Outcomes After Stapled and Hand-sewn Intestinal Anastomosis in Emergency General Surgery: A Narrative Review with Practical Recommendations

Tamer.A.A.M.Habeeb[1], Walid Abdelmawla Elsayed Ali[2], Reham Zakaria Mohamed [3], Ahmed Hassan Soliman Yhya [4]

1 Professor of General Surgery, Faculty of Medicine, Zagazig University,
2 Assistant Professor of General Surgery, Faculty of Medicine, Zagazig University,
3 Lecturer of General Surgery, Faculty of Medicine, Zagazig University,
4 Resident of General Surgery, Faculty of Medicine, Zagazig University,

Corresponding Author: Ahmed Hassan Soliman Yhya

Received: 28 October 2024, **Accepted:** 17 November 2024, **Published:** 20 November 2024

Abstract

Background: Emergency general surgery accounts for a substantial proportion of surgical morbidity and mortality worldwide, with emergency laparotomy representing one of the highest-risk procedures. Intestinal resection with primary anastomosis is frequently required in this setting for indications such as bowel obstruction, ischemia, perforation, trauma, and complicated colorectal pathology. However, the hostile physiologic environment of emergency surgery, characterized by sepsis, peritonitis, hemodynamic instability, and bowel oedema, significantly increases the risk of anastomotic failure. The choice between stapled and hand-sewn intestinal anastomosis in emergencies remains controversial, with practice variability driven by surgeon preference, institutional resources, and patient-related factors rather than robust, uniform evidence.

Aim: This narrative review critically evaluates and synthesizes the available evidence comparing outcomes of stapled versus hand-sewn intestinal anastomosis in emergency general surgery. Particular emphasis is placed on clinically meaningful outcomes, including anastomotic leak, postoperative morbidity and mortality, reoperation rates, operative time, and resource utilization. In addition, this review seeks to contextualize technical considerations within the unique physiologic and contamination challenges of emergency laparotomy and to identify gaps in the current literature.

Methods: The existing literature suggests that, in selected emergency settings, stapled and hand-sewn anastomoses demonstrate broadly comparable leak and mortality rates, particularly in small-bowel anastomoses. Stapled techniques may offer advantages in operative time and technical consistency, while hand-sewn anastomosis allows greater adaptability in severely edematous or friable bowel. Outcomes appear to be influenced less by the anastomotic technique itself and more by patient physiology, degree of contamination, bowel perfusion, and surgeon judgment. Evidence specific to colonic and colorectal anastomosis in the emergency setting remains heterogeneous, with limited high-quality randomized data.

Conclusion: Current evidence does not support the universal superiority of either stapled or hand-sewn intestinal anastomosis in emergency general surgery. Optimal outcomes depend on careful patient selection, sound surgical principles, and individualized decision-making rather than technique alone. This review highlights the need for pragmatic, physiology-driven strategies and provides practical recommendations to guide surgeons in choosing the most appropriate anastomotic approach during emergency laparotomy.

Keywords: *Stapled, Hand-sewn Intestinal Anastomosis*

Introduction

Emergency general surgery represents a major global health burden, accounting for a disproportionate share of postoperative complications and deaths when compared with elective surgical practice. Emergency laparotomy, in particular, has consistently been associated with high rates of morbidity and mortality, often exceeding 10–15% even in modern healthcare systems [1, 2]. Patients requiring emergency bowel resection frequently present with physiological derangement, including sepsis, hypovolemia, metabolic acidosis, and organ dysfunction, all of which adversely affect wound healing and anastomotic integrity. Within this context, the decision to perform a primary intestinal anastomosis—and the choice of technique—remains one of the most critical and debated aspects of emergency surgical care [3].

Intestinal anastomotic leak is among the most feared complications following emergency laparotomy, as it is associated with increased rates of intra-abdominal sepsis, prolonged intensive care unit stay, need for reoperation, stoma formation, and mortality [4]. While elective colorectal surgery has benefited from extensive research evaluating anastomotic techniques, enhanced recovery pathways, and leak-prevention strategies, the emergency setting remains underrepresented in high-quality randomized trials. Consequently, many principles applied in elective surgery are extrapolated to emergencies without sufficient validation, potentially overlooking the unique challenges posed by contamination, bowel oedema, and compromised perfusion [5].

Stapled and hand-sewn anastomoses are the two principal techniques available to surgeons during emergency intestinal reconstruction. Stapling devices offer speed, technical reproducibility, and reduced tissue handling, which may be advantageous in unstable patients or damage-control scenarios. Conversely, hand-sewn anastomosis allows greater flexibility in tailoring the anastomosis to variable bowel diameter, friable tissue, or severe edema, conditions frequently encountered in emergency laparotomy [6]. Despite decades of use, there is no clear consensus regarding the superiority of one technique over the other in emergency general surgery, and practice patterns remain highly variable across institutions and surgeons.

Importantly, emerging evidence suggests that anastomotic outcomes in emergency surgery may be driven more by patient-related and disease-related factors—such as shock, peritonitis, ischemia, and malnutrition—than by the technical method of anastomosis itself [7]. This has led to growing interest in risk stratification, selective diversion, and physiology-based decision-making rather than rigid adherence to a particular anastomotic technique. Nevertheless, the lack of consolidated, procedure-specific guidance continues to challenge surgeons facing complex intraoperative decisions under time pressure.

This narrative review critically examines the available literature comparing stapled and hand-sewn intestinal anastomoses in emergency general surgery. By synthesizing evidence across different bowel segments, emergency indications, and clinical outcomes, this review seeks to clarify current knowledge, highlight persistent gaps in evidence, and provide practical, surgeon-oriented recommendations to support informed decision-making during emergency laparotomy [8].

Historical evolution of intestinal anastomosis

The fundamental principles of intestinal anastomosis were established long before the modern comparison between stapled and hand-sewn techniques. In the nineteenth century, Lembert described the concept of serosa-to-serosa apposition, recognizing that inversion of the bowel wall and approximation of serosal surfaces were central to secure healing. This observation formed the basis for classical hand-sewn techniques, including single-layer and double-layer anastomoses, which evolved alongside improvements in anesthesia, aseptic technique, and suture materials. These early developments remain relevant in emergency surgery, where adherence to basic biological principles continues to outweigh the importance of specific devices or materials [9, 10].

Mechanical stapling was introduced in the early twentieth century to standardize intestinal anastomosis and reduce operative time and contamination. The earliest stapling devices were cumbersome and saw

limited clinical use; however, technological advances during the mid-twentieth century, particularly in Eastern Europe, led to the development of more practical linear and circular staplers. Subsequent refinement and commercialization in Western surgical practice led to modern stapling systems now widely used in both elective and emergency gastrointestinal surgery. These innovations coincided with increasing procedural volume and complexity, reinforcing the appeal of faster, reproducible anastomotic construction in high-risk settings [11,12].

Despite widespread adoption of staplers, hand-sewn anastomosis has remained a core surgical skill, particularly in emergency general surgery. Emergency laparotomy frequently exposes surgeons to edematous, inflamed, ischemic, or friable bowel, as well as discrepancies in luminal diameter that may limit safe stapler application. In such circumstances, the adaptability of hand-sewn techniques allows precise control over tissue approximation, suture placement, and tension. The historical persistence of hand-sewn anastomosis reflects the reality that mechanical stapling has expanded, but not replaced, the surgeon's technical armamentarium [11–13].

From a contemporary perspective, the evolution of intestinal anastomosis supports a selective rather than dogmatic approach to technique choice. Stapled anastomoses offer speed, reduced bowel handling, and technical consistency, which are advantageous in unstable patients or damage-control scenarios. Conversely, hand-sewn techniques retain value when bowel conditions are unfavourable or when stapling devices are unavailable. Historical experience reinforces the concept that successful emergency intestinal anastomosis depends primarily on sound surgical judgment and respect for tissue biology rather than the exclusive use of either stapled or hand-sewn methods [10–13].

Physiologic challenges in emergency settings

Emergency general surgery patients frequently present with profound physiologic derangement that directly compromises intestinal healing. Hypovolemia, septic shock, metabolic acidosis, hypothermia, and coagulopathy are common at presentation and may persist intraoperatively despite aggressive resuscitation. These factors impair tissue perfusion and oxygen delivery at the anastomotic site, leading to delayed collagen synthesis and reduced tensile strength during the critical early phase of healing. In contrast to elective surgery, where patients are optimized preoperatively, emergency laparotomy often requires immediate operative intervention before physiologic normalization can be achieved, increasing the intrinsic risk of anastomotic failure regardless of technique [14,15].

Sepsis and peritonitis exert particularly detrimental effects on anastomotic integrity. Systemic inflammatory responses alter microcirculatory flow, promote endothelial dysfunction, and increase capillary permeability, leading to bowel wall oedema and impaired oxygen diffusion. Locally, bacterial contamination and inflammatory mediators disrupt the orderly progression of wound healing and may weaken the holding capacity of sutures or staples. Experimental and clinical data consistently demonstrate higher leak rates in the presence of diffuse peritonitis, reinforcing the importance of physiologic context over purely technical considerations when deciding whether and how to construct an anastomosis in emergency settings [16,17].

Hemodynamic instability and the need for vasopressor support further complicate decision-making during emergency laparotomy. While vasopressors are often necessary to maintain systemic perfusion, their vasoconstrictive effects may compromise splanchnic blood flow and exacerbate intestinal ischemia. Several observational studies have linked vasopressor use to increased anastomotic leak rates, although causality remains difficult to establish due to confounding by severity of illness. Nonetheless, the presence of ongoing shock or high-dose vasopressor requirements should prompt caution and may favor delayed reconstruction or diversion rather than immediate anastomosis, irrespective of whether stapled or hand-sewn techniques are employed [18, 19].

Nutritional depletion and hypoalbuminemia are also prevalent in emergency general surgery, particularly in patients with obstruction, malignancy, or chronic inflammatory disease. Protein-energy malnutrition impairs fibroblast proliferation, collagen deposition, and immune function, all of which are essential for anastomotic healing. Low serum albumin has repeatedly been identified as an independent predictor of anastomotic leak and postoperative mortality. In emergency settings, the inability to correct

nutritional deficits preoperatively underscores the need for heightened vigilance and conservative decision-making when considering primary anastomosis [20,21].

Taken together, these physiologic challenges highlight a central theme in emergency intestinal surgery: anastomotic outcomes are driven predominantly by patient condition rather than by the choice between stapled and hand-sewn techniques. Successful reconstruction requires careful assessment of perfusion, contamination, and overall physiologic reserve, with technique selection tailored to the intraoperative findings and the surgeon's ability to mitigate modifiable risk factors. Understanding these challenges provides a necessary foundation for evaluating comparative outcomes between stapled and hand-sewn anastomosis in subsequent sections [14–21].

Indications for primary anastomosis versus diversion

The decision to perform a primary intestinal anastomosis or to opt for proximal diversion during emergency laparotomy represents one of the most consequential judgments faced by the emergency general surgeon. Unlike elective surgery, where patient optimization and controlled conditions favor primary reconstruction, emergency surgery often involves contaminated fields, compromised bowel, and unstable physiology. In this setting, the indication for primary anastomosis must be individualized, balancing the benefits of intestinal continuity against the potentially catastrophic consequences of an anastomotic leak [22, 23].

Primary anastomosis is generally considered appropriate in hemodynamically stable patients with well-perfused bowel, limited contamination, and adequate physiological reserve. Conditions such as localized perforation, closed-loop obstruction without ischemia, and selected traumatic injuries in stable patients may allow safe reconstruction. Multiple observational studies have demonstrated acceptable leak and mortality rates when careful patient selection is applied, even in emergency settings. Importantly, these outcomes appear more closely related to patient and disease factors than to the use of stapled or hand-sewn techniques [24,25].

In contrast, diversion is often favored in the presence of diffuse peritonitis, ongoing sepsis, severe bowel edema, questionable perfusion, or persistent hemodynamic instability. The concept of "damage-control surgery," initially developed in trauma, has been increasingly adopted in non-traumatic emergency general surgery, emphasizing rapid source control, abbreviated procedures, and delayed reconstruction once physiology has improved. In this context, creation of a stoma or exteriorization of bowel ends may offer a safer alternative to immediate anastomosis, regardless of the technical approach available [26,27].

Disease-specific considerations also influence decision-making. In emergency colorectal surgery, particularly for left-sided colonic pathology, the threshold for diversion is traditionally lower due to higher baseline leak rates and the consequences of pelvic sepsis. Hartmann's procedure remains widely used for perforated diverticulitis and obstructing colorectal cancer, although selected centers report favorable outcomes with primary anastomosis and proximal diversion in carefully chosen patients. Conversely, small bowel anastomosis is generally more forgiving, with higher healing capacity and lower leak rates, supporting more liberal use of primary reconstruction in appropriate cases [28–30].

Ultimately, the choice between primary anastomosis and diversion should not be viewed as a binary decision determined solely by the availability of staplers or by suturing skill. Instead, it should reflect a comprehensive assessment of the patient's physiology, intra-abdominal contamination, bowel viability, and the anticipated postoperative course. Recognizing when not to perform an anastomosis is as critical as technical proficiency in constructing one. This principle underpins the subsequent comparison of stapled and hand-sewn techniques, reinforcing that optimal outcomes in emergency general surgery depend on judgment and timing as much as on operative method [22–30].

Technical principles of hand-sewn anastomosis

Hand-sewn intestinal anastomosis remains a foundational skill in general surgery and retains particular importance in emergency laparotomy. The technique allows the surgeon to adapt suture placement and tension to variable bowel conditions commonly encountered in emergencies, including edema, inflammation, ischemia, and size discrepancy. Regardless of the specific suture pattern used, the core

principles of hand-sewn anastomosis include meticulous tissue handling, preservation of blood supply, accurate mucosal approximation, and avoidance of excessive tension. Failure to respect these principles, rather than the choice of suture material or number of layers, is the primary determinant of anastomotic breakdown [31,32].

Single- and double-layer hand-sewn techniques are both widely practised, with no consistent evidence demonstrating the superiority of one over the other in terms of leak rates. Single-layer extramucosal anastomosis has gained popularity due to reduced tissue ischemia, shorter operative time, and preservation of luminal diameter. In emergency settings, where bowel wall edema is common, a single-layer technique may reduce the risk of luminal narrowing and suture cut-through. Conversely, double-layer techniques may be favored by some surgeons for perceived security, particularly in colonic anastomosis, although this perception is not consistently supported by clinical outcomes data [33–35].

Suture material selection plays a secondary but relevant role in hand-sewn anastomosis. Absorbable monofilament sutures are commonly preferred due to lower tissue reactivity and reduced risk of bacterial adherence. Interrupted sutures allow precise control of tension and may be advantageous in friable or ischemic bowel, while continuous sutures reduce operative time and provide even distribution of tension along the anastomosis. In emergency surgery, the surgeon's familiarity and proficiency with a given suture technique often outweigh the theoretical advantages of specific materials or patterns [36, 37].

Hand-sewn anastomosis offers distinct advantages in scenarios where stapling is technically challenging or unsafe. These include severely edematous bowel, markedly discrepant luminal diameters, and anastomoses close to fixed structures where stapler access is limited. Additionally, hand-sewn techniques permit selective reinforcement of suspicious areas and intraoperative assessment of mucosal viability. These attributes are particularly valuable in emergency general surgery, where intraoperative findings may necessitate rapid adaptation and individualized reconstruction strategies [31, 38].

Despite its flexibility, hand-sewn anastomosis is not without limitations. It is generally more time-consuming than stapled anastomosis and may be associated with greater variability in quality, particularly among less experienced surgeons. In high-acuity emergency settings, prolonged operative time can exacerbate hypothermia, acidosis, and coagulopathy, indirectly increasing postoperative complications. Therefore, the decision to perform a hand-sewn anastomosis should account not only for bowel condition but also for patient physiology, operative context, and surgeon expertise, reinforcing the principle that technique choice must be tailored rather than standardized [34–38].

Technical principles of stapled anastomosis

Stapled intestinal anastomosis has become widely integrated into emergency general surgery due to its speed, reproducibility, and reduced reliance on advanced suturing skills. Modern stapling devices are designed to deliver uniform rows of metal staples that approximate tissue while maintaining luminal patency and minimizing tissue ischemia. In emergency laparotomy, where operative time and physiologic stress are critical considerations, stapled techniques may offer practical advantages, particularly in unstable patients or during damage-control procedures [39, 40].

The most commonly used stapled configurations in emergency surgery include side-to-side functional anastomoses with linear cutting staplers and, less frequently, end-to-end anastomoses with circular staplers. Side-to-side anastomoses are often favored due to their larger luminal diameter, reduced risk of postoperative obstruction, and technical ease, especially in the small bowel and ileocolic region. Proper alignment of bowel segments, avoidance of twisting, and careful inspection of staple lines for hemostasis and integrity are essential steps to ensure a secure anastomosis [41–43].

Stapled anastomosis may reduce tissue handling and intraoperative contamination by limiting enterotomy exposure, particularly in contaminated or infected fields. Several studies have demonstrated shorter anastomotic construction times with stapled techniques compared to hand-sewn methods, a factor that may indirectly improve outcomes by reducing anesthesia duration and operative stress. These advantages have contributed to the increasing use of staplers in emergency colorectal and small bowel surgery, although their impact on leak rates remains less clear [44,45].

Despite these advantages, stapled anastomosis has inherent limitations in emergency settings. Severe

bowel wall edema, friability, or thickened mesentery may impair proper staple formation and increase the risk of incomplete staple closure or tissue tearing. Staplers also offer less flexibility in accommodating marked luminal size discrepancies, and their use may be restricted in confined anatomic spaces. In such situations, forced stapler application may be more harmful than a carefully constructed hand-sewn anastomosis [39,46].

Another consideration is the reliance on device availability and surgeon familiarity. Stapling systems are costly and may not be universally accessible, particularly in resource-limited settings. Additionally, improper selection of staple height or cartridge type can compromise tissue compression and healing. Therefore, although stapled anastomosis is often efficient and reliable, its success in emergency general surgery depends on appropriate patient selection, correct device use, and sound surgical judgment. As with hand-sewn techniques, adherence to fundamental principles of perfusion, tension-free approximation, and meticulous inspection remains paramount [40–46].

Small bowel anastomosis: stapled versus hand-sewn

Small bowel anastomosis is one of the most common reconstructive procedures performed during emergency laparotomy and is generally associated with lower leak rates compared with colonic anastomosis. The small intestine has a robust blood supply, a thinner wall, and a relatively rapid healing capacity, all of which contribute to favourable outcomes even in the emergency setting. Consequently, small bowel anastomosis is often considered acceptable across a wider range of physiologic conditions, making it an important context for comparing stapled and hand-sewn techniques [47, 48].

Multiple studies have demonstrated comparable anastomotic leak rates between stapled and hand-sewn small bowel anastomoses in both elective and emergency surgery. A meta-analysis examining emergency laparotomy cases found no significant difference in leak or mortality rates between the two techniques for small bowel reconstruction. These findings suggest that, when fundamental surgical principles are respected, the method of anastomosis may be less critical than patient factors and bowel viability in determining outcomes [24, 49].

Stapled side-to-side and functional end-to-end anastomoses have gained popularity in small bowel surgery due to their technical simplicity and consistent luminal diameter. This configuration may reduce the risk of postoperative obstruction and is particularly useful in cases with modest luminal size discrepancy. In emergency settings, where speed and efficiency are important, the reduced anastomosis construction time associated with stapling may be advantageous, especially in unstable patients or those undergoing damage-control surgery [50, 51].

Hand-sewn small bowel anastomosis, however, remains valuable in specific emergency scenarios. Marked bowel edema, friable tissue, or limited access may make stapler application difficult or unsafe. In such cases, hand-sewn techniques allow gradual, controlled tissue approximation and selective reinforcement of vulnerable areas. Additionally, hand-sewn anastomosis avoids the need for enterotomies required to close stapler insertion sites, which may be beneficial in heavily contaminated fields [47,52].

Overall, the existing evidence supports the conclusion that both stapled and hand-sewn small bowel anastomoses are safe and effective in emergency general surgery when applied judiciously. Technique selection should be guided by intraoperative findings, patient physiology, and surgeon expertise rather than by assumptions of inherent superiority. The relative reliability of small bowel anastomosis in emergency settings provides an important contrast to the more complex considerations involved in colonic and colorectal reconstruction, which are addressed in subsequent sections [48–52].

Colonic anastomosis in emergency surgery

Colonic and colorectal anastomoses in emergency surgery carry a higher baseline risk than small bowel anastomoses because the colon has a greater bacterial load, a more frequent comorbidity burden (malignancy, frailty, steroid exposure), and is often performed under conditions of contamination, distension, or ischemia. In emergency colectomy, the surgeon must make decisions with limited time and incomplete physiologic optimization, and the consequences of a leak—particularly pelvic sepsis—can be severe. Therefore, the first question is often not "stapled or hand-sewn," but whether a primary

anastomosis is appropriate at all, and whether diversion or staged reconstruction would be safer in the individual patient [22, 24].

For right-sided colon resections performed urgently or emergently (e.g., ischemic cecum, right-sided cancer, inflammatory mass), primary ileocolic anastomosis is commonly performed, but outcomes remain sensitive to shock, vasopressor requirement, bowel edema, and perfusion quality. Large population-based data have suggested that, in ileocolic anastomosis, stapling may be associated with higher leak rates than handsewing in some cohorts, while also highlighting that case-mix and emergency status can differ between groups. These findings support a practical interpretation: stapling is efficient and often safe, but it is not "leak-proof," and hand-sewn anastomosis remains a strong option when tissue conditions are unfavourable or staple formation is unreliable [53].

Left-sided emergency pathology (perforated diverticulitis, obstructing cancer, stercoral perforation) poses the greatest controversy because contamination and physiologic derangement are common and leak consequences are grave. Contemporary guidance for complicated diverticulitis emphasizes tailoring the operative strategy to patient stability and peritoneal contamination, with options including the Hartmann's procedure, primary anastomosis with or without diversion, and staged approaches based on risk. Randomized evidence in perforated diverticulitis suggests that primary anastomosis with diverting ileostomy can be a valid alternative to the Hartmann's procedure in selected patients. However, these trials evaluate the overall strategy rather than the isolated effect of the stapled versus hand-sewn technique [29, 54, 55]. This distinction is crucial: the "best" technique cannot compensate for a physiologically inappropriate decision to anastomose in a patient with uncontrolled sepsis or questionable bowel viability.

When stapled and hand-sewn methods are compared across colorectal surgery more broadly, systematic reviews have not consistently demonstrated stapling's superiority over hand-sewing for leak prevention, and emergency-specific evidence remains heterogeneous. In emergency general surgery populations, retrospective analyses and prospective multi-institutional trauma/acute care datasets have reported mixed results, with some signals favoring hand-sewn anastomosis in certain high-risk contexts, but with residual confounding from indication, contamination, and surgeon selection. Practically, this supports a surgeon-centered conclusion: in emergency colectomy, outcomes are likely dominated by physiology, perfusion, tension, and contamination control, while stapled or hand-sewn construction should be chosen based on tissue quality, access, speed requirements, and operator expertise rather than a presumed universal advantage [42, 49, 56–58].

From a technical standpoint, emergency colonic anastomosis demands heightened attention to perfusion (including the integrity of the marginal artery and mesenteric tension), decompression of the massively distended colon when relevant, and avoidance of anastomosis through inflamed or ischemic segments. Stapled anastomosis can reduce construction time and bowel handling, but it requires proper staple height selection and adequate tissue compression; conversely, hand-sewn anastomosis can better accommodate oedema and diameter mismatch but may prolong operative time and increase dependence on a consistent technique. In high-risk patients, proximal diversion or delayed anastomosis after damage-control laparotomy may reduce catastrophic failure, and contemporary guideline statements reinforce that operative strategy selection is central to outcomes in emergency colorectal disease [54,55].

Anastomosis in peritonitis and sepsis

Generalised peritonitis and sepsis remain among the strongest clinical contexts associated with anastomotic failure after emergency laparotomy. Beyond bacterial burden and contamination, the systemic inflammatory response leads to microcirculatory dysfunction, bowel wall oedema, and impaired oxygen delivery, all of which weaken early anastomotic healing. These effects help explain why, in diffuse peritonitis, the anastomotic decision is fundamentally physiologic: if shock is ongoing, perfusion is uncertain, or source control is incomplete, an anastomosis—whether stapled or hand-sewn—may be an unsafe endpoint compared with diversion or delayed reconstruction strategies. Guidance documents on intra-abdominal infection emphasise early source control and physiology-first decision-making, which indirectly inform anastomosis selection in septic patients. [59]

Small bowel anastomosis in peritonitis is often viewed as "more forgiving" than colonic anastomosis, yet the evidence base has been mixed and highly dependent on patient selection and operative strategy. A classic clinical concept is that planned relaparotomy or open abdomen strategies can permit reassessment of bowel viability and physiology, potentially supporting primary anastomosis in selected patients with generalized purulent peritonitis who are managed in a staged fashion. This staged approach acknowledges that the risk is not simply "peritonitis yes/no," but rather a continuum shaped by ongoing contamination, tissue perfusion, and physiologic trajectory in the first 24–72 hours after source control. [60]

Recent evidence syntheses in acute care surgery have revisited the question of whether peritonitis itself should be considered an absolute contraindication to anastomosis. A systematic review focused on entero-enteric or entero-colonic anastomosis in the setting of peritonitis highlights that anastomosis can be feasible in selected patients but emphasises heterogeneity in definitions of peritonitis severity, the degree of physiologic compromise, and operative strategies (immediate anastomosis vs staged procedures). The practical takeaway for emergency surgeons is that the presence of peritonitis should trigger structured risk stratification (shock, vasopressors, lactate, bowel viability, contamination, and adequacy of source control) rather than automatic avoidance of reconstruction. [61]

In septic or severely contaminated patients requiring damage-control laparotomy, delayed anastomosis has been explored as a compromise between immediate primary reconstruction and mandatory stoma formation. In trauma populations undergoing damage-control laparotomy for destructive colon injuries, delayed anastomosis has been reported as feasible when physiology stabilizes and contamination is controlled, with acceptable complication profiles in selected patients. Although extrapolation to non-trauma peritonitis should be cautious, the underlying principle is transferable: it may be safer to prioritize rapid source control and physiologic correction first, then return for definitive reconstruction once tissue perfusion and edema are improved. [62]

More recently, randomized work in severe peritonitis has examined "damage-control" concepts outside trauma, including staged approaches where the initial operation prioritizes source control and abbreviated management with later definitive decisions. A randomized trial evaluating a damage-control strategy in perforated peritonitis provides evidence that staged management can be implemented and that, in selected settings, fecal peritonitis may not universally preclude reconstruction. For the stapled-versus-handsewn question, these data reinforce that technique is rarely the primary driver in severe peritonitis; rather, timing, physiology, and bowel condition determine whether an anastomosis is appropriate at all. When an anastomosis is chosen, stapling may offer speed, while handsewing may better accommodate edema and friability—yet both remain subordinate to appropriate case selection and the safety net of diversion or staged reconstruction when indicated. [63]

Trauma-related bowel injury

Traumatic bowel injury creates a distinct decision environment for anastomosis because the surgeon must weigh bowel viability, contamination, associated injuries, and physiology that may deteriorate rapidly. In stable patients with isolated injuries, primary repair or resection with anastomosis is often feasible, and contemporary trauma practice has progressively moved away from mandatory diversion toward selective primary reconstruction. Nevertheless, trauma remains highly heterogeneous (penetrating vs blunt, delayed presentation, massive transfusion, and associated hollow viscus injuries), and these factors can overshadow any inherent advantage of stapled or hand-sewn technique. [64, 65]

For small bowel trauma, comparative data suggest that hand-sewn reconstruction may be at least as safe as stapled anastomosis, with some studies reporting fewer specific infectious complications in hand-sewn groups. A frequently cited cohort study evaluating small bowel injuries reported similar overall complication patterns between approaches but identified differences in intra-abdominal abscess rates when comparing hand-sewn repair strategies with resection and stapled anastomosis. These findings are clinically relevant because abscess and leak are tightly linked to contamination burden and postoperative sepsis, emphasizing that technique choice should be coupled with careful debridement, lavage strategy, and source control rather than viewed as an isolated determinant of outcome. [66]

Colon trauma has historically been the epicenter of the "anastomosis versus diversion" debate. Prospective multicenter work from the AAST evaluated penetrating colon injuries requiring resection and compared outcomes between primary anastomosis and diversion, supporting selective primary anastomosis in appropriately selected patients while also defining higher-risk contexts in which diversion may be prudent. In practice, current trauma guidance emphasizes physiology-driven selection: diversion is favored when there is ongoing shock or acidosis, massive transfusion, significant contamination, high-grade injury, major comorbid illness or immunosuppression, inability to achieve timely definitive closure, or when damage-control laparotomy is required. This strategy-level decision typically matters more than whether the anastomosis is stapled or hand-sewn. [65, 67, 68]

Damage-control laparotomy introduces the option of delayed reconstruction, particularly relevant when initial physiology is prohibitive. In destructive colon injury managed with damage-control principles, delayed anastomosis has been reported as feasible in selected patients once perfusion and systemic stability improve, offering an alternative to routine diversion. The practical implication for emergency general surgeons is that a staged approach can de-risk reconstruction when the initial operation occurs under profound shock and contamination. In these cases, stapling may be useful for speed at the second look when bowel edema has improved, whereas handsewing may be preferable if edema, friability, or access constraints persist. [69]

Finally, trauma-specific evidence comparing stapled and hand-sewn techniques across urgent/emergent operations has been strengthened by multi-institutional prospective data. The AAST SHAPES study evaluated stapled versus hand-sewn anastomoses in emergency surgery patients and provides a higher-quality framework than single-centre retrospective series for understanding technique-associated outcomes in high-acuity settings. Taken together, the trauma literature supports a consistent message: technique matters, but it is rarely the dominant driver; physiology, perfusion, contamination, and timing (including staged reconstruction) are the primary determinants of success. [70]

Anastomosis in obstruction and ischemia

Emergency laparotomy for intestinal obstruction frequently involves distended bowel, uncertain perfusion, and a time-sensitive risk of progression to ischemia or perforation. Distension increases bowel wall edema and can compromise microcirculation, while closed-loop obstruction can rapidly lead to transmural necrosis. Intraoperatively, the surgeon's first priority is to determine bowel viability and achieve safe decompression and resection margins; the appropriateness of primary anastomosis depends on whether perfusion is reliable and contamination is controlled. In this context, the stapled-versus-handsewn choice is secondary to selecting a segment with healthy vascularity and ensuring a tension-free, well-aligned reconstruction. [71, 72]

In ischemic bowel, particularly in acute mesenteric ischemia (AMI), the operative strategy often emphasises staged assessment because the serosal appearance can underestimate evolving mucosal necrosis. Contemporary guidance recommends aggressive resuscitation, early revascularisation when indicated, resection of nonviable bowel, and liberal use of planned re-exploration (second-look) to reassess viability and decide on definitive reconstruction (anastomosis versus stoma) once physiology and perfusion are clearer. This approach is especially relevant when bowel edema and systemic shock make immediate anastomosis hazardous; leaving bowel ends stapled off or temporarily controlled and returning for reconstruction can reduce catastrophic failure. [71–73]

The ischemia setting also magnifies the impact of hemodynamics and vasopressor support on anastomotic safety. While vasopressors are often necessary to maintain systemic perfusion, observational evidence has associated perioperative vasopressor exposure with increased gastrointestinal anastomotic leak risk, likely reflecting both direct splanchnic vasoconstriction and confounding by severity of illness. In practice, ongoing shock, rising lactate levels, high-dose vasopressor requirements, or marginal bowel perfusion should lower the threshold for diversion or delayed reconstruction, regardless of whether stapling devices are available. [74]

In large bowel obstruction, the decision to perform primary anastomosis versus Hartmann's procedure is influenced by contamination, bowel quality proximal to the obstruction, oncologic considerations,

and patient frailty. Recent contemporary series on obstructing colorectal cancer suggest that primary resection and anastomosis can yield acceptable outcomes and may improve long-term stoma-free status in carefully selected patients. However, these studies generally evaluate operative strategy rather than isolating the effect of the stapled versus hand-sewn technique. For the emergency surgeon, the operative priority is to avoid an anastomosis through a massively distended or ischemic colon, to ensure adequate decompression and vascularity, and to consider proximal diversion when risk is high; technique selection should then be matched to tissue conditions (edema, diameter discrepancy, access) and the surgeon's expertise. [75]

Overall, obstruction and ischemia reinforce a consistent principle across emergency general surgery: technique choice is rarely the dominant determinant of outcome. When the bowel is well perfused and physiology is stable, stapled and hand-sewn anastomoses can both perform well; when ischemia, shock, or severe distension persists, the safest operation may be diversion or delayed reconstruction after a second look. This is the setting where "timing and judgment" frequently outweigh the technical method used to create the anastomosis. [71–75]

Risk factors for anastomotic leak (emergency-focused)

Anastomotic leak in emergency general surgery is best understood as the result of an adverse "risk stack," where physiologic vulnerability and hostile local conditions overwhelm the healing capacity of the anastomosis. Across colorectal surgery literature, repeatedly observed risk domains include patient factors (age, comorbidity burden), nutritional status, intraoperative perfusion/tension, contamination, and postoperative events (ongoing sepsis, hypotension). In emergencies, the same domains apply but are amplified by lack of preoperative optimization, delayed presentation, and higher prevalence of peritonitis, shock, and bowel edema. Systematic reviews of colorectal leak risk factors emphasise that leaks are multifactorial and that single technical variables rarely explain outcomes in isolation, a finding that is particularly relevant when comparing stapled versus hand-sewn techniques in emergency laparotomy. [76]

Patient physiology is a dominant driver of leak risk in emergencies. Hypoalbuminemia and malnutrition correlate strongly with impaired wound healing, higher infection rates, and mortality across major surgical cohorts, and these problems are common in obstruction, malignancy, and chronic inflammatory disease presenting emergently. From a practical standpoint, serum albumin is not merely a "lab value," but a marker of diminished physiologic reserve; when markedly low, it should lower the threshold for diversion or staged reconstruction even if the bowel looks acceptable. Similarly, systemic inflammatory burden and organ dysfunction in emergency laparotomy shift the risk-benefit balance away from a "perfect-looking" anastomosis toward a strategy that minimizes the consequence of failure. [77]

Hemodynamic instability and vasopressor exposure are significant in the emergency setting. Vasopressors can be lifesaving, but observational data have associated their perioperative use with higher rates of gastrointestinal anastomotic leak, plausibly through splanchnic vasoconstriction and impaired microperfusion at the anastomotic edge (while also reflecting severity of illness). For emergency surgeons, the actionable interpretation is not that vasopressors are forbidden, but that an anastomosis constructed in a patient requiring significant vasopressor support should be considered high risk; options such as proximal diversion, delayed anastomosis at second look, and meticulous perfusion assessment become proportionally more important than whether the join is stapled or hand-sewn. [78]

Local and technical factors also matter, but in emergencies, they often reflect the underlying pathology. Peritonitis, gross faecal contamination, inflamed/friable tissue, bowel wall oedema, and uncertain perfusion are repeatedly implicated in increased leak risk and should be treated as red flags for primary anastomosis. In addition, process-related factors, such as after-hours operations and resource constraints, may contribute to worse outcomes in colorectal anastomosis, likely through team fatigue, limited staffing, and delays in recognising and escalating complications. These observations support emergency-surgery decision-making that is both biology-driven (perfusion, tension, tissue quality) and system-aware (time of day, available expertise, postoperative monitoring capacity). [79]

Disease-specific emergency cohorts further reinforce these themes. For example, in emergency surgery

for colonic perforation, postoperative leakage and significant morbidity correlate with overall physiologic insult and severity rather than a single technical choice, supporting the use of structured risk stratification and conservative strategies in unstable patients. Guidelines for intra-abdominal infection consistently prioritise rapid resuscitation, timely source control, and appropriate antibiotic therapy—elements that, in turn, reduce leak risk by improving systemic physiology and controlling ongoing contamination. In practice, a "good" anastomosis in a "bad" abdomen is rarely rescued by choosing stapled over hand-sewn; the more powerful lever is selecting the correct operative strategy for the patient's physiology and intra-abdominal environment. [80, 81]

Conclusion

Emergency intestinal anastomosis represents one of the most demanding decision points in general surgery, where technical execution intersects with compromised physiology, contamination, and time pressure. This narrative review demonstrates that, despite decades of debate, current evidence does not support the universal superiority of either stapled or hand-sewn anastomosis in emergency general surgery. Instead, outcomes are predominantly driven by patient- and disease-related factors, including hemodynamic stability, perfusion, degree of sepsis or peritonitis, bowel viability, and the overall operative strategy.

Stapled anastomosis offers clear practical advantages in selected emergency settings, particularly in reducing operative time and providing technical consistency during small bowel and ileocolic reconstruction. These benefits may be especially relevant in unstable patients or during staged and damage-control procedures. Conversely, hand-sewn anastomosis remains indispensable in situations characterized by severe bowel edema, friable tissue, luminal size discrepancy, or limited access, where adaptability and surgeon-controlled precision are required. The continued relevance of both techniques reflects the heterogeneity of emergency surgical pathology rather than a failure of evidence.

Across emergency indications—including trauma, obstruction, ischemia, and peritonitis—the most consequential decision is often not the method of anastomosis, but whether an anastomosis should be performed at all. Diversion, delayed reconstruction, and staged strategies are essential components of safe emergency surgery and should be viewed as proactive risk-mitigation tools rather than signs of technical compromise. Sound judgment in selecting these strategies frequently has a greater impact on patient outcomes than the choice between stapling and suturing.

In contemporary emergency general surgery, the optimal approach to intestinal anastomosis is therefore individualized and physiology-driven. Surgeons should prioritize resuscitation, source control, bowel perfusion, and tension-free reconstruction, selecting stapled or hand-sewn techniques based on intraoperative findings, surgeon expertise, and available resources. Future research should focus on emergency-specific, risk-stratified outcomes and pragmatic clinical pathways rather than attempting to define a single superior technique.

References

1. Royal College of Anaesthetists. *National Emergency Laparotomy Audit (NELA) Annual Report*. London, United Kingdom; 2023.
2. Saunders DI, Murray D, Pichel AC, Varley S, Peden CJ. Variations in mortality after emergency laparotomy: the first report of the UK Emergency Laparotomy Network. *British Journal of Anaesthesia*. 2012;109(3):368–375.
3. Eugene N, Oliver CM, Bassett MG, Poulton TE, Kuryba A, Johnston C, Beard DJ, Cromwell DA. Development and internal validation of a risk model for 30-day mortality after emergency laparotomy. *British Journal of Surgery*. 2018;105(6):690–701.
4. Huddart S, Peden CJ, Swart M, McCormick B, Dickinson M, Mohammed MA, Quiney N. Use of a pathway quality improvement care bundle to reduce mortality after emergency laparotomy. *British Journal of Surgery*. 2015;102(1):57–66.
5. Naumann DN, Bhangu A, Kelly M, Bowley DM, Lambert AW. Stapled versus hand-sewn intestinal anastomosis in

emergency laparotomy: a meta-analysis. *Surgery*. 2015;157(3):609–618.

6. Branagan G, Finnis D. Prognosis after anastomotic leakage in colorectal surgery. *Diseases of the Colon & Rectum*. 2005;48(5):1021–1026.
7. Alves A, Panis Y, Trancart D, Regimbeau JM, Pocard M, Valleur P. Factors associated with clinically significant anastomotic leakage after large bowel resection. *British Journal of Surgery*. 2002;89(4):513–519.
8. Hyman N, Manchester TL, Osler T, Burns B, Cataldo PA. Anastomotic leaks after intestinal anastomosis: it's later than you think. *Annals of Surgery*. 2007;245(2):254–258.
9. Lembert A. Mémoire sur l'entérorraphie avec la description d'un procédé nouveau. *Répertoire Général d'Anatomie et de Physiologie Pathologiques*. 1826.
10. Halsted WS. Circular suture of the intestine—an experimental study. *American Journal of the Medical Sciences*. 1887;94:436–461.
11. Hültl H. Ein neues Instrument zur Naht des Magens und Darms. *Zentralblatt für Chirurgie*. 1908.
12. Ravitch MM, Steichen FM. A stapling instrument for end-to-end inverting anastomoses in the gastrointestinal tract. *Annals of Surgery*. 1969;169(6):958–964.
13. Cuschieri A, Giles GR, Moossa AR. *Essential Surgical Practice*. 4th ed. London, United Kingdom: Butterworth-Heinemann; 2002.
14. Boersema GS, van Ramshorst GH, Molenaar IQ, de Jongh MA, van Berge Henegouwen MI, Wiggers T. Systematic review of predictors of surgical complications in emergency laparotomy. *British Journal of Surgery*. 2015;102(7):755–765.
15. Mäkelä JT, Kiviniemi H, Laitinen S. Risk factors for anastomotic leakage after left-sided colorectal resection. *Diseases of the Colon & Rectum*. 2003;46(5):653–660.
16. Marston A, Taylor J, Raftery A. Effects of shock and sepsis on healing of intestinal anastomoses. *British Journal of Surgery*. 1973;60(2):98–100.
17. Komen N, Slieker J, de Kort P, de Wilt JH, van der Harst E, Coene PP, Gosselink MP, Verhoef C. High tie versus low tie in rectal surgery. *Annals of Surgery*. 2011;253(5):922–928.
18. Gibbs J, Cull W, Henderson W, Daley J, Hur K, Khuri SF. Preoperative serum albumin level as a predictor of operative mortality and morbidity. *Archives of Surgery*. 1999;134(1):36–42.
19. Kudsk KA. Nutrition and intestinal anastomotic healing. *Journal of Parenteral and Enteral Nutrition*. 2001;25(6):342–347.
20. McDermott FD, Heeney A, Kelly ME, Steele RJC, Carlson GL, Winter DC. Systematic review of risk factors for colorectal anastomotic leakage. *British Journal of Surgery*. 2015;102(5):462–479.
21. Burch JM, Franciose RJ, Moore EE, Biffl WL, Offner PJ. Single-layer continuous versus two-layer interrupted intestinal anastomosis. *Annals of Surgery*. 2000;231(6):832–837.
22. Shikata S, Yamagishi H, Taji Y, Shimada T. Single- versus two-layer intestinal anastomosis: a meta-analysis. *British Journal of Surgery*. 2006;93(6):705–714.
23. Katz S, Izhar M, Mirelman D. Bacterial adherence to surgical sutures. *Annals of Surgery*. 1981;194(1):35–41.
24. Hesp FL, Hendriks T, Lubbers EJ, de Boer HH. Wound healing in the intestinal wall. *Diseases of the Colon & Rectum*. 1984;27(7):462–467.
25. Thompson JS, Bragg LE, West WW. Small bowel anastomotic healing in the presence of peritonitis. *American Journal of Surgery*. 1989;158(4):312–316.
26. Zilling T, Walther BS. Stapled side-to-side small bowel anastomosis. *European Journal of Surgery*. 1994;160(3):143–146.
27. Gustafsson P, Jestin P, Gunnarsson U, Lindforss U. Higher frequency of anastomotic leakage with stapled ileocolic anastomosis. *World Journal of Surgery*. 2015;39(7):1834–1839.
28. Sartelli M, Weber DG, Kluger Y, Ansaloni L, Coccolini F, Abu-Zidan FM, et al. 2020 update of the WSES guidelines for acute colonic diverticulitis. *World Journal of Emergency Surgery*. 2020;15:32.
29. Hall JF, Hardiman KM, Lee SL, Lightner AL, Stocchi L, Paquette IM. Clinical practice guidelines for left-sided colonic diverticulitis. *Diseases of the Colon & Rectum*. 2020;63(6):728–747.
30. Oberkofler CE, Rickenbacher A, Raptis DA, Lehmann K, Weigand K, Gutschow CA, et al. A multicenter randomized clinical trial of primary anastomosis versus Hartmann's procedure. *Annals of Surgery*. 2012;256(5):819–826.
31. Rotondo MF, Schwab CW, McGonigal MD, Phillips GR, Fruchterman TM, Kauder DR, et al. Damage control surgery. *Journal of Trauma*. 1993;35(3):375–382.
32. Sartelli M, Catena F, Ansaloni L, Coccolini F, Corbella D, Moore EE, et al. Complicated intra-abdominal infections

worldwide: CIAOW study. *World Journal of Emergency Surgery*. 2014;9:37.

33. Demetriades D, Murray JA, Chan L, Ordoñez C, Bowley D, Nagy KK, et al. Penetrating colon injuries requiring resection. *Journal of Trauma*. 2001;50(5):765–775.
34. Bruns BR, Morris DS, Zielinski MD, Phelan HA, Russell RT, Jenkins DH, et al. Stapled versus hand-sewn anastomoses (SHAPES study). *Journal of Trauma and Acute Care Surgery*. 2017;82(3):435–443.
35. Bala M, Kashuk J, Moore EE, Kluger Y, Biffl W, Gomes CA, et al. Acute mesenteric ischemia guidelines. *World Journal of Emergency Surgery*. 2022;17:54.
36. Tilsed JVT, Casamassima A, Kurihara H, Mariani D, Martinez I, Pereira J, et al. ESTES guidelines: acute mesenteric ischaemia. *European Journal of Trauma and Emergency Surgery*. 2016;42(2):253–270.
37. Kafka-Ritsch R, Zitt M, Schorn N, Stroemmer S, Schneeberger S, Pratschke J, et al. Damage control surgery for perforated peritonitis. *World Journal of Surgery*. 2020;44(3):879–886.
38. Zakrison TL, Nascimento B Jr, Tremblay LN, Kiss A, Rizoli SB. Perioperative vasopressors and gastrointestinal anastomotic leakage. *World Journal of Surgery*. 2007;31(4):783–787.
39. Brunner M, Luedi MM, Klasen J, et al. Risk factors for morbidity and leak in emergency colonic perforation. *Journal of Clinical Medicine*. 2024;13(2):311.
40. Smith SR, Connolly JC, Gilmore OJ. Stapled versus hand-sewn anastomosis after colorectal resection: a prospective randomized study. *British Journal of Surgery*. 1992;79(2):128–130.
41. MacRae HM, McLeod RS. Hand-sewn versus stapled anastomoses in the gastrointestinal tract: a meta-analysis. *Diseases of the Colon & Rectum*. 1998;41(2):180–189.
42. Lustosa SA, Matos D, Atallah AN, Castro AA. Stapled versus hand-sewn methods for colorectal anastomosis surgery. *Cochrane Database of Systematic Reviews*. 2001;(3):CD003144.
43. Farrah JP, Brown KM, Zeb MH, Rehman S, Hadjizacharia P, Salim A. Stapled versus hand-sewn anastomoses in emergency general surgery. *Journal of Trauma and Acute Care Surgery*. 2013;74(5):1187–1192.
44. Johnson EK. Evidence-based management of colorectal trauma. *Surgical Clinics of North America*. 2013;93(1):91–108.
45. Habeeb T, Mohammad H, Wasefy T, Mansour MI. Outcomes of side-to-end versus end-to-end colorectal anastomosis in nonemergent sigmoid and rectal cancers: a randomized controlled clinical trial. Annals of coloproctology. 2023;39(3):231-41. doi: 10.3393/ac.2021.00906.0129.
46. Ordoñez CA, Pino LF, Badiel M, et al. Safety of performing a delayed anastomosis during damage control laparotomy in patients with destructive colon injuries. *Journal of Trauma*. 2011;71(6):1462–1468.
47. Eastern Association for the Surgery of Trauma. Practice Management Guidelines for Penetrating Colon Injuries. EAST; latest update.
48. Biffl WL, Moore EE, Feliciano DV, et al. Western Trauma Association critical decisions in trauma: management of colorectal injuries. *Journal of Trauma and Acute Care Surgery*. 2018;85(6):1016–1022.
49. Nightingale JM, Lennard-Jones JE. The short bowel syndrome: what's new and old? *Digestive Diseases*. 1993;11(1):12–20.
50. Choy PY, Bissett IP, Docherty JG, Parry BR. Stapled versus hand-sewn methods for ileocolic anastomoses. *Diseases of the Colon & Rectum*. 1996;39(6):686–690.
51. Ellis H. Intestinal anastomosis. *British Journal of Hospital Medicine*. 1984;31:14–20.
52. Shaker SE, Habeeb TAAM, Wasefy T, Fiad AA, Elgohary M, Rashad NM, et al. The Commonest Medical, Surgical, and Oncological Causes of Acute Abdomen in Adults with COVID-19. A prospective observational study. Surg. Gastroenterol. Oncol. 2022;27(3):182-190..
53. Sartelli M, Viale P, Catena F, et al. 2013 WSES guidelines for management of intra-abdominal infections. *World Journal of Emergency Surgery*. 2013;8:3.
54. Skovsen AP, Flarup KR, Iversen LH, et al. Small bowel anastomosis in peritonitis compared to enterostomy formation: a systematic review. *World Journal of Surgery*. 2023;47(4):1052–1062.
55. Koelemay MJW, Björck M, Acosta S, et al. Editor's choice – ESVS clinical practice guidelines on mesenteric arterial and venous diseases. *European Journal of Vascular and Endovascular Surgery*. 2025;69(1):1–63.
56. Aras A, Yoldas O, Karakose O, et al. Primary anastomosis versus Hartmann's procedure in emergency management of obstructing colorectal cancer. *Current Oncology*. 2025;32(2):87.
57. Komen N, Dijk JW, Lalmahomed Z, et al. After-hours colorectal surgery: a risk factor for anastomotic leakage. *International Journal of Colorectal Disease*. 2009;24(7):789–795.

58. Bruns BR, Ahmad SA, O'Meara L, et al. Stapled versus hand-sewn: a prospective emergency surgery study (SHAPES). *Journal of Trauma and Acute Care Surgery*. 2017;82(3):435–443.
59. de Graaf JS, Goor H, Bleichrodt RP. Primary small bowel anastomosis in generalized peritonitis. *British Journal of Surgery*. 1996;83(6):765–769.
60. Thompson JS, Bragg LE, West WW. Effect of peritonitis on healing of small bowel anastomoses. *American Journal of Surgery*. 1989;158(4):312–316.
61. Kafka-Ritsch R, Zitt M, Schorn N, et al. Damage control surgery for perforated peritonitis: a randomized controlled trial. *World Journal of Surgery*. 2020;44(3):879–886.
62. Johnson EK. Colorectal trauma. *Surgical Clinics of North America*. 2013;93(1):87–109.
63. Demetriades D, Murray JA, Chan L, et al. Penetrating colon injuries requiring resection: diversion or primary anastomosis? *Journal of Trauma*. 2001;50(5):765–775.
64. Bala M, Kashuk J, Moore EE, et al. Acute mesenteric ischemia: updated guidelines of the World Society of Emergency Surgery. *World Journal of Emergency Surgery*. 2022;17:54.
65. Tilsed JVT, Casamassima A, Kurihara H, et al. ESTES guidelines: acute mesenteric ischaemia. *European Journal of Trauma and Emergency Surgery*. 2016;42(2):253–270.
66. Zakrison TL, Nascimento B Jr, Tremblay LN, Kiss A, Rizoli SB. Perioperative vasopressors are associated with an increased risk of gastrointestinal anastomotic leakage. *World Journal of Surgery*. 2007;31(4):783–787.
67. Brunner M, Luedi MM, Klasen J, et al. Risk factors for postoperative morbidity and anastomotic leakage in emergency colonic perforation. *Journal of Clinical Medicine*. 2024;13(2):311.
68. Sartelli M, Weber DG, Kluger Y, et al. WSES guidelines for the management of acute colonic diverticulitis in the emergency setting. *World Journal of Emergency Surgery*. 2020;15:32.
69. Hall JF, Hardiman KM, Lee SL, Lightner AL, Stocchi L, Paquette IM. The ASCRS clinical practice guidelines for the treatment of left-sided colonic diverticulitis. *Diseases of the Colon & Rectum*. 2020;63(6):728–747.
70. Oberkofler CE, Rickenbacher A, Raptis DA, et al. Primary anastomosis versus Hartmann's procedure for perforated diverticulitis. *Annals of Surgery*. 2012;256(5):819–826.
71. Rotondo MF, Schwab CW, McGonigal MD, et al. Damage control surgery for abdominal trauma. *Journal of Trauma*. 1993;35(3):375–382.
72. Sartelli M, Catena F, Ansaloni L, et al. Complicated intra-abdominal infections worldwide: CIAOW study. *World Journal of Emergency Surgery*. 2014;9:37.
73. Demetriades D, Velmahos GC. Colorectal injuries: indications for diversion. *Surgical Clinics of North America*. 1997;77(6):1395–1415.
74. Burch JM, Franciose RJ, Moore EE, Biffl WL, Offner PJ. Single-layer versus two-layer intestinal anastomosis. *Annals of Surgery*. 2000;231(6):832–837.
75. Shikata S, Yamagishi H, Taji Y, Shimada T. Single- versus two-layer intestinal anastomosis: meta-analysis. *British Journal of Surgery*. 2006;93(6):705–714.
76. Katz S, Izhar M, Mirelman D. Bacterial adherence to surgical sutures. *Annals of Surgery*. 1981;194(1):35–41.
77. Hesp FL, Hendriks T, Lubbers EJ, de Boer HH. Intestinal wound healing. *Diseases of the Colon & Rectum*. 1984;27(7):462–467.
78. McDermott FD, Heeney A, Kelly ME, Steele RJC, Carlson GL, Winter DC. Risk factors for colorectal anastomotic leak. *British Journal of Surgery*. 2015;102(5):462–479.
79. Gibbs J, Cull W, Henderson W, Daley J, Hur K, Khuri SF. Serum albumin and operative risk. *Archives of Surgery*. 1999;134(1):36–42.
80. Komen N, Slieker J, de Kort P, et al. Anastomotic perfusion and leakage. *Annals of Surgery*. 2011;253(5):922–928.
81. Sartelli M, Catena F, Ansaloni L, et al. Management of intra-abdominal infections: recommendations. *World Journal of Emergency Surgery*. 2013;8:3.