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Hartmann's Procedure versus Primary Anastomosis for Emergency Left Colectomy: A Retrospective Cohort Study

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Abstract

Background: The ideal surgical strategy for left emergency colectomy remains controversial and is decided on a case-by-case basis. The aim of this study was to analyze our current practice and outcomes to define a standardized approach.

Method: This retrospective review included all consecutive patients who underwent left emergency colectomy between July 2006 and June 2013. Demographics, surgical data, and postoperative outcomes were compared between patients with primary anastomosis (PA group) and those having Hartmann's procedure (HP group).

Results: Final analysis included 148 patients (89 men, median age 76 (range 22-95) years). Patients with HP (n=73) were older and had higher ASA score ($p< 0.001$) and Charlson index ($p< 0.001$) than patients with PA (n=75). Indications were similar between the comparative groups, but noradrenalin requirements and Hinchey III/IV status were more frequent in the HP group. Patients with HP had higher in-hospital mortality (15 *vs.* 4%, $p=0.020$), overall (78 *vs.* 56%, $p=0.005$) and severe complications (29 *vs.* 17%, $p=0.033$). Anastomotic leak rate was 8% (n=6) after PA. Only 18 patients (25%) of the HP group proceeded to stoma take-down, while all patients with PA were stoma-free 12 months after hospital discharge.

Conclusion: Emergent left-sided colectomy remains associated with high postoperative morbi-mortality. Patient's condition and intraoperative findings appear to guide surgical decision-making. Hartmann's procedure does not prevent adverse outcomes and entails a high permanent ostomy rate.

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Abbreviations

ASA: American Society of Anaesthesiologists; ICU: Intensive Care Unit; PA: Primary Anastomosis; HP: Hartmann Procedure; SSI: Surgical Site Infection

Introduction

Minimal-invasive surgery and optimized perioperative care by standardized multimodal pathways have lead to significant improvements of outcomes after elective colonic resections that are mostly performed by colorectal specialist surgeons [1,2]. In the emergency setting, multimodal pathways are challenging and surgery is often performed by general surgeons or junior staff. In addition, patients' condition and intraoperative findings are worse when compared to the elective situation. Therefore, reported outcomes are considerably worse with reported morbidity and mortality rates up to 40 and 20%, respectively [3-6]. All of the above explains why Hartmann's procedure is often the preferred approach for emergent left-sided resections in order to avoid anastomosis and shorten the operative time [7]. The reported permanent ostomy rate is high (75% for ASA III) after Hartmann's procedure and more recent reports have suggested interesting alternatives to this strategy [8-11].

The aim of the present study was to assess our institutional practice and outcomes for emergency left colectomy comparing Hartmann's procedure and resections with primary anastomosis.

Methods

Patients

This retrospective analysis included all consecutive patients who underwent emergency left-sided colonic resection from July 2006 to June 2013 in the department of visceral surgery, in

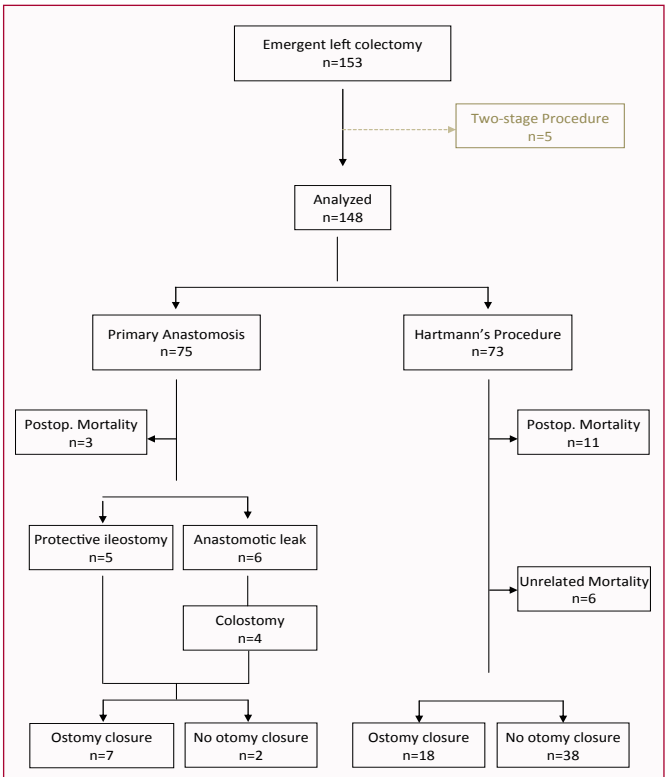

Figure 1: Population flow-chart.

Lausanne University Hospital. Left-sided resections included formal and extended left colectomy as well as sigmoidectomy, while rectal resections and total colectomies were excluded. In addition, patients with two-stage procedure and planned second look and deferred anastomosis or HP were not included. Emergency intervention was defined as being performed during an unplanned admission. Surgeries were performed by the general surgeon on call (all board certified). The study was approved by the local Ethics Committee. STROBE statement was followed for analysis (www.strobe-statement.org) and reporting, and the study were online-registered (www.researchregistry.com; UIN: 1750).

Hartmann's procedure (HP group) was compared with resections and synchronous primary anastomosis with or without protective ileostomy (PA group).

Data collection

Demographics and risk factors as well as outcome measures were defined a priori and entered in a computerized database. Documented co-morbidities included diabetes (insulin-dependent and no insulin-dependent), overweight (>25 (Kg/m2)), chronic renal failure, cirrhosis, cardiomyopathy, tobacco smoking or immunosuppressive treatment including corticoids, anti-TNF and chemotherapy [12-14]. Patient preoperative co-morbidities were prospectively graded using the American Society of Anesthesiology (ASA) score and Charlson co-morbidity Index [15,16]. Surgical data included operative time, surgeon's expertise (junior or senior consultant), estimated blood loss (ml), as well as intraoperative vasopressor requirements (Noradrenalin >10ug/min intravenously) [13,17].

Outcomes

Mortality and postoperative complications were recorded until 30 days after surgery according to the Clavien classification. Grade III and IV were defined as severe complications [18]. Ostomy rate was assessed at one year after index surgery.

Other outcomes included length of hospital stay (days), length of intensive care unit (ICU) stay (days), destination after discharge (home or rehabilitation) and time to stoma reversal (months). Reasons not to close the stoma were entered in the database.

Statistical analysis

Descriptive statistics for continuous variables were reported as median (interquartile range: IQR and range), categorical variables were reported as frequency (%). Chi-square was used for comparison of categorical variables and the Wilcoxon test for continuous data. All statistical tests were two-sided and a level of 0.05 was used to indicate statistical significance. Data analyses were performed using SPSS Inc. released 2012. For Mac (Version 21.0. Chicago, USA).

Results

Patients

One hundred and fifty-three patients underwent emergency left colectomy during the study period. Five patients underwent a two-stage procedure with planned second look; these patients were excluded from analysis according to the study protocol. The remaining 148 patients were eligible for analysis (Figure 1). Seventy-three patients (49%) underwent a primary HP, while primary anastomosis was performed in 75 (51%) patients. Protective ileostomy was constructed in 5 out of these 75 patients (6.7%).

Demographic information for the two comparative groups is displayed in Table 1. Patients having a HP were older and had significantly more co-morbidities (higher ASA score, higher Charlson

Table 1: Demographics data for primary anastomosis *vs.* Hartmann's procedure.

	PA group (n= 75)	**HP group** (n=73)	***P*** value
Age (IQR)	70 (56-80)	76 (66-82)	**0.047**
Sex ratio, (M:F)	48:27	41:32	0.402
Body mass index >25 (Kg/m^2)	31 (41%)	33 (45%)	0.730
ASA score I-II / III-IV	40/35	14/59	**<0.001**
Charlson comorbidity index >3	48 (64%)	64 (88%)	**0.001**
Comorbidity			
Diabetes, n (%)	10 (13%)	17 (23%)	0.139
Cardiomyopathy, n (%)	15 (20%)	24 (33%)	0.094
Tobacco smoking, n (%)	15 (20%)	28 (39%)	**0.018**
Immunosuppression, n (%)	10 (13%)	13 (18%)	0.502

Table 2: Surgical data for primary anastomosis *vs.* Hartmann's procedure.

	PA group (n= 75)	**HP group** (n=73)	***P*** value
Surgical indication			
Perforation, n (%)	47 (63%)	45 (62%)	0.964
Mechanical obstruction, n (%)	20 (26%)	16 (22%)	0.630
Hemorrhage, n (%)	6 (8%)	7 (10%)	0.173
Other, n	2	5	
Hinchey I-II / III-IV	20/11	10/20	**0.015**
Operator			0.137
Junior Consultant, n (%)	39 (52%)	47 (64%)	
Senior Consultant, n (%)	36 (48%)	26 (36%)	
Surgery time			0.378
Nightshift, n (%)	21 (21%)	26 (37%)	
Intraoperative Noradrenalin >10ug/min	26 (35%)	41 (56%)	**0.013**
Surgical approach			0.442
Open, n (%)	70 (93%)	71 (97%)	

IQR; Interquartile Range

Table 3: Clinical outcomes after primary anastomosis *vs.* Hartmann's procedure.

	PA group (n= 75)	**HP group** (n=73)	***P*** value
30d complications			
overall	42(56%)	57(78%)	**0.005**
III-IV, n (%)	17 (23%)	29(40%)	**0.033**
Mortality, n (%)	3 (4%)	11 (15%)	**0.020**
Surgical site infection, n (%)	13 (17%)	26 (36%)	**0.015**
Postoperative ileus, n (%)	9 (12%)	12 (16%)	0.486
Need for Transfusion , n (%)	3 (4%)	15 (21%)	**0.002**
Anastomotic leak, n (%)	6 (8%)	-	-
ICU stay in days (IQR)	0 (0-0)	1 (0-5)	**<0.001**
LOS in days (IQR)	10 (8-17)	19 (11-25)	**<0.001**
Discharge home	52 (70%)	14 (19%)	**<0.001**

IQR; Interquartile Range

index, higher prevalence of smoking) as their counterparts in the PA group.

Surgical data

Indications for emergency left colectomy were similar in both groups. Perforation was the most frequent indication (overall 62%), followed by mechanical obstruction (overall 24%) and haemorrhage (overall 9%); other causes for emergent left colectomy were volvulus (n=3), Crohn's disease (n=2) and ileus due to adhesions (n=2) (Table 2).

Causes for perforation were diverticulitis 66% (n=61), obstruction due to malignancy 19% (n=17), iatrogenic perforation post colonoscopy (n=6), ischemia (n=5), abdominal trauma (n=2) and faecaloma (n=1). Mechanical obstruction without perforation was caused by malignancy in 70% (n=25) of patients and by inflammatory stenosis due to diverticulitis in 30% (n=11). Haemorrhage was due to inflammatory colitis in 8 patients and due to diverticulosis in=5 patients.

The median operation time was 180 min (62–466 min) in PA group versus 174 min (52-350min) for no-PA group (p=0.228). Five procedures with primary anastomosis were performed laparoscopically, 2/73 in the HP group (p=0.442). 36/75 anastomoses in the PA group were stapled. Hinchey classification was applicable in 31 and 30 patients in PA *vs.* HP group, respectively. Five and fifteen patients in the HP group had Hinchey class III and IV, as compared with 8 and 3 patients in the PA group, respectively. More patients in the HP group required elevated doses of Noradrenalin intraoperatively (56 *vs.* 35%, p=0.013). No significant difference was found with regards to qualification of the operating surgeon (junior *vs.* senior) or the timing of the procedure (working hours *vs.* nightshift (Table 2).

Clinical outcomes

Eleven patients (15%) died after HP, and 3 (4%) patients after resection with primary anastomosis 4% in patients with primary anastomosis (p=0.020), giving an overall mortality of 9%. In the PA group, 2 patients died of multiple organ failure (MOF) following septic shock of abdominal origin and one of pulmonary embolism. Causes of death in the HP group were abdominal sepsis with consecutive MOF in 8 patients, ruptured abdominal aortic aneurysm (causing colonic ischemia) (n=2), and bronchoaspiration and acute myocardial infarction in one patient each (Table 3).

Overall complication rate after emergent left-sided colectomy

was 66%. Patients having HP procedure had significantly more overall and severe complications. Type and incidence of individual complications are detailed in Table 3. Anastomotic leak occurred in 6 patients of the PA group (8%). Two leaks were managed by re-anastomosis and 4 with re-exploration and terminal colostomy. Two had HP reversal the remaining two had definitive colostomy due to medical contraindication.

Mean ICU stay and hospital stay was significantly longer in the HP group. Patients with PA were more likely to be discharged home as compared to more transfers to rehabilitation units for patients after HP (Table 3).

Ostomy closure

Six patients of the HP group died after discharge due to unrelated causes. Accounting for the post-operative mortalities (n=11), 57 patients were eligible for HP reversal. Eighteen of those patients (32%) actually proceeded to ostomy closure. Median time to ostomy take-down was 6 (3-31) months. No anastomotic leak occurred after ostomy closure. Causes for no ostomy closure were medical contraindication (n=28), and patients' preference or unknown in 29 patients.

Five primary anastomoses were protected with a loop ileostomy; all protective's ileostomy was closed. Four colostomies were created for anastomotic leaks; two were closed.

Discussion

In this series, morbi-mortality remains high after emergent left-sided colectomy irrespective of the surgical strategy. Patient's condition and intraoperative findings appear to guide intraoperative decision-making. HP does not prevent adverse outcomes and entails a high permanent ostomy rate.

The present study was not designed to compare primary anastomosis *vs.* HP for left-sided resections. Not surprisingly, patients in the HP group were older, sicker and had worse intraoperative findings (Hinchey class, noradrenalin requirements). Most surgeons would have decided probably for the "safer" HP in this context. However, permanent ostomy rates after HP are between 50 and 75% [8]. Furthermore, it has never been convincingly shown that HP is really the better option in terms of postoperative morbidity. A prospective study with comparative groups well-matched by randomization could answer this question but is difficult to conduct. In a multicenter randomized trial comparing HP *vs.* PA and protective loop ileostomy in patients with left-sided colonic perforation (Hinchey III/IV), the study was discontinued after an interim analysis of 30 patients in the HP group and 32 patients with primary anastomosis [11]. Morbi-mortality was equally high (67 *vs.* 57%, 9 *vs.* 13%) in both groups after the initial surgery. However, PA group compared favorably with regards to higher stoma reversal rate (90 *vs.* 57%) and significantly better outcomes after stoma take-down in terms of operation time, complications and costs [11]. The main limitation of this study was the non-inclusion of a considerable number of eligible patients, arguably those in worse shape. Our data confirmed that anastomotic leak rate and outcomes in patients with PA and without protective ileostomy compared favorably to the outcomes of patients with PA with ileostomy. However, it remains unclear whether protective ileostomy is necessary in this setting. This is paramount since stoma-associated morbidity remains high [11].

For the case of diverticular perforation, organ-sparing approaches such as laparoscopic lavage have been suggested to lower complications and secondary resection rates [9]. On the other hand, organ-preserving lavage is not an option for the other frequent indications such as obstruction, ischemia and bleeding [19-22].

Several attempts have been made to target risk factors for worse outcomes after colonic resection. In addition to the emergency, which is a risk factor for postoperative complications patient-related risk factors are age (>70 years), gender (male), ASA score >3, diabetes, smoking or immunosuppression. Procedure-related risk factors include intra-operative blood transfusion, hemodynamic instability, surgeon expertise or interventions performed during night-shift [12-14]. Some of those risk factors were significantly more prevalent in patients having HP and have probably influenced surgeons' decision to abstain from primary anastomosis. However, it remains unknown whether primary anastomosis with our without protective ileostomy would have been worse in this context. Interestingly, surgeon's expertise and timing of surgery were not significantly different for both comparative groups. Other studies showed a clear tendency for less open resection and less HP, when emergency resections were performed during daylight and by colorectal specialists [1,2].

For the reasons mentioned above, 2-stage procedures have been suggested with 2nd look and definitive surgery 24-48h after initial resection [23]. In line with principles of trauma surgery, only sepsis control is performed by initial resection of the diseased bowel part limiting the additional surgical trauma and allowing immediate resuscitation in the intensive care unit. Early postoperative course and operative status during 2nd look surgery help to define better whether primary anastomosis can be performed.

One of the major limitations of the study includes a single-center experience involving a relatively small number of patients. The described results can therefore not be generalized. Surgical strategy was at the discretion of the surgeon on call and no standardized algorithm was available in our institution at that time. This is likely to be similar in many institutions, as no widely accepted algorithm exists so far for the optimal strategy of emergent left-sided resections.

Conclusion

High morbi-mortality and high permanent ostomy rates remain the challenge after emergent left-sided colectomy and the ideal strategy remains yet to be defined. Primary HP does not prevent severe surgical complications, but primary anastomosis appears to be safe in selected patients in good condition and with favorable intraoperative findings. In the remaining patients, two-stage procedure with planned 2nd look and deferred anastomosis could help to improve early outcomes and to reduce permanent ostomy rates. A prospective study is underway to evaluate this strategy.

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