Surgery for Caustic Injuries of the Upper Gastrointestinal Tract

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Background: Surgery is the criterion standard for the treatment of severe burns and of late sequels after ingestion of corrosive agents, but long-term outcome is unknown.

Methods: Patients who underwent surgery between 1987 and 2006, for the treatment of severe caustic burns (group I, n = 268) or of late sequels (group II, n = 79) were included in the study. Survival and functional outcomes were analyzed. *Functional success* was defined as nutritional autonomy after removal of the jejunostomy and tracheotomy tubes. To compare the observed mortality with the expected mortality in the general population, a standardized mortality ratio (SMR) was used.

Results: Overall Kaplan-Meyer survival at 1, 5, 10, and 20 years of patients in group I was 76.4%, 63.6%, 53.9%, and 44.1%, respectively. On multivariate analysis, advanced age (P = 0.0021), extended resection (P = 0.0009), emergency esophagectomy (P = 0.013), and tracheobronchial injuries (P = 0.0011) were independent negative predictors of survival. The SMR of patients in group I was increased to 21.5 when compared to the general French population. Functional success was recorded in 147 (56%) patients in group I. Advanced age (P = 0.012), extended resection (P = 0.012), and emergency tracheotomy (P = 0.02) were independent predictors for failure. After esophageal reconstruction, patients in group II fared better than patients in group I in terms of survival (P = 0.0006) and functional success (P < 0.0001). Still, the SMR of patients in group II increased to 3.67.

Conclusions: The need to perform surgery for caustic injuries has a persistent long-term negative impact on survival and functional outcome.

Keywords: caustic injuries, esophageal resection, esophageal reconstruction

Ingestion of corrosive agents, accidentally or with suicidal intent, is a rare but potentially devastating event. Most patients experience low-grade injuries of the upper gastrointestinal tract that resolve without sequels, but surgery is necessary in a small number of patients for the treatment of more severe injuries.[1] Worldwide, expert centers use similar algorithms for the management of corrosive injuries relying on emergency upper digestive endoscopy findings.[1–5] Emergency surgical exploration is usually undertaken in patients with high-grade endoscopic injuries to avoid involvement of adjacent organs and death.[6–10] Delayed surgery is performed for the treatment of late sequels.[11–15]

The surgical literature focuses mainly on operative outcomes of esophageal reconstruction for corrosive esophagitis,[11–13,16–19] whereas data on outcome following emergency surgery is scarce.[7,9,10] Adverse events, related to successive complex and highly morbid surgical procedures and the resulting nutritional and psychological issues, have deleterious influence on patient's outcome and should be considered together when evaluating the results of surgery for caustic injuries. Current lack of such information renders appropriate decision making and the counselling of patients, families, and professionals involved in the management of caustic injuries a difficult task.

The aim of this study was to report the experience with surgery for caustic injuries in a large volume referral center over a 20-year period.

PATIENTS AND METHODS

Study Design

Patients who underwent emergency evaluation of the upper gastrointestinal tract after caustic ingestion between March 1987 and December 2006 at the Saint-Louis Hospital in Paris were identified from a prospectively maintained database recording the name, age, and date of caustic ingestion. Patients who underwent surgery for caustic injuries at any time during follow-up were included; they were identified after consulting all operative reports of surgical procedures performed in the Digestive Unit across this period. Patients were divided into 2 distinct groups according to the initial therapeutic approach (Fig. 1). The first group (group I) included patients who underwent surgical exploration in prevision of digestive resection during the initial hospital admission. The second group (group II) included patients who underwent initial nonoperative management but eventually required surgery for the treatment of corrosive sequels. Patients who underwent jejunostomy for nutritional support and patients who were referred for esophageal reconstruction or management of esophageal substitute dysfunction were excluded. The first objective was to evaluate long-term survival and functional outcomes after emergency surgery for caustic injuries. The second objective was to assess overall results of surgery for the treatment of caustic injuries by using the combined experience of the 2 groups of patients.

Management Protocol

Emergency Management

The same protocol was used for the emergency management of patients with corrosive injuries of the upper gastrointestinal tract during the study period.[20] Upon arrival, patients were admitted to the intensive care unit for resuscitation. Clinically unstable patients and patients with signs of digestive perforation underwent immediate surgery. Upper digestive endoscopy was performed by the gastroenterologist on call in the presence of the attendant surgeon in all other patients and further decision making relied on the endoscopic findings according to the Zargar[5] classification (Fig. 2). Patients with mild injuries underwent nonoperative emergency management and close follow up; surgery was performed in case of progression of endoscopic injuries to grade 3b, signs of digestive perforation or incontrollable bleeding. Emergency surgical exploration was systematically performed in patients with grade 3b injuries of the upper gastrointestinal tract. Esophagectomy was performed in all patients with grade 3b esophageal injuries; gastrectomy was performed if laparotomy confirmed full-thickness necrosis of the gastric wall (Fig. 3). No attempt at esophageal reconstruction was made at the time of the emergency operation. Caustic necrosis of adjacent intra-abdominal
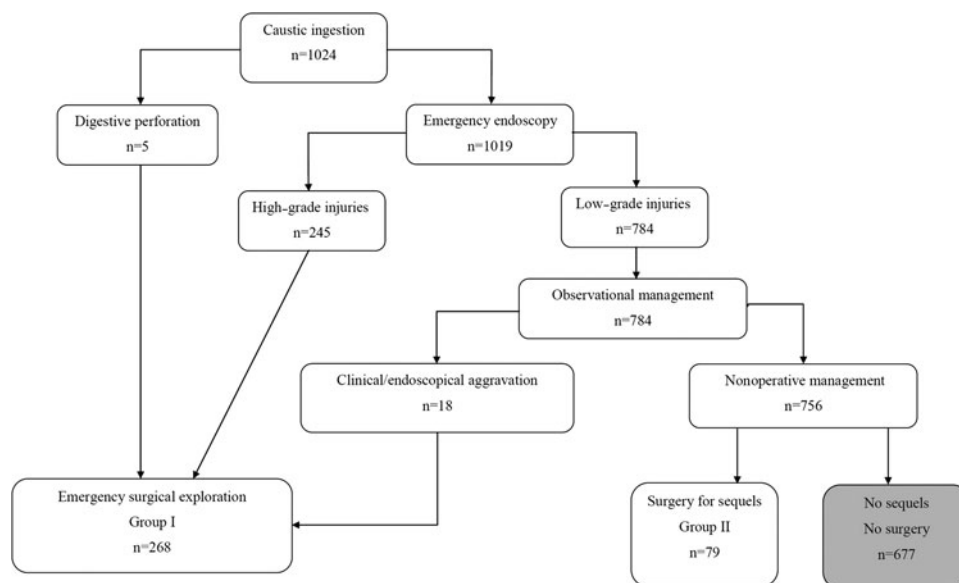
FIGURE 1. Flowchart of patients who underwent management for caustic injuries at the Saint-Louis Hospital between 1987 and 2006.
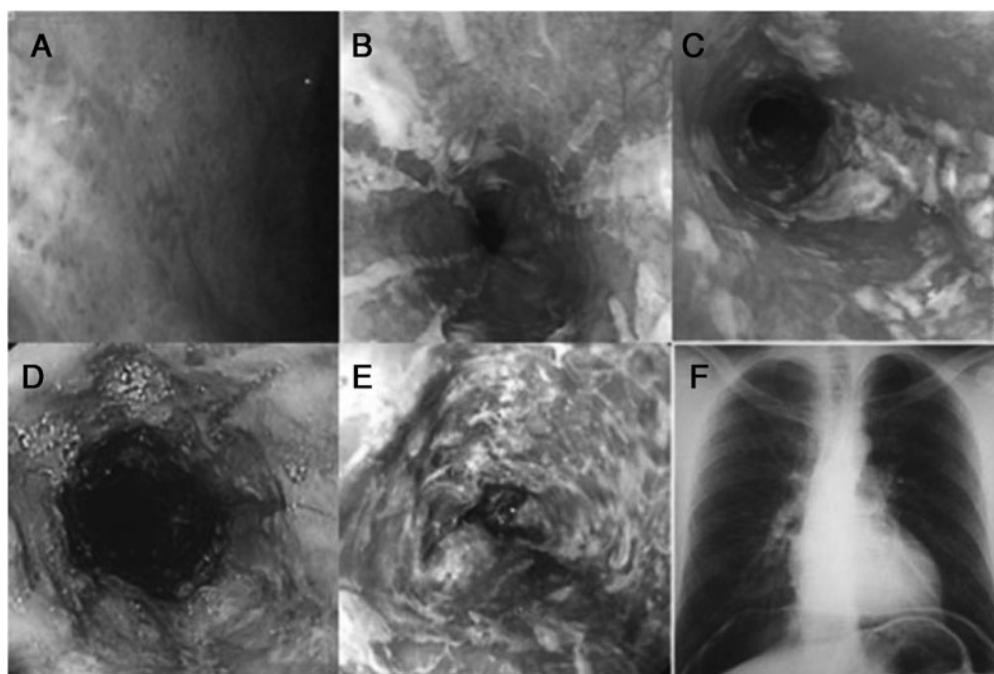

FIGURE 2. Endoscopic classification of corrosive injuries, which directed the therapeutic approach. A, Grade I: edema and hyperemia of the mucosa; B, Grade IIa: superficial localized ulcerations, friability and blisters; C, Grade IIb: circumferential and deep ulcerations; D, Grade IIIa: multiple deep ulcerations and small scattered areas of necrosis; E, Grade IIIb: extensive necrosis; F, Grade IV: perforation.

organs was managed by resection of the involved structures.[7,21] Tracheobronchial necrosis was treated by construction of a pulmonary patch through a right thoracotomy approach.[22] Extensive necrosis of the bowel and/or colon was considered a contraindication for resection because of poor patient survival and compromised nutritional and reconstructive issues.[7] Tracheotomy was performed in the postoperative period if severe pharyngolaryngeal injuries precluded extu-

bation. Patients requiring esophageal reconstruction were discharged to facility care structures specialized in the management of enteral nutrition and psychological support. Reconstruction was undertaken 3 to 6 months after ingestion in psychologically stable patients.[23] Thereafter, clinical follow-up was conducted every 6 months during the first 2 years and then yearly; lifelong psychological follow-up was counselled.[23]

FIGURE 3. Esophagogastrectomy specimen showing transmural necrosis of the esophagus and the stomach after massive ingestion of caustic soda.

Surgery for Caustic Sequels

Patients who experienced complete mucosal healing were discharged at home and seen on an outpatient basis at 6 months; thereafter, they were counselled to seek medical advice in case of alimentary intake-related difficulties.[20] Patients who developed esophageal strictures underwent esophageal reconstruction if they have failed or were considered unsuitable for endoscopic dilation.[16] Surgery was the preferred approach for the treatment of corrosive gastric sequels.

Statistical Analysis

Results are expressed as mean and standard deviation, median and first and third quartiles or counts and percents. The study outcomes were defined as survival and functional outcome. Survival was defined as the time between surgical exploration and death. Patients lost to follow up for more than 1 year were contacted up to January 2009; when patients could not be reached directly, family members or general practitioners were contacted. Living patients were censored at the date of the last available information (visit or phone call). Inpatient costs (readmissions during the whole follow-up period included) after emergency surgery for caustic injuries were estimated by summing surgical expenses (operation room use: 1470€ [$2096]/hour) and expenses required for patient care in the digestive unit (1500€ [$2139]/day), the intensive care unit (1800€ [$2566]/day) and the facility care unit (400€ [$570]/day). Figures correspond to rates currently charged at our center.

Marginal association between single variables and survival were evaluated using a Cox model and test by a Wald test. Restricted cubic spline regression did not indicate deviation from linearity assumption for continuous covariates.[24] Proportional hazard was checked for all covariates.[24] Variables associated with intervention at a 0.15 level were considered in a multiple Cox model. A backward stepwise variable selection algorithm was then performed based on P value cutoff at 0.05. Hazard ratios with their 95% confidence intervals are given. Survival curves were estimated using the Kaplan-Meier estimator. Median follow-up was assessed using a Kaplan-Meier estimator by considering death as censoring. To compare the observed mortality with the expected mortality, a standardized mortality ratio (SMR) was used. SMR is the ratio of the observed patient mortality and the mortality in the total French population with the corresponding sex and year of birth.[25,26] Expected mortality rates were obtained from the French national Statistical Institute (Institut National de la Statistique et des Etudes Economiques).[27] Confidence intervals were calculated directly from the Poisson distribution.[25]

Functional outcome was considered successful if patients were on an exclusive oral diet, and the tracheotomy and jejunostomy tubes had been removed at 1 year after ingestion. Marginal association between single variables and functional outcome was assessed by a Wilcoxon rank-sum test for quantitative variables and Fisher exact test for categorical variables. Variables associated with intervention at a 0.15 level were considered in a multiple logistic model. Restricted cubic spline regression did not indicate deviation from linearity assumption for continuous covariates. The validity of the logistic regression model was checked using Le Cessie and Van Houwelingen goodness-of-fit test.[28] Odds ratios with their 95% confidence intervals are given. Differences between groups were assessed by Wilcoxon rank-sum tests for quantitative variables and Fisher exact tests for categorical variables. All tests were 2-sided at the 0.05 significance level. Analyses were performed using R statistical package (online at http://www.R-project.org).

RESULTS

Emergency Surgery (Group I)

Patients

Emergency surgical exploration was undertaken in 268 (26%) of the 1024 patients evaluated for caustic injuries across the study period. There were 153 (57%) male patients, and median age at the time of caustic ingestion was 40 years (30; 50) (Table 1). Ingestion was performed with suicide intent in 260 (97%) patients, and 176 (70%) patients had a psychiatric history of depression (n = 108), schizophrenia (n = 51), or other (n = 17). The causal substances were caustic soda–based strong alkali (n = 192), strong acids (n = 48), and other (n = 23) and unknown (n = 5). Surgery was performed a median of 8 hours (6; 14.75 hours) after admission.

Extensive necrosis of the small bowel and the colon precluded resection in 10 (4%) patients. Esophagogastrectomy was performed

TABLE 1. Characteristic of Patients Who Underwent Emergency Surgery (Group I) and Surgical Treatment for Late Sequels (Group II) After Caustic Ingestion

	Group I (n = 268) N (%)	Group II (n = 79) N (%)
Age (yrs)	40 [30; 50]	30 [24; 41]
Men	153 (57.1)	39 (49.4)
Ingestion with suicide intent	260 (97)	68 (86.1)
Previous suicide attempt	60 (23.8)	13 (17.6)
Psychiatric disease	176 (69.3)	41 (54.7)
Depression	108 (42.7)	27 (37)
Schizophrenia	51 (20.2)	11 (15.1)
Ingested agents		
Strong alkali	192 (73)	62 (87.3)
Acids	48 (18.3)	5 (7)
Other	23 (8.7)	4 (5.6)

in 197 (74%) patients and was extended to other intra-abdominal organs in 51 (19%) patients: duodenopancreas (n = 18), small bowel (n = 23), spleen (n = 19), and colon (n = 9). Tracheobronchial necrosis was treated by construction of a pulmonary patch in 17 (6%) patients. Twenty-seven (10%) patients underwent stripping esophagectomy with gastric preservation. Total gastrectomy with "Roux en Y" reconstruction was performed in 11 (4%) patients with gastric necrosis and low-grade esophageal injuries. In 23 (9%) patients with endoscopic grade 3b gastric injuries and mild esophageal involvement, laparotomy failed to disclose full-thickness necrosis of the stomach and resection was not undertaken (Fig. 4). Tracheotomy was performed in 92 (34%) patients.

Operative Outcome

Forty-two patients (16%) died in the postoperative period. Operative morbidity was recorded in 167 (62%) patients. The most frequent operative complication was pneumonia (n = 127). Fifty-one (19%) patients underwent reoperation for surgical complications, and 178 (66%) patients required postoperative intensive care unit management. Pathologic examination revealed full-thickness necrosis of the stomach in all gastrectomy specimens but failed to show transmural necrosis in 33 (15%) of the 224 esophagectomy specimens.

Secondary Surgery After Emergency Surgical Management

Five of the 23 patients without transmural necrosis at laparotomy, in whom resection was not performed, required surgery for late complications. One patient underwent total gastrectomy and segmental colectomy for diffuse gastric strictures complicated by gastrocolonic fistula, 3 months after ingestion. Another patient underwent distal gastrectomy for gastric stricture, 4 months after ingestion. Three patients underwent esophageal reconstruction for esophageal strictures that failed endoscopic dilation.

Overall, esophageal reconstruction was required in 200 patients who survived the emergency operation and was eventually undertaken in 185 patients. Reconstruction was contraindicated in 15 patients on psychological grounds. Median delay in reconstruction was 5 months (4; 7). Reconstruction was performed with the right colon (n = 152), the left colon (n = 29), and the stomach (n = 4). Pharyngeal reconstruction was undertaken in 90 patients. Six patients (3%) died after esophageal reconstruction, 112 patients (62%) experienced operative complications, and 86 patients (47%) developed late complications. (Table 2)

Overall Survival

Median follow-up from the time of ingestion was 5 years (interquartile range 2.4 to 8.9 years). Three patients (1%) were lost to follow-up. At the end of the follow-up, 103 patients (39%) had died. Death was the result of operative complications in 55 patients (emergency surgery n = 42, esophageal reconstruction n = 6, surgery for late complications n = 7), suicide in 28 patients, severe deterioration of the psychiatric disease and progressive malnutrition in 13 patients, and sudden unexplained causes in 7 patients.

Overall Kaplan-Meyer survival at 1, 5, 10, and 20 years of patients in group I was 76.4%, 63.6%, 53.9%, and 44.1%, respectively (Fig. 5). On univariate analysis, age ($P = 0.0018$), extended resection ($P < 0.0001$), pancreatoduodenectomy ($P = 0.004$), caustic
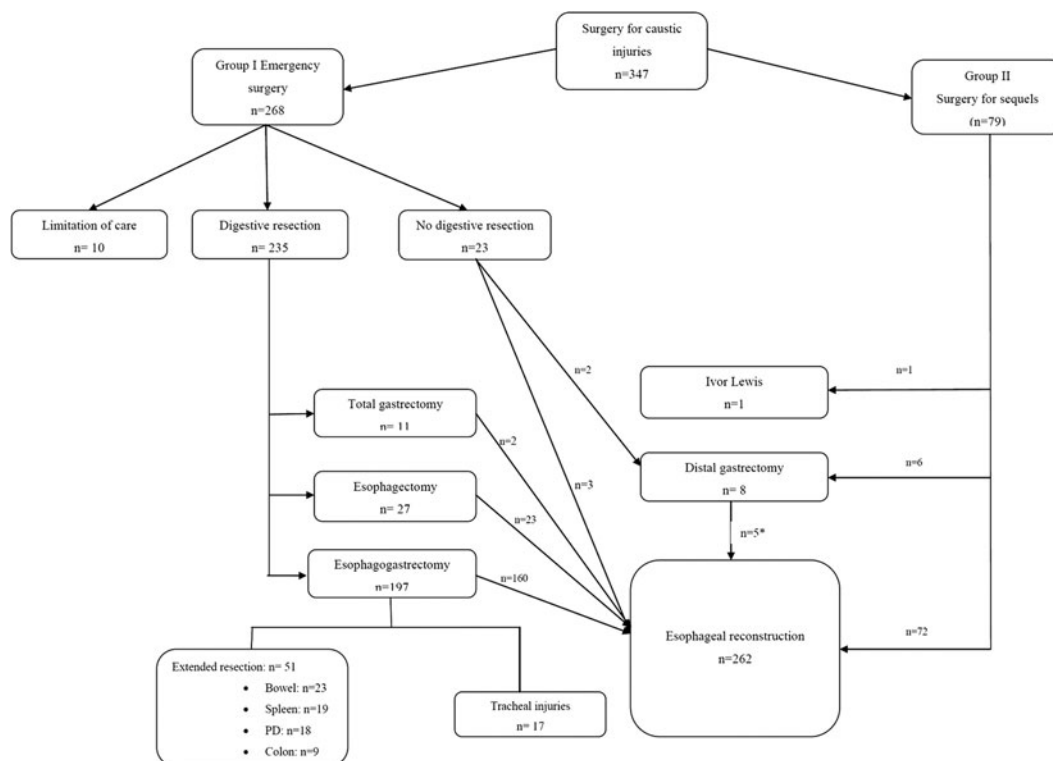

FIGURE 4. Flowchart of patients who underwent surgery for the treatment of caustic injuries at the Saint-Louis Hospital between 1987 and 2006. *All patients came from Group II.

TABLE 2. Characteristics of Esophageal Reconstruction in Patients in Group I (n = 185) and Group II (n = 77)

	Group I (n = 185) N (%)	Group II (n = 77) N (%)	*P*
Delay in reconstruction (mo)	5 [4; 7]	5 [4; 8]	0.90
Operative time (min)	395 [320; 480]	300 [245; 380]	<0.0001
Esophageal substitute			
Ileocolon	149 (82.3)	47 (61.8)	<0.0001
Left colon	28 (15.5)	8 (10.5)	
Stomach	4 (2.2)	21 (27.6)	
Pharyngeal reconstruction	90 (48.6)	15 (19.5)	<0.0001
Colpharyngoplasty	72 (38.9)	11 (14.3)	
Other	18 (9.7)	4 (5.2)	
Operative mortality	6 (3.2)	2 (2.6)	1
Operative morbidity	112 (61.5)	36 (48)	0.052
Pneumonia	64 (34.6)	23 (29.9)	0.50
Cervical fistula	33 (17.8)	14 (18.2)	1
Graft necrosis	10 (5.4)	3 (3.9)	0.80
Intra-abdominal fistula	19 (10.3)	4 (5.2)	0.20
Reoperation	49 (27.4)	15 (20.3)	0.30
Late complications	86 (46.5)	48 (62.3)	0.021
Stenosis	57 (30.8)	32 (41.6)	0.10
Recurrent nerve palsy	26 (14.1)	4 (5.2)	0.054
Reflux	18 (9.7)	13 (16.9)	0.10
Redundancy	6 (3.2)	4 (5.2)	0.50
Intensive care unit stay (d)	0 [0; 7]	0 [0; 1]	0.20
In-hospital stay (d)	37.5 [23.75; 60]	30 [19.5; 47.5]	0.02
Functional success	122 (67)	72 (93.5)	<0.0001

FIGURE 5. Kaplan-Meyer survival of patients who underwent emergency surgery for caustic injuries patients (group I, n = 268).

130) days per patient. Median duration of facility care unit stay was 5 months (4; 7). The median overall cost of in-hospital patient care after emergency surgery for caustic injuries was €139,600 ($199,046) (96,690; €216,800).

Surgery for Caustic Sequels (Group II)

Patients

During the follow-up period, 79 patients (7.7%) underwent surgery for the treatment of caustic sequels following nonoperative emergency management. Six patients developed gastric strictures and underwent distal gastrectomy a median of 6 weeks (range, 5 to9 weeks) after ingestion. One patient underwent Ivor-Levis esophagectomy 8 months after ingestion. Eventually, 77 patients underwent esophageal reconstruction for strictures that had failed (n = 25) or were unsuitable for dilation (n = 52).

Outcome

Median follow-up from the time of ingestion was 105 months (44; 216) in group II. Four patients (5%) were lost to follow-up. The SMR of patients in group II was 3.67 when compared with the general French population. Functional success was recorded in 74 (94%) patients in group II and was superior to the success rate in group I (*P* < 0.0001). The median overall cost of patient's care after surgery for caustic sequels was €62,920 ($89,776) (45,160; €103,300).

Esophageal Reconstruction

Esophageal reconstruction was undertaken in 185 patients in group I and 77 patients in group II. Despite strict patient selection in both groups, there was a significant long-term functional success (95% vs 71%, *P* < 0.0001) and survival benefit (*P* = 0.0006) from the time of esophageal reconstruction in patients in Group II (Fig. 6).

Operative time (*P* < 0.0001) and duration of hospital stay (*P* = 0.02) were longer in patients in group I. After esophageal reconstruction, there was a trend for higher operative morbidity rates (62% vs 48%) in patients in group I (*P* = 0.052). No difference was observed between group I and group II regarding operative mortality (3.2% vs 2.6%, *P* = 1), graft necrosis (5, 4% vs 3.9%, *P* = 0.8), cervical fistula (17.8% vs 18.2%, *P* = 1), and reoperation rates (27% vs 23%,

tracheobronchial injuries (*P* = 0.0019), and intensive care unit management at the time of emergency admission (*P* = 0.0018) were significant prognostic factors of survival. On multivariate analysis age (*P* = 0.0021), extended resection (*P* = 0.0009), emergency esophagectomy (*P* = 0.013), and presence of caustic tracheobronchial injuries (*P* = 0.0011) were independent negative predictors of survival (Table 3).
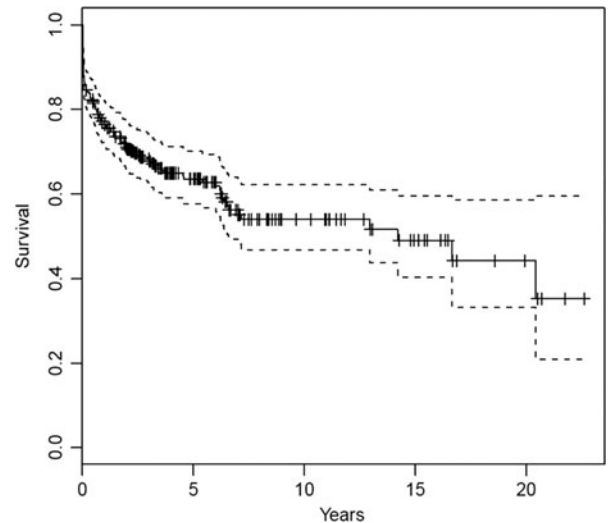
The SMR of group I patients was 21.5 when compared with the general French population. Thirty-six of the patients who survived the emergency operation attempted suicide again (caustic re-ingestion: n = 9), a median of 29 months (15; 67) after caustic ingestion.

Functional Outcome

Functional success was recorded in 147 (56%) patients in group I. On univariate analysis, advanced age (*P* = 0.0012), extended resection (*P* < 0.0001), pancreatoduodenectomy (*P* = 0.0017), tracheobronchial injuries (*P* = 0.04), emergency tracheotomy (*P* < 0.0001), and postoperative intensive care unit admission at the time of the emergency operation (*P* < 0.0001) were predictive of failure (Table 4). Of them, multivariate analysis identified advanced age (*P* = 0.012), extended resection (*P* = 0.012), and emergency tracheotomy (*P* = 0.02) as independent predictive factors of failure.

Costs Analysis

Median overall operation room utilization time in patients in group I was 6.15 hours per patient. Median intensive care unit stay was 9 (3; 21) days per patient and median in-hospital stay was 86.0 (55;

TABLE 3. Univariate and Multivariate Prognostic Factor Analysis for Survival in Patients Who Underwent Emergency Surgery (N = 268)

	Univariate			Multivariate		
	HR	95% CI	*P*	HR	95% CI	*P*
Age	1.02	1.01–1.04	0.0018	1.03	1.01–1.04	0.0021
Sex	0.78	0.53–1.14	0.20			
Psychiatric disease	1.49	0.93–2.41	0.099			
Suicide attempt	3.25	0.45–23.27	0.24			
Extended resection	3.85	2.55–5.82	<0.0001	2.29	1.41–3.74	0.0009
Emergency esophagectomy	1.86	0.86–4.03	0.11	3.09	1.27–7.49	0.013
Pancreatoduodenectomy	2.53	1.35–4.75	0.004			
Tracheobronchial injuries	2.53	1.41–4.54	0.0019	2.87	1.53–5.41	0.0011
Intensive care unit admission	2.08	1.63–3.66	0.0018			
Emergency tracheotomy	1.16	0.08–1.74	0.48			

TABLE 4. Univariate Prognostic Factor Analysis for Success in Patients Who Underwent Emergency Surgery for Caustic Injuries
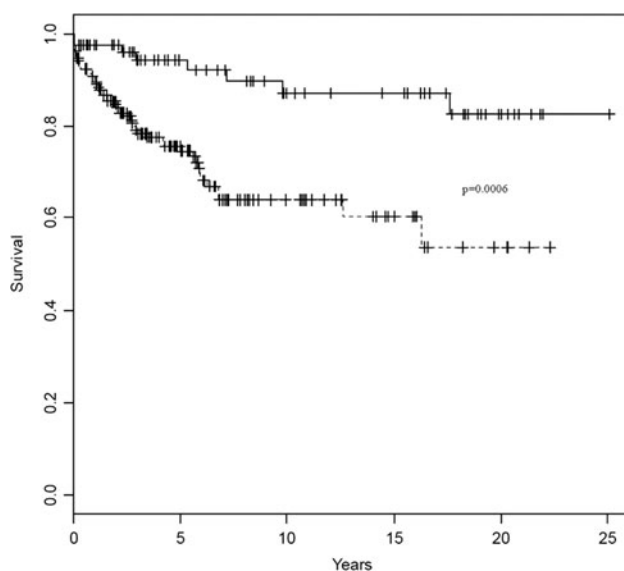
	Failure (n = 118) N (%)	Success (n = 147) N (%)	*P*
Age (yrs)	42.5 [33; 54]	36 [28; 47]	1
Men	67 (56.8)	84 (57.1)	0.0007
Ingestion with suicide intent	116 (98.3)	141 (95.9)	0.30
Psychiatric disease	79 (73.1)	95 (66.4)	0.30
Ingested agents			0.20
Strong alkali	81 (70.4)	110 (75.9)	
Acids	26 (22.6)	21 (14.5)	
Other	8 (7.0)	14 (9.7)	
Extended resection	36 (30.5)	14 (9.5)	<0.0001
Pancreatoduodenectomy	14 (11.9)	3 (2)	0.0017
Tracheobronchial injuries	12 (10.2)	5 (3.4)	0.041
Emergency tracheotomy	58 (49.2)	33 (22.4)	<0.0001
Intensive care unit stay	96 (81.4)	81 (55.1)	<0.0001
Esophagectomy	104 (88.1)	117 (79.6)	0.07

FIGURE 6. Kaplan-Meyer survival from the time of the esophageal reconstruction in group I (n = 185 interrupted line) and group II (n = 77; continuous line) (log rank, *P* = 0.0006).

P = 0.30) (Table 2). Multivariate analysis in patients who underwent reconstruction identified emergency esophagectomy as the only negative predictive factor of survival (HR: 2.37, CI: 1.09–5.13, *P* = 0.028) (Table 5). Esophagectomy (OR: 0.25, CI: 0.10–0.64, *P* = 0.0038), age (OR: 0.97, CI: 0.95–0.99, *P* = 0.0325), and emergency tracheotomy (OR: 0.26, CI: 0.14–0.50, *P* < 0.00001) were independent predictors of failure.

DISCUSSION

Over the last 30 years, the Saint-Louis Hospital in Paris has progressively become the single emergency referral center for treatment of caustic injuries of the upper gastrointestinal tract in Paris and its suburbs[21]; across this period, an aggressive endoscopy-based surgical policy was developed for the management of caustic injuries. By using this policy, mortality was nil in patients eligible for observational therapy. Findings of this study offer new insights into the "natural history" of the surgical patient with caustic injuries.

The SMR after emergency surgery for caustic injuries was 21.5 when compared with the general French population. The ongoing decrease of the Kaplan-Meyer survival during follow-up, beyond the emergency period was a most troublesome and highly unexpected finding. Roughly half of these young patients who are taken to the operation room with intent to perform digestive resection of severe caustic injuries would die during the 10 years after ingestion. Patients continue to die over time as a result of operative complications, malnutrition, late morbidity, progressive deterioration of the psychiatric condition, and suicide. Moreover, only half of the patients who underwent emergency surgery eventually regained nutritional and respiratory autonomy. On multivariate analysis, advanced age and the extent of the initial insult (as reflected by extended resection, emergency tracheotomy, and tracheal necrosis) had a negative impact on both survival and functional outcome. These findings stress the tremendous implications of the need to perform emergency surgery for caustic injuries.

Patients who required corrective surgery for caustic sequels after conservative management fared better than those who underwent emergency surgery. However, their SMR was still 3.67 when compared with the general French population. Even in patients eligible for esophageal reconstruction, both the survival and functional advantages persisted over time after initial nonoperative management. Emergency esophagectomy was an independent predictor of survival and failure after reconstruction. Together, these data emphasize the

TABLE 5. Univariate and Multivariate Prognostic Factor Analysis for Survival in Patients Who Underwent Esophageal Reconstruction (N = 262)

	Univariate			Multivariate		
	HR	**95% CI**	***P***	**HR**	**95% CI**	***P***
Age	1.03	1.01–1.05	0.0038	1.02	1.00–1.04	0.05
Sex	0.99	0.58–1.70	0.99			
Psychiatric disease	2.06	1.10–3.87	0.025	1.64	0.85–3.17	0.14
Suicide attempt	4.00	0.55–28.94	0.17			
Extended resection	1.89	0.81–4.44	0.14	1.115	0.48–2.77	0.75
Emergency esophagectomy	3.30	1.58–6.86	0.0014	2.37	1.09–5.13	0.028
Pharyngeal reconstruction	1.71	1.00–2.93	0.051	1.39	0.78–2.45	0.24
Emergency tracheotomy	1.50	0.85–2.65	0.17			

long-lasting negative influence of the severity of the initial insult on patients' outcome.

Concerns have been raised regarding the lack of correlation between endoscopic findings and the extent of parietal necrosis.[2,3,29] In our experience, laparotomy avoided unnecessary gastrectomy in 12% of the patients with gastric injuries staged 3b. In the absence of additional diagnosis tools, decision to perform esophagectomy was based exclusively on endoscopy findings and resulted in 15% unnecessary esophagectomy rate. Esophageal resection per se, was an independent negative predictor of survival after emergency surgery. There is an urgent need to improve patient selection for esophageal resection after caustic ingestion; we are currently investigating the role of computed tomography as an adjunct to endoscopy in this indication.

The huge health care resource utilization and costs triggered by the necessity to operate on caustic ingestion victims is alarming. It has been estimated that 35,000 patients require hospital care after ingestion of corrosive agents in the United States each year.[2] In view of this data, one-third would require surgery during follow-up for total in-hospital patient expenses reaching $1.5 billion. As recently as 1971, Leape et al[30] pointed out that liquid lye was a major public health problem and suggested that prevention was the best solution. Forty years later, the problem is still here. Actually, 75% of the patients (data not shown) who underwent surgery in this study had ingested over-the-counter, strong alkali-based cleansing agents.

In conclusion, need for surgery for caustic injuries, particularly on an emergency basis, is a critical point in the lives of these patients because of the long-lasting effects on survival and functional outcomes. Efforts to improve outcome should be directed at avoiding unnecessary esophageal resection in parallel with the development of public health prevention strategies aimed at limiting access to strong corrosive agents and at providing explicit information on their deleterious effects.

ACKNOWLEDGMENTS

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