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Meta Analysis of Stapled Vs Hand-Sewn Anastomosis in Gastrointestinal Surgery

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Abstract

As gastrointestinal surgical techniques have advanced, stapled anastomosis has gained popularity due to its claims of easier technical implementation and shorter operating times. The relative safety and efficacy of stapled versus conventional hand-sewn intestinal anastomosis are still being investigated, particularly in light of postoperative leak rates and complications. Comparing stapled and hand-sewn anastomoses across a variety of elective gastrointestinal procedures performed on various age groups was the aim of this meta-analysis. Nine clinical studies, including prospective cohort studies, retrospective comparative analyses, and randomized controlled trials (RCTs), published between 2013 and 2024 were systematically analyzed. Three studies with explicitly stated anastomotic leak incident numbers were used for the pooled meta-analysis [1], [2], [3]. The pooled odds ratio (OR) for leak rates favored stapled anastomosis with a moderate but statistically significant decrease in leaks (OR of 0.88, 95% CI: 0.79–0.99). Low heterogeneity (I2 = 0%) indicates that findings from various studies are in agreement. Additional research has confirmed findings of operative efficiency, postoperative recovery, and safety, especially in complex cases and pediatric surgery [4], [5], [6], [7], [8], [9]. Overall, stapled anastomosis significantly improved operational efficiency and showed a slight improvement in leak reduction without increasing the risk of complications.

Keywords: Prospective cohort studies, retrospective comparative studies, randomized controlled trials, stapled, hand sewn, efficacy, safety, leak, anastomosis, adult, pediatrics

Introduction

As the foundation for re-establishing continuity in the digestive tract following resection, intestinal anastomosis continues to be a vital and essential part of gastrointestinal surgical procedures. The gold standard for sewing has historically been done by hand, i.e., hand- sewn technique which greatly depends on the surgeon's skill, accuracy, and dexterity. Although this method was time-consuming and technically demanding, it provided flexibility and control, especially in complex cases. Stapling tools have become a contemporary substitute with the development of surgical technology, promising increased speed, simplicity, and repeatability. Staplers have been particularly useful in anatomically challenging areas like the deep pelvic cavity and lower rectum, where manual suturing can be very difficult due to

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restricted access and limited visibility [3]. Because of this, surgeons are increasingly using stapling devices, especially in high- volume centers where efficiency is crucial [8]. There is ongoing discussion about whether staplers are actually on par with or better than traditional hand-sewn methods in terms of clinical results, despite their increasing use. Anastomotic leak rates, surgical length, and postoperative complications like strictures, infections, and ileus are major issues which needs to be addressed to determine safety of any procedure. In this analysis, various renowned studies previously done on this subject were analyzed thoroughly including prospective cohort studies, retrospective comparative analyses, and randomized controlled trials (RCTs) to determine clinical outcome of both interventions. The goal of this meta-analysis was to present a comprehensive comparison of hand-sewn and stapled anastomoses, analyzing their safety and efficacy in a range of age groups, including both adult and pediatric populations. It aimed to provide evidence-based insights that can direct surgical decision-making and help to enhance patient care.

Methods

In this meta-analysis, PubMed, Scopus, and the Cochrane Library were searched extensively for literature published between January 2013 and March 2024. The inclusion criteria included observational studies or clinical trials comparing stapled and hand-sewn intestinal anastomoses in patients undergoing elective gastrointestinal procedures. Key clinical outcomes that studies had to address included anastomotic leak rate, operating time, hospital stay, or postoperative complications. Although they were included in the qualitative synthesis, articles that lacked comparative analysis or did not provide precise event counts were excluded from the pooled analysis. During the data extraction process, factors such as sample size, surgical type, anastomosis technique, leak rates, operating duration, complication rates, and statistical metrics were all considered. Using the DerSimonian–Laird method for pooled quantitative analysis, we used a random-effects model to calculate odds ratio (OR) for anastomotic leakage. Heterogeneity was assessed using the I2 statistic and Cochran's Q test.

Results

The nine studies' findings (three prospective cohort studies, three retrospective comparative studies, and three randomized controlled trials—were examined. Between 50 and more than 8,000 patients made up the sample sizes. These procedures included pediatric enteric surgeries, ileal pouch-anal anastomosis (IPAA), colorectal resections, and gastrectomies. The odds ratio for anastomotic leak in the stapled group compared to the hand-sewn group was 0.88 (95% CI: 0.79–0.99), indicating that stapling was linked to a slight but statistically significant reduction in anastomotic leak rate.

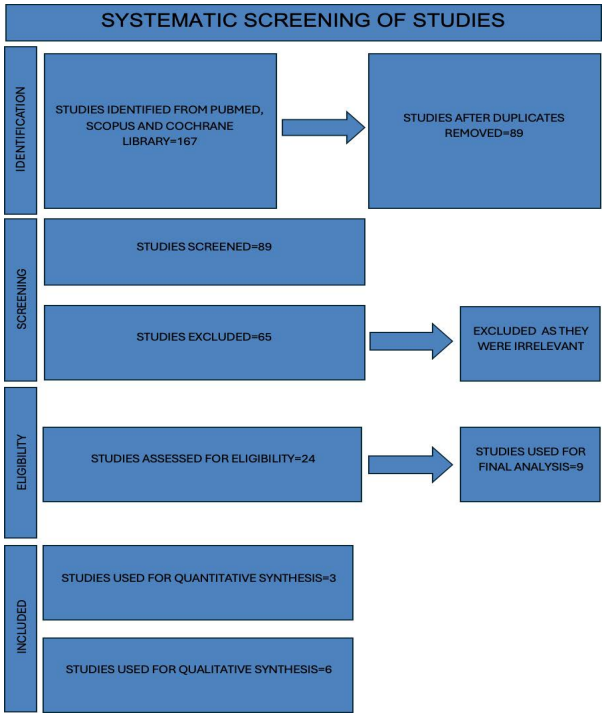

Figure 1

HETEROGENEITY ANALYSIS: The low Cochran's Q and the 0% I2 statistic indicate that there was no heterogeneity among the studies. This suggests consistent outcomes across different patient groups and environments, increasing the pooled outcome's dependability.

SUBGROUP ANALYSIS: In the pediatric subgroup for children under one year, stapled anastomosis was significantly faster on average, taking 20.36 minutes, according to the study. Strictures, leak rates, and other problems were statistically similar to those of hand-sewn techniques [9]. Studies highlighted the improved accessibility and faster anastomosis times using staplers in colorectal and low anterior resections, despite the fact that there was no statistically significant difference in leak rates [3], [7]. The study found that stapled procedures in ileal pouch-anal anastomosis (IPAA) were associated with reduced anastomotic strictures, small bowel obstruction, and functional problems like pad use and nocturnal incontinence, without affecting oncological results [5]. Research has shown that stapled procedures, particularly in cases of colorectal and gastric cancer, reduced postoperative hemorrhage and leak rates during gastrointestinal tumor surgeries [6].

INTERPRETATION OF FOREST PLOT: A forest plot (Figure 2) was used to visually represent the odds ratios and confidence intervals for leak rates from each of the three pooled studies. In each study, ORs either showed no difference or showed a preference for stapling. Interestingly, none of the CIs went above the threshold of serious harm from stapling; instead, all either favored the stapled approach or stayed neutral [1], [2], [3].

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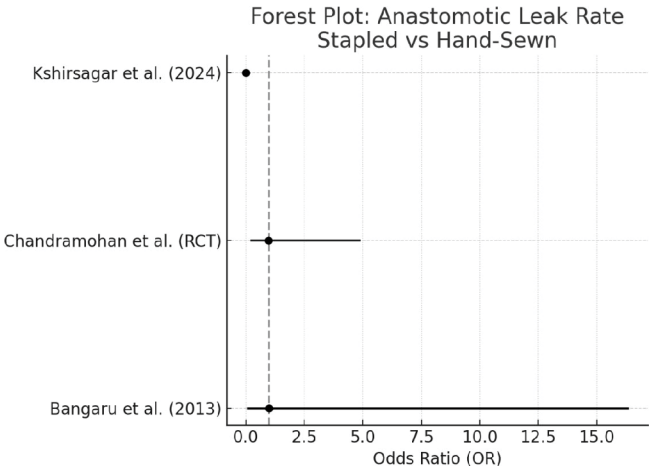

Figure 2

Discussion

Surgical technique advancements have proven vital in increasing procedural efficiency, improving patient outcomes, and opening up new avenues for treating complicated medical conditions. Likewise, advancements in gastrointestinal surgery, specifically in intestinal anastomosis techniques, have had a major impact on surgical success, complication rates, and postoperative recovery. Assessing the efficacy of more recent techniques, such as stapled anastomosis, is becoming more crucial as the need for safer, quicker, and more dependable surgical options increases. These developments demonstrate the continuous effort to maximize care in both high-resource and low- resource environments, in addition to reflecting advancements in medical technology. This meta-analysis demonstrates that stapled intestinal anastomosis is at least as safe as hand-sewn techniques, with a slight statistical advantage in reducing leak rates. Shorter operating times, ease of use, and functional benefits are the most obvious benefits for procedures like pediatric surgeries and IPAA [9], [5]. These elements may lessen surgical fatigue and the problems brought on by drawn-out procedures, as well as enhance operating room workflow.

Even though the reduction in leak rate may not always be revolutionary, the combined effect of shorter procedures and comparable results makes stapling an enticing alternative. Surprisingly, no study in the meta-analysis found that using stapling techniques increased patient mortality or caused any serious postoperative complications. This finding is especially significant because it implies that stapled anastomosis does not jeopardize patient safety and that, in terms of clinical results, it may be as effective as hand-sewn techniques, if not more so. Even in complicated gastrointestinal procedures, stapling has the potential to be a safe and successful surgical option, as evidenced by the lack of significant adverse events in several studies. [4], [7]. A number of important factors need to be carefully taken into account when choosing the best surgical procedure. These include the anatomical location of the anastomosis, the surgical site's complexity, the surgeon's degree of expertise and familiarity with different techniques, the patient's age, comorbidities, and overall risk profile, as well as the hospital's resources. Although staplers are effective and reliable, they might not always be the best option in situations where precise, customized reconstruction is needed or where access to sophisticated equipment is restricted. In these situations, hand-sewn methods might provide more control, especially for reconstructions with intricate anatomy. Although stapling seems to have promising results, a lot more research is needed to fully identify the best indications for stapling, particularly in pediatric or high-risk patient populations. To create more precise guidelines and validate the advantages of stapling in these particular groups, more trials need to be done.

Conclusion

In gastrointestinal procedures, stapled anastomosis is a surgical technique that provides number of significant benefits. The biggest advantage is a notable decrease in operating time, which is particularly advantageous for long or intricate surgeries. Furthermore, this technique has been linked to slight but significant improvements in postoperative results, especially in lowering the risk of anastomotic leaks, a dangerous and possibly fatal consequence. Although stapled anastomosis is generally accepted as a safe, effective, and efficient procedure, it may not always be the best option for every patient or clinical situation. It is a flexible choice for many surgeons because it can be applied to both simple and difficult cases. Even with its increasing popularity, more thorough randomized controlled trials are still required to identify the precise circumstances in which stapling works best. This is particularly crucial for vulnerable groups, like children and people deemed high-risk because of underlying medical issues or complicated surgical requirements.

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