Clinical Review

Stapled versus handsewn intestinal anastomosis in emergency laparotomy: A systemic review and meta-analysis

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Background. The optimal technique for gastrointestinal anastomosis remains controversial in emergency laparotomy. The aim of this meta-analysis was to compare outcomes of stapled versus handsewn anastomosis after emergency bowel resection.

Methods. A systematic review was performed for studies comparing outcomes after emergency laparotomy using stapled versus handsewn anastomosis until July 2014 (PROSPERO registry number: CRD42013006183). The primary endpoint was anastomotic failure, a composite measure of leak, abscess and fistula. Odds ratio (OR; with 95% CI) and weighted mean differences were calculated using meta-analytical techniques. Subgroup analysis was conducted for trauma surgery (TS) and emergency general surgery (EGS) cohorts. Risk of bias for each study was calculated using the Newcastle–Ottawa scale for cohort studies, and Cochrane Collaboration’s tool for randomized trials.

Results. The final analysis included 7 studies of 1,120 patients, with a total of 1,205 anastomoses. There were 5 TS studies and 2 EGS studies. There were no differences in anastomotic failure between handsewn and stapled techniques on an individual anastomosis level (OR, 1.53; 95% CI, 0.97–2.43; P = .070), or on an individual patient level (OR, 1.44; 95% CI, 0.92–2.25; P = .110). There were no differences in the individual rates of anastomotic leak, abscess, fistulae, or postoperative deaths between techniques. Subgroup analysis of EGS and TS studies demonstrated no superior operative technique.

Conclusion. Available evidence is sparse and at high risk of bias, and neither stapling nor handsewing is justifiably favored in emergency laparotomy. Surgeons might therefore select the technique of their own choice with caution owing to unresolved uncertainty. (Surgery 2015;157:609-18.)

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The recent Cochrane review that compared elective stapled and handsewn colorectal anastomosis showed no differences in outcome between techniques, but commented that during higher risk emergency laparotomy, this question remains unanswered.1 Another recent Cochrane review analyzing elective ileocolic anastomosis found that, although none of the individual studies favored handsewn or stapled techniques, meta-analysis favored the stapled technique in the cancer resection subgroup but not the Crohn’s disease resection subgroup.2 Such a finding suggests that there may be unique circumstances in which even small differences in outcomes between techniques have the potential to make a difference in specific populations. Choice of operative technique also depends on differences in opinion, interpretation of evidence, as well as both personal and institutional practice, making this a topic of debate and controversy. There have been no randomized clinical trials (RCTs) in the last 10 years regarding elective handsewn versus stapled colorectal anastomoses, leading the Cochrane reviewers to stipulate that the research question has lost its strength. However, emergency surgery differs from elective surgery in terms of pathology,
perioperative physiology, and general management principles, which may mean that technical success in the elective setting may not be transferable to emergency patients, and that these situations must be considered separately. There is particular concern that edematous bowel is less suited to stapled anastomosis than handsewn in an emergency situation. Bowel becomes edematous after splanchnic hypoperfusion and subsequent reperfusion; in addition, the inflammatory host response may be initiated in response to sepsis or trauma. We hypothesized that there would be a favorable trend toward handsewn anastomosis in an emergency setting, because this technique might be more suitable than stapling for technical “fine tuning” by the operating surgeon to compensate for the more hostile conditions of bowel.

We also hypothesized that there may be additional differences between trauma surgery (TS) and emergency general surgery (EGS) patients, because the physiologic conditions are typically dominated by hemodynamic instability from hemorrhage in the former, whereas the latter is predominantly complicated by sepsis. The 2 groups may also have different patient demographics, with TS patients being younger and more likely to be male than EGS patients. There have been no systematic reviews comparing handsewn and stapled anastomosis in the emergency laparotomy setting; neither have there been any analyses of the subgroups of TS and EGS. We therefore sought to address this gap in the literature with a summation of the best available evidence.

RCTs in the emergency surgical context remain challenging. Because there is no preoperative certainty that anastomosis will be required, gaining informed consent is difficult. Furthermore, institutional review boards may prohibit RCTs that seek to predetermine operative techniques among surgeons, because it may not be ethical or practical to “force” surgeons to use techniques they are not accustomed to, or do not wish to use. Therefore, when conducting this systematic review and meta-analysis, we were aware that RCT data might be sparse, and that a pragmatic approach of utilizing all other retrospective and cohort study data would likely have to suffice. Summation of these data, although less than scientifically ideal, will provide the largest and most generalizable evidence to date on this topic, which may help to assess the need for more specifically targeted trials if potential avenues of investigation were to be highlighted. We aimed to determine whether there was a difference in outcome between stapled and handsewn anastomosis after emergency laparotomy, as well as whether there were any differences among trauma and EGS study subgroups.

METHODS

Data sources and search strategy. This review was performed according to a prespecified protocol, which was registered with the International Prospective Register of Systematic Reviews (PROSPERO, ID number: CRD42013006183). A systematic search of the OVID SP and PubMed versions of Medline, the Cochrane Database of Systematic Reviews, Current Controlled Trials, and ClinicalTrials.gov was performed for published studies comparing stapled and handsewn anastomoses for emergency bowel surgery. Only studies published after 1990 in English were included. The search was performed independently by 2 authors (M.K., A.B.). Medical subject heading terms were used to search Medline, combining domains of the operation, anastomosis type and randomization, using the AND function (Supplementary Table I). A manual search of reference lists in relevant review articles was undertaken to further identify studies of potential interest. Abstracts and conference proceedings were excluded because of the high probability of incomplete data. Citations were collated with EndNote Reference Manager (Version X4, Thomson Reuters), and duplicates removed. The last search was performed on July 25, 2014.

Inclusion and exclusion criteria. RCTs, as well as both prospective and retrospective cohort studies comparing ≥1 outcome of stapled versus handsewn anastomosis after emergency bowel resection were included. All gastrointestinal anastomoses, for any emergency indication, were eligible for inclusion. Studies with only elective patients or unclear anastomosis technique were excluded. Where there was overlap in the same patients between studies, the older study was excluded. Patients who underwent concurrent handsewn and stapled anastomoses during multiple anastomoses were excluded from further analysis, because it would be impossible to identify which outcome was attributable to which anastomosis.

Data extraction. Two authors extracted data independently (D.N.N., M.K.). Discrepancies in outcome extraction were resolved by reexamination of the relevant study until consensus was achieved. Data extracted on study design included: Indication (TS or EGS), randomization technique, intervention arms, mechanism of anastomosis (using a stapling device or handsewn). Details relating to the included patients were number, age, gender, mechanism of injury, injury severity score, and anatomic level of bowel resection and anastomosis.
Details relating to the operation were policy for anastomosis technique and type of stapler or sutures used.

Definitions. “Stapled” was defined as an anastomosis fashioned using a stapling device of any kind, with or without sutured closure of enterotomy or oversewing of staple lines. “Handsewn” was defined as an anastomosis that was fashioned by the surgeon using any suture material, and without the utilization of a stapling device. Anastomotic leak, abscess, and fistula were defined as present if a statement of definitive diagnosis was made in the text and/or table of the study, including ≥1 of (a) radiologic or (b) intraoperative (celiotomy/laparotomy) diagnosis, regardless of whether subsequent percutaneous or operative intervention was required. “Anastomotic failure” was defined as any anastomotic leak, abscess or fistula as defined above. “TS studies” were defined as studies that reported patient outcomes after bowel resection as a result of blunt or penetrating trauma to the abdomen. “EGS studies” were defined as studies as studies that reported patient outcomes after emergency laparotomy in the absence of any traumatic injury to the abdomen.

Outcome measures. Outcomes in emergency surgery studies differ slightly from elective surgery in that they are typically presented with the denominator being either the total number of patients or the total number of anastomoses (or both may be simultaneously reported), because some patients in this situation may receive multiple anastomoses. This is especially true for retrospective studies in which the methodology does not exclude multiple anastomoses. Data extraction was therefore performed at both the patient and individual anastomosis levels. The authors agreed that, where possible, final analysis would be presented on both of these levels because this most accurately reflects the available literature. Furthermore, presentation of these data might further serve to illustrate the differences between elective and emergency surgery in terms of patterns of surgical practice. However, where a choice between these 2 reporting methods was necessary, patient-level data are reported in preference to anastomotic-level data, because they are more clinically relevant to patient-centered surgical practice.

Because some studies did not contain all 3 of (a) anastomotic leak, (b) abscess, and (c) fistula, the primary outcome assessed for meta-analysis was a composite measure of “anastomotic failure” (as defined). Secondary outcomes recorded were individual rate of anastomotic leaks, abscesses, and fistulae, duration of stay in hospital, duration of stay in intensive care, postoperative mortality, blood product requirement, surgical site infections, and duration of operating time.

Subgroup analysis. As well as meta-analysis for all emergency studies, the subgroups of trauma and EGS were also separately analyzed using the same primary outcome (anastomotic failure). Secondary outcomes listed were also meta-analyzed where ≥2 studies reported each outcome.

Assessment of bias. The Newcastle–Ottawa score was applied to assess the quality of nonrandomized and cohort studies based on the risk of bias. Predefined criteria were used to determine this score, including assessment of the selection and comparability of the study groups, and the methods of measuring outcomes. A star system was used to judge quality in 8 domains, with a maximum of 9 stars. The authors defined studies with ≥7 stars as relatively high quality, and those with ≤6 stars as relatively low quality. Additionally, risk of bias for RCTs was assessed using domains provided by the Cochrane Collaboration’s tool for assessing risk of bias in randomized trials, including assessment of sequence generation, allocation concealment, blinding, completeness of data, and method of outcome reporting. Two authors (D.N.N., A.B.) independently calculated the quality scores using these systems, verified by a third author in case of discrepancy until consensus achieved. Funnel plots were also used to assess for publication bias, being judged by 2 authors independently (M.K., A.B.).

Statistical analysis. A meta-analysis was conducted according to guidelines from the Preferred Reporting Items for Systematic reviews and Meta-Analysis group (PRISMA). The odds ratio (OR) was used as the statistical measure for dichotomous outcomes, and the weighted mean difference was used as the statistical measure to compare continuous data. ORs were calculated from the original data and meta-analyzed using the Mantel–Haenszel method. The OR represents the odds of an adverse event (such as anastomotic leak) occurring in the intervention (stapled) versus control group (handsewn). An OR of >1.00 indicated a greater risk of an adverse event occurring in the intervention group, but when the 95% CI crosses 1.00, then the overall effect is not significant. Significance was judged using the Chi-square test. The $I^2$ method was used to quantify heterogeneity (between-studies variance). The authors decided that meta-analysis would only performed for outcomes that ≥3 studies reported to maximize reliability of data. However, for subgroup analysis of TS and EGS groups, this threshold was reduced to ≥2 studies because there were fewer studies available in each subgroup.
Metaregression was used to test the relationship between year of study and OR for each outcome. Statistical analysis was performed using Review Manager 5.1 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2011).

**Heterogeneity and mixed effects modelling.** The authors were aware that the studies included in this meta-analysis were likely to be at relatively high risk of bias owing to heterogeneity (owing to variations in study methodology and populations between studies). Random effects modelling was used to mitigate this risk, as described by DerSimonian and Laird.\(^{10}\) Regardless of the calculation of heterogeneity (\(I^2\)) for each individual comparison, the fixed-effect model could not be used because it requires the assumption that the effect size for all the studies is identical, with the variation in effect size between studies being owing to sampling error only (ie, all studies are treated as if they essentially contain patients from the same population). By using the random effects model, the aim is not to estimate 1 true summary effect, but instead to measure the mean of a distribution of effects. This approach allows each study to contribute its own effect size to the overall mean effect, without any 1 of the studies having overwhelming (or underwhelming) influence.

This meta-analysis asks the question: “Is there a generalizable difference between handsewn and stapled anastomosis in emergency laparotomy?” Therefore, the null hypothesis is that the mean outcome effect (for all studies) of handsewn versus stapled anastomosis techniques is equal. Such a null hypothesis is best tested by using the random effects model, because the fixed effects model would only test the null hypothesis that the outcome effects in every study are equal.

**RESULTS**

**Study selection.** The initial literature search yielded 1825 potential studies of interest after duplicates were removed. After abstract screening, there were 36 full texts assessed for eligibility. One study\(^ {11} \) was excluded because it included overlapping patients with a later study,\(^ {3} \) and 28 further studies did not adequately compare outcomes after handsewn and stapled anastomosis. Final analysis therefore included 7 studies, consisting of 5 studies regarding TS laparotomy\(^ {3,4,12,13} \) and 2 studies regarding EGS laparotomy\(^ {5,14} \) (Fig 1). Two of the studies were prospective (one each of trauma and EGS), of which one (EGS) was randomized. The remainder were retrospective cohort studies.

**Study characteristics.** The 7 analyzed studies included patients from the United States, Canada, South Africa, Colombia, and Italy between 2000 and 2013, with study periods ranging from 20 to 130 months. There were a total of 1,120 patients with 1,205 anastomoses included. None of the studies included data from minimally invasive or laparoscopic surgery. Study characteristics, as well as the OR for the primary outcome (anastomotic failure) are summarized in Table I (patients with multiple combined handsewn and stapled anastomoses are not illustrated in this table because they were excluded from further analysis). Five studies included the gender of patients, with 579 of 867 being male (66.8%). Six studies included patient age with a mean (±SD) of 40.9 years (±17.3) for all studies.

**Study quality assessment.** The included studies were all found to be at potentially high risk of bias according to the Newcastle–Ottawa score and Cochrane assessments (Supplementary Table II). All of the nonrandomized studies lacked well-matched stapled and handsewn groups, independent outcomes assessment, or data regarding patient comorbidities or risk factors for adverse outcomes. The studies were also deemed to be at high risk of clinical heterogeneity owing to variation in outcomes definitions for anastomotic leak, abscess, and fistula, including a combination of radiologic, operative and clinical findings (Supplementary Table III). There was some asymmetry in funnel plots, indicating the presence of a degree of publication bias, most likely arising from the pooling of results from low-quality and small numbered studies (Supplementary Figure).

**Reporting of outcomes.** One TS study\(^ {12} \) and 1 EGS study\(^ {5} \) only reported outcomes with total
anastomoses as the chosen denominator, with no data reported with regard to total number of patients. The remaining 5 studies (4 TS and 1 EGS) all reported outcomes with both total anastomoses and total patients as denominators. Of the 7 studies reporting data on an individual anastomosis level, 6 reported anastomotic leak, 4 reported abscesses, 4 reported inpatient duration of stay, and 3 reported enterocutaneous fistulae.

Of the 5 studies reporting data on an individual patient level, all 5 reported anastomotic leak and postoperative mortality, 3 reported abscesses, and 2 reported enterocutaneous fistulae.

Because only 2 studies reported injury severity score, 5,6 2 studies reported duration of stay in intensive care, 5,6 and 2 studies compared operating times, 5,14 a meta-analysis was not performed for these outcomes. Similarly, because only 1 study 7 reported associated injury score, 1 reported surgical site infections, 14 and 1 reported perioperative blood product requirement, 5 these variables could not be meta-analyzed.

**Primary outcome.** Table II summarizes the meta-analysis of the outcomes in terms of (1) total anastomoses and (2) total patients. When the primary outcome of anastomotic failure was assessed on an anastomosis level for all 7 studies, there was no difference in outcome, with 101 of 673 anastomotic failures (15%) in the stapled group, and 62 of 532 in the handsewn group (11.7%); \( P^2 = 28\% \); OR, 1.53; 95% CI, 0.97, 2.43; \( P = .070 \); Fig 2, A). When anastomotic failure was assessed on a patient level for all 5 eligible studies, there was similarly no difference between groups, with 66 of 357 anastomotic failures (18.5%) in the stapled group and 50 of 334 (15.0%) in the handsewn group (\( P^2 = 0\% \); OR, 1.44; 95% CI, 0.92, 2.25; \( P = .110 \); Fig 2, B).

Using meta-regression analysis, there were no associations between year of study and anastomotic failure at patient level (beta, -0.204; 95% CI, -0.647, 0.240; \( P = .240 \)), or at an anastomosis level (beta, 0.035; 95% CI, -0.299, 0.299; \( P = .746 \)).

**Secondary outcomes.** For the studies that reported anastomotic leak, there was no difference at an anastomosis level between stapled (20/540; 3.7%) and handsewn (21/432; 4.9%) groups (OR, 1.00; \( P = 0.99 \)). Similarly, there was no difference on an individual patient level between the stapled (19/450; 4.2%) and handsewn (20/361; 5.5%) groups (OR, 1.11; \( P = .80 \)). For the studies reporting abscesses, there was no difference between stapled and handsewn groups on a patient level (41/450 [9.1%] vs 27/361 [7.5%]; OR, 1.58; \( P = .12 \)), or on an anastomosis level (53/540 [9.8%] vs 32/432 [7.4%]; OR, 1.42; \( P = .24 \)). Fistulae could only be analyzed at an anastomosis level, and there was no difference between the stapled and handsewn groups on an anastomosis level (8/540; 1.5%) and handsewn (3/432; 0.70%) groups (OR, 1.29; \( P = .69 \)). There was no difference in inpatient duration of stay between stapled and handsewn groups (weighted mean difference, -1.37; \( P = .180 \)). There was no difference between stapled and handsewn groups with regard to postoperative death (OR, 1.87; \( P = .100 \)).

**Subgroup analysis.** In a subgroup analysis of patient characteristics, those in the TS group were more likely to have multiple anastomoses (688 patients with 827 anastomoses) than the EGS group (432 patients with 434 anastomoses). Trauma patients were more likely to be male than EGS patients (86.4% and 47.0%, respectively). Mean age was significantly younger for TS studies (29.9 years) than for EGS studies (62.9 years).

The 2 EGS studies could only be analyzed on an anastomosis level because 1 of them only reported this denominator. 5 There was no difference between the groups with regard to anastomotic failure (27/239 [11.3%] stapled vs 11/195 [5.64%])
handsewn; \( P = .06; \text{Fig 3, A} \). Furthermore, there was no difference in mean duration of hospital stay between stapled and handsewn groups (weighted mean difference, -2.2; 95% CI, -4.84, 0.43; \( P = .10 \)). There was no difference in mortality between the stapled (14/239 [5.9%]) and handsewn (7/195 [3.6%]) groups (\( P = .29 \)).

The 5 trauma studies were analyzed on both an individual patient and individual anastomosis level. There was no difference between the groups with regard to anastomotic failure on an individual anastomosis level (74/434 [17.1%] stapled versus 51/337 [15.1%] handsewn; \( P = .30; \text{Fig 3, B} \)). Similarly, there was no difference on an individual

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**Table II.** Summary table for all stapled versus handsewn anastomoses outcomes reported for individual anastomosis and individual patients

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total (n)</th>
<th>OR/WMD</th>
<th>95% CI</th>
<th>( I^2 )</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual anastomoses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anastomotic failure</td>
<td>1,205</td>
<td>1.53</td>
<td>0.97, 2.43</td>
<td>28</td>
<td>.070</td>
</tr>
<tr>
<td>Anastomotic leak</td>
<td>972</td>
<td>1.00</td>
<td>0.42, 2.40</td>
<td>20</td>
<td>.999</td>
</tr>
<tr>
<td>Abscess</td>
<td>742</td>
<td>1.42</td>
<td>0.79, 2.57</td>
<td>23</td>
<td>.240</td>
</tr>
<tr>
<td>Enterocutaneous fistula</td>
<td>535</td>
<td>1.29</td>
<td>0.36, 4.69</td>
<td>0</td>
<td>.690</td>
</tr>
<tr>
<td>Inpatient duration of stay (d)</td>
<td>815</td>
<td>-1.37</td>
<td>-3.37, 0.63</td>
<td>49</td>
<td>.180</td>
</tr>
<tr>
<td><strong>Individual patients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anastomotic failure</td>
<td>691</td>
<td>1.44</td>
<td>0.92, 2.25</td>
<td>0</td>
<td>1.10</td>
</tr>
<tr>
<td>Anastomotic leak</td>
<td>691</td>
<td>1.11</td>
<td>0.53, 2.31</td>
<td>0</td>
<td>.800</td>
</tr>
<tr>
<td>Abscess</td>
<td>461</td>
<td>1.58</td>
<td>0.89, 2.79</td>
<td>2</td>
<td>.120</td>
</tr>
<tr>
<td>Postoperative death</td>
<td>918</td>
<td>1.87</td>
<td>0.88, 3.96</td>
<td>0</td>
<td>.100</td>
</tr>
</tbody>
</table>

\( OR \), Odds ratio; \( WMD \), weighted mean difference.
patient level (59/251 [23.5%] stapled versus 45/239 [18.8%] handsewn; \( P = .18 \); Fig 3, C). There was no difference in mortality between the stapled (17/269 [6.3%]) and handsewn (4/215 [1.8%]) groups (\( P = .19 \)).

**Operative technique.** The types of individual anastomoses varied between studies; 2 trauma studies\(^4,12\) excluded large bowel anastomosis and 1 trauma study\(^6\) excluded small bowel anastomosis. Three studies specifically described the stapling technique and product used for stapled anastomoses\(^5,12,14\); however, no studies explicitly discussed whether the staple line was oversewn. Four studies specifically described the criteria for handsewn anastomoses in terms of which suture and which type of anastomosis (ie, single layer or double layer; Supplementary Table III).

**DISCUSSION**

**Main findings.** This systematic review and meta-analysis specifically investigates the differences in outcomes between handsewn and stapled anastomosis after emergency laparotomy. The results using a random effects model show that there are no differences between the handsewn and stapled groups in terms of anastomotic failure on
either individual patient or anastomosis levels. Similarly, there are no demonstrable differences in the rates of anastomotic leak, abscess, fistula, duration of hospital stay, or mortality between these groups. Rather than specifically favoring either operative technique, these data give credibility to a surgeon selecting a technique of their own choice in the knowledge that this is supported by the currently available summation of evidence.

Subgroup analysis. When comparing the TS and EGS subgroups there are some (perhaps obvious) patterns that emerge: Trauma patients were younger and more likely to be male. They were also much more likely to have multiple anastomoses during a single laparotomy. Similar to the meta-analysis of all the studies, when using random effects analysis, neither of the 2 subgroups favored handsewn or stapled anastomosis in any of the outcome measures. However, the number of studies in each subgroup was low (especially EGS). Because there are only 2 studies examining the outcomes after EGS, we recommend that further evidence in this particular subgroup may be required to more fully address the question in this circumstance.

Comparison with other studies. There have been a number of systematic reviews comparing stapled and handsewn techniques for elective surgery in the last 15 years, the most recent identifying 7 RCTs for ileocolic anastomoses and 9 for colorectal anastomoses. A recently published systematic review of systematic reviews and panoramic meta-analysis of pooled estimates that compare stapled and handsewn anastomoses for all operative procedures analyzed 11 systematic reviews and reported no evidence of superiority for either stapled or handsewn anastomosis with respect to postoperative complications, or duration of stay, but a potential benefit of stapled anastomosis in ileocolic anastomosis. However, none of these systematic reviews specifically analyzed emergency surgery (or indeed separate trauma or EGS subgroups) as a separate entity. There is a striking paucity of data regarding anastomosis in emergency laparotomy, and this may warrant further investigation through well-designed cohort studies if RCTs are not feasible. Because such future studies are unlikely to be RCTs, but instead utilize prospective observational data regarding operative techniques, propensity score matching analysis may be used to measure treatment effects while reducing the bias associated with nonrandomization. We observed that none of the nonrandomized studies in this review utilized this statistical test, although it was described in 1983.

Handsewn anastomoses have been reported as more time consuming than stapled during elective surgery. Such differences in time may be particularly important during emergency surgery, because duration of anesthetic and operative times may need to be kept to a minimum to curtail the adverse physiologic effects of prolonged surgery in a metabolically vulnerable group. Unfortunately, only 2 of the included studies in this review compared duration of surgery between techniques, both of which were EGS studies. However, they both reported a significantly shorter operating time for stapled anastomosis than handsewn, although neither demonstrated an effect on patient outcome. Comparison of overall cost for each of the operative techniques has previously been reported in a systematic review regarding elective surgery, but such considerations could not be analyzed in this study owing to lack of reporting by the individual studies.

Strengths and limitations of this study. Statistical approach. When analyzing data from different studies with a high likelihood of differences in populations and methodology, it is important to incorporate this heterogeneity into the analysis of the overall effects of the intervention. The authors’ suspicions regarding the heterogeneity and quality of studies was borne out by quality assessment of individual studies, confirming the superiority of the random effects to the fixed effects model. One potential problem when using this model is that it is much more likely that variances, CIs, and standard errors for the overall summary effects will be larger, making it more likely that the null hypothesis will be accepted (ie, there are no differences in outcome between handsewn and stapled techniques). Such an approach, despite being less likely to demonstrate superiority in an operative technique, is nevertheless superior to the alternative of using fixed effects modelling, which would require errant assumptions to be made regarding interstudy homogeneity. What remains unknown, unfortunately, is whether there is a genuine yet undetected overall effect.

Individual studies. In terms of study availability, an obvious limitation to the current review is that there was only 1 RCT that directly compared handsewn and stapled anastomosis in the emergency setting, and another prospective study that was nonrandomized; the remainder were retrospective, cohort studies. Furthermore this single RCT did not stand up well to the Cochrane Collaboration’s tool for assessing risk of bias in randomized trials, with lack of clarity regarding randomization and allocation concealment.
Definitions. Unfortunately, although anastomotic leak is among the most commonly reported outcomes in colorectal surgery, its definition is variable among studies,24 and this review was also limited by some heterogeneity in this respect. In an attempt to compensate for this problem, the composite measure of “anastomotic failure” was used as the primary outcome, which allowed the authors to encompass all complications for a given individual anastomosis or patient (ie, the sum of all reported anastomotic leaks, abscesses, and fistulae). We believe that anastomotic failure is also the most clinically relevant measure in surgical practice because it is the key element in whether a patient requires intervention after operative resection, regardless of the perceived etiology or presentation.

Potential for missing data. Although the systematic search for studies was thorough, it is possible that some data may have missed inclusion owing to being published in a language other than English, and the authors acknowledge that ideally all published literature might be used for analysis. Furthermore, unpublished data were not included, which was considered sensible by the authors, who believe that peer-reviewed data represent more reliable basis for analysis.

There has been a trend toward increased utilization of minimally invasive techniques for emergency abdominal surgery, but it is likely that open laparotomy will still be the most commonly performed technique for trauma and EGS. It is possible that the inclusion of data from laparoscopic surgery may have increased the selection bias for the stapled technique. However, this meta-analysis was unaffected by such bias, with no minimally invasive data reported in any of the included studies.

Policy implications. Although the gold standard for best possible practice to guide surgeons would be through multicenter, randomized controlled trial data, it is clear from the current review that there is a paucity of this standard of evidence, and the studies available are at overall high risk of bias. With such deficiencies, calling for further studies may seem intuitive to those with equipoise regarding optimal operative technique, but unfortunately the practicalities of such aspirations are not straightforward. Ours is the first systematic review of the literature to formally summaries the current available data regarding handsewn versus stapled anastomosis in trauma and EGS laparotomy. Although the available meta-analysis is less than ideal, it suggests that until any further evidence is presented, surgeons and institutions may opt for either operative technique based on their own preference. However, such practice must also be undertaken with a cautious skepticism, because it is still possible that 1 technique is superior to another in certain circumstances that have not yet been borne out by evidence to date. Recent large-scale collaborations in the UK have demonstrated the achievability of well-designed, multicenter, surgical studies through regional networks25 that could be used as a model in the design larger and more reliable studies to further investigate more specific question regarding bowel anastomosis in trauma and emergency abdominal surgery, even if not in the form of RCTs.

SUPPLEMENTARY DATA
Supplementary data related to this article can be found online at http://dx.doi.org/10.1016/j.surg.2014.09.050.

REFERENCES