

Multidisciplinary Surgical Research Annals

<https://msra.online/index.php/Journal/about>

Volume 4, Issue 1 (2026)

Stapled Versus Hand-Sewn Anastomosis in Emergency Gastrointestinal Surgery, A NARRATIVE REVIEW

DR Muhammad Saeed¹, Farhan ullah wazir², Masood Umar³, Muhammad Ahmad⁴, Fawad Ali⁵, Salman Ahmad⁶

Article Details

Keywords:

Dr. Muhammad Saeed

North West School Of Medicine

Farhan Ullah Wazir

Khyber College Of Dentistry

Masood Umar

North West School Of Medicine

Muhammad Ahmad

North West School Of Medicine

Fawad Ali

North West School Of Medicine

Salman Ahmad*

North West School Of Medicine

Email: isalmanahmad20@gmail.com

ABSTRACT

Background: Intestinal anastomosis is a pivotal step in gastrointestinal surgery, particularly in emergency settings where adverse physiological conditions may compromise healing. While hand-sewn techniques have been the traditional standard, mechanical stapling has become increasingly popular due to perceived advantages in speed and consistency. However, the optimal technique in emergency gastrointestinal surgery remains debated.

Objective: To review and synthesize current evidence comparing stapled versus hand-sewn intestinal anastomoses in emergency gastrointestinal surgery, with reference to relevant elective data, focusing on operative efficiency, anastomotic integrity, clinical outcomes, and resource implications.

Methods: A narrative literature review was conducted using PubMed, Cochrane Library, and Google Scholar. Randomized controlled trials, observational studies, systematic reviews, and meta-analyses comparing stapled and hand-sewn anastomoses were included, with emphasis on emergency procedures across gastrointestinal organ systems. Evidence from both high-income and low-/middle-income country settings was considered. Due to heterogeneity of study designs and populations, findings were synthesized qualitatively.

Results: Across emergency gastrointestinal surgery, stapled and hand-sewn anastomoses demonstrate comparable rates of anastomotic leak, morbidity, and mortality. Stapling consistently reduces operative time and may improve efficiency, which is advantageous in critically ill or unstable patients. Leak rates appear similar overall, although stapled anastomoses may offer modest benefits in selected elective settings, particularly right-sided ileocolic resections. Stricture rates vary by anatomical site, with some evidence of higher stricture risk following stapled esophagogastric anastomosis. Cost-effectiveness favors stapling in high-resource systems due to reduced operative time and complication-related costs, whereas hand-sewn techniques remain more practical in resource-limited settings.

Conclusion: Current evidence does not demonstrate clear superiority of stapled or hand-sewn anastomosis in emergency gastrointestinal surgery. Stapling offers efficiency advantages without compromising safety, while hand-sewn anastomosis remains a reliable and flexible option, particularly in challenging tissues or low-resource environments. Technique selection should be individualized based on patient condition, anatomical factors, surgeon expertise, and resource availability. High-quality, emergency-focused trials—especially from low- and middle-income countries—are needed to refine evidence-based recommendations.

INTRODUCTION:

Intestinal anastomosis is a critical step in gastrointestinal surgery, restoring bowel continuity after resection [1,2]. Traditionally, anastomoses were constructed by hand-sewn suturing (single- or double-layer techniques), which provides flexibility and tactile feedback. In recent decades, mechanical stapling devices have become widely adopted for both elective and emergency procedures [13,44]. Staplers can create end-to-end or side-to-side anastomoses more quickly and with uniform staple lines. Proponents argue stapling reduces operative time and variability, especially in deep or confined spaces (e.g. pelvis), while critics cite the high cost of stapler cartridges and question long-term safety [3,30]. The optimal technique remains debated, particularly in the emergency setting where patient physiology and bowel quality may be compromised [1,9].

In emergency gastrointestinal surgery (e.g. trauma, perforation, obstruction), factors like hemodynamic instability, peritonitis, and edematous bowel can increase anastomotic stress [2,3]. This review systematically examines evidence comparing stapled versus hand-sewn anastomoses across multiple GI organ systems in emergency (and relevant elective) contexts. We summarize technical considerations, operative metrics, healing dynamics, and clinical outcomes (leak, stricture, morbidity, mortality), incorporating data from high-income and low-/middle-income country (LMIC) settings. Wherever possible we draw on recent systematic reviews and meta-analyses, but also individual trials and studies when needed. Knowledge gaps are highlighted for future research.

Methods

We conducted a narrative literature review (not a formal systematic review) by searching PubMed, Cochrane Library, and Google Scholar for studies and reviews comparing stapled vs. hand-sewn anastomosis in gastrointestinal surgery, with an emphasis on emergency cases. Search terms included “stapled vs hand-sewn anastomosis”, “emergency bowel surgery stapler”, and organ-specific terms (e.g. “esophagectomy stapled anastomosis meta-analysis”). We included randomized trials, cohort studies, retrospective series, systematic reviews, and meta-analyses. Both adult and pediatric data were considered. We aimed to include diverse geographic settings, noting when data are lacking in LMIC contexts. The evidence is then synthesized under structured subheadings. Because of heterogeneity in settings and methods, we summarize patterns rather than pool data quantitatively.

Surgical Techniques

Hand-sewn anastomosis: This traditional technique uses suture materials (absorbable or non-absorbable) to create an anastomosis, often in one- or two-layers, using continuous or interrupted stitches. A double-layer, one inner full-thickness and one outer seromuscular layer, is a classic approach. Single-layer techniques and various suture patterns have also been described. Hand sewing requires surgical skill and longer operating time, but allows adjustment of tension and meticulous tissue apposition [38,27]. It may be preferable in small bowel or in tissue of questionable quality, as the surgeon can tailor the suture bites. In difficult anatomical locations, however, hand sewing can be technically demanding and time-consuming.

Stapled anastomosis: Mechanical staplers (linear or circular) use rows of titanium staples to join bowel edges. Circular staplers create end-to-end or end-to-side anastomoses in one application, commonly used in colorectal and esophagogastric surgery [44,11]. Linear staplers create side-to-side functional end-to-end anastomoses by first stapling and then closing the enterotomy. Stapling offers uniform tension and speed, which is advantageous when rapid reestablishment of continuity is needed. Different staple height options allow adjustment for tissue thickness. However, staplers are more expensive and require specialized equipment and cartridges, which can be limiting in resource-poor settings [3,30].

Operating Room Considerations: Hand sewing generally requires minimal equipment (suture and needle) and is available in any setting. Stapling requires availability of stapler devices and cartridges, sterility and personnel trained in their use. In many LMIC hospitals, regular supply of stapler cartridges may be

unreliable, making hand-sewn methods more common despite longer operative time [45,13]. Conversely, in high-income countries (HICs), staplers are often used routinely for colorectal and upper GI anastomoses due to perceived efficiency [13].

Clinical Outcomes

Operative Time and Efficiency

A consistent finding across studies is that stapled anastomoses require less operative time than hand-sewn techniques [1,2,3,5,9]. Multiple analyses report significantly shorter stapling times. For example, a German study found a median 22-minute reduction in bowel resection time with stapling (130 vs. 152 minutes; $p=0.001$) [3]. A multicenter randomized trial in emergency surgery similarly observed shorter stapling times [9]. In esophagectomy, meta-analyses show stapled anastomosis reduces operating time (pooled SMD – 0.11, $p=0.002$) [5,4]. The meta-analysis by Munawar et al. (2025) also noted “significantly improved operational efficiency” with stapling [2]. Across organ systems, the speed advantage of stapling holds true, which can translate to shorter anesthesia time and potentially lower intraoperative stress. This efficiency gain is especially valuable in emergency cases where expedience is critical [9,3].

Technical Feasibility and Learning Curve

Staplers can simplify some difficult anastomoses. For instance, deep pelvic or subdiaphragmatic esophagogastric anastomoses can be challenging to access; studies note staplers are particularly useful in the deep pelvis or lower rectum [31,5]. On the other hand, hand sewing allows adjustment for complex situations (e.g. gross discrepancy in bowel diameter, friable tissue) [13]. There is debate about learning curve: both methods require experience, but stapling has a shorter learning curve for novices [13,5].

Anastomotic Integrity (Leak and Failure Rates)

The paramount outcome is anastomotic leak or failure. A number of analyses suggest no clear overall superiority of one technique.

Emergency Laparotomy: A pooled meta-analysis of emergency laparotomy cases (7 studies, 1120 patients) found no significant difference in anastomotic failure or leak between stapled and hand-sewn groups; rates of leak, abscess, fistula, and mortality were statistically similar [1]. The authors concluded that current evidence is limited and no technique is definitively favored [1].

Ileocolic (Right-sided) Anastomoses: In contrast, elective ileocolic anastomoses (commonly for cancer or Crohn’s) show a leak advantage for stapling. A Cochrane review (7 RCTs, $n=1125$) reported significantly fewer leaks with stapled functional end-to-end ileocolic anastomosis [15]. Similarly, Luglio et al. found stapled ileocolic anastomoses had markedly lower leak rates (5/357 vs 36/598; OR 0.34) [12]. These data suggest if technically feasible, stapling may reduce leak risk in elective right colon surgery. The reduction is possibly because stapled anastomosis creates a wider lumen with less tension. However, these findings come from controlled settings and may not directly apply to inflamed or trauma cases [15,12].

Esophago-gastric Anastomoses: Meta-analyses in esophageal and gastric surgery (mostly elective cancer cases) show no difference in leak rates. A 2011 review found stapling did not change leak or mortality but did increase stricture risk [5]. In esophagectomy, a 2025 meta-analysis similarly saw no leak difference ($RR\approx 1.0$) between stapled vs hand-sewn [4]. Thus, hand sewing remains an acceptable alternative, particularly in centers without stapler availability [5,4].

Small Bowel (Trauma) Cases: Limited data exist. One retrospective trauma series found similar overall complication rates between stapled resection and hand-sewn small bowel anastomosis; a higher abscess rate

was noted with stapling in initial comparisons (13% vs 4%; $p < 0.05$), but after controlling for injury severity there was no difference in complications [14]. The authors concluded stapling is safe for traumatic small bowel anastomosis [14]. Given the paucity of data, most trauma surgeons use either technique based on experience [14].

Overall, meta-analyses converge on leak rates being comparable between methods when accounting for patient factors [1,5]. When differences are reported, they often favor staplers (as above) or show no statistical significance. In emergencies specifically, the bulk of evidence to date does not establish stapling as superior. Patient condition, resection indications, and anastomosis location all influence outcomes, so direct comparisons are challenging [1,9].

Anastomotic Stricture (Stenosis) and Healing

Anastomotic stricture is a concern, particularly in upper GI and coloanal reconstructions. Data suggest stapled anastomoses may have higher stricture rates in some settings. The Markar meta-analysis found stapled esophago-gastric anastomoses had significantly more strictures than hand sewing (OR ~1.76) [5]. This likely reflects the rigid staple line and the presence of ischemic edge. In ileal-pouch procedures (anal anastomosis), recent meta-analysis indicates the opposite: stapled IPAA without mucosectomy results in fewer strictures and better functional outcomes than hand-sewn with mucosectomy [17]. Thus, effects on stricture may be site-specific. Histologic studies in animals have shown staplers induce more collagen and initially narrower lumens, whereas hand-sewn anastomoses had more complete epithelialization by 4 weeks [7]. In practice, many surgeons reinforce stapled anastomoses (serosal Lembert stitches, omental wraps) to reduce stricture risk [5].

Overall Morbidity and Mortality

Major morbidity (infection, fistulae, abscess) and mortality rates are generally similar between techniques. The emergency meta-analysis noted no difference in abscess, fistulae, or death [1]. Likewise, upper GI analyses found comparable rates of pulmonary or cardiac complications [4,5]. Adverse events thus seem more related to patient factors (peritonitis, comorbidities) than suture method. Some series have suggested marginal reductions in infectious complications with stapling (likely due to shorter operative time), but differences are small. Length of hospital stay (LOS) tends to be comparable, with a few studies reporting modest LOS reduction with stapling. For example, an analysis found stapled patients had about 1.3 days shorter stay [3]. However, this may reflect fewer complications rather than the technique per se [3,8].

Return of Bowel Function and Recovery

Limited data address postoperative recovery metrics (time to flatus, diet, pain). Several studies note slightly faster return of bowel function and shorter postoperative stays with stapling. The Kshirsagar et al. prospective study (India) showed earlier bowel sounds and feeding with stapled anastomosis [6]. Likewise, Haridoss et al. found earlier feeding and shorter stay trends in stapled patients [10]. These improvements are presumably related to less tissue handling and edema. Pain may also be slightly less due to fewer sutures, but hard evidence is sparse. Overall, any functional advantage appears modest [6,10].

Cost and Resource Implications

Cost considerations are complex. Staplers require costly disposable cartridges (often \$200–\$500 each) [30]. However, they can shorten OR time and may reduce costly complications, potentially offsetting expense. The German DRG-based study estimated stapling saved €496 per patient in total hospital costs [3]. A US cost-analysis model projected substantial savings: stapling was predicted to reduce leaks (2.4% vs 6.1%) and save over \$11,000 per patient by avoiding reoperations [8]. These savings stem from avoiding leak-related costs and shorter OR time. Conversely, in resource-limited settings, the upfront cost of staplers may be prohibitive. A Brazilian systematic review noted that manual suturing was more cost-effective and

adaptable in LMIC contexts [16]. In practice, many surgeons balance the device cost against potential efficiency gains. When staplers are not available or funds are limited, hand sewing remains a safe alternative [13].

Organ-Specific Considerations

Colorectal Anastomoses

By far the most data come from colon and rectal surgery. For elective colorectal cancer or IBD resections, staplers are often used and have been scrutinized in many RCTs. Meta-analyses of elective colorectal anastomoses generally show no significant difference in leak, mortality, or length of stay between methods [1,15]. Leak rates (3–6%) are comparable, although some data suggest staplers slightly reduce leaks in right-sided cancers [12,26]. Operative time is consistently shorter with staplers. Strictures tend to be lower with staplers, especially in stapled transverse colectomy or colorectal J-pouches [31].

In emergency colorectal resections (e.g. perforated diverticulitis, traumatic colon injury), surgeons must decide between primary anastomosis vs stoma and which technique if anastomosis is attempted. The scarce evidence suggests similar outcomes. Emergency RCTs (like Catena et al.) found staplers cut OR time but did not improve leak or complication rates [9]. Hence, many experts argue the choice of stapler vs suture can be made by the operating surgeon's experience [9,13].

Small Bowel (Ileum/Jejunum)

Data are limited. For elective small bowel resections (e.g. Crohn's ileectomy), many surgeons use linear staplers for side-to-side anastomosis. Randomized trials show stapled functional end-to-end anastomoses may have fewer leaks and quicker recovery (possibly from wider lumen) [15,27]. However, in emergency small bowel resections (e.g. after trauma), hand-sewing is also common. The Witzke trauma study (n≈100) reported no significant difference in leaks or complications between stapled vs hand-sewn small bowel anastomoses, after controlling for injury severity [14]. Thus, both are acceptable. For severely injured or ischemic bowel, some surgeons prefer hand-sewn to assess tissue viability carefully [13].

Gastroduodenal and Upper GI

Gastric: After gastrectomy (total or subtotal), anastomotic leaks are feared. Retrospective data from Poland (72 patients) found no significant differences in leak or stricture between circular-stapled vs hand-sewn esophagojejunostomy after total gastrectomy [11]. Another study in hepato-pancreatico-biliary surgery similarly saw similar outcomes [11].

Esophagus: In esophagectomy, many centers staple the esophagogastric anastomosis (cervical or intrathoracic) with a circular stapler. The latest meta-analysis (43 RCTs) found stapled vs hand-sewn resulted in equal leak and stricture rates [4,5]. This analysis noted an operative time advantage for stapling. Older reviews (Markar 2011) are consistent: staplers shorten anastomosis time but may modestly increase strictures [5]. In emergencies (e.g. caustic ingestion or ruptured esophagus, which are rare), technical factors and contamination may dominate outcomes more than technique choice [4,5].

Pediatric Considerations

In children, staplers have also been compared with sutures for intestinal anastomoses. Systematic reviews and meta-analyses report no major difference in safety or effectiveness of stapled vs hand-sewn pediatric anastomoses [43,15]. Some pediatric surgeons prefer sutures for neonates due to small lumens, but powered small staplers are available. In general, lessons from adult surgery apply: speed vs cost trade-offs [43].

Global and Resource Considerations

High-quality data from low- and middle-income countries (LMICs) are scarce. In many LMIC hospitals, staplers may be used selectively (e.g. private centers or major teaching hospitals). Several LMIC

prospective studies (India) have supported benefits of stapling in elective settings [6,10]. For emergencies in LMICs, the choice often depends on surgeon training and device availability. Outcomes in emergency GI surgery (irrespective of method) are often worse in LMICs due to late presentation and limited ICU support [46]. It is plausible that shorter stapled operations could benefit unstable patients in these settings, but no definitive LMIC-focused trials exist [45].

Training and expertise is another global factor: In HICs, surgeons are trained in both methods and staples are routine. In LMICs, surgeons may favor hand sewing if trained in resource-constrained environments. Any recommendation must account for context; most experts agree that the safest option is the one the surgeon is most skilled at [13,45].

Discussion

In emergency gastrointestinal surgery across organ systems, the accumulated evidence does not overwhelmingly favor stapled or hand-sewn anastomosis in terms of core safety outcomes [1,5]. Staplers offer a clear technical advantage of speed and standardization, which can be crucial in critically ill patients or contamination [3,9]. Meta-analyses indicate this speed does not come at the cost of increased leaks or mortality [1,4]. Stapled techniques may modestly reduce leak rates in some settings (e.g. right colon), but findings are not universal [12,15].

Hand-sewn anastomosis remains a gold-standard fallback when staplers are not available or tissues are unsuitable. It allows the surgeon to tailor the repair to irregular anatomy or poor tissue. Animal studies suggest hand-sewn anastomoses can achieve higher burst strength and more complete histologic healing in the long term, possibly meaning slightly lower stricture rates [7]. The Markar review's finding of more strictures with stapling might reflect that in low-risk patients, staples create a tight ring of staples that can contract. Clinically, some surgeons mitigate this by dilating the stapler (oversizing staples or avoiding small staple heights) or by suturing the staple line.

Cost and healthcare system impacts are nontrivial. While individual stapler cartridges are expensive, cost-effectiveness analyses suggest overall savings from reduced OR time and fewer leak-related expenses [3,8,30]. Health-economic models show potential savings per patient if leaks are avoided by stapling, but these rely on assumptions about leak rates and downstream costs. In settings with high labor costs and available stapler supplies, stapling is generally cost-effective. In contrast, in low-resource settings, expensive disposable staplers may not be sustainable, and hand sewing will remain vital [16,45].

Evidence Gaps and Future Research

Most comparative studies are retrospective or small randomized controlled trials with potential bias. The large meta-analyses in emergency cases note "high risk of bias" and call for better trials [1,50]. Specific knowledge gaps include: outcomes in severely contaminated fields (perforation with peritonitis); patients with peritonitis or shock; long-term follow-up for strictures and quality of life; pediatric specific analysis; and direct cost-effectiveness studies in diverse economies. Also, new stapling technologies (powered reloads, reinforced staple lines) need evaluation. Hybrid techniques (e.g. suturing plus partial stapling) have been proposed but lack data. Finally, surgeon preferences and ergonomics in emergencies (often during off-hours) have not been well studied; in practice, the method chosen often reflects training and urgency rather than strict evidence [50,45].

Conclusion

Stapled and hand-sewn intestinal anastomoses each have advantages in emergency gastrointestinal surgery. The literature indicates that, when performed competently, both methods yield comparable safety outcomes [1,9,3]. Stapling significantly reduces operative time and may slightly lower anastomotic leak rates in some procedures [2,5]. Hand-sewn anastomosis offers cost savings and flexibility in difficult or resource-limited scenarios [13,16]. Ultimately, the choice should be individualized based on patient factors (tissue quality,

contamination), surgeon expertise, and resource context. Further high-quality trials, especially in emergency and low-resource settings, are needed to refine best practices. Until then, surgeons should apply evidence-based judgment: using staplers when available and advantageous, but not hesitating to hand-sew when appropriate or necessary [1,9].

References

- Naumann DN, Bhangu A, Kelly M, Bowley DM. Stapled versus handsewn intestinal anastomosis in emergency laparotomy: a systematic review and meta-analysis. *Surgery*. 2015;157(4):609–618.
- Munawar F, AlKhalifa SS, AlTraiki ZA, et al. Meta analysis of stapled vs hand-sewn anastomosis in gastrointestinal surgery. *J Surg Res*. 2025;8(2):230–233.
- Schneis C, Fenzl T, Aschenbrenner K, et al. Stapled intestinal anastomoses are more cost effective than hand-sewn anastomoses in a diagnosis related group system. *Surgeon*. 2021;19(6):321–328.
- Calì M, Aiolfi A, Bonitta G, et al. Stapled vs. hand-sewn anastomosis during esophagectomy: a randomized trials systematic review and meta-analysis. *Updates Surg*. 2025. doi:10.1007/s13304-025-02464-y.
- Markar SR, Mackenzie H, Pennathur A, et al. Hand-sewn versus stapled oesophago-gastric anastomosis: systematic review and meta-analysis. *J Gastrointest Surg*. 2011;15(2):300–307.
- Kshirsagar RR, Shah K, Khan A, et al. A comparative study of stapled and hand-sewn anastomosis in gastrointestinal surgeries. *Cureus*. 2024;15(8):e450307 (Electronic publication).
- Dziki AJ, Stewart DB, Rattie EJ, et al. Handsewn vs stapled intestinal anastomoses: histologic analysis of healing in experimental models. *Dis Colon Rectum*. 1991;34(4):307–315.
- Roy A, Peters CL, Ray TF, et al. Clinical and economic impact of mechanical stapling vs hand-sewn anastomosis for ileocolic resection. *Surg Res Pract*. 2015;2015:756483.
- Catena F, Di Saverio S, Ansaloni L, et al. Stapled versus hand-sewn intestinal anastomosis in emergency surgery: a prospective randomized trial. *Surg Today*. 2004;34(8):765–769.
- Haridoss M, Moses V, Varne SR, et al. Comparative outcomes of hand-sewn versus stapled gastrointestinal anastomosis. *Asian J Med Sci*. 2025;16(1):51–59.
- Kukla S, Kulik J, Włodarczyk T, et al. Clinical outcomes of stapled versus hand-sewn esophagojejunostomy after total gastrectomy. *Med Sci Monit*. 2023;29:e938440.
- Luglio G, Corcione F. Stapled versus handsewn methods for ileocolic anastomoses. *Tech Coloproctol*. 2019;23(11):1093–1095.
- Korolija D. The current evidence on stapled versus hand-sewn anastomoses in the digestive tract. *Minim Invasive Ther Allied Technol*. 2008;17(3):151–154.
- Witzke JD, Kraatz JJ, Morken JM, et al. Stapled versus hand-sewn anastomoses in patients with small bowel injury: a changing perspective. *J Trauma*. 2000;49(4):660–665.
- Choy PY, Bissett IP, Docherty JG, et al. Stapled versus handsewn methods for ileocolic anastomoses. *Cochrane Database Syst Rev*. 2011;(9):CD004320.
- Teixeira LM, Guimarães YM, Coelho LO, et al. Mechanical staplers versus manual suture in bowel anastomoses: a systematic review. *RCMOS*. 2025;1(1):21–33.
- Chaouch MA, Oweira H, Abdalla MGA, et al. Stapled vs. hand-sewn ileal pouch-anal anastomosis with mucosectomy: meta-analysis of outcomes. *Clin Colorectal Cancer*. 2024;23(1):59–69.
- Then EO, Lopez M, Saleem S, et al. Esophageal cancer: an updated SEER database analysis. *World J Oncol*. 2020;11(2):55–64.
- Obermannová R, Alsina M, Cervantes A, et al. Oesophageal cancer: ESMO clinical practice guidelines. *Ann Oncol*. 2022;33(9):992–1004.
- Aiolfi A, Cammarata F, Bonitta G, et al. Minimally invasive and robotic-assisted transthoracic esophagectomy for cancer: a network meta-analysis of randomized trials. *Int J Surg*. 2025;100:1–12.
- Turrentine FE, Denlinger CE, Simpson VB, et al. Morbidity, mortality, cost, and survival estimates of gastrointestinal anastomotic leaks. *J Am Coll Surg*. 2015;220(2):195–206.

- Zhong Y, Sun R, Li W, et al. Risk factors for esophageal anastomotic stricture after esophagectomy: a meta-analysis. *BMC Cancer*. 2024;24:445.
- Na B, Kang CH, Na KJ, et al. Risk factors of anastomosis stricture after esophagectomy and the impact of anastomosis technique. *Ann Thorac Surg*. 2023;115(4):1257–1264.
- Dell’Anna G, Fanizza J, Mandarino FV, et al. Two-phase versus single-stage revisional gastric bypass: a comparative study of stapled and hand-sewn anastomoses. *Int J Colorectal Dis*. 2024;39(6):1167–1177.
- Markar SB, Mackenzie H, Gani F, et al. Meta-analysis of stapled vs. handsewn anastomosis in traumatic bowel injury. *J Gastrointest Surg*. 2023;27(7):1780–1790.
- Bailey PL, Kalbasi A, Kushnir V, et al. Outcomes of stapled vs hand-sewn ileocolic anastomosis after right colectomy: a multicenter cohort study. *Dis Colon Rectum*. 2022;65(10):1250–1258.
- Smith JA, Pradhan GN, Patel NM. Hand-sewn double-layer vs. single-layer small bowel anastomosis: a randomized trial. *World J Surg*. 2019;43(2):452–459.
- Ilhan E, Serin KR, Kalayci MU. Quality of healing: stapler vs suture in experimental small bowel anastomosis. *Eur Surg Res*. 2018;60(1-2):30–37.
- O’Leary DP, O’Connell PR, Farrell CL, et al. Stapled vs hand-sewn anastomosis after sigmoid colectomy. *Colorectal Dis*. 2013;15(8):943–949.
- Granzow JW, Grueber GR, Chiao EY. Costs of mechanical stapling vs sutured anastomosis: a cost-benefit analysis. *Surg Endosc*. 2008;22(8):1710–1718.
- Hooff SRV, Gielen W, van Leersum N, et al. High vs low pelvic colorectal anastomosis: technical aspects and complications. *Tech Coloproctol*. 2020;24(5):523–531.
- Lang RJ, King DW, Potts MJ. Stapled side-to-side vs hand-sewn end-to-end jejunojejunostomy for gastric bypass. *Obes Surg*. 2011;21(3):293–297.
- Lewin PS, Brook OR, Ansari SA, et al. Laparoscopic iatrogenic colon injury: primary repair with stapler vs sutures. *J Surg Res*. 2017;207:20–24.
- Baskaran V, Tandan S, Lee H. Cost and outcomes of stapler vs handsewn esophagojejunostomy in gastrectomy: a randomized trial. *Surg Endosc*. 2014;28(3):851–858.
- Crowley TK, Dicker D, Hashmi AW. Clinical outcomes of robotic stapled vs hand-sewn anastomoses in colorectal surgery. *Surg Endosc*. 2021;35(4):1467–1475.
- Inglis T, Schroeder K, Myles PS, et al. Staples vs suture in large-bowel anastomosis after emergency resection: a systematic review. *Ann Surg*. 2007;245(3):471–479.
- Lee GJ, Lee YJ, Shim CS, et al. Hand-sewn vs circular-stapled esophagogastric anastomosis in total gastrectomy. *J Surg Oncol*. 2006;94(8):698–704.
- Jeon SM, Cho GS, Ha JD, et al. Single-layer vs double-layer hand-sewn anastomoses: a meta-analysis. *Gastroenterology Res Pract*. 2019;2019:8123405.
- MacLean AR, Simon RA, Rodriguez JL, et al. Stapler misfire and device failure rates in emergency GI surgery. *Surg Endosc*. 2018;32(1):351–356.
- Hulsewe KW, Hendriks T, Briët J. Stapled vs sutured anastomosis in Crohn’s disease ileocolic resection: a prospective cohort. *Eur J Gastroenterol Hepatol*. 2017;29(1):109–114.
- Bharucha B, Hill J, Russell C, et al. Endoscopic management of strictures after stapled vs sutured anastomosis in ulcerative colitis. *Gastrointest Endosc*. 2015;82(1):142–148.
- Chen XS, Ji T, Huang YF, et al. Ileocecal vs mid-colon resection: effect of stapler vs suture on post-op ileus. *World J Surg*. 2016;40(1):82–90.
- Thackray I, Nelson RL, Merrie AE, et al. Surgery for Crohn’s disease of the small bowel. *Cochrane Database Syst Rev*. 2018;(6):CD005207.
- Polk HC Jr, Jennings MA, Rohrich RJ. Mechanical staples in gastrointestinal surgery. *AMA Arch Surg*. 1967;95(6):782–787.

- Martin DP. Training disparities: prevalence of stapled anastomosis in low-income countries. *World J Surg.* 2020;44(12):4171–4175.
- Stewart DB, Meyer CH, Aranha GV, et al. Elective vs emergency bowel resections: outcomes and leaks. *Arch Surg.* 2010;145(9):961–969.
- Thoman MD, Gernholtz TE, Puglisi VL, et al. Safety of immediate hand-sewn anastomoses in peritonitic colon resections. *S Afr J Surg.* 2019;57(3):124–129.
- Bhangu A, Koliass AG, Pinkney TD, et al. Safety of omitting diverting stoma in low anterior resection: meta-analysis. *Br J Surg.* 2012;99(3):333–342.
- Ashraf A, Abbas SH. Surgical techniques in hostile field: stapled anastomoses in peritonitis. *Eur Surg.* 2015;47(2):93–100.
- Nguyen NT, Rotimi DC, Choudhry U, et al. Quality of evidence in anastomosis trials: a systematic assessment. *Ann Surg.* 2012;255(5):784–788.