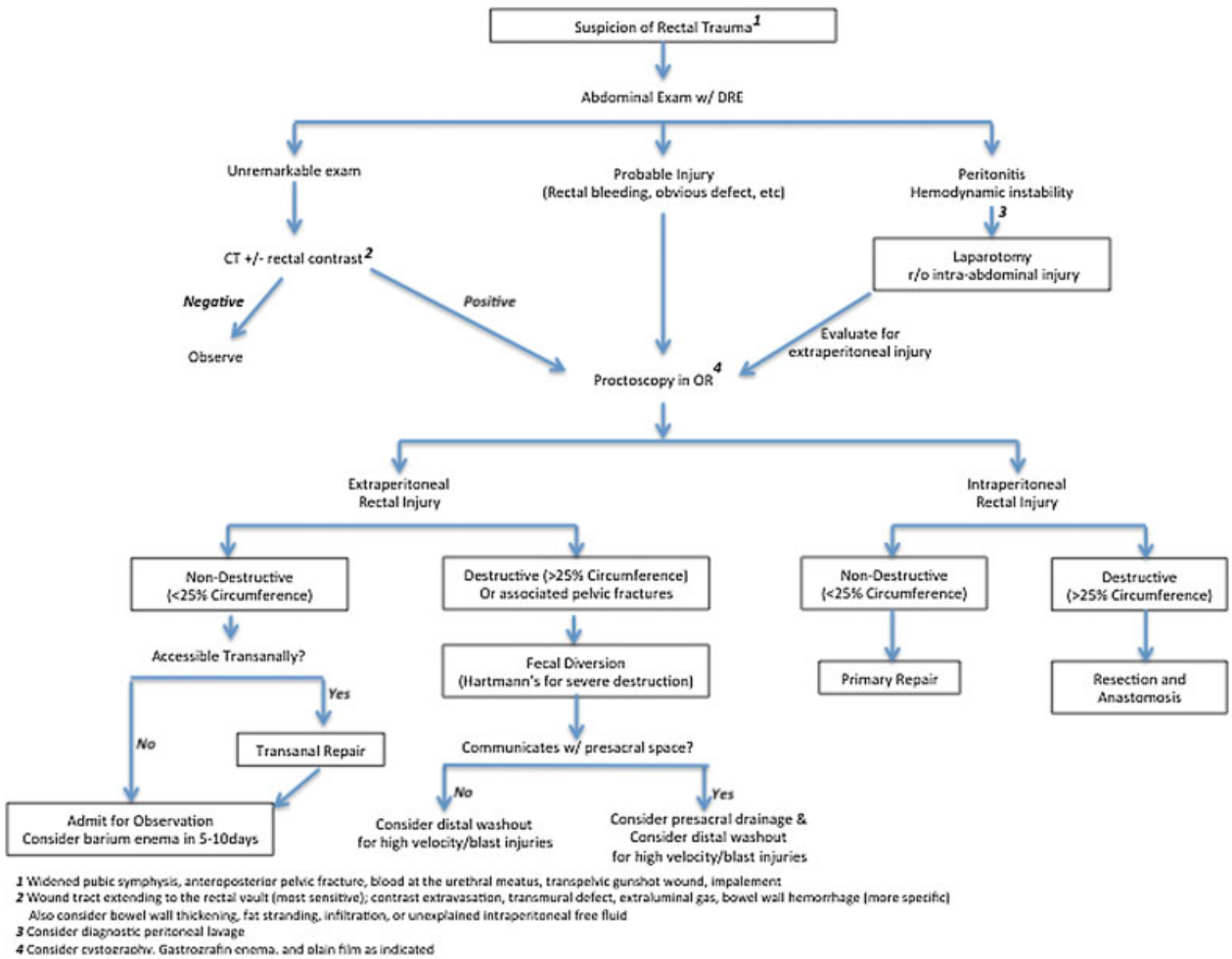

Fig. 1 Algorithm for the management of rectal trauma. DRE, digital rectal examination; "r/o," rule out; CT, computed tomography.

concomitant rectal injury. A retrospective review of 362 patients with blunt pelvic fractures noted a 2.2% incidence of rectal injury.[14] Of the injuries evaluated, a widened pubic symphysis was noted to be associated with a threefold increase in the risk of rectal injury.[14] When suspicion is high based on associated injuries or mechanism, a workup is warranted. The current workup of rectal injuries is often an amalgam of clinical and diagnostic studies to include digital rectal exam, computed tomography (CT), contrast enema studies, and endoscopy.

Digital Rectal Examination

All trauma patients should be evaluated and treated according to the principles of Advanced Trauma Life Support to stabilize life-threatening injuries. During the secondary survey, physical exam findings of pelvic instability, blood at the urethral meatus, soft-tissue defect of the perineum, or penetrating injury near the pelvis should heighten the suspicion for rectal trauma. While digital rectal examination (DRE) is often performed routinely as part of the secondary survey, recent literature has given less credence to the role of the rectal exam during every trauma evaluation.[15–17] DRE has a sensitivity of 33 to 52% for rectal injury, but a high false-negative rate of 63 to 67%.[15,17] The variable rates in detection are likely secondary to the evaluator's experience in detecting injury. Other confounding issues are related to associated injuries which may complicate the results of a DRE.

The DRE can also be a hazard for the practitioner as well as the patient. The exam potentially exposes the practitioner to injury, transmission of infectious disease, and even litigation for assault.[15] The nonselective use of a DRE has been shown to alter management in only 1.2% of trauma evaluations, but this number increases to 11% when the clinician's pre-test suspicion was high.[15,18] However, its careful use has been recommended in the setting of an open pelvic fracture and high-velocity trauma with sacral and pubic fractures to assess for a gross defect in the rectal vault. Concerning findings on DRE include a defect in the rectal wall, gross blood, decreased anal sphincter tone, bony fragments, or a high-riding prostate. However, gross blood may often be confused with alternative sources in the setting of large soft-tissue defects.[19] Also, even experienced clinicians have poor inter-rater reliability for anal sphincter tone and prostatic examinations.[20] Other clinical indicators often predict rectal injury with similar improved accuracy over the DRE, although these indicators are poorly defined.[15] Based on these findings, a digital rectal exam may still have a role in light of questionable physical exam findings or as confirmation of diagnostic suspicion. Caution should be heeded if there is potential danger for the examiner.

Role of Computed Tomography

Clinicians will often have concern for a rectal injury based on mechanism of injury without overt abnormalities on physical examination. In this circumstance, there is increasing literature to support the role of CT.[19,21] The most sensitive finding on CT is a wound tract that extends adjacent to the bowel.[21] However, extravasation of intraluminal contrast, a full-thickness wall defect, foci of asymmetric extraluminal free air, and hemorrhage within the bowel wall are more specific findings. Additional secondary findings that suggest a rectal injury include rectal wall thickening, perirectal fat stranding, and unexplained intraperitoneal free fluid.[19,21] A retrospective review of 10 patients injured in combat demonstrated that CT was able to detect each rectal injury, but had a 20% false-positive rate.[19] Pararectal air was the most common finding on CT, though pararectal air and adjacent projectile fragments were demonstrated in both false-positive cases.[19] Triple-contrasted CT in pediatric blunt trauma has been shown to be equally efficacious for detecting rectal trauma as proctoscopy, but studies in adults suggest the ability to forego oral or rectal contrast.[22] Ultimately there is inadequate evidence to decisively support or refute the routine use of intraluminal contrast.[19,21]

Patients with hemodynamic instability on initial trauma evaluation should proceed immediately to surgical exploration while stable patients with obvious abnormalities on physical examination are best evaluated with intraoperative proctoscopy. However, in patients with a normal physical exam but heightened suspicion for rectal trauma (e.g., widened pubic symphysis, penetrating injury near the rectum, blood at the urethral meatus), a pelvic CT offers a noninvasive evaluation for rectal injury. This can also be done sequentially with CT cystography when there is a concern for bladder injury. The use of rectal contrast is institution dependent and may not adequately evaluate the distal rectum due to occlusion by the device's balloon. Stable patients with a normal physical examination and CT can be observed clinically or discharged. A positive finding on CT warrants further evaluation with proctoscopy unless the injury is clearly intraperitoneal, prompting surgical management.

Role of Proctoscopy

Patients with a possibility of rectal trauma are often evaluated with proctoscopy. The evolution of this practice stemmed from the burden of operating room utilization and patient sedation. Proctoscopy has a sensitivity of 71% for rectal injury and is most sensitive for extraperitoneal injuries (88%).[16] Some providers advocate for proctoscopy in the emergency department/trauma bay, though uncooperative patients may decrease the quality of the examination. Lack of bowel preparation and associated injuries (limited pelvic mobility, bloody field) may further decrease the sensitivity of proctoscopy. It remains important to still perform proctoscopy, given the distinction in management for intra- and extraperitoneal rectal injuries. The identification of an extraperitoneal injury avoids the morbidity of a negative laparotomy.[16] Additionally, proctoscopy allows documentation of the size and extent of the patient's injury.[1] However, proctoscopy often does not detect a distinct injury, but demonstrates less conclusive findings such as intraluminal blood. Given the lower sensitivity for intraperitoneal injuries, these circumstances may prompt evaluation via laparoscopy to rule out intra-abdominal rectal injury.[1]

Clinical Significance of Associated Injuries

Rectal trauma is often associated with injuries to adjacent structures, such as the urogenital system, bony pelvis, or pelvic vasculature. A series of 28 patients with penetrating pelvic trauma demonstrated a 43% incidence of urological injury and nearly 50% rate of vascular trauma.[23] Typically, pelvic fractures would be detected on X-ray as an adjunct to the secondary survey, though small fractures may be noticed on CT. Widening of the pubic symphysis has been associated with rectal trauma and a single retrospective study noted that 75% of rectal injuries were associated with an anteroposterior compression pelvic fracture.[14] The exact nature of the type of rectal injuries was not specified in this study, but based on this association, a thorough workup should be pursued in anteroposterior compression pelvic fractures. Additional associated findings of blood at the urethral meatus or prostatic displacement should prompt urethral evaluation with a retrograde urethrogram. Consideration should also be given for CT cystography.

Surgical Management

The management of rectal trauma is dictated by anatomy. The lower one-third of the rectum and posterior upper two-thirds are extraperitoneal and only the anterior upper two-thirds are serosalized and intraperitoneal. A recent case series noted that 93% of penetrating rectal trauma occurs in an extraperitoneal location, and 88% of these injuries occur in the lower one-third of the rectum.[24]

Intraperitoneal Injuries

The exact incidence of rectal trauma is poorly defined and confounded by the difficulty of separating colon and rectal injuries in the literature. However, given the low general incidence of colorectal trauma (<1% of civilian trauma and 5.1% of injuries sustained in modern combat environments), the incidence of intraperitoneal rectal trauma is very low.[9,25] In general, intraperitoneal rectal injuries can be managed similar to a colonic injury.[26] If the defect involves less than 25% of the circumference of the intraperitoneal rectum, it is considered a nondestructive injury and can be repaired primarily. When the defect is destructive (>25% circumferential involvement), the injury should be resected to healthy tissue and reanastomosed. It is generally accepted that these patients do not benefit from fecal diversion, though consideration of ostomy formation is reasonable in the setting of persistent hypotension or high transfusion requirements.[1,9,13,27–29] A historic trial by Stone and Fabian in 1979 randomized penetrating colon injuries to primary repair or colostomy and demonstrated equivalent rates of infection (48 vs. 57%, $p > 0.05$) and mortality (1.5 vs. 1.4%, $p > 0.05$); these data have been extrapolated to intraperitoneal rectal injuries.[9,13] A 2009 Cochrane Review analyzed six randomized trials of primary repair compared with fecal diversion for colon injuries from 1975 to 2002 and noted a significantly lower rate of infections and wound complications in the primary repair group.[29] A prospective trial involving 19 trauma centers compared 197 patients managed with primary repair to 100 patients undergoing fecal diversion and noted a lower mortality with primary repair (0 vs. 1.3%).[27] They noted a comparable rate of abdominal complications between groups with three independent risk factors: severe fecal contamination, blood transfusion of greater than 4 units in 24 hours, and single-agent antibiotic prophylaxis. However, none of these demonstrated an effect on operative management.[27] A literature review in 2009 concluded that primary repair of all colorectal injuries should be attempted, regardless of risk factors as long as the colonic tissue was viable and adequately perfused.[28] However, some retrospective studies have demonstrated increased complication rates in patients with hypotension or high transfusion requirements, which has prompted authors to encourage surgeon discretion in these cases.[1]

Extraperitoneal Injuries—Divert?

For extraperitoneal injuries, the role of fecal diversion is more controversial. A recent EAST practice management guideline conditionally recommended diversion, while noting generally low-quality evidence to address the question.[30] Their pooled analysis of the published literature identified 26 patients managed without diversion compared with 532 patients who were diverted. However, there were no reported mortalities among the 26 nondiverted patients, though there was a clinically higher incidence of infectious complications (18.2% nondiverted vs. 8.8% diverted).[30] Additional consideration must be made for the 5 to 25% rate of complications associated with the colostomy takedown, 35 to 55% incidence of complications associated with the ostomy itself, and 17% readmission rate.[10,31–33] Local wound infections after ostomy reversal occur in 3 to 20% of patients with an additional risk for sepsis.[31,33] Ostomies are also associated with a risk of parastomal herniation or prolapse, stenosis, retraction, and metabolic imbalance. Quality of life has also been shown to decrease in patients with an ostomy, though patients are typically reversed at a median of 6 months postinjury.[34,35]

A trial by Gonzalez et al treated 14 patients with nondestructive, penetrating extraperitoneal rectal injury without fecal diversion and reported no complications or mortality.[36] Extrapolation from nontrauma data would suggest the viability of nondiversion for rectal trauma. Penetrating, extraperitoneal rectal injuries are analogous to a supralevator abscess that is drained trans-anally, allowing preferential drainage into the rectum. Similarly, patients with rectal tumors undergoing full-thickness excision via trans-anal minimally invasive surgery do not require fecal diversion for successful healing.[37,38] Definitive management algorithms regarding fecal diversion for extraperitoneal rectal injuries remain lacking, pending an appropriately designed clinical trial.

Some authors recommend obtaining a contrast enema after injury to ensure complete healing of extraperitoneal injuries.[36,39] In cases of nondiversion, this was obtained 5 to 10 days postinjury, and for diverted patients, at 3 months postinjury to evaluate for ostomy takedown. Though a

small trial, Gonzalez et al noted that all 14 patients demonstrated healing by postinjury day 10, suggesting the viability of nondiverted observation or early colostomy takedown.[36] A recent systemic review in a diverse patient cohort through the last two decades demonstrated comparable outcomes with early loop ileostomy reversal (within 8–14 days) versus the traditional approach of waiting.[32]

Fecal diversion through either a loop ileostomy or colostomy is best suited for patients with destructive extraperitoneal rectal injuries (>25% circumferential involvement) or associated pelvic fractures, given the concern for open fractures and pelvic sepsis. A single prospective study has demonstrated the safe use of laparoscopy in this setting.[39] However, when an ostomy is necessary, it may be reversed within 2 weeks or during the same hospital admission with consideration for the patient's other injuries. It is reasonable to obtain a contrast enema prior to reversal to ensure adequate healing without stricture. Patients with isolated, nondestructive injuries will likely benefit from a nondiversion approach to avoid multiple operations as well as the morbidity of an ostomy.

Role of Presacral Drainage

Historically, the management of rectal trauma revolved around the four Ds (debridement, drainage, diverting colostomy, and distal rectal washout) proposed by Lavenson and Cohen during the Vietnam war.[7] The roles of presacral drainage and distal washout have been questioned in the intervening decades. In the only randomized, prospective study on the issue, Gonzalez et al treated 23 patients with presacral drainage and 25 without, noting a higher rate of infectious complications among patients undergoing presacral drainage (8 vs. 4%).[40] This finding was supported by a literature review of 17 studies on presacral drainage with a 40% reduction of sepsis and intra-abdominal infections in the no-drainage group.[30] It is generally advised that new tissue planes should not be mobilized or dissected to place a presacral drain, though some authors still advocate selective use in severe presacral destruction from high-velocity mechanisms.[26,41] In a literature review of 203 articles, Cleary et al concluded that the most suitable patients for presacral drainage would have destructive rectal injuries that communicate with and contaminate the presacral and pararectal soft tissues.[41]

Role of Distal Rectal Washout

The role of distal washout was established during the Vietnam war by Lavenson and Cohen who published a decrease in mortality from 22 to 0% and morbidity from 72 to 10%.[7] Since this recommendation, only one study has advocated distal washout by demonstrating a decrease in infectious complications in 26 patients with extraperitoneal rectal injuries.[11] In the subsequent decades, a series of retrospective studies have demonstrated no benefit of distal rectal washout.[1,42,43] The pooled comparison of 13 studies including 202 patients with distal rectal washout to 301 without washout noted a comparable mortality (0.99 vs. 1.37%) and infectious morbidity (9.9 vs. 10.3%).[30] It is advised that there is no clinical utility in performing distal rectal washout for low-velocity rectal trauma; however, some authors postulate a role in the setting of large soft-tissue defects or proximity to pelvic fractures.[1,2,41]

Role of Primary Repair

In 1996, Levine et al described a retrospective review of 30 patients with extraperitoneal rectal injuries and specifically noted that 6 patients underwent primary repair without diversion without complication.[44] However, a recent literature review suggested there is no benefit to primary repair.[1] While there is no prospective data to compare, it is suggested that additional tissue planes should not be mobilized to facilitate primary repair of extraperitoneal rectal injuries. However, if the planes are mobilized to address a concurrent injury or are accessible transanally, they can be primarily repaired at the surgeon's discretion.[39]

Vascular Injuries and Rectal Trauma

The close proximity of structures within the pelvis makes concomitant pelvic, soft-tissue, and vascular injury frequent in association with rectal injury. Vascular injury can compromise blood supply to the rectum and cause repairs to fail. A 2006 review by Arthurs et al revealed a 36% mortality rate in patients with vascular and rectal injuries.[23] In these cases, management with colostomy may still be the safer course of action to prevent the increased mortality associated with coexistent hemorrhage and sepsis.

The Future

Current literature demonstrates a knowledge gap within the diagnostic algorithm for rectal trauma. Sensitivity for detecting rectal trauma is low at 33% while protoscopy is moderately better at 71%.[15–17] The utility of CT lacks large volume studies and has not addressed the role of rectal, oral, or intravenous contrast.[19,21] However, given the usefulness of transanal minimally invasive surgery (TAMIS) to remove and repair full-thickness rectal masses, there is potential to utilize this technology for trauma. If a patient has suspicion of rectal trauma, TAMIS would allow direct visualization of the distal 15 cm and a viable mechanism for primary repair of extraperitoneal and even simple, nondestructive intraperitoneal rectal injuries.[37,38,45] Alternatively, there have been isolated reports detailing the closure of small, full-thickness, extraperitoneal rectal injuries with disposable endoscopic clips. These minimally invasive techniques may augment management for rectal trauma.

The unique medical entity, that is, trauma, often presents diagnostic and management dilemmas that will require triage and individual treatment strategies unique to each patient. The information presented thus far shows that not one diagnostic strategy can be the silver bullet in diagnosing injuries and will mandate combined modalities in most cases. Safe and expedient treatment of the patient is the

goal and ultimately requires astute clinical suspicion and appropriate action for the ideal outcome.

Disclaimer

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