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Cutting-Edge Insights: Advancing Laparoscopy in the Management of Diffuse Peritonitis

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Abstract

Diffuse peritonitis remains a significant challenge due to high mortality rates, especially in septic shock cases. Historically, laparoscopic surgery was avoided in peritonitis management due to concerns about hypercapnia, toxic shock, and technical challenges. However, advancements in techniques and growing evidence of benefits—reduced postoperative pain, shorter hospital stays, and fewer complications—have expanded its use in selected patients. This state-of-the-art review highlights the role of laparoscopy in managing diffuse peritonitis, focusing on its advantages, limitations, and future directions. Diagnostic laparoscopy ensures high diagnostic accuracy, avoids unnecessary laparotomies, and supports therapeutic interventions in conditions like perforated peptic ulcers, appendicitis, and diverticulitis in stable patients. Despite these benefits, challenges remain, including difficult access, diffuse contamination, and high conversion rates to open surgery due to technical difficulties. Key recommendations emphasize the importance of patient selection, limiting laparoscopy to hemodynamically stable individuals with adequate physiological reserves. Surgeons require advanced skills, particularly for complex cases, and must maintain a low threshold for conversion to open surgery. Institutional readiness, including modern equipment and trained personnel, is essential. In conclusion, laparoscopy is a valuable tool in managing diffuse peritonitis. Addressing evidence gaps and enhancing training and technology will optimize its use, improving outcomes and reducing surgical morbidity.

Keywords: diffuse peritonitis, laparoscopy, septic abdomen, conversion, minimally invasive surgery

Introduction

Diffuse peritonitis is a severe inflammatory condition of the peritoneal cavity often caused by microbial invasion or chemical irritants following gastrointestinal perforations. It is categorized as primary, secondary, or tertiary, with secondary peritonitis being the most common form encountered in surgical practice (1). Despite medical advancements, diffuse peritonitis remains a significant clinical challenge due to its high mortality rate—ranging from 20% to 80% in cases of septic shock (2). Historically, laparoscopic surgery (LS) was largely avoided in cases of peritonitis, as it was considered either absolutely or relatively contraindicated due to several concerns. One

major worry was the potential for hypercapnia caused by the increased absorption of carbon dioxide, which is linked to elevated intra-abdominal pressure (IAP), infection, and inflammation. Another concern was the risk of toxic shock syndrome, as elevated IAP could facilitate the transfer of toxins and bacteria into the bloodstream.

Additionally, the technical challenges of dealing with an inflamed and fragile bowel, restricted working space, and difficulties in handling the bowel discouraged surgeons from using laparoscopy for perforative peritonitis (3,4). More recently, the benefits of laparoscopy—such as reduced postoperative pain, shorter hospital stays, faster recovery, and lower rates of complications—have motivated surgeons to expand its use in appropriate situations (5). Diagnostic laparoscopy, in particular, provides the advantage of uncovering unexpected findings in cases of suspected peritonitis or visceral perforation. Favorable pathology identified during the procedure can often be managed laparoscopically, while cases requiring conversion to open surgery benefit from smaller and more targeted skin incisions. Reflecting this shift in perspective, the European Association for Endoscopic Surgery (EAES) guidelines no longer consider laparoscopy an absolute contraindication for managing a peritonitic abdomen (6–8). Advancements in laparoscopic techniques and equipment have prompted a revaluation of its potential, especially for carefully selected patients. This review aims to explore the current evidence on the use of laparoscopy in diffuse peritonitis, highlighting its advantages, limitations, clinical scenarios, and future directions.

Classification and Epidemiology of Peritonitis

Types of Peritonitis

Primary Peritonitis

Often seen in cirrhotic patients or patients in the course of peritoneal dialysis, primary peritonitis occurs without any direct breach of the gastrointestinal tract. It constitutes 32-34% of hospital admissions among cirrhotic individuals (9).

Secondary Peritonitis

This type arises from a physical or functional disruption of the gastrointestinal tract, allowing polymicrobial contamination of the peritoneal cavity. Common causes include perforated peptic ulcers, acute diverticulitis, appendicitis, and anastomotic leaks. Secondary peritonitis accounts for approximately 1% of hospital visits but has a mortality rate of up to 80% in severe cases (10,11).

Tertiary Peritonitis

Defined as peritonitis that persists or recurs 48 hours after apparently successful management of primary or secondary peritonitis, tertiary peritonitis has a mortality rate of 30-60% (2,11,12).

The most common causes of peritonitis include acute diverticulitis, perforated peptic ulcer (PUP), and perforated appendicitis. Acute diverticulitis leads to approximately 312,000 hospital admissions annually in the United States, with 15% of these cases resulting in complications such as perforation (13). Perforated peptic ulcer has an annual incidence ranging from 0.004% to 0.014% and is associated with a 30-day mortality rate of 23.5%, which can rise to 50% if treatment is delayed beyond 24 hours (14). Perforated appendicitis, responsible for 7% of all diffuse peritonitis cases, has a mortality rate of 1% to 2.5% (15–17).

Role of Laparoscopy in Diffuse Peritonitis

Advantages

Laparoscopy offers several clinical benefits in managing diffuse peritonitis, including(18–20):

- High Diagnostic Accuracy: laparoscopy allows direct visualization of the abdominal cavity, enabling precise identification and staging of peritoneal pathology.
- Reduced Tissue Trauma: the minimally invasive nature of laparoscopy results in less tissue damage compared to open surgery.
- Faster Recovery: patients often experience shorter hospital stays, reduced postoperative pain, and a faster return to normal activities.
- Avoidance of Unnecessary Laparotomy: in 5-10% of cases, laparoscopy can help avoid non-therapeutic laparotomies.

Limitations

Despite its advantages, laparoscopy presents specific challenges in diffuse peritonitis (18,21):

- Difficult Access: distended bowel loops, adhesions, and previous surgical scars complicate trocar placement.
- Diffuse Contamination: the widespread presence of contaminants increases the risk of systemic infections.
- Patient Physiology: the deteriorating physiological state of critically ill patients limits the feasibility of laparoscopic interventions.
- High Conversion Rates: approximately 25% of cases require conversion to open surgery due to technical difficulties.

Clinical Applications

Perforated Peptic Ulcer (PUP)

Laparoscopic repair is increasingly recommended for stable patients with PUP due to its potential to reduce septic complications and incisional hernias. Studies show no significant difference in postoperative mortality or complications between laparoscopic and open approaches. However, laparoscopy requires advanced technical skills and should be avoided in unstable patients (22).

Diffuse Peritonitis from Diverticulitis

Emergency laparoscopic sigmoid resection is viable in selected cases of diffuse peritonitis caused by perforated diverticulitis. This approach has been shown to reduce overall postoperative complications compared to open surgery. However, its success hinges on the surgeon's expertise in advanced laparoscopic colorectal techniques (23).

Acute Appendicitis

Laparoscopic appendectomy (LA) has demonstrated comparable safety and efficacy to open appendectomy in managing diffuse peritonitis from perforated appendicitis. Despite its benefits, LA is still underutilized in these cases, highlighting the need for broader acceptance (24).

Rescue Surgery

In cases of postoperative complications, such as anastomotic leaks, laparoscopy can mitigate the second-hit effect of the new surgery. While the approach is technically challenging, it offers the advantage of reduced surgical trauma and lower complication rates (19).

Controversies and Evidence Gaps

Despite encouraging data, significant controversies persist regarding the laparoscopic management of diffuse peritonitis. Concerns about the theoretical risks of hypercapnia, toxic shock, and incomplete peritoneal lavage have limited its widespread adoption (1,19). Furthermore, the lack of large, multi-center randomized controlled trials (RCTs) leaves critical gaps in the evidence, particularly regarding long-term outcomes and the impact of the learning curve on surgical performance.

Technical Considerations

Carbon Dioxide Insufflation

CO2 insufflation during laparoscopy elevates intra-abdominal pressure, potentially aggravating hemodynamic instability in critically ill patients. However, studies have demonstrated that a pneumoperitoneum pressure of 15 mmHg does not significantly increase the risk of complications in bacterial peritonitis, supporting its safe use in stable patients (25,26).

Advanced Skills and Equipment

The successful application of laparoscopy in diffuse peritonitis requires advanced surgical skills, particularly for complex cases such as colorectal perforations. Surgeons must maintain a low threshold for converting to open surgery when technical challenges arise (8,18).

Recommendations for Laparoscopic Management of Diffuse Peritonitis

1. Patient Selection: the successful use of laparoscopy in managing diffuse peritonitis begins with meticulous patient selection. Hemodynamically unstable patients, who are at greater risk of cardiovascular compromise, are generally contraindicated for laparoscopy due to the physiological stress imposed by pneumoperitoneum and elevated intra-abdominal pressure. Conversely, laparoscopy can be safely considered in hemodynamically stable patients who demonstrate adequate physiological reserves. Careful preoperative assessment, including evaluation of comorbidities and the extent of peritoneal contamination, is crucial to identify candidates who are likely to benefit from a minimally invasive approach. Recent studies have indeed demonstrated how a preoperative optimization of the sickest patients can improve the outcome. As a result, this aspect could allow to widen the indications to use laparoscopy as a first approach (18,21,24,27).

2. Training and Expertise: the role of surgical expertise cannot be overstated. Laparoscopy in diffuse peritonitis requires advanced technical skills, particularly when addressing complex cases such as colorectal perforations or dense intra-abdominal adhesions. Surgeons attempting these procedures should have extensive training in advanced laparoscopic techniques and be capable of managing potential complications. A low threshold for conversion to open surgery is essential to prioritize patient safety when technical difficulties arise. Structured training programs and mentorship opportunities can help equip surgeons with the necessary skills to manage these challenging scenarios effectively (8,23,28).

3. Institutional Awareness: the implementation of laparoscopy for diffuse peritonitis requires not only skilled

surgeons but also institutional awareness. Hospitals must ensure the availability of modern laparoscopic equipment, including energy devices, laparoscopic staplers, and updated visualization systems. A team approach involving anesthesiologists, nurses, and surgical assistants familiar with laparoscopic techniques is critical to optimize patient outcomes. Regular training sessions and simulation-based learning can enhance team coordination and proficiency, particularly in resource-limited settings (29,30).

4. Future Directions: to further establish the role of laparoscopy in the management of diffuse peritonitis, ongoing research and innovation are necessary. Key areas of focus include large RCTs to provide high-quality evidence on the comparative outcomes of laparoscopy versus open surgery, particularly in terms of long-term survival, postoperative complications, and cost-effectiveness; understanding how surgeon expertise and the laparoscopic learning curve influence outcomes will help refine training programs and establish minimum proficiency standards; advancements in technology, such as augmented reality for intraoperative navigation and robotic-assisted surgery, hold promise in enhancing precision and reducing the technical challenges associated with laparoscopy in diffuse peritonitis. Future research should evaluate the effectiveness and feasibility of integrating these innovations into clinical practice.

Conclusion

Laparoscopy has emerged as a valuable tool in the diagnostic and therapeutic management of diffuse peritonitis, offering significant benefits such as reduced tissue trauma, shorter recovery times, and avoidance of unnecessary laparotomies for selected patients. However, its application remains challenging, particularly in complex cases involving extensive contamination or adhesions, and in resource-limited settings where access to skilled personnel and advanced equipment may be constrained. Addressing the current gaps in evidence through robust research, enhancing surgical training, and leveraging technological advancements are critical to expanding the role of laparoscopy in diffuse peritonitis. By doing so, the surgical community can improve patient outcomes, reduce surgical morbidity, and ensure the optimal use of this minimally invasive approach.

References

1. Hranjec T, Watson CM, Sawyer RG. Peritonitis: Definitions of Primary, Secondary, and Tertiary. In: Vincent JL, Hall JB, editors. Encyclopedia of Intensive Care Medicine [Internet]. Berlin, Heidelberg: Springer; 2012 [cited 2024 Dec 9]. p. 1723–9. Available from: https://doi.org/10.1007/978-3-642-00418-6_84

2. Ordoñez CA, Puyana JC. Management of Peritonitis in the Critically Ill Patient. Surg Clin North Am. 2006 Dec;86(6):1323□49.

3. Uyanikoğlu A, Danalioğlu A, Akyüz F, Ermış F, Güllüoğlu M, Kapran Y, et al. Etiological factors of duodenal and gastric ulcers. Turk J Gastroenterol. 2012 Apr;23(2):99–103.

4. Svanes C, Soreide J, Skarstein A, Fevang B, Bakke P, Vollset S, et al. Smoking and ulcer perforation. Gut. 1997 Aug;41(2):177–80.

5. Ahmed S, Belayneh YM. Helicobacter pylori And Duodenal Ulcer: Systematic Review Of Controversies In Causation. Clin Exp Gastroenterol. 2019;12:441–7.

6. White SI, Frenkiel B, Martin PJ. A ten-year audit of perforated sigmoid diverticulitis: highlighting the outcomes of laparoscopic lavage. Dis Colon Rectum. 2010 Nov;53(11):1537–41.

7. Francis NK, Sylla P, Abou-Khalil M, Arolfo S, Berler D, Curtis NJ, et al. EAES and SAGES 2018 consensus conference on acute diverticulitis management: evidence-based recommendations for clinical practice. Surg Endosc. 2019 Sep;33(9):2726–41.

8. Agresta F, Ansaloni L, Baiocchi GL, Bergamini C, Campanile FC, Carlucci M, et al. Laparoscopic approach to acute abdomen from the Consensus Development Conference of the Società Italiana di Chirurgia Endoscopica e nuove tecnologie (SICE), Associazione Chirurghi Ospedalieri Italiani (ACOI), Società Italiana di Chirurgia (SIC), Società Italiana di Chirurgia d□Urgenza e del Trauma (SICUT), Società Italiana di Chirurgia nell□Ospedalità Privata (SICOP), and the European Association for Endoscopic Surgery (EAES). Surg Endosc. 2012 Aug;26(8):2134–64.

9. Lingiah VA, Pyrsopoulos NT. Bacterial Infections in Cirrhotic Patients in a Tertiary Care Hospital. J Clin Transl Hepatol. 2021 Feb 28;9(1):32–9.

10. Clements TW, Tolonen M, Ball CG, Kirkpatrick AW. Secondary Peritonitis and Intra-Abdominal Sepsis: An Increasingly Global Disease in Search of Better Systemic Therapies. Scand J Surg. 2021 Jun;110(2):139–49.

11. Ross JT, Matthay MA, Harris HW. Secondary peritonitis: principles of diagnosis and intervention. BMJ. 2018 Jun 18;361:k1407.

12. Calandra T, Cohen J, Conference for the ISFD of I in the IC. The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit. Critical Care Medicine. 2005 Jul;33(7):1538.

13. Matrana MR, Margolin DA. Epidemiology and Pathophysiology of Diverticular Disease. Clin Colon Rectal Surg. 2009 Aug;22(3):141–6.

14. Schneider R, Perugini R, Karthikeyan S, Okereke O, Herscovici DM, Richard A, et al. Perforated peptic ulcer disease in

transferred patients is associated with significant increase in length of stay. Surg Endosc. 2024 Mar;38(3):1576–82.

15. Di Saverio S, Birindelli A, Kelly MD, Catena F, Weber DG, Sartelli M, et al. WSES Jerusalem guidelines for diagnosis and treatment of acute appendicitis. World Journal of Emergency Surgery. 2016 Jul 18;11(1):34.

16. Potey K, Kandi A, Jadhav S, Gowda V. Study of outcomes of perforated appendicitis in adults: a prospective cohort study. Ann Med Surg (Lond). 2023 Mar 16;85(4):694–700.

17. Andersson RE. The natural history and traditional management of appendicitis revisited: spontaneous resolution and predominance of prehospital perforations imply that a correct diagnosis is more important than an early diagnosis. World J Surg. 2007 Jan;31(1):86–92.

18. Agresta F, Ciardo LF, Mazzarolo G, Michelet I, Orsi G, Trentin G, et al. Peritonitis: laparoscopic approach. World Journal of Emergency Surgery. 2006 Mar 24;1(1):9.

19. Virdis F, Podda M, Reccia I, Gallo G, Khan M, Martin M, et al. Laparoscopy and Minimally Invasive Surgery Techniques in Acute Care Surgery. In: Chiara O, editor. Trauma Centers and Acute Care Surgery: A Novel Organizational and Cultural Model [Internet]. Cham: Springer International Publishing; 2022 [cited 2024 Dec 9]. p. 235–48. Available from: https://doi.org/10.1007/978-3-030-73155-7_19

20. Zafar SN, Onwugbufor MT, Hughes K, Greene WR, Cornwell EE, Fullum TM, et al. Laparoscopic surgery for trauma: the realm of therapeutic management. The American Journal of Surgery. 2015 Apr 1;209(4):627–32.

21. Malangoni MA, Inui T. Peritonitis – the Western experience. World Journal of Emergency Surgery. 2006 Sep 5;1(1):25.

22. Sokhal BS, Mohamedahmed A, Zaman S, Wuheb AA, Abdalla HE, Husain N, et al. Laparoscopic versus open repair for peptic ulcer perforation: a systematic review, meta-analysis and trial sequential analysis of randomised controlled trials. Time to conclude! Ann R Coll Surg Engl. 2024 Oct 3;rcsann20240082.

23. Sermonesi G, Tian BWCA, Vallicelli C, Abu-Zidan FM, Damaskos D, Kelly MD, et al. Cesena guidelines: WSES consensus statement on laparoscopic-first approach to general surgery emergencies and abdominal trauma. World Journal of Emergency Surgery. 2023 Dec 8;18(1):57.

24. Gomes CA, Sartelli M, Podda M, Di Saverio S, Coccolini F, Segovia-Lohse HA, et al. Laparoscopic versus open approach for diffuse peritonitis from appendicitis ethiology: a subgroup analysis from the Physiological parameters for Prognosis in Abdominal Sepsis (PIPAS) study. Updates Surg. 2020 Mar 1;72(1):185–91.

25. Gutt CN, Oniu T, Mehrabi A, Schemmer P, Kashfi A, Kraus T, et al. Circulatory and Respiratory Complications of Carbon Dioxide Insufflation. Digestive Surgery. 2004 Jun 18;21(2):95–105.

26. Marshall Rl, Jebson Pjr, Davie It, Scott Db. Circulatory Effects of Carbon Dioxide Insufflation of the Peritoneal Cavity For Laparoscopy. BJA: British Journal of Anaesthesia. 1972 Jul 1;44(7):680–4.

27. Sartelli M, Barie P, Agnoletti V, Al-Hasan MN, Ansaloni L, Biffl W, et al. Intra-abdominal infections survival guide: a position statement by the Global Alliance For Infections In Surgery. World Journal of Emergency Surgery. 2024 Jun 8;19(1):22.

28. Sánchez-Rodríguez M, Tejedor P. Faecal peritonitis. British Journal of Surgery. 2024 Jul 1;111(7):znae169.

29. de'Angelis N, Marchegiani F, Schena CA, Khan J, Agnoletti V, Ansaloni L, et al. Training curriculum in minimally invasive emergency digestive surgery: 2022 WSES position paper. World Journal of Emergency Surgery. 2023 Jan 27;18(1):11.

30. Stahel PF, Cobianchi L, Dal Mas F, Paterson-Brown S, Sakakushev BE, Nguyen C, et al. The role of teamwork and non-technical skills for improving emergency surgical outcomes: an international perspective. Patient Safety in Surgery. 2022 Feb 8;16(1):8.