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Restoration of Bowel Continuity after Emergency Hartmann's Procedure

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Abstract

Aim: To analyze the factors involved in and the results of stoma reversal after an emergency Hartmann's operation.

Methods: A multicenter retrospective study from the Valencian Society of Surgery of patients who had undergone an emergent Hartmann's operation from 2004 to 2008. An analysis of the reversal rate and related factors, delay, and morbidity of reconstruction was performed.

Results: Three hundred sixty-two patients were studied. The most frequent initial diagnosis was colorectal cancer, followed by complicated acute diverticulitis; the primary surgical indication was acute peritonitis. After a median follow-up of 52 months, 151 patients (41.7%) underwent surgery to reverse the stoma at a median of 10 months after initial surgery. Diagnosis of diverticulitis or trauma, peritonitis as the surgical indication, and non-advanced tumors were associated with reversal. Multivariate analysis showed that only age and tumor stage were predictive of reversal. Postoperative complications occurred in 44% of the cases, and wound infection was the most common. There were 9 (6%) anastomotic leaks. Thirteen patients (8.6%) retained a permanent or temporary stoma after the attempted reconstruction.

Conclusion: Hartmann's reversal after emergency surgery is performed in less than half of all such patients and has significant morbidity.

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Introduction

Although it is controversial and even defamed, Hartmann's operation remains a current practice in hospitals. Some indications for the operation are universally accepted, but in others, such as left colon obstruction, trauma and even purulent peritonitis, resection and primary anastomosis, have gained increasing acceptance [1-3]. Even in elective surgery, there have been recent observations that amputation of the rectum may be superior to an ultra-slow Hartmann's procedure in terms of morbidity in patients with rectal tumors that do not infiltrate the sphincter complex but in whom anastomosis is contraindicated [4]. Another point against the Hartmann's operation is attributed to a late reversal and a high post-operative morbidity rate [5-7].

When discussing Hartmann's reversal, is important to distinguish whether the indication was emergent or elective because many of the programmed cases are made with definitive intention. In addition, another indication for a Hartmann's procedure occurs following an anastomotic leak (AL) [8].

The aims of this study were to analyze the factors involved and to examine the results of stoma reversal after an emergency Hartmann's operation.

Material and Methods

A multicenter retrospective study was suggested to all members of Valencia Society of Surgery. Patients who received an emergency Hartmann's operation between 2004 and 2008 were eligible for this study. Operations performed after an AL or another emergency reoperation were excluded. The centers involved were given a database for data collection. Data were analyzed using the SPSS v. 15 for Windows (SPSS Inc., Chicago IL, USA). Student's *t*-test, Kruskal-Wallis or Mann-Whitney *U*-test were used to analyze the results of continuous variables. Categorical variables were analyzed using either the χ^2 test or Fisher's exact test. The actuarial study of the reconstruction of gastrointestinal continuity was performed using the Kaplan-Meier's test and log-rank test, and the significant variables in the univariate analysis in the Hartmann's reversal were entered into the multivariate proportional hazards Cox's regression model. A *P*-value <0.05 was considered statistically significant. Hospitals were identified by letters (A, B…F), depending on their overall reconstruction rate.

Results

Seven hospitals participated in the study, and 397 patients were identified for enrollment in this study. Thirty-five (8.8%) patients were excluded because they did not meet all of the inclusion criteria. Therefore, 362 patients were included in this study. There were 196 males and 166 females, with a mean age and standard deviation (SD) of 67.2 (16) years (range, 16-97 years). As shown in Table 1, the most common diagnosis was colorectal carcinoma (138 colonic and 34 rectal neoplasms), followed by acute diverticulitis, without significant differences among hospitals (*P*=0.11).

Generalized or local peritonitis was the most common indication for the Hartmann's procedure in 203

cases (56%). The mean postoperative stay (SD) was 16.7 (16) days (range, 4-133 days), with significant differences between hospitals that ranged from 12.6 to 20.4 days (P=0.025). One hundred patients (27.6%) presented with severe post-operative morbidity, and 46 (12.7%) died during the first month after surgery.

After a median (IQR) follow-up of 52 (34-65) months, 151 patients (41.7% of the whole group and 47.8% of the first-surgery survivors) were scheduled to have reversal of their stoma, with important differences among hospitals (range 19.5%-65.1%, P<0.001). The surgery was performed at a median (IQR) follow-up of 10 (7-15) months (range, 1-41 months). As shown in Table 2, the most common reason for not reversing the stoma was patient death, followed by comorbidity and metastatic disease, all of which exhibited significant differences between hospitals (P=0.005).

Table 1. Initial surgery

Indication for Hartmann's procedure	N (%)
Large bowel obstruction	150 (41.4)
Pericolonic abscess	57 (15.9)
Purulent peritonitis	74 (20.4)
Fecal peritonitis	72 (19.9)
Recurrence risk	2 (0.6)
Other	7 (1.9)
Diagnosis	
Malignant neoplasm*	182 (50.2)
Acute diverticulitis	127 (35.1)
Colonic ischaemia	13 (3.6)
Colonic volvulus	9 (2.5)
Tra Colonic trauma	8 (2.2)
Other	23 (6.3)
U.I.C.C. Stage (N=182 malignancies)**	
I	0
II	49 (26.9)
III	75 (41.2)
IV	58 (31.9)

Data are numbers with percentages between parenthesis

* 172 colorectal and 10 gynaecological malignancies

** U.I.C.C. International Union Against the Cancer

The mean age (SD) of patients undergoing reversal was 56.7 (16) years *vs.* 74.7 (11) for non-reversed patients (P<0.001), and the postoperative length of hospital stay (SD) of the first surgery was lower for the patients who were subsequently reversed than for those who were not reversed: 14.7 (14) *vs.* 18.7 (17) days, respectively (P=0.002). However, there were no differences between the months at risk of the stoma closing. Actuarial analysis showed that Hartmann's reversal was performed more frequently in younger, males and in patients who underwent the surgery for peritonitis. The possibility of reconstruction was decreased and more delayed in patients with malignancy, volvulus, or ischemia than in those who had the initial operation for diverticulitis, trauma, or other pathologies (Figure 1). Additionally, patients with advanced colorectal cancer were less frequently reversed. Cox regression analysis showed the predictors for reconstruction were only age (P <0.001) and tumor stage (Table 3).

Table 2. Causes for no stoma-reversal

	N (%)
Exitus*	102 (28.2)
Comorbidities	45 (21.5)
Metastatic disease	35 (16.7)
Patient's refusal	24 (11.5)
Lost of follow-up	15 (7.2)
Local recurrence risk	8 (3.8)
Local recurrence	8 (3.8)
Local conditions	1 (0.5)
Other	14 (6.7)

Data are numbers with percentages in parentheses

* 46 at the postoperative period and 56 during follow-up

Of the patients who underwent operation to reverse the stoma, 28% were preoperatively classified as having an American Society of Anesthesiologists score

Figure 1. Stoma maintenance based on diagnosis. Patients with colorectal cancer, colonic volvulus, or ischemia were less frequently reversed, and it was performed after a longer period.

(ASA) of III or IV, and 54.7% were classified as ASA II. Antegrade mechanical bowel preparation was used in 88.8% of the patients, and 26.6% of the patients were operated on by a surgeon who was specifically dedicated to colorectal surgery. An open approach was used in 148 patients (98%). The anastomosis was performed mechanically using a circular device in 69.2% of the patients, side to side stapling in 14.4% and hand sewing in 16.4%. In four patients (2.7%), the anastomosis was not feasible, and the patients kept their stoma *in situ*. Another four patients underwent a derivative ileostomy to protect the anastomosis. Occasional procedures such as cholecystectomy or repair of ventral hernia were also performed.

Statistically significant differences among hospitals included the length of the surgery, with an average (SD) of 158 (59) minutes (range 115-184 mins, $P<0.001$), and postoperative hospital stay, with a mean (SD) of 12.2 (7.8) days (range 7.9-14.1, $P=0.006$). Postoperative complications were observed in 44% of the patients. The most common complications were surgical site infection in 35 patients and an anastomotic leak in nine patients. The anastomotic leak was treated by taking down the anastomosis in three patients, an associated ileostomy in two patients, a re-do operation without covering stoma in one patient and conservative treatment (percutaneous drainage) in three cases. Overall, 18 (11.9%) patients required a re-operation (attributed to leaks in 6 patients, acute wound failures in 9 patients and an intraabdominal abscess in one patient). Thirteen patients (8.6%) still had a stoma after surgery. Four (2.6%) patients died in the postoperative period after the stoma reversal (due to a duodenal perforation, intraabdominal abscess, catheter sepsis, or acute leukemia in one patient each).

The mean age of patients with post-operative complications was higher than the age of those who did not have any complications. The presence of complications was not related to any preoperative risk factor or the surgeon's specialization (Table 4). The postoperative stay (SD) was higher in patients with complications than in those without complications: 17.1 (9) *vs.* 8.3 (3) days ($P<0.0001$). When we specifically analyzed the anastomotic leaks, the only significant risk factor was the method used (25% leaks after a hand-sewn anastomosis *vs.* 2.4% in stapled anastomosis; $P<0.0001$). Postoperative mortality (SD) was significantly correlated with older age (mean age: 72.7 (6) years in patients who died *vs.* 56.3 (15) years for patients who did not die, $P=0.032$).

Discussion

After nearly a century since its description, the Hartmann's operation remains in use.[1] The main objective of this operation is to reduce the morbidity and mortality that are caused by an anastomotic failure, but it may also be used to treat advanced tumors or associated to fecal incontinence. In an emergency setting, a primary anastomosis has been shown to be safe in the presence of obstruction or diffuse peritonitis [3], but it requires technical expertise to perform under adverse conditions; therefore, the emergency surgeon may avoid performing an anastomosis. This approach is not free of problems. Complications of stoma range between 21% and 70%[9] and the need for a re-operation to reconstruct the bowel continuity place the patient at risk of even further complications and generate another hospital stay, result in increased health costs, and have

Table 3. Univariate and multivariate analysis of the factors associated with Hartmann's reversal

		% reverted	Univariate P value	Multivariate P value
Sex			0.002	0.666
	Male	47.4		
	Female	35.5		
Hospital			0.011	0.319
	A	65.1		
	B	48.2		
	C	44.4		
	D	35.7		
	E	35.5		
	F	29.6		
	G	19.5		
Hartmann's indication			0.014	0.885
	Colonic obstruction	32.7		
	Abscess	61.4		
	Purulent peritonitis	47.3		
	Fecal peritonitis	0.2		
	Recurrence risk	50		
	Other	42.8		
Tumour staging*			0.029	0.015
	II	46.9		
	III	25.3		
	IV	18.9		
Diagnosis			<0.001	0.109
	Malignant CRC**	29.6		
	Acute diverticulitis	56.7		
	Trauma	87.5		
	Ischemic colitis	15.4		
	Volvulus	44.4		
	Other	48.4		
Serious complications at the first surgery				
			0.39	--------
	Yes	21.2		
	No	50		

Data are percentages
* Malignant tumors; ** Colorectal cancer

social impacts. In fact, the morbidity associated with a stoma reversal is estimated to be approximately 50%, and the risk of mortality is greater than 5% [5-7,10].

This study evaluated the long-term outcomes of a cohort of 362 patients undergoing an emergency Hartmann's procedure (excluding those performed after an anastomotic leak). The minimum follow-up was 18 months in this study, which involved an in-depth

Table 4. Complications after reversal and related risk factors

Complications		N (%)		
Wound infection		35 (23.2)		
Anastomotic leak		9 (6)		
Wound disruption		9 (6)		
Intra-abdominal abscess		8 (5.3)		
Diffuse peritonitis		4 (2.6)		
Atelectasis/Pneumonia		3 (2)		
Catheter sepsis		2 (1.3)		
Venous thromboembolism		2 (1.3)		
Urinary infection		1 (0.7)		
Other		22 (14.6)		
Risk factors of postoperative morbidity				
Continuous variables		**Uncomplicated**	**Complicated**	***P value***
Age (years) (SD)		53.8 (15)	60.4 (15)	0.009
BMI Kg/m^2 (SD)		27.9 (5)	28.4 (4)	0.653
Months after initial surgery (SD)		11.4 (6)	11.9 (7)	0.633
Number of risk factors (SD)		1.2 (1.1)	1.4 (1.2)	0.225
Lenght of surgery (minutes) (SD)		153 (54)	165 (64)	0.233
Categorical variables		**Complicated (%)**		
Sex				0.8
	Men	37 (40.2)		
	Women	29 (49.1)		
ASA risk				0.701
	I - II	49 (42.6)		
	III - IV	17 (47.2)		
Diagnosis				0.844
	Colorectal neoplasm	24 (45.3)		
	Acute Diverticulitis	29 (42)		
	Other	13 (44.8)		
Tumour stage (U.I.C.C.)*				0.87
	II	10 (43.4)		
	III	7 (36.8)		
	IV	5 (45.4)		
First surgery indication				0.796
	Obstruction	24 (48.9)		
	Peritonitis	40 (40.8)		
	Other	2 (50)		
Surgeon				0.582
	Colorectal	16 (38.1)		
	Non colorectal	48 (45)		
Anastomosis				0.74
	Circular stapler	46 (45.5)		
	Linear stapler	10 (47.6)		
	Hand sewn	9 (37.5)		

SD: Standard deviation; U.I.C.C.: International Union Against the Cancer

analysis of patients who were previously included in a wider study [7] that did not assess the specific factors or problems related to emergencies.

In our series, the Hartmann's reversal was planned in 41.7% of the patients at a median of 10 months after initial surgery; this is slightly higher than the rate reported by a series from Spain, where it was performed in 25.9% of patients at a median of 13.3 months [11]. Other publications have reported stoma closure rates ranging between 45% and 68.5% that were performed between 4.5 and 9 months after the first operation [6,10,12-17], although some only included patients with diverticular disease [12,15,16]. In this series, patients with a benign pathology had a reconstruction rate almost double that of patients with malignant pathology; this is consistent with findings from other studies [17]. A large British multicenter review of 3,950 Hartmann's operations (2,853 in the emergency setting) showed a reversal rate of only 22.3%, ranging from 4 to 34% [18].

The most common reason not to close the stoma was postoperative mortality in 28.2% of the subjects based on the Hartmann's operation index and during the follow-up. Other reasons included comorbidities in 21.5% of the patients, metastatic disease, and patient refusal. The indication of Hartmann's operation as a definitive procedure is performed less frequently in an emergency setting than it is in an elective setting. Univariate analysis identified several factors associated with stoma closure, but only age and tumor stage remained significantly associated with stoma closure on multivariate analysis. Another study by Roque Castellano et al. [11] showed that age, male gender, and low anesthetic risk were associated with a greater number of reconstructions. These findings have been corroborated by other studies [15]. Riansuwan *et al.* [19] defined a risk-benefit score for stoma closure in patients undergoing surgery for acute diverticulitis, regarding age, ASA risk, perioperative transfusion, pulmonary complications, bowel perforation, and use of anticoagulation. It would be ideal to have a predictive table or algorithm to evaluate not only the risks at the time of the initial surgery but also the potential need for further closure of the stoma to facilitate the surgeon's decision making during emergent situations.

Another point of discussion is the minimum waiting time for reversal. To reduce peritoneal adhesions, the consensus is a waiting time of an average of three months [6,17,18,20]. However, this waiting period tends to increase, which can be attributed to factors such as the time needed to complete adjuvant chemotherapy or the negative impact of inclusion on a waiting list. However, some surgeons perform earlier closures. [6,15,19,21].

A laparoscopic approach for stoma reversal was used in only in three cases in our series. Several publications and systematic reviews have shown good results [22-25], although there are no prospective randomized studies that have stratified patients by surgical difficulty and risks [8]. Our postoperative complication rate of 44% is similar to previously reported rates [7,11,12,17,21]. One of the most serious complications, anastomotic leak, occurred in 6% of our patients, and 12% needed a reoperation in the postoperative period. Although risk factors for complications are similar to those of other digestive anastomosis [7,26-28], the results of our study showed that only advanced age was a negative predictor. Moreover, anastomotic leaks were associated with hand-sewn anastomosis. This may be due to the anastomosis technique used or the tumor location (e.g., on a long sigmoid stump, even affected by diverticular disease, compared to a stapled anastomosis at the sacral promontory) [17,29,30].

Given the low percentage of reversals, their delay, and morbidity, the indications for an emergency Hartmann's operation must be questioned. Although it is

lifesaving, it usually portends two surgeries that should be compared in terms of their risk of mortality and morbidity, economic and social costs, with a single operation, at least when the surgeon is faced with a left colonic obstruction or with localized and even diffuse purulent peritonitis in a patient with otherwise acceptable general conditions [2,4,8,31].

The daily practice of our emergency departments is not always ideal. Many times, patients with colonic emergencies are operated on by non-colorectal surgeons who rarely perform colon resections including anastomosis. This may result in higher morbidity rates. This is one of the few disadvantages related to working in very specialized units. However, an unprepared colon is not a contraindication for performing an anastomosis [32]. In addition, a multicenter study showed that a primary anastomosis protected by a derivative stoma provides an improved cost-benefit in terms of postoperative leakage, risks of keeping the stoma permanently and quality of life [33].

In conclusion, there is a high possibility of maintaining a permanent stoma after an emergent Hartmann´s operation is high. The intent to reverse stoma is often made late, mainly due to the age and tumor stage in cases of malignancy, and is burdened with significant morbidity.

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