

Comprehensive Management of Combat-Related Rectal Injuries: A Case Series of the Role of Endoscopic and Surgical Interventions on Diagnosis, Management, and Outcomes

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ABSTRACT

Rectal injuries are significant in wartime trauma, occurring in 5-6% of cases, often associated with explosive injuries. These injuries rarely occur in isolation due to the rectum's proximity to other pelvic organs, complicating diagnosis and treatment. This case series examines combat-related rectal injuries in military personnel, focusing on diagnostic challenges, operative management, and postoperative care. Three cases of combat-related rectal injuries caused by transpelvic explosive and gunshot wounds are presented, highlighting the use of laparotomy, colonoscopy, colostomy, wound debridement, and endoscopic clipping. Mortality and complication rates of rectal injuries in wartime are 3-10% and 18-21%, respectively. Effective management protocols such as the "FOUR Ds" (Debridement, Diversion, Drainage, Distal Washout) have evolved through conflicts from World War I to the present. Our case series illustrates the importance of prompt surgical interventions and the use of modern techniques like colonoscopy and endoscopic clipping in the successful treatment of combat-related rectal injuries. All patients in this series had uneventful recoveries following surgical intervention.

KEYWORDS: Rectal injuries, combat-related, gunshot, explosive, colostomy, faecal diversion, wound debridement, distal washout, colonoscopy, endoscopic clipping, colostomy closure, recovery, outcomes.

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INTRODUCTION

Rectal injuries are a serious concern in military trauma care, particularly in cases involving explosive or high-velocity pelvic trauma. Penetrating rectal injuries account for a significant portion of wartime abdominal trauma and pose diagnostic and therapeutic challenges. Early surgical interventions have historically resulted in high mortality rates, with up to 75% in World War I. Advances in surgical techniques, particularly the introduction of colostomy, fecal diversion, and distal rectal washout, have drastically reduced mortality and morbidity in modern times (1).

Wartime rectal injuries have been well-documented in various conflicts, from World War II to the Vietnam War, with modifications in management protocols based on evolving battlefield conditions and medical advancements. The current standard treatment, encapsulated in the "FOUR Ds" (Debridement, Diversion, Drainage, Distal Washout), emphasizes comprehensive management of both the rectal injury and associated pelvic trauma (1). However, despite the advances, rectal injuries continue to present a high risk of complications such as infection, fistula formation, and prolonged recovery times (2).

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The rectum's deep pelvic location, surrounded by vital structures including the bladder, urethra, and pelvic vasculature, creates significant challenges in both diagnosis and treatment. These injuries often occur in conjunction with damage to adjacent organs, making the surgical approach more complex. Furthermore, the extraperitoneal location of many rectal injuries limits direct visualization during surgical exploration, requiring advanced imaging techniques for accurate assessment and management (3).

The introduction of advanced imaging modalities has revolutionized the diagnostic approach to rectal injuries. Computed tomography (CT) and magnetic resonance imaging (MRI) provide high-resolution imaging of the pelvic region, enabling the identification of rectal perforations, retained foreign bodies, and associated injuries. Additionally, colonoscopy has emerged as a critical tool, allowing direct visualization of the rectal mucosa and facilitating therapeutic interventions, such as endoscopic clipping, for smaller perforations (4).

Surgical management of rectal injuries has evolved significantly over the decades. Early techniques focused on damage control and minimizing contamination through fecal diversion and wound debridement. More recently, advances in surgical technology have enabled the adoption of minimally invasive approaches. Techniques such as endoscopic clipping and laparoscopic-assisted repairs are now utilized to address specific injury patterns, reducing surgical morbidity and enhancing recovery times. Recent innovations, including the use of endoscopic clipping for small perforations, represent a paradigm shift toward minimally invasive approaches (5).

Managing rectal injuries requires a multidisciplinary approach involving trauma surgeons, radiologists, anesthesiologists, and critical care specialists. This collaborative approach ensures comprehensive care, from initial resuscitation to definitive surgical intervention and postoperative recovery. Postoperative management, including nutritional support, infection prevention, and regular monitoring, plays a crucial role in achieving favorable outcomes (6).

This case series documents combat-related rectal injuries in military personnel treated in a surgical unit. These cases demonstrate the surgical challenges presented by rectal trauma, the importance of prompt and appropriate management, and the outcomes of different surgical approaches. This case series aims to provide an in-depth exploration of the management of rectal trauma through three detailed case presentations. By analyzing the clinical scenarios, diagnostic processes, surgical strategies, and outcomes, this report seeks to highlight best practices and contribute to the ongoing refinement of rectal injury management in both wartime and civilian settings.

CASE PRESENTATION

Case 1: Complex Rectal Injury with Bladder Perforation

A 40-year-old male soldier sustained explosive trauma to the back and buttocks during combat (Figure 1). He presented with hypovolemic shock, characterized by pallor, tachycardia, and hypotension. The patient reported severe pain, inability to ambulate, and visible wounds to the gluteal region. Initial resuscitation measures, including intravenous fluids and blood transfusion, stabilized the patient.



Figure 1. Explosive multiple injuries to the back and buttocks (Case 1)

Contrast-enhanced CT revealed a rectal perforation with contrast extravasation into the recto-pubic region and paracolic gutters with free fluid. Multiple metallic foreign bodies were identified in the pelvic cavity (Figure 2). A perforation at the dome of the bladder and a retroperitoneal hematoma were also noted. Laboratory findings indicated anemia and elevated inflammatory markers.

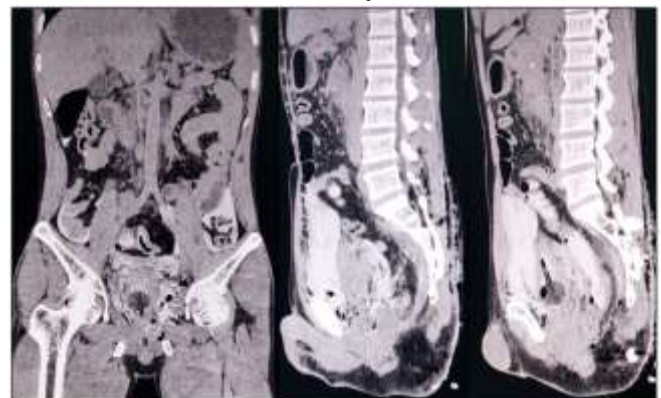


Figure 2. CECT abdomen views of rectal and bladder perforations with multiple metallic foreign bodies in pelvic cavity (Case 1)

Emergency laparotomy was performed, revealing a 500 mL hemoperitoneum, retroperitoneal hematoma and perforation

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of at the dome of the bladder (~3cm) with trigonal injury about 3 cm distal end just above bladder neck. The sigmoid colon displayed a serosal tear. Sigmoid colon serosal tear was repaired and transverse loop colostomy was created for fecal diversion. Simultaneously, the bladder perforation was repaired with a two-layer closure. Debridement of necrotic tissue and removal of foreign bodies were performed, followed by distal rectal washout (Figure 3).

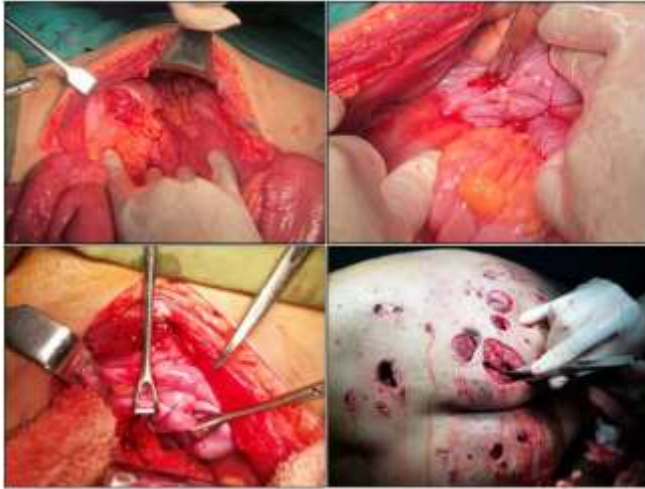


Figure 3. Operative views of sigmoid colon serosal tear repair, bladder perforation repair and wound debridement (Case 1)

The patient's recovery was closely monitored. Nutritional support, colostomy care and wound care facilitated recovery. Postoperatively, the patient underwent multiple colonoscopies to assess rectal perforation. During colonoscopic examination after one month surgery, anterior rectal perforation (1 o'clock position) and posterior rectal perforation (7 o'clock position) were detected at about 5 cm away from anal verge (Figure 4) and prepared for transanal repair of these perforations under endoscopic guidance.

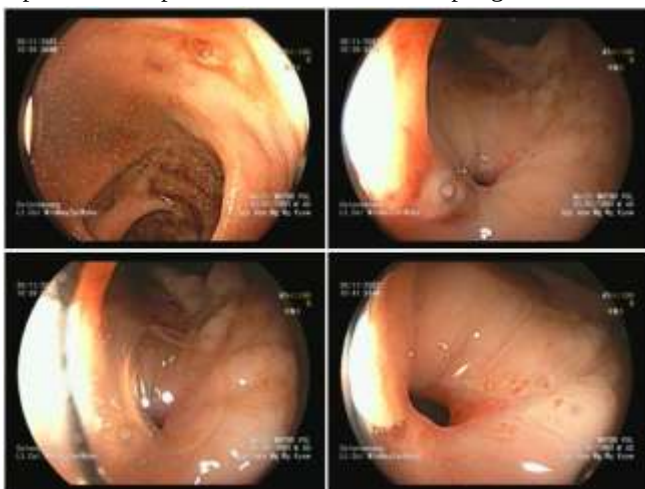


Figure 4. Colonoscopic views of anterior and posterior rectal perforations (~5 cm away from anal verge) (Case 1)

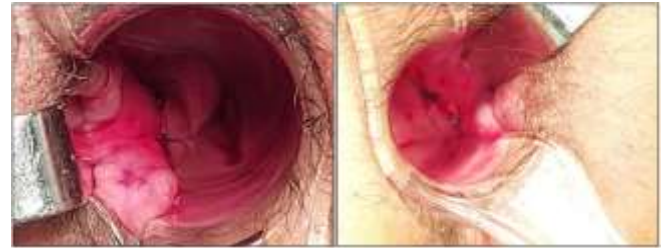


Figure 5. Operative views of repair of rectal perforations both anterior and posterior (Case 1)



Figure 6. Rectal perforation repair under intraoperative colonoscopic guidance (Case 1)

After attempt to repair the anterior and posterior rectal perforations via transanal approach under colonoscopic guidance (Figure 5 & 6), complete healing was confirmed by colonoscopy at four weeks later after repair (Figure 7). Distal loop colonogram also confirmed the absence of contrast leakage and the patient underwent colostomy closure and had an uneventful recovery. He returned to functional status within three months.

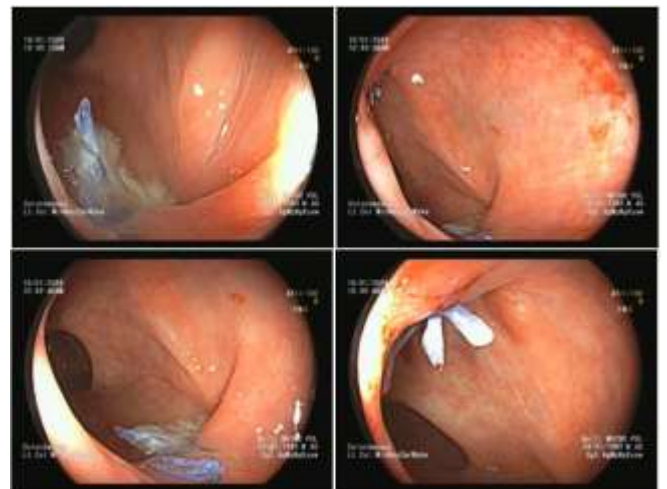


Figure 7. Colonoscopic views of complete healing of rectal perforations (Case 1)

Case 2: Perianal Gunshot Wound with Sepsis

A 58-year-old man presented with a gunshot wound to the perianal region. Initial treatment at a peripheral hospital

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included resuscitation and blood transfusion. Upon transfer, the patient exhibited signs of systemic sepsis, including fever, tachycardia, and leukocytosis. Examination revealed a lacerated posterior anal wound with foul smelling discharge (Figure 8).



Figure 8. Gunshot injury to the perianal region and lacerated posterior anal wound (Case 2)

CECT imaging identified a rectal perforation in the middle third, along with multiple retained metallic foreign bodies in the presacral region (Figure 9). Emphysematous changes in the recto-vesical pouch were indicative of gas-forming infection. Laboratory studies confirmed systemic inflammation.

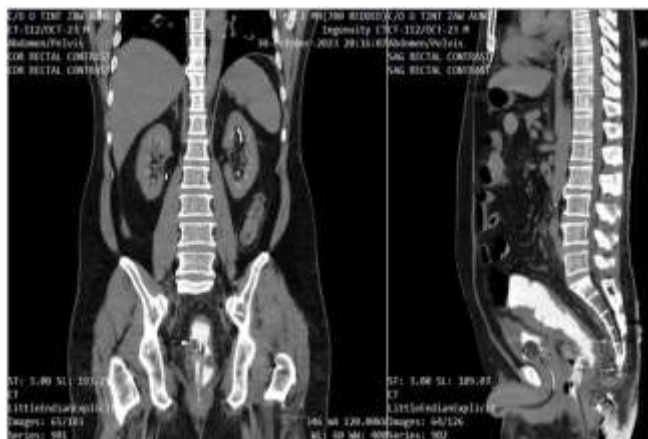


Figure 9. CECT abdomen views of middle third rectal perforation with multiple metallic foreign bodies in presacral region (Case 2)

An emergency sigmoid colostomy was performed, and the anal wound was debrided. After one month surgery, colonoscopy identified a small rectal perforation 8 cm from the anal verge, which was closed using endoscopic clips (Figure 10).

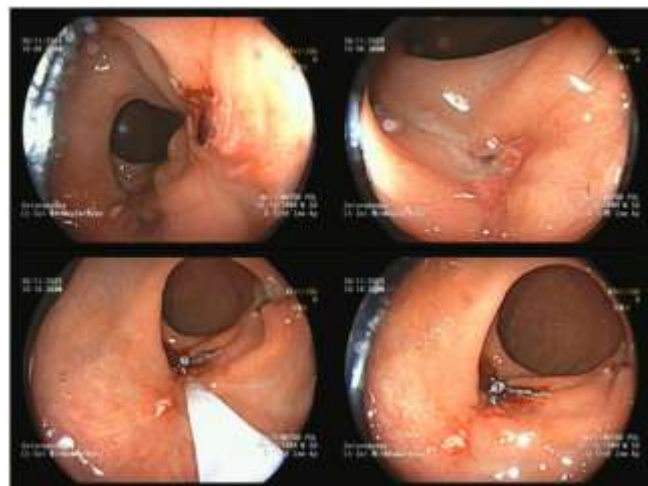


Figure 10. Colonoscopic views of small rectal perforation (~8 cm away from anal verge) closure by endoscopic clips (Case 2)

Subsequent follow-up colonoscopy confirmed successful closure of the perforation (Figure 11). Postoperative imaging also confirmed the absence of contrast leakage, and the colostomy was reversed following complete healing of the rectal defects (Figure 12). The patient's recovery was uneventful, with no evidence of complications on follow-up.



Figure 11. Colonoscopic views of complete healing of rectal perforation (Case 2)



Figure 12. Operative view of colostomy closure (Case 2)

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Case 3: Retained Foreign Body with Rectal Perforation

A 20-year-old male soldier sustained a gunshot wound to the right buttock. He presented three weeks later with perineal pain, foul-smelling discharge, and a sinus tract in the perineum. Initial management included wound dressing and antibiotics at a field hospital.

Colonoscopy confirmed a 1 cm posterior rectal perforation at 8 cm from the anal verge, with signs of localized inflammation (Figure 13). CT imaging confirmed a small rectal perforation and a retained metallic foreign body in the pelvic cavity.

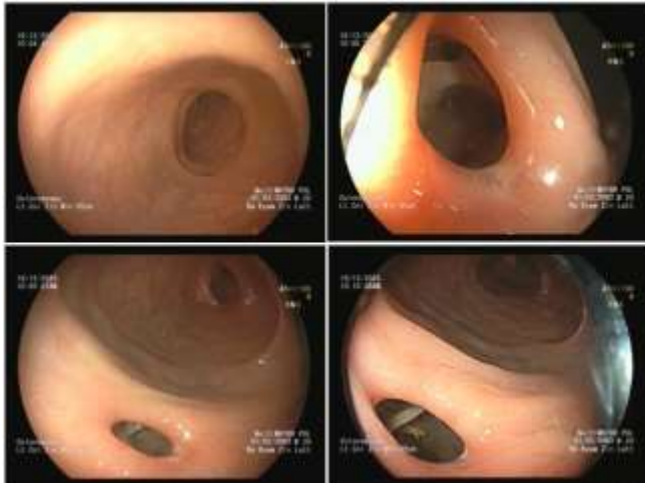


Figure 13. Colonoscopic views of rectal perforation about 1cm (~8 cm away from anal verge) (Case 3)

Definitive management involved a sigmoid colostomy and intraoperative repair of the rectal perforation via transanal approach under colonoscopic guidance (Figure 14 & 15). A retained bullet was retrieved during surgery. The infected sinus tract was excised, and surrounding tissue was debrided (Figure 14). The postoperative condition of the patient was uneventful.



Figure 14. Operative views of repair of rectal perforation, infected sinus tract excision, wound debridement and retained foreign body removal (Case 3)

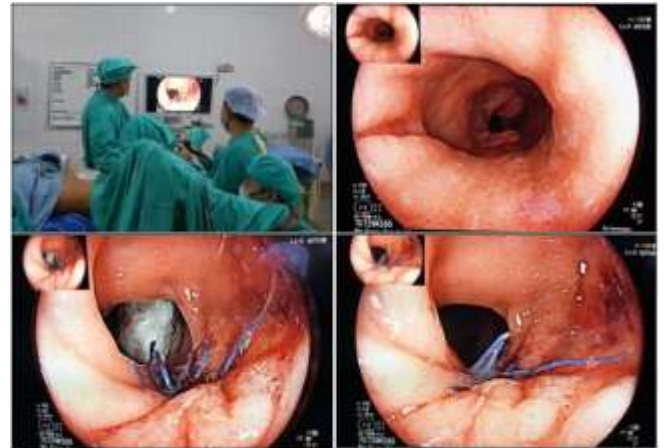


Figure 15. Rectal perforation repair under intraoperative colonoscopic guidance (Case 3)

After one month surgery, colonoscopy confirmed complete healing of the rectal defect (Figure 16). Postoperative distal loop colonogram also confirmed the absence of contrast leakage. The colostomy was closed two months postoperatively (Figure 17). The patient resumed normal activities within four months.

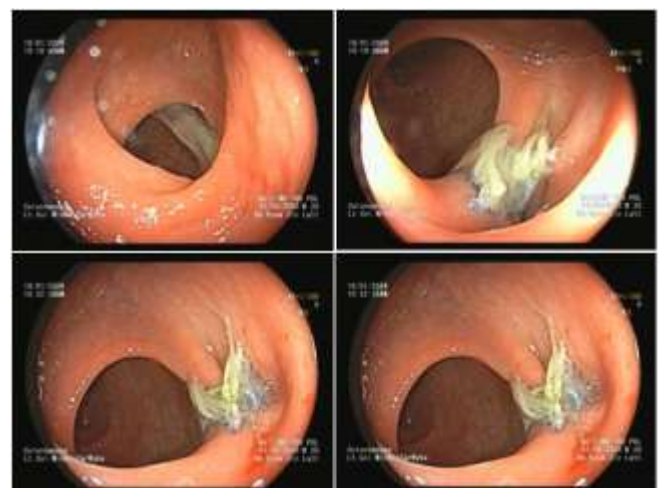


Figure 16. Colonoscopic views of healing of rectal perforations (Case 3)



Figure 17. Operative view of colostomy closure (Case 3)

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DISCUSSION

Combat-related rectal injuries are often the result of high-velocity injuries, such as gunshots or explosive mechanisms. These injuries are characterized by significant tissue disruption and contamination from fecal material. The rectum's anatomical location deep within the pelvis provides some degree of protection; however, the force of wartime injuries often overcomes this defense, leading to complex injury patterns.

Combat-related rectal injuries are inherently complex due to their anatomical location and the high likelihood of associated injuries to the pelvic organs and vasculature. The proximity of other structures often complicates both diagnosis and treatment, leading to a higher incidence of morbidity if not managed promptly and correctly.

Historical data suggest that mortality rates for rectal injuries in wartime have significantly decreased due to the evolution of surgical techniques and the increased use of imaging modalities such as computed tomography (CT) and colonoscopy. Diagnosing rectal injuries requires a high index of suspicion, particularly in patients with penetrating pelvic trauma. Clinical examination alone is insufficient, as the rectum's location and associated injuries may obscure the extent of damage. Advanced imaging techniques such as CT and colonoscopy have become indispensable tools for identifying rectal perforations, retained foreign bodies, and other complications.

In this case series, all three patients sustained rectal injuries in the context of explosive or gunshot injury, consistent with the literature, which indicates that up to 23% of rectal injuries in wartime are caused by explosive trauma. These injuries, particularly extraperitoneal rectal injuries, are associated with high complication rates, including infection, abscess formation, and fistula development.

Historically, surgical management of rectal injuries has shifted from expectant management to more proactive interventions. World War I saw mortality rates of 60-75% due to the lack of effective surgical techniques. The advent of colostomy and fecal diversion in later conflicts dramatically improved outcomes, and these techniques remain the cornerstone of modern rectal injury management. Early reliance on fecal diversion and debridement has given way to more nuanced approaches that incorporate minimally invasive techniques. Endoscopic clipping, for example, offers a viable alternative for managing small, localized perforations, reducing the need for extensive surgical intervention.

In all three cases, emergency colostomy and wound debridement were performed. The use of colonoscopy to assess the extent of rectal injury and guide repair was crucial in identifying the exact location and severity of the perforations. Endoscopic clipping was utilized successfully in one case, demonstrating the utility of this minimally invasive approach in closing small, full-thickness

perforations. This technique aligns with recent literature, which suggests that endoscopic clipping can be a viable alternative to more invasive surgical repairs in certain cases of rectal injury.

The "FOUR Ds" approach—Debridement, Diversion, Drainage, and Distal Washout—was applied in each of these cases. This protocol remains the standard of care for managing rectal trauma, especially in wartime settings where patients often present with multiple injuries and significant contamination. Postoperative care is critical for patients with rectal injuries, given the high risk of complications such as infection, abscess formation, and anastomotic failure. Close monitoring, daily wound dressing, nutritional support, and regular follow-up imaging and endoscopy are essential components of comprehensive care. Additionally, timely colostomy reversal is crucial for restoring bowel function and improving quality of life.

The management of combat-related rectal injuries necessitates a multidisciplinary approach. Trauma surgeons, radiologists, anesthesiologists, and critical care specialists must work in concert to ensure optimal outcomes. This collaborative model not only enhances diagnostic accuracy but also streamlines the decision-making process for complex surgical interventions.

Advancements in biomaterials, imaging technology, and surgical techniques hold promise for improving outcomes in rectal injury. Research into minimally invasive approaches and tissue regeneration may pave the way for more effective and less invasive treatment options. Additionally, the development of standardized protocols for managing rectal injuries in both military and civilian settings could further enhance care.

CONCLUSION

Combat-related rectal injuries are a significant surgical challenge due to the complexity of the injury and the high risk of associated complications. This case series highlights the importance of early diagnosis, prompt surgical intervention, and comprehensive postoperative care. Advances in surgical techniques, particularly the use of endoscopy and minimally invasive repairs, have improved outcomes for patients with rectal injuries. Despite the high complication rates historically associated with rectal trauma, modern management protocols such as the "FOUR Ds" have drastically reduced mortality and morbidity. The cases presented demonstrate that with appropriate management, even severe rectal injuries can result in favorable outcomes. Further research into the long-term outcomes of patients with rectal war injuries is needed to refine surgical techniques and improve patient care.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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