Title

Perforated Diverticulitis: To Anastomose or Not to Anastomose? A Systematic Review and Meta-Analysis.

ABSTRACT

Background

No consensus has been reached in the management of perforated diverticulitis. Many surgeons opt for a Hartmann's procedure to avoid the risk of an anastomotic leak. We hypothesize that resection with primary anastomosis is a safe alternative in selected patients. We aim to conduct a systematic review and meta-analysis on the available literature.

Methods

Studies that compared emergency Hartmann's with primary anastomosis in perforated left sided colonic diverticulitis were systematically reviewed. The search strategy included all study types that compared primary anastomosis to Hartmann's in perforated diverticulitis and reported on morbidity and mortality. 5 databases (PubMed, MEDLINE via PubMed, OVID, EMBASE via OVID and The Cochrane Collaboration). The Cochrane's Bias Methods Group tool was used to assess the risk of bias and a meta-analysis of the relevant studies was conducted.

Results

The review retrieved 1933 abstracts of which 14 studies (2 RCTs, 4 prospective non-randomised and 8 retrospective non-randomised) with 765 patients in total, 482 in the Hartmann's group and 283 in the primary anastomosis group, met the inclusion criteria. This showed a significantly lower mortality with primary anastomosis (10.6%) compared to Hartmann's (20.7%) (p=0.0003). Morbidity was also significantly lower (41.8% vs. 51.2%) (p=0.0483). The RR for mortality was 0.92 in favour of primary anastomosis (p=0.0019). The average anastomotic leak rate was 5.9%.

Conclusion

Resection and primary anastomosis should be considered as a feasible and safe operative strategy in selected patients with perforated diverticulitis. There is however a paucity of high level evidence and further research is needed.

INTRODUCTION

Background on diverticulitis and its management

Acute diverticulitis represents a significant health problem with a UK hospital admission rate of 1.20 per 1000 population/year, double what it was in 1996 (0.56 per 1000 population/year). Over 75% of admissions are emergencies, with a 30-day mortality of 5.1% and 1-year mortality of 14.5%[1]. Perforated diverticulitis is uncommon with an age-adjusted incidence of 3.5 per 100,000 per annum. The highest incidence is in women over the age of 65, associated with high mortality rates, especially if on NSAIDs or in renal failure[2].

Optimal management of perforated diverticulitis (Hinchey III and IV) remains uncertain. Many surgeons favour a Hartmann's resection where there is no risk of an anastomotic leak in the setting of peritonitis and where the reversal is done when the pelvic inflammation settles (usually 6 months later). It is worth noting that the reversal procedure has an anastomotic leak rate as high as 30% in some older series[3] and that over 50% of patients will not have their stoma reversed at all[4].

Belding first described resection and primary anastomosis in perforated diverticulitis with peritonitis in 1957[5]; he described 3 cases with no anastomotic leaks. Benefits of primary anastomosis for the patient include avoidance of a stoma and its inherent morbidity. Additionally, the significant morbidity and mortality associated with a reversal of Hartmann's procedure is avoided.

Current literature

To date five systematic reviews on primary anastomosis vs. Hartmann's for diverticulitis have been published[6-10]. All have concluded that a primary anastomosis has favourable outcomes compared to Hartmann's procedure in the setting of diverticulitis; however most of them acknowledge the poor quality of the studies included.

None of these systematic reviews looked at primary anastomosis vs. Hartmann's purely in perforated left sided diverticulitis (Hinchey III-IV) operated on as an emergency. They included studies looking at Hinchey I-IV, studies with elective surgery and patients with fistulae, obstruction or cancer.

Again, to date there have only been two randomised control trials (RCTs) addressing this topic[11,12]. Both compared primary anastomosis to a Hartmann's procedure in perforated (Hinchey III-IV) diverticulitis. They are discussed in this review.

We are only aware of one other RCT on this subject: the DIVA-arm of the Ladies Trial[13]. This is a multicentre randomised control trial. The primary outcome is stoma free survival in patients with perforated (purulent or faeculant) diverticulitis having a resection with primary anastomosis vs. a Hartmann's procedure. It has completed recruitment, with a power calculation requiring a minimum of a 118 patients in each arm. It is due to be reported soon.

Rationale for the review

The treatment of perforated diverticulitis (Hinchey III-IV) is not as clear-cut. Historically this was done in a three-stage procedure: a defunctioning transverse colostomy and washout, followed by a resection of the diseased portion with an end colostomy when the patient improves, followed by reversal of colostomy to restore intestinal continuity. This was first described in 1907[14]. In the 1980s, this evolved to a two-stage procedure: primary resection with end colostomy (the Hartmann's procedure) followed by reversal six months later. Hartmann's procedure was first described in 1921 for colorectal cancer[15]. Krukowski & Matheson[16] were the first to revise the treatment strategy for perforated diverticulitis and show increased survival and lower morbidity with a Hartmann's procedure. In the 1990s a one stage procedure was proposed: resection and primary anastomosis – however this was not highly adopted due to the high morbidity and mortality in Hinchey III-IV patients.

Moreover in the late 1990s and early 2000s, laparoscopic lavage and drainage gained some popularity with some series showing better outcomes than resection[17]. More controversy emerged when non-operative management was suggested as an alternative for Hinchey III diverticulitis in haemodynamically stable patients; one series showed that 74% of patients did not need surgery and that mortality was 0%[18]. These options are not discussed in this review.

It is because of this ongoing debate regarding the management of perforated Hinchey III-IV diverticulitis, as well as the lack of reviews exclusive to this group of patients, that this review was conducted.

Aims and hypotheses

We aim to assess outcomes of primary anastomosis in the emergency setting of perforated diverticulitis. We hypothesise that resection with primary anastomosis is a feasible and safe alternative to a Hartmann's procedure in selected patients with perforated diverticulitis, with comparable outcomes and a lower permanent stoma rate.

METHODS

The research question and eligibility criteria

No formal protocol was published. The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidance[19] were used to conduct the search and write this review.

Studies were eligible for the review if they compared resection and primary anastomosis with Hartmann's procedure in emergency surgery for acute left sided diverticulitis. After a preliminary literature search, only two RCTs were found[11,12] and therefore the search was expanded to include any type of comparative study of primary anastomosis with Hartmann's in acute perforated diverticulitis (Hinchey III-IV).

Information sources

The sources of search included the following databases: PubMed, MEDLINE via PubMed, OVID, EMBASE via OVID and The Cochrane Collaboration. The search was conducted on the 30th of April 2017. Two authors (FS and KC) reviewed the abstracts independently for inclusion. Any discrepancy was reviewed by a third author (SH).

Conference abstracts were included in the EMBASE and OVID searches and the author of the one eligible abstract was contacted for the full dataset. The relevant studies and systematic reviews retrieved had their references hand-searched for further eligible studies.

The International Prospective Register of Systematic Reviews (PROSPERO) was also searched for ongoing systematic reviews or meta-analyses: one was found. A review registered on the 16th of May 2016 by collaborators at the University of Toronto looking at resection and primary anastomosis (with or without a defunctioning stoma), laparoscopic lavage and Hartmann's for perforated diverticulitis[20]. The estimated completion date was July 2016 although the status on PROSPERO is 'ongoing'. No published review by the registered authors was found when the literature search was conducted.

Search criteria

The search criteria used utilised Medical Subject Headings (MeSH) and the Boolean operators 'AND' and 'OR' as follows:

(((Colon AND diverticulitis) AND (perforated OR complicated OR peritonitis)) AND (Hartmann* OR anastomosis OR surgery))

No language or year limitation was applied. Translation was done through Google Translate.

Study selection

Inclusion criteria:

Patient Characteristics

- Adults over 18 years old
- Emergency presentation and operation
- Presenting with acute perforated (Hinchey III-IV) diverticulitis
- Left sided diverticulitis of the colon

Intervention

- Resection and primary anastomosis of the colon
- With or without protective loop ileostomy / colostomy

Comparison/Control

- Hartmann's procedure

Outcomes

- Studies needed to report at least one of the following outcomes
  - Mortality
  - Morbidity
  - Permanent stoma rate
  - Morbidity or mortality from stoma reversal

Exclusion criteria:

- Studies that did not report on primary anastomosis in an emergency setting for complicated left sided diverticulitis exclusively
- Studies that included operations for obstruction, haemorrhage, fistulae, right sided diverticulitis, perforated malignancy and elective or semi-elective operations.
- Studies that did not compare primary anastomosis to Hartmann's procedure
- Studies that did not separate patients Hinchey I and II from those with Hinchey III and IV

Data extraction

Details of each study were collected: main author's name, year of publication, number of patients included, duration of the study and study design. Outcome data included mortality, any morbidity, specific surgical complications (e.g. anastomotic leak), any data on stoma rates and reversal complications, patient demographics, Hinchey scores included and length of follow up.

One conference abstract was eligible for inclusion and all the authors were contacted for further information. The conference admin team were also contacted. Unfortunately there was no response from the authors and the conference team were unable to divulge the information needed; therefore only basic data from the abstract was included.

Quality assessment of the studies and risk of bias

Studies were assessed for bias using the Cochrane's Bias Methods Group tools available in their handbook[21]. Bias was assessed at study level. The GRADE system[22] was used to assess the quality of the evidence presented in each of the included studies.

Statistical analysis

Statistical analysis was performed using SPSS. Chi-squared and Fisher's Exact Test were used to assess difference in proportions of categorical data.

The meta-analysis was done using the program R – version 3.4.1[23] utilising the Metafor R Package – version 2.0[24]. Heterogeneity was tested using I^2 and the Cochran's statistic (Q). Funnel plots and quantile-quantile (Q-Q) plots were drawn.

Due to several studies having one or both groups with very small numbers, the Random-Effects model was initially used, in order to avoid disproportionate weighting of such studies if the Fixed-Effects model were to be used. However the analysis was also done in the Fixed-Effects model to compare results. Forest plots were drawn. Dichotomous data (mortality and morbidity) was analysed using relative risk (RR) and reported with 95% confidence intervals (CI). An RR <1 favoured primary anastomosis. Odds ratio analysis gave very similar results and so relative risk was used as it is easier to interpret.

A p-value of <0.05 was deemed significant.

RESULTS

Study selection and PRISMA flow chart

The systematic search of the five electronic databases retrieved 1920 abstracts (682 from MEDLINE and PubMed, 1188 from OVID and EMBASE and 50 from the Cochrane Library). 13 extra articles were found through hand-searching of the relevant references. After duplicates were manually removed, the total was 1428 abstracts. These were screened and 1276 excluded. The remaining 152 articles had their full texts reviewed. 109 were excluded for the reasons detailed in *Figure 1*. 43 studies in total were included in the qualitative analysis and 13 in the quantitative analysis. At time of writing this review, despite using the Inter-Library Loan Service, one potentially relevant study could not be fully accessed[25].

Study characteristics

There were 14 studies that met the inclusion criteria and compared primary anastomosis to Hartmann's in perforated diverticulitis (Hinchey III-IV). Two were randomised control trials, 4 prospective non-randomised studies and 8 retrospective non-randomised. The study size ranged from 6 to 90 and the total number of patients included was 765 (482 in the Hartmann's group and 283 in the anastomosis group). Eleven out of the 14 were at a single institution. The mean duration of data collection was 7.9 years (range 2 – 22). *Table 1* summarises those characteristics.

Quality assessment of the studies and risk of bias

The quality assessment of the two RCTs included[11,12] is summarised in *Figure 2* and in more details in supplementary *Tables S1 and S2*. Overall they were both found to have high risk of bias. The main source of bias was the small numbers and the premature termination, leading to underpowered studies. Binda et al.[11] terminated with only 15% accrual despite extending the study period from two years to nine. Oberkofler et al.[12] discontinued the study with 50% of the target number of patients due to slowing of accrual rate over the study period and interim analysis showing adequately powered *secondary* outcomes.

The quality assessment of the 11 non-randomised studies included[27-37] is shown in *Table 2,* which summarises the total number of studies exhibiting each level of risk in the eight domains. Supplementary *Tables S3-S13* show the detailed reasoning.

Overall the studies seem to have a high risk of selection bias (question 2) and bias with regards to matching the two groups (questions 4 and 5). Given they are non-randomised studies, selection bias is always going to be the main problem. This is evident in all studies as none of them showed that the two groups were matched for confounding and prognostic factors (age, American Society of Anesthesiologists (ASA) score, comorbidities, degree of peritonitis, Hinchey grade). Several of the studies did not report morbidity, and others did not report it specifically for the two groups (Hartmann's vs. primary anastomosis for perforated Hinchey III-IV diverticulitis).

Several studies did not specify follow up duration nor specific co-interventions administered to the patients both intraoperatively and postoperatively. They all however reported mortality for Hinchey III-IV in the two groups (Hartmann's vs. primary anastomosis) separately and thus were included in this review.

Sileri et al.[26] presented an abstract at the annual meeting of the American Society of Colon and Rectal Surgeons comparing Hartmann's with primary anastomosis in perforated diverticulitis. Given we were unable to obtain the full text, we were unable to assess the quality of study.

The majority of the studies' level of evidence would fall under level 4 (poor quality cohort and case control studies) and recommendation grade C (option). *Table 3* summarizes the findings. Because of these findings, the conclusions of this review should be interpreted with caution.

Synthesis of results

Rates of mortality and morbidity, of any severity or grade, of the Hinchey III-IV studies are shown in Table 4. Primary anastomosis had a statistically significant lower mortality (10.6%) and morbidity (41.8%) compared to the Hartmann's group (20.7% and 51.2%). The anastomotic leak rate from primary anastomosis was 5.9%.

Meta-Analysis of Mortality

Thirteen of these studies are included in the meta-analysis. In the study by Nagorney et al.[36] there was no mortality in the anastomosis group (4 patients). The Yates's correction of adding 0.5 to any value of zero in the meta-analysis meant that the anastomosis group had an apparent 12.5% mortality compared to 8.7% in the Hartmann's group. Therefore, the study was excluded from the forest plot.

The funnel plot (Figure 3) and Q-Q plot (Figure 4) show that overall there was a low heterogeneity (I^2= 0.10%, Q 13.7564, df=12, p=0.3165). Trenti et al.'s study[27] is an outlier, most likely because the results very much favour an anastomosis; it is the only study with the forest plot that does not cross the line of no effect. As discussed earlier, this is because of substantial selection bias. Tudor et al.'s study[34] is close to the edge of the funnel, this is likely due to the very small number in the anastomosis group (n=8) with an unusually high mortality (75%). Richter et al[28]., Medina et al.[35], and Drumm et al.[37] are low down in the funnel plot due to the small number in one or both of the groups. The rest of the studies are clustered at the top indicating very similar characteristics.

The forest plot (Figure 5) shows an overall effect with a relative risk of 0.92 (log RR -0.08, p=0.0019), in favour of a primary anastomosis. Although the effect size is small, it does not cross the line of no effect (95% confidence intervals -0.13 to -0.03). The Fixed-Effects model gave identical results.

Meta-Analysis of Morbidity

The seven studies reporting on morbidity are included in the meta-analysis. The funnel plot (Figure 6) and Q-Q plot (Figure 7) show that overall there was a low level heterogeneity (I^2=11.80%, Q 6.02, df=6, p=0.42). Medina et al.[35] is low down the funnel plot due to the very small total number of patients (n=6). The rest of the studies are clustered at the top indicating similar characteristics.

The forest plot (Figure 8) shows an overall effect with a relative risk of 0.93 (log RR -0.07, p=0.19) in favour of a primary anastomosis. The effect size is small and the 95% confidence intervals (-0.19 to 0.04) cross the line of no effect. The Fixed-Effects model gave very similar results; effect size relative risk of 0.92 (log RR -0.08, 95%CI -0.18 to 0.03, p=0.16).

DISCUSSION

Summary of evidence

Mortality and morbidity

On meta-analysis, for Hinchey III-IV diverticulitis mortality for the Hartmann's group (20.7%) was higher than that for the primary anastomosis group (10.6%) (p=0.0003). It demonstrated a relative risk of 0.92 (p=0.0019) for mortality, favouring the anastomosis group. It is worth re-iterating that despite the meta-analysis showing low heterogeneity and a statistically significant overall effect for mortality in favour of primary anastomosis; the overall effect was minor (RR 0.92) and the studies, inherently, are limited by significant selection bias. Morbidity was also higher in the Hartmann's group (51.2% vs 41.8%, p=0.0483) with a relative risk of 0.93 in favour of a primary anastomosis (p=0.19), this was not statistically significant.

The two RCTs[11,12] showed no statistically significant difference in mortality or morbidity between Hartmann's procedure and primary anastomosis. Binda et al.[11] do, however, highlight the difficulty in drawing conclusions from the underpowered study given the accrual of 15%.

Of the studies that reported the cause of death, only three attributed it to an anastomotic leak[27,33,34]: Trenti et al.[27] had one death, Wedell et al.[33] had one death and Tudor et al.[34] had three deaths contributed to "anastomotic leak or bleeding" but does not elaborate further. Five studies[12,28,31,32,37] do not discuss the causes for mortality in any detail. The rest of the studies[11,29,30,35,36] contributed the mortality to persisting sepsis, multi-organ failure, respiratory failure, renal failure, myocardial infarction, arrhythmias, cerebrovascular accident, chronic obstructive pulmonary disease and pulmonary emboli.

This means that a maximum of four patients (out of 131 – 3.1%) died as a consequence of an anastomotic leak. This begs the question as to whether the higher mortality rate in the Hartmann's group is due to the patients in that group inherently having worse physiological parameters and reserves from the onset and not related to the surgery of choice. Some of the studies that did compare the two groups showed a higher ASA and peritonitis score in the Hartmann's group as discussed earlier.

To anastomose or not anastomose?

The permanent stoma rates after emergency colorectal surgery is an important outcome measure; patients without a stoma have a better quality of life in general[29]. The 7 studies that did report on permanent stoma rates, showed that 36.9% of patients had a permanent stoma after a Hartmann's procedure – significantly higher than 8.9% of patients in the anastomosis group (p<0.00001) (Table 5). For a significant proportion of patients the primary operation may be the only opportunity for restoration of bowel continuity. Here we consider the factors influencing the decision to make a primary anastomosis in the setting of perforated diverticulitis.

Faecal loading

There is some evidence to suggest anastomotic leakage is related to the faecal load at the time of anastomosis[38-40]. Some studies have shown a threefold increase in anastomotic leak rate in a 'loaded' colon in an emergency setting compared to an elective anastomosis after bowel preparation[41,42]. This raises the question of the potential use of intra-operative colonic lavage at time of anastomosis in an emergency setting. Studies have shown that a primary anastomosis with intra-operative colonic lavage is safe in emergency cases of an obstructed left colon, even in the setting of faecal contamination[43].

Some of the studies in this review refer to the use of intra-operative colonic lavage. Oberkofler et al.[12] describe colonic lavage as being the surgeon's choice, however they do not elaborate on it in the results or show that it improves outcomes. Regenet et al.[29] used intra-operative colonic lavage for all the cases of primary anastomosis; their anastomotic leak rate however, has proven higher than most studies included in this review (11.1%). Wedell et al.[33] state that a non-quantified proportion of their primary anastomosis group received formal bowel preparation pre-operatively, but are not analysed separately. The leak late rate in that series (7.1%) is higher than the rate of the aggregated results (5.9%).

It is worth noting that mechanical bowel preparation is not recommended as routine in elective colorectal surgery, this is reflected in the Association of Coloproctology of Great Britain and Ireland Guidelines[44]. This is based on a Cochrane systematic review[45] showing that mechanical bowel preparation showed no benefit in reduction of anastomotic leak rates or other septic complications. There has however been a prior RCT that showed some benefit in rectal cancer surgery[46].

Surgeons' experience

A surgeon's experience is imperative to judgement and operative decision-making. Colorectal specialists have more day-to-day experience in colorectal resections and are more likely to consider primary anastomosis in the emergency setting compared to their non-colorectal counterparts.

Only two studies discuss surgeons' experience and the influence this has on choice of operation and outcomes. Trenti et al.[27] report a significantly higher proportion of primary anastomosis operations performed by colorectal surgeons ($p=0.003$). They also showed a significantly lower mortality rate in patients having an anastomosis by a colorectal surgeon compared to a general surgeon ($p=0.035$). In the study by Schilling et al.[31], most of the patients in the primary anastomosis group are operated on by a single surgeon, although not explicitly mentioned; it is insinuated that they were a colorectal surgeon. None of the studies report operations being done by trainees.

Extent of peritonitis

Although there is no evidence in animal studies that anastomotic leak rates are higher in the setting of peritonitis[39,40,47]; some human studies did show a correlation[48,49,50]. The limitation of those studies is the lack of bowel preparation, a significant confounding factor.

A few studies in this review analysed the association between outcomes and the extent of peritonitis, using a validated scoring system (e.g. Mannheim Peritonitis Index – MPI). Binda et al.[11] showed that the only parameters correlating with mortality on multivariate analysis were the MPI and type of peritonitis (faeculant vs. purulent). Richter et al.[28] showed that the MPI of the patients who died was significantly higher than those who survived ($p<0.001$). Thaler et al.[32] also showed a statistically significant increase in mortality with a higher MPI (p=0.0043). Nagorney et al.[36] showed a significantly higher mortality in faecal peritonitis compared to purulent peritonitis (p<0.001). None of the studies correlated the extent of peritonitis with the anastomotic leak rate.

Stoma reversal morbidity

The only statistically significant result from Binda et al.[11] was a higher morbidity from a Hartmann's reversal (23.5%) compared to the loop ileostomy reversal (4.5%). Oberkofler et al.[12] showed a higher median total number of complications in a Hartmann's reversal vs. an ileostomy closure. Binda et al.[11] had a similar permanent stoma rate in both groups whereas Oberkofler et al.[12] had a significantly lower rate in the primary anastomosis group. Oberkofler et al.[12] showed that the operation time for an ileostomy reversal is significantly shorter than a reversal of Hartmann's (73 minutes vs. 183 minutes, p<0.001).

Only two of the non-randomised studies address morbidity from stoma reversal, albeit not in much detail. Trenti et al.[27] report no leaks after reversal. Regenet et al.[29] report a morbidity of 24% and a leak rate of 7% after the reversal of Hartmann's.

Limitations of the review

The main limitation to this review is the poor quality of the included studies. The majority of the studies included were non-randomised and retrospective in nature, leading to selection bias. This is evident in several of these studies where the cohort of patients in each group are clearly unmatched; older patients, those with multiple comorbidities and those with more advanced peritonitis are more likely to receive a Hartmann's procedure.

The two RCTs included[11,12] both terminated prematurely and were underpowered. Some studies had very small numbers, the smallest of which was only 6 patients[35]. The average number of patients per study was 55. Binda et al.[11] do not report the number of patients declining to take part in the study. They admit to surgeons possibly influencing the ill patients not to take part. In the trial by Oberkofler et al.[12], 7 out of 83 eligible patients declined to participate. In addition, 52 patients had already been excluded on the basis of the surgeons refusing to randomise them, as they felt it was unsafe to do so. This will inevitably lead to a selection bias.

Six studies have excluded morbidity from their analyses, and several others do not report morbidity using a standardised method (for example the Clavien-Dindo classification), nor is it reported in sufficient detail. None of the studies, with the exception of Binda et al.[11] and Regenet et al.[29] included data on rectal stump leaks – a recognised complication of a Hartmann's procedure with an incidence of approximately 5%[51]. It is essential for morbidity and complications to be reported in a standardised and detailed fashion in such studies in order to make informed decisions with regards to operation choice. Due to the lack of accurate rates of morbidity, let alone the severity or classification of them, it is difficult to draw conclusions from this review.

Only 7 studies included data on permanent stoma rates. Very few included data on morbidity and mortality caused by the reversal of Hartmann's or loop ileostomy. There is some evidence to show that reversal of a loop ileostomy is both technically easier and safer than a reversal of Hartmann's, yielding lower morbidity and mortality rates[52,53]. This would be one of the many factors to consider when opting to perform a primary anastomosis with a defunctioning ileostomy vs. a Hartmann's procedure in the emergency setting.

Some studies suggest the use of intra-operative colonic lavage as an adjunct to primary anastomosis. This, however, was not universally used. It adds another layer of complexity to the data analysis (a primary anastomosis with or without a defunctioning ileostomy, or a primary anastomosis with intra-operative colonic lavage with or without a defunctioning ileostomy) and subsequently diminishes the statistical power of any results.

As discussed earlier, the surgeon's clinical experience, subspecialty and training, play an important role in the choice of procedure, but also potentially the outcomes. Nonetheless most studies did not report the level of experience or the subspecialty of the surgeons performing the operation.

CONCLUSION

The evidence shows lower morbidity and mortality rates in patients receiving a primary anastomosis for perforated diverticulitis compared to a Hartmann’s procedure. However, given the poor quality of the evidence – largely non-randomised and retrospective – this should be interpreted with caution. The two RCTs available showed no significant difference in mortality or morbidity between the two groups. Despite the difficulty in providing reliable conclusions, this systematic review and meta-analysis does suggest the feasibility of primary anastomoses in selected patients with perforated diverticulitis.

More well designed randomised control trials to answer the question of whether to anastomose or not anastomose in the setting of perforated diverticulitis are needed. However such methodologically-sound RCTs will not be easy to design or easy to implement and recruit into. In order to detect any significant differences, a large number of patients will need to be included. Recruiting randomised consecutive patients having an emergency operation for a life threatening condition is not practical and may not be possible. What this means in current practice is that the decision is left to the surgeon’s expertise and personalized choice for the individual patient on the operating table.

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