

Hydrogen peroxide irrigation as an adjunct to digital rectal examination for detection of penetrating low rectal injuries

Matthew O'Brien ,¹ Lawrence Diebel²

► Additional supplemental material is published online only. To view, please visit the journal online (<https://doi.org/10.1136/tsaco-2024-001432>).

¹Surgery, Detroit Medical Center, Detroit, Michigan, USA

²Surgery, Wayne State University School of Medicine, Detroit, Michigan, USA

Correspondence to

Dr Matthew O'Brien; mobrien@dmc.org

Received 8 April 2024
Accepted 28 July 2024

ABSTRACT

Background Rectal trauma carries significant morbidity, particularly if there is a delay in diagnosis. Digital rectal examination has a relatively low sensitivity. Proctoscopy and sigmoidoscopy are available but can be limited in situations with increased fecal burden or uncooperative patients. We suggest more sensitive bedside techniques are necessary to diagnose low rectal injury, and here present a case report to demonstrate proof of concept using hydrogen peroxide to directly visualize an injury.

Methods Digital rectal examination was performed in a patient after multiple gunshot wounds and was negative for gross blood. Suspicion for low rectal injury remained high, and hydrogen peroxide was used to evaluate bullet trajectory. Approximately 25 mL of 3% hydrogen peroxide was instilled into the bullet tract.

Results Hydrogen peroxide evaluation of the bullet tract was performed in less than 1 min with minimal supplies and preparation. It revealed an extraperitoneal injury where the rectal examination had been falsely negative.

Conclusion Hydrogen peroxide may be used to evaluate a suspected penetrating injury of the rectum. Considering the potential of this modality to diagnose injuries in a timely and reliable manner, additional investigation may be warranted.

BACKGROUND

Traumatic rectal injuries are fairly infrequent; however, a delay in diagnosis can invoke significant morbidity. Successful management involves establishing an early diagnosis. While a thorough physical examination is a critical aspect of the trauma evaluation, the advanced trauma life support (ATLS) manual currently suggests digital rectal examination (DRE) in only select situations for evaluation of rectal blood, anal sphincter tone, bowel wall integrity, and bony fragments.¹ Published data suggest low overall sensitivity of DRE as part of the trauma evaluation. Docimo *et al* illustrated a sensitivity of 33.3%, and Shlamovitz revealed a 0% sensitivity, although these were limited by the small population sizes of rectal trauma patients.^{2,3} According to Esposito *et al*, the digital rectal examination was found to be equivalent to other clinical indicators for confirming or excluding the presence of injuries.⁴ In this text, we present a case of false negative digital rectal examination. Additionally, we describe a simple procedure to detect an extraperitoneal rectal injury at the bedside.

METHODS

This study involves a single patient and describes a diagnostic procedure; therefore, no institutional review board (IRB) approval was performed. Consent was obtained from the patient prior to submission and peer review. In regard to the procedure, 3% undiluted hydrogen peroxide was prepared in a Toomey syringe. Then, 25 mL of hydrogen peroxide was injected into the penetrating injury seen posterior to the rectum, at the level of the coccyx. The peroxide was immediately visualized returning from the anus, confirming the existence of suspected rectal injury.

RESULTS

The case involves an adult male who presented as a trauma code for multiple gunshot wounds. He was found to have a through and through injury to the right forearm, left chest wall wound, coccygeal injury at midline, as well as an injury to the left axilla. Given the proximity of the coccygeal injury to the rectum, there was suspicion for a rectal injury and a digital rectal examination was performed. No gross blood was seen on DRE; however, a large amount of brown stool was felt within the vault. There was no evidence of peritonitis, and vital signs were stable in the trauma bay; therefore, he was sent to the CT scanner. CT illustrated hollow viscous perforation with free air ([figure 1](#)), and the interpretation was that the bullet had entered at the level of the coccyx and terminated in the proximal left axilla. Of note, the patient also had impressive rectosigmoid colon fecal stasis measuring up to 17 cm in size ([figure 2](#)).

The patient was taken to the operating room suite and a rapid bedside technique to diagnose rectal injury was performed. Hydrogen peroxide was injected through the bullet tract at the level of the coccyx and the peroxide was seen exiting the anus, confirming a trajectory through the rectum (online supplemental file 1). This technique took less than 1 min to perform and confirmed a low rectal injury where the digital rectal examination had been falsely negative.

A midline laparotomy was performed and the massively dilated rectosigmoid had an injury in the anterior aspect of the sigmoid. The distal rectal injury was not visible on exploratory laparotomy and may have been missed without hydrogen peroxide. Decision was made to perform diverting colostomy. Even without

© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: O'Brien M, Diebel L. *Trauma Surg Acute Care Open* 2024;**9**:e001432.



Figure 1 Representative slice taken from CT scan illustrating pneumoperitoneum.

confirmation of the rectal injury, colostomy would have likely been performed given massive distention of the colon. The dilated rectosigmoid colon was manually disimpacted and distal rectal washout performed. The abdomen was then re-inspected carefully and a penetrating wound to the diaphragm was seen and repaired. The chest was irrigated, the patient was then closed, colostomy matured, and a chest tube was placed into the left pleural space.

In this instance, hydrogen peroxide injection proved to be more accurate than digital rectal examination. The patient illustrated no adverse reaction to the injection of hydrogen peroxide and recovered uneventfully from his injuries. Nasogastric tube was removed by postoperative day 6, he began to tolerate diet shortly after, and colostomy was productive. He was discharged on postoperative day 9. Colostomy reversal was performed without complication 4 months later.



Figure 2 Representative image taken from CT scan illustrating massive rectosigmoid distention.

DISCUSSION

The ideal modality to evaluate patients for rectal trauma would be low cost, performed rapidly with minimal equipment, accurate, and cause negligible discomfort. This case report demonstrates that hydrogen peroxide irrigation into a penetrating injury where there is suspicion for extraperitoneal rectal violation is feasible.

Hydrogen peroxide has been traditionally discussed as a wound cleansing agent due to its production of reactive oxygen species.⁵ Hydrogen peroxide reacts with catalase within body tissues, resulting in its characteristic foamy appearance through production of oxygen and water.⁶ In a penetrating injury, the volume of gas expands within the cavity and fluid is forced to make its egress toward the exit site of the wound. The ability to diagnose rectal injury has not been described, but it has been described as an adjunct to CT for diagnosis of penetrating abdominal injury.⁷ Hydrogen peroxide has also been demonstrated to assist identification of an anal fistulous tract and, more recently, combined with ultrasound to enhance detection of fistulas.^{8,9}

Future research is needed to determine the safety and statistical accuracy of using hydrogen peroxide to outline rectal injury. In this report, the DRE had been falsely negative for gross blood. Hydrogen peroxide irrigation outperformed the DRE and requires only simple tools that are available within most trauma bays and can be completed rapidly at the bedside.

Acknowledgements We thank the patient involved in the case scenario for their cooperation and consent to publish the article.

Contributors MO'B performed literature search, writing of the original manuscript, and participated in the care of the patient described. LD developed the concept of hydrogen peroxide irrigation, led the care of the patient, and performed critical editing/review of the manuscript. LD and MO'B act as guarantors.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Consent obtained directly from patient(s).

Provenance and peer review Not commissioned; externally peer reviewed.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Matthew O'Brien <http://orcid.org/0009-0005-4177-8905>

REFERENCES

- 1 ATLS Subcommittee. *Advanced trauma life support (ATLS): the student course manual tenth edition*. American College of Surgeons, 2018.
- 2 Docimo S, Diggs L, Crankshaw L, Lee Y, Vines F. No Evidence Supporting the Routine Use of Digital Rectal Examinations in Trauma Patients. *Indian J Surg* 2015;77:265–9.
- 3 Shlamovitz GZ, Mower WR, Bergman J, Crisp J, DeVore HK, Hardy D, Sargent M, Shroff SD, Snyder E, Morgan MT. Lack of evidence to support routine digital rectal examination in pediatric trauma patients. *Pediatr Emerg Care* 2007;23:537–43.

- 4 Esposito TJ, Ingraham A, Luchette FA, Sears BW, Santaniello JM, Davis KA, Poulakidas SJ, Gamelli RL. Reasons to omit digital rectal exam in trauma patients: no fingers, no rectum, no useful additional information. *J Trauma* 2005;59:1314–9.
- 5 Zhu G, Wang Q, Lu S, Niu Y. Hydrogen Peroxide: a Potential Wound Therapeutic Target? *Med Princ Pract* 2017;26:301–8.
- 6 Watt BE, Proudfoot AT, Vale JA. Hydrogen peroxide poisoning. *Toxicol Rev* 2004;23:51–7.
- 7 VanFleet AX, Humeda YS, Schuetz CR. Role of hydrogen peroxide injection for penetrating abdominal injury in creating CT Tractogram. *Am J Emerg Med* 2021;41:264.
- 8 Beavis RE. Use of hydrogen peroxide to identify internal opening of anal fistula and perianal abscess. *Aust N Z J Surg* 1987;57:137.
- 9 Zbar AP, Oyetunji RO, Gill R. Transperineal versus hydrogen peroxide-enhanced endoanal ultrasonography in never operated and recurrent cryptogenic fistula-in-ano: a pilot study. *Tech Coloproctol* 2006;10:297–302.