International Surgery Journal
Mourad R et al. Int Surg J. 2026 Mar;13(3):505-512
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20260484

Review Article

Robotic surgery in emergency abdominal surgery: current applications and future directions

Rayan Mourad[1,2]*, Ernest Cheng[2-4], Mina Sarofim[2-4], Assad Zahid[3,4]

[1]Department of Surgery, St. George Hospital, Kogarah, New South Wales, Australia
[2]St George and Sutherland Clinical Campus, School of Clinical Medicine, UNSW Medicine and Health, Sydney, New South Wales, Australia
[3]Department of Colorectal Surgery, Liverpool Hospital, Liverpool, New South Wales, Australia
[4]Innovation, Surgical Teaching and Research Unit, Liverpool, New South Wales, Australia

Received: 30 January 2026
Revised: 11 February 2026
Accepted: 13 February 2026

***Correspondence:**
Dr. Rayan Mourad,
E-mail: rayan.mourad@health.nsw.gov.au

ABSTRACT

Emergency abdominal surgery carries substantial morbidity, mortality, and healthcare utilisation. While laparoscopy is now standard for many acute abdominal conditions, the role of robotic-assisted surgery remains debated in emergency settings due to concerns regarding time to source control, cost, system access, and staffing. Across indications, robotic emergency surgery appears feasible and generally safe in carefully selected, haemodynamically stable patients managed in experienced centres. Short-term clinical outcomes are broadly comparable to laparoscopy, with the most consistent potential advantage being reduced conversion-to-open rates in technically challenging cases at the expense of longer operative times in several cohorts. For common emergencies such as acute cholecystitis and appendicitis, evidence does not demonstrate clear superiority over laparoscopy, and safety signals during adoption underscore the need for governance and audit. Economic analyses consistently report higher costs for robotic emergency cases that are not reliably offset by shorter length of stay or reduced complications. Robotic-assisted surgery should therefore be considered a selective adjunct in emergency abdominal surgery, guided by patient stability, procedural complexity, surgeon expertise, and institutional resources.

Keywords: Robotic surgery, Minimally invasive surgery, Emergency general surgery

INTRODUCTION

Emergency abdominal surgery includes urgent, unplanned operative interventions for acute intra-abdominal conditions. This common include the management of appendicitis, cholecystitis, bowel obstruction, perforated peptic ulcers, bowel ischaemia, and complicated diverticular disease. Emergency abdominal surgery is a common and essential component of our healthcare system and accounts for millions of hospital admissions each year worldwide. In comparison to elective and planned procedures, it has, expectantly, higher rates of morbidity, mortality, and healthcare utilisation than elective procedures.[1,2] Over recent decades, minimally invasive surgery (MIS) has increasingly replaced open surgery for many emergency abdominal procedures, with laparoscopy now considered standard of care. Conditions once considered unsuitable for minimally invasive surgery such as perforated diverticular disease, are increasingly being managed with laparoscopic or other minimally invasive approaches, reflecting a shift in contemporary surgical practice.[3]

Robotic-assisted surgery now represents the most technologically advanced form of MIS. Compared with conventional laparoscopy, robotic platforms provide three-

dimensional visualization, articulated instruments, tremor filtration, and improved ergonomics. Early adoption of robotic-assisted surgery occurred primarily in anatomically confined and technically challenging regions, such as the pelvis.[4] However, the advantages from robotic platforms can be now employed in technically demanding emergency scenarios, such as where there is severe inflammation, distorted anatomy, obesity, or in redo operations. While robotic surgery has become widely adopted in elective abdominal procedures, particularly in colorectal, urological, gynaecological, and bariatric surgery, its role in emergency settings remains controversial.

Concerns regarding operative time, system availability, cost, staffing, and potential delays to definitive source control have historically limited adoption; however, in some parts of the world, growing institutional experience has prompted expanding use in selected emergencies. In 2021, the World Society of Emergency Surgery (WSES) stated that an emergency setting should not be considered an absolute contraindication to robotic surgery, provided appropriate expertise, infrastructure, and patient selection are ensured.[5] This review aims to synthesizes contemporary evidence on robotic surgery in emergency abdominal conditions, focusing on clinical outcomes by indication, economic considerations, surgeon perspectives and workflow, global utilization patterns, and remaining gaps in the literature.

METHODS

Search strategy

A narrative literature review was conducted to evaluate the role of robotic-assisted surgery in emergency abdominal surgery. Two authors independently performed a comprehensive search of the published literature. Electronic databases searched included MEDLINE (via PubMed), Embase, and Scopus. The search covered publications from January 2000 to December 2025. This reflected the period of clinical availability and adoption of robotic surgical platforms.

Search terms were combined using Boolean operators and included variations of: “robotic surgery”, “robot-assisted surgery”, “emergency surgery”, “emergency abdominal surgery”, “acute care surgery”, “urgent surgery”, “appendicitis”, “cholecystitis”, “bowel obstruction”, “perforation”, “diverticulitis”, “colorectal emergency”, and “incarcerated hernia”. Reference lists of relevant articles and reviews were manually screened to identify additional studies not captured by the initial search.

Study selection

Titles and abstracts were screened independently by the two reviewing authors to identify potentially relevant studies. Full-text review was undertaken for articles deemed relevant or where eligibility was uncertain. Discrepancies were resolved through discussion, with input from a senior author where consensus could not be reached.

Inclusion criteria

Studies included if they reported on robotic-assisted surgery performed in an emergency or urgent abdominal setting, adult patients, reported clinical outcomes, feasibility, safety, or comparative data and original research articles, systematic reviews, or consensus statements.

Exclusion criteria

Studies were excluded if they focused exclusively on elective surgery and paediatric-only series.

Data extraction and synthesis

Data extracted included study design, patient population, emergency indication, type of robotic procedure, comparator (if any), peri-operative outcomes, conversion rates, complications, length of stay, costs (where reported), and study limitations. Given the heterogeneity of study designs, indications, and outcome measures, formal meta-analysis was not performed.

Instead, findings were synthesized narratively and grouped by clinical indication (e.g. acute cholecystitis, appendicitis, colorectal emergencies, bowel obstruction, perforation, and incarcerated hernias), with additional thematic analysis addressing cost, workflow, clinician perspectives, and global utilization patterns.

Development of the discussion

Following data extraction, the authors collectively reviewed and interpreted the evidence to identify consistent findings, areas of controversy, and gaps in the literature. Particular attention was paid to patient selection, institutional factors, and comparative effectiveness versus laparoscopy. The discussion was developed iteratively through group consensus and refined to reflect contemporary emergency surgery practice and guideline recommendations.

CLINICAL OUTCOMES BY INDICATION

Acute cholecystitis

Robotic cholecystectomy has seen increasing adoption in acute care surgery, particularly in high-volume centres.[6,7] Multiple observational studies report lower conversion-to-open rates with robotic approaches compared with laparoscopy, suggesting potential technical advantages in difficult inflammatory dissections.[7] These advantages, however, have not consistently translated into superior clinical outcomes particularly when compared to the cost. Comparative analysis of robotic versus laparoscopic

emergency abdominal surgery including cholecystectomies, demonstrated that the peri-operative outcomes to cost ratio was typically higher and operative time varied significantly depending on the procedure.[8,9] In the acute cholecystitis setting specifically, Woldehana et al reported higher postoperative complication rates and longer length of stay for robotic cases, with similar bile duct injury rates as laparoscopic cases.[10]

In contrast, Mullens et al, using Medicare claims data, identified higher bile duct injury rates following robotic-assisted cholecystectomy across patient complexity subgroups.[11] These findings should be interpreted cautiously, as claims-based analyses are susceptible to confounding related to case selection, coding, and adoption phase, but they nonetheless highlight the need for careful governance and robust audit when introducing robotic pathways for emergency biliary surgery. This mirrors the experience seen during the early adoption of laparoscopic cholecystectomy, where unfamiliarity with new technology, evolving surgical concepts, and learning-curve effects initially resulted in higher complication rates compared with open surgery.[12]

Additional non-emergency comparative studies are frequently cited to contextualize learning curves, efficiency, and training implications. For instance, Ghanem et al reported a case-control analysis suggesting feasibility and exploring resident training implications, while Balachandran et al compared single-site robotic with multi-port laparoscopic cholecystectomy in benign disease, concluding that multi-port laparoscopy should remain standard, with single-site robotics being a suitable alternative for selected patients with benign gallbladder pathology.[13,14]

Additionally, given the higher rates of wound infection and incisional hernia post-operatively for patients who had undergone robotic cholecystectomy, careful counselling regarding these post-operative complications should be performed while consenting for this procedure.[14] Randomized data in benign gallbladder disease suggest that robot-assisted single-site cholecystectomy can reduce surgeon stress and match patient outcomes but increases costs compared to traditional laparoscopy.[15]

Large elective series and learning-curve comparisons further support future feasibility but are not directly generalizable to emergency inflamed gallbladders, where time-to-source control, staffing and theatre logistics are key determinants of safety.[16,17] Overall, robotic cholecystectomy appears feasible in experienced centres, but current evidence does not demonstrate clear superiority over laparoscopy, and cost and safety indicators require ongoing scrutiny. Nonetheless, wider adoption within appropriately governed settings may be required to mature learning curves, optimize efficiency, and support structured training of future surgeons.

Acute appendicitis

Robotic appendicectomy remains uncommon in emergency practice. National analyses in the United States (US) demonstrate that robotic cases account for less than 1% of emergency appendicectomies.[6] Comparative studies indicate that robotic appendicectomy is feasible and associated with broadly similar short-term outcomes compared with laparoscopy. Becker et al, using ACS-NSQIP data, reported no clear reduction in 30-day morbidity or readmission, while operative times were longer for robotic cases.[18] While mortality events were rare across both groups, robotic appendicectomies had a higher mortality rate. Interpretation is limited, however, as robotic cases accounted for only 0.1% of included cases.[18] Furthermore, there is the potential for confounding such as due to the higher rates of appendiceal tumours or malignancy in the robotic subgroup.[18] Given the efficiency and excellent outcomes of laparoscopic appendicectomy, current evidence does not support routine robotic appendicectomies. Its role is likely limited to selected complex cases, such as patients with perforated appendicitis or significant obesity, but data supporting its use in these populations are lacking. The potential value of robotic appendicectomy may therefore lie in selected complex scenarios; patients with extensive intra-abdominal adhesions from prior surgery, severe inflammatory or perforated disease, or cases in which unexpected pathology raises concern for appendiceal neoplasia and the need for more advanced dissection or conversion to oncologic resection. In these situations, the enhanced dexterity and visualization offered by robotic platforms may facilitate a safer adhesiolysis and decision-making, although supportive comparative data remain limited.

Small bowel obstruction

Evidence supporting robotic surgery for small bowel obstruction (SBO) is limited, and published experience is dominated by small, heterogeneous series and mixed-indication cohorts. In a systematic review of robotic-assisted surgery for acute abdominal emergencies in which 1,142 cases were included, Coco and Leanza reported that SBO accounted for a meaningful minority of emergency robotic procedures but noted that comparative data were sparse, and indications varied substantially.[19] Two additional systematic reviews that explicitly assessed emergency and urgent general surgery reached similar conclusions.[8,9] Anyomih et al evaluated comparative studies of emergency robotic versus laparoscopic general surgery and found overall peri-operative outcomes broadly comparable in selected patients, but highlighted the limited number of comparative studies, substantial heterogeneity, and higher costs associated with robotics across several indications.8 Reinisch et al similarly concluded that urgent abdominal operations can be performed robotically without an obvious signal of excess harm, but emphasized that evidence is primarily retrospective, selection is likely strong, and outcomes are inconsistently reported,

limitations that are particularly important for SBO, where bowel viability, distension, and physiological compromise drive outcomes and conversion thresholds.[9]

From a technical standpoint, robotics may theoretically facilitate meticulous adhesiolysis and intracorporeal suturing, such as for iatrogenic enterotomy repair, but these potential advantages have not yet been demonstrated in robust comparative SBO cohorts. In practice, many patients with SBO present with marked bowel distension, ischaemia, or haemodynamic instability, which may limit suitability for a robotic approach and favour rapid open access. Therefore, the most defensible interpretation of current evidence is that robotic surgery for SBO is feasible in carefully selected, physiologically stable patients within high-volume robotic programmes, but remains investigational with respect to comparative efficacy and cost-effectiveness.

Perforated peptic ulcer

Robotic repair of perforated peptic ulcer has emerged as a niche application of robotic surgery, and US national trend analyses indicate increasing robotic utilization for minimally invasive ulcer repair within emergency general surgery.[6] The robotic platform may facilitate intracorporeal suturing and omental patch placement, however, the emergency upper gastrointestinal perforation evidence base remains narrow, and is often reported as part of mixed emergency cohorts rather than disease-specific comparative studies.[8] In comparative synthesis, Anyomih et al. noted that emergency robotic surgery outcomes appear broadly comparable to laparoscopy in selected patients but emphasized limited comparative evidence and higher costs associated with robotics in several settings.[8] Reinisch et al likewise highlighted that urgent robotic surgery is feasible across multiple abdominal emergencies, but the heterogeneity of included operations and the predominance of retrospective designs preclude strong evidence-based recommendations.[9] In Coco and Leanza's systematic review of acute abdominal emergencies, perforated peptic ulcer comprised a notable proportion of published emergency robotic cases, with conversions and complications generally within the expected range for selected minimally invasive perforation cohorts.[19] Nevertheless, high-quality head-to-head comparisons remain uncommon.

The most relevant disease-adjacent comparative dataset is provided by Robinson et al., who examined emergent robotic versus laparoscopic repair of perforated gastrojejunal ulcers in 44 patients and reported comparable clinical outcomes with higher costs for robotic cases.[20] Notably, "in-room-to-incision" time was not prolonged with robotics in that centre, underscoring that institutional workflow and team familiarity can be as important as platform choice in emergency care.[20] While gastrojejunal ulcer perforation, often post-bypass, is not identical to classic gastric or duodenal peptic ulcer perforation, these data offer proof-of-concept that robotic suturing can be deployed in time-sensitive perforation scenarios when systems are mature. Overall, current evidence supports feasibility of robotic perforation repair in haemodynamically stable patients where expertise and rapid access exist, but does not establish superiority over laparoscopy, and the priority remains timely source control and sepsis management. Robotic surgery may have an expanding role in the management of perforated peptic ulcer disease, particularly in complex presentations involving large, friable, or anatomically challenging ulcers that are not amenable to simple omental patch repair. Drawing on evidence from emergency bariatric surgery, robotic platforms may offer technical advantages when definitive procedures such as gastric resection or bypass are required, potentially reducing conversion to open surgery. Importantly, ulcer complexity is often difficult to predict pre-operatively, and intra-operative conversion from laparoscopy to robotics is frequently impractical due to time, workflow, and resource constraints. In this context, an upfront robotic approach may be advantageous in carefully selected cases where operative complexity is anticipated. Future studies should focus on defining the role of robotic surgery in complex perforated peptic ulcer disease, particularly its impact on conversion-to-open rates, operative decision-making, and clinical outcomes compared with conventional laparoscopic approaches.

Colorectal emergencies

Emergency colorectal surgery represents one of the most promising applications of robotic technology. US national database studies demonstrate significantly lower conversion-to-open rates for robotic emergency colectomy compared with laparoscopy.[7] Procedure-specific evidence in emergent diverticulitis is provided by Curfman et al, who analyzed a large national database and found that robotic colectomy in emergent diverticulitis was associated with longer operative time, but substantially lower conversion compared with laparoscopy, with several favourable outcome signals versus open surgery.[21] However, interpretation is again limited by selection effects, institutional expertise, and potential unmeasured confounds.[21] A systematic review and meta-analysis focusing on acute colorectal emergencies found lower conversion and complication rates with robotic surgery, albeit with longer operative times and no mortality difference, supporting the concept that robotics may help maintain minimally invasive surgery in technically challenging emergency colorectal cases.[22] Adoption-phase single-centre data further suggest that comparable outcomes can be achieved during implementation with structured pathways, appropriate training, and careful selection.[23]

Additional colorectal literature, which largely presents elective or mixed urgency data, is often cited to contextualize technical advantages and conversion effects. For example, Anderson et al reported early experience with urgent robotic subtotal colectomy for severe acute ulcerative colitis, demonstrating feasibility and peri-

operative outcomes comparable with laparoscopy in a small cohort.[24] Solaini et al's meta-analysis of predominantly elective robotic versus laparoscopic left colectomy found lower conversion with robotics and suggested possible morbidity advantages in some subgroups, although these findings are not directly emergency-specific.[25] Similarly, Zambonin et al compared minimally invasive approaches in Crohn's disease and reported short- and longer-term outcomes and quality-of-life measures with no statistically significant differences in complication rates for robotic surgery compared to other forms of MIS, however better hospital experiences as reported by patients.[26] While not an emergency study, it illustrates how robotic platforms may perform in complex inflammatory dissection and redo operations, which may be comparable to emergency phenotypes.[26] Overall, the findings of these papers suggest that robotics may be particularly valuable in complex emergency colorectal surgery by reducing conversion to open, but high-quality prospective comparative studies and cost-effectiveness analyses are required.

Incarcerated hernias

Robotic surgery for emergency abdominal wall hernia is an emerging application, driven largely by the efficiency of robotic preperitoneal approaches in elective practice and the desire to extend minimally invasive benefits to selected urgent cases. In a high-volume Australian centre, a prospective cohort of 200 elective robotic transabdominal preperitoneal (R-TAPP) inguinal hernia repairs demonstrated short console and "skin-to-skin" times with a day-only protocol and low short-term morbidity, illustrating how standardized workflows can make robotic inguinal hernia repair operationally efficient, an important prerequisite if robotics is to be deployed in urgent pathways.[27] Translating this to emergencies, Murgante Testa et al reported a retrospective, propensity-matched comparison of incarcerated inguinal hernia repair showing that emergency R-TAPP was feasible and safe in carefully selected patients.[28] Among 34 patients which included 15 R-TAPP and 19 open repairs, there were no intra-operative complications, operative time was similar between approaches, and bowel resections occurred only in the open cohort, likely reflecting selection of more compromised cases for open surgery.[28]

For ventral and incisional hernias, Kudsi et al described a single-centre series of emergent robotic ventral hernia repair consisting of 34 cases with acceptable morbidity and low midterm recurrence, supporting feasibility in selected presentations of incarcerated hernias.[29] Importantly, these reports are observational and subject to selection bias. In strangulation with suspected ischaemia, perforation, or physiological instability, rapid open-source control may remain appropriate. Mesh strategy should follow established emergency hernia principles. WSES guidance highlights ongoing debate regarding mesh use where bowel resection or contamination is present, considerations that apply irrespective of platform.[30]

Emergency hernia surgery in the upper gastrointestinal and diaphragmatic domains has also been reported. Ceccarelli et al described five cases of minimally invasive laparoscopic and robot-assisted emergency treatment of strangulated giant hiatal hernias and reviewed available literature, supporting feasibility in selected patients within experienced units, although evidence remains limited to small series.[31] Taken together, robotic emergency hernia surgery appears feasible in selected patients where expertise and access exist, but robust comparative data are limited, and generalizability is constrained by centre-related factors.

COST AND ECONOMIC CONSIDERATIONS

Robotic surgery is associated with higher direct costs due to capital investment, maintenance, and disposable instruments. US national database analyses consistently demonstrate higher hospitalization costs for robotic emergency cases compared with laparoscopy, and comparative emergency syntheses similarly note higher costs as a recurring theme.[6-8] These costs have not been consistently offset by reductions in complications or length of hospital stay. Emergency surgery introduces additional economic challenges, including after-hours staffing and competition with elective robotic cases. Learning-curve effects may further increase costs during early implementation. Emergency-specific cost-effectiveness analyses incorporating long-term outcomes or quality-adjusted life years are currently lacking. Broader economic principles regarding robotic surgery costs are well established in the elective setting.[32] Until platform costs decrease, or stronger evidence of clinical benefit emerges, robotic emergency surgery is likely to remain concentrated in high-resource centres.

CLINICIAN PERSPECTIVES, TEAM FACTORS, AND WORKFLOW

Expert consensus emphasizes that robotic emergency surgery is feasible but dependent on surgeon experience and institutional readiness. WSES guidance recommends limiting robotic emergency surgery to haemodynamically stable patients and experienced teams.[4] While we agree that this reflects the current realities of feasibility, safety, and learning-curve considerations, continued progress in robotic emergency surgery will ultimately require broader and more proactive adoption within appropriately governed settings. Prescribing restrictive guidelines only risks limiting experiential growth, delaying skill acquisition, and impeding the evolution of technology and practice necessary to define its optimal role in emergency care. Successful implementation requires trained operating theatre staff and rapid system availability. UK-based analyses demonstrate that robotic emergency surgery is largely confined to tertiary centres with established elective programmes and adequate workforce capacity.[33] Adoption-phase studies highlight that outcomes comparable to conventional surgery can be achieved with structured implementation, and systematic evidence

reviews emphasize that most published data arise from high-volume centres, with heterogeneity and selection limiting inference.[9,23,34]

Clinician attitudes remain mixed. Proponents cite improved ergonomics and precision, particularly in challenging dissections, while critics emphasize increased operative time and cost, as well as potential delays to source control. Workflow efficiency, particularly out-of-hours availability, remains a key determinant of feasibility. Overall, clinician consensus is largely in line with available evidence and supports selective robotic use in emergencies where clear technical advantages are anticipated, and institutional conditions permit safe and timely execution.

In the Australian context, our adoption of robotic surgery has been comparatively slower, likely reflecting the realities of a universal healthcare system in which the cost–benefit profile of new technologies must be carefully evaluated before widespread implementation. As Australian surgeons, we identify a greater uptake has been observed in the private sector, but only within elective surgical practice. We have a clear enthusiasm for the use of robotic platforms in emergency surgery; however, practical and systemic barriers currently limit broader implementation within our healthcare environment.

GLOBAL UTILIZATION AND DISTRIBUTION

Robotic emergency abdominal surgery is practiced predominantly in high-income regions. The United States accounts for the majority of robotic installations and produces most large-scale outcome data.[6] Western Europe, particularly Italy and the United Kingdom, has contributed significantly to clinical experience and consensus development.[4,33] Select centres in East Asia and the Middle East also report emergency robotic use. Utilization is largely confined to tertiary referral centres with established elective robotic programmes and continuous technical support. Global diffusion remains uneven, with substantial barriers in low- and middle-income countries related to cost, infrastructure, and training.[35] In Australia, robotic general surgery is available mainly in larger metropolitan tertiary hospitals and remains largely reserved for elective operations.

EVIDENCE GAPS AND FUTURE DIRECTIONS

The current evidence base is limited by retrospective designs, selection bias, and heterogeneity across indications. Prospective multicentre registries and comparative studies are needed to better define patient selection, learning curves, and outcomes. Emergency-specific cost-effectiveness analyses remain a priority. Long-term outcomes, including quality of life and long-term complications such as incisional hernia rates, are poorly studied.[34] Additional work is also needed to define training standards, optimize emergency workflows, and evaluate emerging technologies such as tele-mentoring and next-generation robotic platforms.

CONCLUSION

Robotic-assisted surgery in emergency abdominal conditions is feasible and generally safe in carefully selected patients treated at experienced centres. Short-term outcomes across various indications appear comparable to laparoscopy, with consistent evidence of reduced conversion-to-open rates in complex cases, particularly colorectal emergencies. Robotic approaches have however not demonstrated clear superiority in morbidity or mortality and are associated with higher initial and ongoing costs, which are not significantly offset by reduced lengths of stay. Currently, robotic emergency surgery should therefore be viewed as a selective adjunct rather than a standard approach. Its use should be individualized based on patient stability, procedural complexity, surgeon expertise, and institutional resources. Ongoing technological advances and higher-quality evidence will ultimately determine whether robotic platforms assume a broader role in emergency abdominal surgery or remain a relatively niche application. Nevertheless, there is reason for cautious optimism. The current trajectory of robotic emergency surgery may parallel the evolution of laparoscopic surgery in the 1990s and early 2000s, where early concerns regarding cost, efficiency, and safety gradually gave way to widespread adoption as technology matured, experience increased, and evidence accumulated. With ongoing refinement of platforms, improved access, and structured training of future surgeons, robotic surgery has the potential to transition from a selective adjunct to an integral component of emergency abdominal surgical care in appropriately selected settings.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Havens JM, Peetz AB, Do WS, Cooper Z, Kelly E, Askari R, et al. The excess morbidity and mortality of emergency general surgery. J Trauma Acute Care Surg. 2015;78(2):306-11.
2. Scott JW, Olufajo OA, Brat GA, Rose JA, Zogg CK, Haider AH, et al. Use of national burden to define operative emergency general surgery. JAMA Surg. 2016;151(6):e160480.
3. Bunjo Z, Traeger L, Murshed I, Bedrikovetski S, Dudi-Venkata NN, Dobbins C, et al. Impact of surgeon specialization on outcomes in emergency colorectal surgery: a systematic review and meta-analysis. Dis Colon Rectum. 2025;68(1):14-30.
4. de'Angelis N, Khan J, Marchegiani F, Bianchi G, Aisoni F, Alberti D, et al. Robotic surgery in emergency setting: 2021 WSES position paper. World J Emerg Surg. 2022;17(1):4.

5. Alkatout I, O'Sullivan O, Peters G, Maass N. Expanding robotic-assisted surgery in gynecology using the potential of an advanced robotic system. Medicina (Kaunas). 2023;60(1):53.
6. Charland N, Hadaya J, Mallick S, Tran Z, Cho NY, Le N, et al. National trends and outcomes of robotic emergency general surgery in the United States. Surgery. 2024;176(3):835-40.
7. Lunardi N, Abou-Zamzam A, Florecki KL, Chidambaram S, Shih IF, Kent AJ, et al. Robotic technology in emergency general surgery cases in the era of minimally invasive surgery. JAMA Surg. 2024;159(5):493-9.
8. Anyomih TT, Mehta A, Sackey D, Woo CA, Gyabaah EY, Jabulo M, et al. Robotic versus laparoscopic general surgery in the emergency setting: a systematic review. J Robot Surg. 2024;18(1):281.
9. Reinisch A, Liese J, Padberg W, Ulrich F. Robotic operations in urgent general surgery: a systematic review. J Robot Surg. 2023;17(2):275-90.
10. Woldehana NA, Jung A, Parker BC, Coker AM, Haut ER, Adrales GL. Clinical outcomes of laparoscopic vs robotic-assisted cholecystectomy in acute care surgery. JAMA Surg. 2025;160(7):755-62.
11. Mullens CL, Sheskey S, Thumma JR, Dimick JB, Norton EC, Sheetz KH. Patient complexity and bile duct injury after robotic-assisted vs laparoscopic cholecystectomy. JAMA Netw Open. 2025;8(3):e251705.
12. Strasberg SM, Brunt ML. Rationale and use of the critical view of safety in laparoscopic cholecystectomy. J Am Coll Surg. 2010;211(1):132-8.
13. Ghanem M, Shaheen S, Blebea J, Tuma F, Zayout M, Conti N, et al. Robotic versus laparoscopic cholecystectomy: case-control outcome analysis and surgical resident training implications. Cureus. 2020;12(4):e7641.
14. Balachandran B, Hufford TA, Mustafa T, Kochar K, Sulo S, Khorsand J. A comparative study of outcomes between single-site robotic and multi-port laparoscopic cholecystectomy: an experience from a tertiary care centre. World J Surg. 2017;41:1246-53.
15. Grochola LF, Soll C, Zehnder A, Wyss R, Herzog P, Breitenstein S. Robot-assisted versus laparoscopic single-incision cholecystectomy: results of a randomized controlled trial. Surg Endosc. 2019;33(5):1482-90.
16. Lee JH, Song KB, Shin SH, Kim SC, Lee YJ, Park KM. Robotic single-site cholecystectomy of 520 cases: surgical outcomes and comparing with laparoscopic single-site procedure. Surg Endosc. 2018;32(1):S351.
17. Spinoglio G, Lenti LM, Maglione V, Lucido FS, Priora F, Bianchi PP, et al. Single-site robotic cholecystectomy (SSRC) versus single-incision laparoscopic cholecystectomy (SILC): comparison of learning curves. First European experience. Surg Endosc. 2012;26(6):1648-55.
18. Becker T, DeLeon G, Rao V, Pei KY. A comparison of outcomes between laparoscopic and robotic appendectomy among ACS-NSQIP hospitals. Laparosc Endosc Robot Surg. 2023;6(2):39-42.
19. Coco D, Leanza S. Robotic-assisted surgery for acute abdominal emergencies: a systematic review of 1142 cases. J Robot Surg. 2025;19(1):558.
20. Robinson TD, Sheehan JC, Patel PB, Marthy AG, Zaman JA, Singh TP. Emergent robotic versus laparoscopic surgery for perforated gastrojejunal ulcers: a retrospective cohort study of 44 patients. Surg Endosc. 2022;36(2):1573-7.
21. Curfman KR, Jones IF, Conner JR, Neighorn CC, Wilson RK, Rashidi L. Robotic colorectal surgery in the emergent diverticulitis setting: is it safe? A review of large national database. Int J Colorectal Dis. 2023;38:142.
22. Coco D, Leanza S. Robotic surgery in acute colorectal emergencies: a comprehensive systematic review and meta-analysis. J Robot Surg. 2025;19(1):738.
23. Cole K, Shahdoost-Rad A, Ibrahim Y, Chaplin G, Pucher PH. Robotic emergency general surgery, future or fallacy? case-matched comparison of operative and clinical outcomes during the adoption phase in a tertiary centre. J Robot Surg. 2025;19(1):657.
24. Anderson M, Lynn P, Aydinli HH, Schwartzberg D, Bernstein M, Grucela A. Early experience with urgent robotic subtotal colectomy for severe acute ulcerative colitis has comparable perioperative outcomes to laparoscopic surgery. J Robot Surg. 2020;14:249-53.
25. Solaini L, Bocchino A, Avanzolini A, Annunziata D, Cavaliere D, Ercolani G. Robotic versus laparoscopic left colectomy: a systematic review and meta-analysis. Int J Colorectal Dis. 2022;37(7):1497-507.
26. Zambonin D, Giudici F, Ficari F, Pesi B, Malentacchi C, Scaringi S. Preliminary study of short- and long-term outcome and quality of life after minimally invasive surgery for Crohn's disease: comparison between single incision, robotic-assisted and conventional laparoscopy. J Minim Access Surg. 2020;16(4):364-71.
27. Choi JD, Bradford L, Tang K, Bukofzer M, Dunkin P, Wong H, et al. Robotic transabdominal preperitoneal inguinal hernia repair is feasible and efficient: a prospective cohort study of a day-only protocol from a high-volume robotic surgery centre evaluating short-term outcomes. ANZ J Surg. 2025;95(10):2097-103.
28. Murgante Testa N, Mongelli F, Sabbatini F, Iaquinandi F, Prouse G, Pini R, et al. Safety and feasibility of emergency robot-assisted transabdominal preperitoneal repair for the treatment of incarcerated inguinal hernia: a retrospective study. World J Surg. 2024;48(3):622-8.
29. Kudsi OY, Bou-Ayash N, Chang K, Gokcal F. Perioperative and midterm outcomes of emergent

robotic repair of incarcerated ventral and incisional hernia. J Robot Surg. 2021;15(3):473-81.
30. Birindelli A, Sartelli M, Di Saverio S, Coccolini F, Ansaloni L, Van Ramshorst GH, et al. 2017 update of the WSES guidelines for emergency repair of complicated abdominal wall hernias. World J Emerg Surg. 2017;12:37.
31. Ceccarelli G, Pasculli A, Bugiantella W, De Rosa M, Catena F, Rondelli F, et al. Minimally invasive laparoscopic and robot-assisted emergency treatment of strangulated giant hiatal hernias: report of five cases and literature review. World J Emerg Surg. 2020;15:37.
32. Barbash GI, Glied SA. New technology and health care costs—the case of robot-assisted surgery. N Engl J Med. 2010;363(8):701-4.
33. Smith EF, Okocha M. Robotic surgery in emergency general surgery: an overview of UK practice. World J Emerg Surg. 2025;20(1):85.
34. Ibrahim Y, Rahman MA, Pickering O, Cole K, Pucher PH. Current evidence and reported experiences for robot-assisted emergency general surgery: systematic review. J Robot Surg. 2025;19(1):534.
35. Tustumi F, Bolm L, Edelmuth RC, Maegawa FA, Andraus W, Herman P, et al. Global strategies for the diffusion of robotic surgery. Arq Bras Cir Dig. 2025;38:e1908.

Cite this article as: Mourad R, Cheng E, Sarofim M, Zahid A. Robotic surgery in emergency abdominal surgery: current applications and future directions. Int Surg J 2026;13:505-12.