A retrospective case note review of laparoscopic versus open reversal of Hartmann's procedure

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ABSTRACT

INTRODUCTION First described in 1921, Hartmann's procedure is the gold standard treatment for complicated sigmoid diverticular disease. It is also used commonly for other causes of perforation of the large bowel. However, the reversal rate in the UK is much lower than in comparable countries, at only 18–22%. Furthermore, laparoscopic reversal (LRH) is used far less frequently than open reversal (ORH) despite evidence that a laparoscopic technique reduces patient morbidity and decreases patient recovery time.

METHODS This retrospective case note review undertook an analysis of all the patients who had undergone Hartmann's procedure at two centres in Leeds Teaching Hospitals NHS Trust between February 2007 and February 2012. Out of 305 patients, 235 were identified and included in the analysis. Comparisons were then drawn between LRH and ORH groups.

RESULTS The reversal rate was 21%. Three-quarters (76%) were performed using an open technique, 20% were laparoscopic and 5% were converted to an open procedure. The mean hospital stay was longer for the ORH group (9.82 days, standard deviation [SD]: 5.85 days, 95% confidence interval [CI]: 2.99 days) than for the LRH group (7.29 days, SD: 4.65 days, 95% CI: 11.58 days) $p=0.006$. Seven ORH patients (21%) were reoperated but only one LRH patient (13%) had a reoperation at six months. Five factors were found to have a significant effect on the likelihood of reversal of Hartmann's procedure.

CONCLUSIONS The overall reversal rate for Hartmann's procedure remains low. Shorter hospital stays, lower 6-month reoperation rates and reduced 30-day complication rates are associated with LRH when compared with ORH.

KEYWORDS

Hartmann's procedure – Reversal – Open surgery – Laparoscopic

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Hartmann's procedure has become the gold standard for complicated diverticular disease since it was found to reduce morbidity compared with Hinchey's primary anastomosis.^{1–3} It is now used in 56–70% of complex diverticular cases.⁴ The UK, in particular, has a poor reversal rate, being stated as low as 18–22%.^{5,6} This rate is extremely low compared with studies in the US that report reversal rates of 37%⁷ and in Spain, reporting 35%.⁵ Reversal is also associated with high complication and morbidity rates.^{8,9}

Laparoscopic reversal of Hartmann's procedure (LRH) has been associated with a lower postoperative complication rate, a shorter hospital stay and a reduction in morbidity compared with open reversal (ORH).^{7,10,11} LRH could therefore offer reduced morbidity and mortality while improving reversal rates as patients are more likely to be fit for laparoscopic surgery. This retrospective case note review aimed to examine the differences between ORH and LRH on patient morbidity and mortality in a single teaching trust. In addition, factors that influence the success and likelihood of reversal of Hartmann's procedure were explored.

Methods

A five-year retrospective case note analysis was carried out of patients who had undergone Hartmann's procedure in Leeds Teaching Hospitals NHS Trust. The inclusion period was February 2007 to February 2012. A list of 305 patients was obtained via coding, containing the patient's name, case note number, date of birth and the date Hartmann's procedure was carried out. The coding list was cross-checked with the theatre records to ensure all patients had been captured. The CLINiCOM patient administration system (CSC, Banbury, UK) was then used to locate the relevant case notes. The notes were requested from the appropriate medical records library using a standard request form. Some notes were also obtained personally, by the first author (CLW), from inpatient wards and outpatient clinics that patients had recently attended.

A proforma for data collection was designed with 19 criteria: 9 were associated with index Hartmann's procedure (including comorbidities, body mass index, ASA [American Society of Anesthesiologists] grade and smoking status)

and 10 with reversal of Hartmann's procedure (including type of reversal, time to discharge and postoperative complications). The data collected from the case notes were supplemented with data from the trust's Patient Pathway Manager software. A patient was deemed to have had a reversal if a reversal procedure had been attempted, regardless of its success. A patient was deemed to be in the 'never reversed' group if the patient had died or had been discharged from the surgeon's care without having a reversal. Patients not currently fit for surgery or still in outpatient care being considered for a reversal were classed as having the Hartmann's procedure 'not yet reversed'.

The main comorbidities that were considered included arteriosclerosis (and any resulting ischaemic event), diabetes mellitus, cancer treated with chemotherapy, chronic obstructive pulmonary disorder and steroid treatment. Complication rates were measured at 30 days following reversal of Hartmann's procedure and reoperation rates were considered up to 6 months after reversal. Ethical approval was not required for this retrospective service evaluation although support was sought from the trust.

Statistical analysis

The results were analysed using SPSS® version 21 (IBM, New York, US). The chi-squared test was used for continuous variables. Any difference was considered statistically significant if the *p*-value was <0.05. A linear regression t-test was used to establish factors affecting reversal.

Results

In total, 238 out of 305 patient notes were located and analysed (Fig 1). Three of these patients were lost to follow-up because of further care being carried out at other centres. The remaining 67 patient notes were unable to be obtained owing to no longer being held at the trust as the patient had passed away some years previously. A total of 235 patients' notes were therefore included in the analysis.

Of the 235 patients included in the review, 120 (51%) were female and 115 (49%) were male. The mean age was 67 years (range: 22–95 years). In general, male patients underwent Hartman's procedure at a younger mean age than women (63 vs 71 years). Most patients had a smoking history: 91 patients (39%) were current smokers and 68 (29%) were ex-smokers. Only 74 patients (32%) had never smoked. Male patients were more likely to have a smoking history (72%) than female patients (63%). Smoking history was not recorded for two patients (one male and one female). The body mass index data were too incomplete to draw any reliable conclusions, with only 37 patients having this recorded in the case notes.

Indications

The most common indication for Hartmann's procedure was complex diverticular disease (*n*=121, 52%), followed by cancer (*n*=93, 40%), and 21 patients had 'other' indications. Most of the Hartmann's procedures were performed in an acute setting with 148 (63%) being emergency procedures and the remaining 87 (37%) elective procedures.

Diverticular disease was much more commonly treated as an emergency procedure (88%) whereas cancer was more commonly seen as an elective procedure (69%).

Reversal

The reversal rate was 21% (*n*=49), with 134 patients (61%) 'never' having a reversal and 52 (22%) 'not yet' having a reversal. ORH (*n*=37, 76%) was much more common than LRH (*n*=10, 20%). Two patients had laparoscopic procedures that were converted to open as a result of surgical difficulty. For statistical analysis, these patients were included in the LRH group on an intention-to-treat basis.

There was no statistical significant difference in reversal rates for men and women (*p*=0.06, chi-squared test, degrees of freedom [df]=1). However, indication for reversal (*p*=0.001, chi-squared test, df=2) and emergency or elective procedures (*p*=0.001, chi-squared test, df=1) did influence the reversal likelihood. Only 4 patients (4%) with an indication of cancer had a reversal, 45 patients (36%) with diverticular disease had a reversal and 2 patients (10%) with other indications had a reversal: one patient with Crohn's disease and the patient with a foreign body. Emergency patients were more likely to have a reversal, with 42 patients undergoing reversal in this group compared with 7 elective patients.

Laparoscopic reversal vs open reversal

The patients who underwent LRH had shorter procedure times with a mean operative time of 2 hours and 57 minutes (range: 2 hours – 3 hours 30 minutes). The mean operative time for ORH was 3 hours and 55 minutes (range: 2–7 hours). This was based on 35 patient records as 4 had missing data. ORH had a higher postoperative complication rate than LRH (46% vs 25%). There were no deaths in either group. However, patients undergoing ORH had more severe complications (Table 1). Time until

Table 1 Postoperative complications after reversal of Hartmann's procedure

Complications after open reversal	n=37	Complications after laparoscopic reversal	n=12
Anastomotic leakage	1	Hospital acquired pneumonia	1
Difficulty defecating for six months	1	Wound infection	2
Hospital acquired pneumonia	3		
Incisional hernia	2		
Perioperative axillary nerve injury	1		
Postoperative ileus	1		
Superficial stitch abscess	1		
Wound dehiscence	2		
Wound infection	8		
Total patients with complications	17*		3

*3 patients had multiple complications

discharge varied between groups. ORH patients had a longer time to discharge (mean: 8.52 days, range: 5–15 days). This mean excludes a patient who had severe complications delaying discharge to 41 days following surgery. LRH patients had a shorter mean time to discharge (6.00 days, range: 3–15 days).

The reoperation rate was calculated excluding reoperations performed to reverse a loop ileostomy that was done during reversal. ORH had a higher rate of reoperation at 17% (7 patients) and reasons for reoperation included incisional hernia repair, division of adhesions and drainage of wound infection. Only one patient had a reoperation in the LRH group (equating to a reoperation rate of 10%) for an incisional hernia repair. Patients who underwent ORH were more likely to have significant comorbidities (46% vs 40%). In addition, only patients with diverticular disease and one patient with a bowel obstruction due to a foreign body as indications for their Hartmann's procedure underwent LRH.

Non-reversal

Death was the most common reason for never having a reversal of Hartmann's procedure ($n=53$ patients, 40%). Ongoing cancer treatment or metastasis prevented 31 patients (23%) from having their Hartmann's procedure reversed. A further 19 patients (24%) refused a reversal and 19 (22%) were deemed unsuitable for elective surgery. The remaining patients had no documented reasons for never having their Hartmann's procedure reversed.

Table 2 Regression analysis on predictors of reversal of Hartmann's procedure. The adjusted coefficient of determination indicates that 34.8% of the variance in the likelihood of reversal is explained by the model used.

Variable	Odds ratio (95% CI)	p-value
Age (>67 years)	0.253 (0.010–0.024)	<0.001
Sex (female)	0.458 (-0.115–0.249)	0.467
Indication for Hartmann's procedure (cancer)	0.184 (0.120–0.411)	<0.001
Procedure type (emergency)	4.690 (-0.428–0.016)	0.034
Smoking (current and ex-smokers)	0.153 (-0.074–0.138)	0.553
ASA grade (>2)	0.001 (0.063–0.287)	0.002
Comorbidities (multiple)	0.163 (0.075–0.361)	0.003

CI = confidence interval; ASA = American Society of Anaesthesiologists

Likelihood of reversal

Seven parameters were tested to see the influence they had on the likelihood of Hartmann's procedure being reversed. The factors that were assessed were age, sex, indication for Hartmann's procedure, procedure type, smoking status, ASA grade and comorbidity status. The data were processed using regression software, SPSS®, and tested to see if they were significant in the likelihood of reversal.

Table 2 shows the co-efficient related to each variable and its p -value. Age ($p<0.001$), indication for Hartmann's procedure ($p<0.001$), number of comorbidities ($p=0.003$) and ASA grade ($p=0.002$) all had a strong predictive factor of likelihood of reversal. Type of procedure (elective or emergency) had a weaker predictive factor ($p=0.034$). Younger patients were more likely to have their Hartmann's procedure reversed. In addition, an indication of diverticular disease meant that there was a greater chance of reversal than for patients with cancer or any other indication listed. If a patient had an elective procedure, he or she was less likely to have Hartmann's procedure reversed. However, those with lower ASA grades were more likely to have a reversal. In addition, patients with many comorbidities were less likely to have their Hartmann's procedure reversed. Sex and smoking status had no statistical significance in likelihood of reversal.

Discussion

Living with a colostomy has a substantial effect on a patient's quality of life, satisfaction and self-image.^{12,15} In this review, the reversal rate was in line with previous UK studies,^{6,8} at 21%. This is an improvement on the 1992 Pearce *et al* study, which showed a reversal rate of 10%.¹⁴

The complication rates for ORH (46%) and LRH (25%) were higher than in most previous studies. Keck *et al* found a complication rate of 26% in ORH¹⁵ while Griffa *et al* reported a 38% complication rate.¹⁶ Siddiqui *et al* published the first substantial systematic review of LRH, concluding that it has fewer complications than ORH.⁸ Complications resulting from ORH were much more serious and debilitating than those resulting from LRH. It should be noted that those patients undergoing ORH were more likely to have significant comorbidities. LRH patients had a reduced length of hospital stay and lower reoperation rates, in line with similar studies. Anastomotic leak was a complication for one patient with a loop ileostomy, which challenges Bell *et al*'s recommendation for loop ileostomy in this circumstance although it is difficult to draw definitive conclusions.¹⁷

Age, number of comorbidities, ASA grade and indication for Hartmann's procedure were factors that were shown to have a significant effect on the reversal of Hartmann's procedure. Age over the mean of 67 years, more comorbidities, ASA grade >2 and the presence of malignancy all affect the chances of reversal detrimentally. This is in line with the study by Tokode *et al*, who found that a higher ASA grade at the time of Hartmann's procedure may have an adverse effect on likelihood of reversal.¹⁸ Further review needs to be undertaken in this area.

More women underwent laparoscopic reversal of Hartmann's procedure than men although the overall reversal rate in women was 15% compared with 27%. This may be due to the higher mean age of female patients and that there was a higher proportion of women who had an indication of cancer. Patient choice is also a substantial factor that affects the reversal of Hartmann's procedure with 19 patients refusing a potential reversal. Many of these patients were keen to avoid more surgery and the associated risks, and were experiencing a good quality of life with their stoma.

Study limitations

As our study was retrospective, some datasets were unusable owing to missing or inconclusive data. A prospective design would provide more accurate and reliable data. Aydin *et al* reported a complication rate that was 5.5 times higher for ORH than for LRH, with reversal being carried out at 8 months after Hartmann's procedure.⁶ In our study, the mean waiting time for ORH was 10.6 months and for LRH it was 10.9 months. The later timing could therefore have introduced bias. Patients selected for LRH mostly had diverticular disease and LRH was not attempted in those with cancer. This may have led to selection bias in the LRH group.

In addition, the difference in size of the ORH and LRH groups was large, and could have introduced skewed data. A large multicentre prospective study or meta-analysis on ORH and LRH and factors adversely affecting the reversal of Hartmann's procedure could provide more conclusive evidence.

Conclusions

The overall reversal rate for Hartmann's procedure remains low. Shorter hospital stays, lower 6-month reoperation rates and reduced 30-day complication rates are associated with LRH when compared with ORH.

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