



Diagnosis and management of caustic ingestion: an interdisciplinary nationwide cross-sectional survey from the Italian society of endoscopic surgery and new technologies (SICE), the Italian society of digestive endoscopy (SIED), the world society of emergency surgery-Italy chapter (WSESit), and the Italian society of surgical endoscopy and digestive diseases (ISSE)

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Abstract

Caustic ingestion (CI) in adults represents a potentially life-threatening condition. Diagnosis and management of CI in real life remain challenging. The aim of the survey is to evaluate on a national scale the multidisciplinary management of these patients. 24-item online Survey was sent to the mailing lists and social media of Italian Society of Endoscopic Surgery and New Technologies, Italian Society of Digestive Endoscopy, World Society of Emergency Surgery-Italy Chapter, and Italian Society of Surgical Endoscopy and Digestive Diseases. Overall, 240 subjects answered to the survey, corresponding to 22.1% of the total members of the scientific societies involved. 131 (54.5%) respondents evaluated fewer than ten CI patients per year. The recommendations provided by the WSES and SIED guidelines were followed by 133 (55.2%) and 83 (34.4%) participants, respectively. Emergency surgery was advocated by 180 (77.6%) of the respondents for patients with transmural necrosis or signs of perforation, using minimally invasive surgery in 47% of the cases and considering initial esophagojejunal anastomosis as safe in 33 (14.2%) of the responses. Our study is the first to provide real-life data on how the management of CI varies across Italian physicians, according to regional, institutional, and specialty-related factors. This survey highlights the need for standardized and uniform guidelines.

Keywords Caustic ingestion · Emergency surgery · Multidisciplinary approach · Diagnostic endoscopy · Minvasive emergency surgery

Introduction

Caustic ingestion (CI) in adults may result in death or severe digestive sequelae. Reported early mortality and morbidity rates after massive ingestion of strong caustic agents range from 13 to 16% and from 36 to 80%, respectively [1]. Following initial conservative management, 14–37% of patients develop esophageal strictures [2]. Both early and late complications associated with caustic ingestion require

significant health care resource utilization and can have a long-term negative impact on the patient's quality of life, nutritional status, and survival [3]. A relevant limitation in the contemporary literature is that the few studies focusing on this topic come from high-volume referral centers with expertise in esophageal surgery. The scarcity of nationwide epidemiological data leads to challenges regarding the applicability of their results to less-specialized centers, which are nevertheless frequently involved in the emergency treatment of patients following caustic ingestion [4]. Caustic ingestion requires a multidisciplinary evaluation approach as outlined

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by the latest World Society of Emergency Surgery (WSES) guidelines [5]. Previous studies have emphasized the need of homogeneous data for conducting prospective studies that may help improving current clinical practices [6, 7]. Interestingly, a recent and large nationwide study conducted in France showed that referral to expert centers is associated with improved early survival after caustic ingestion [8].

This national survey aims to evaluate the current knowledge of the approach to patients with caustic ingestion and adherence to current guidelines in Italy.

Methods

This survey was designed according to the Checklist for Reporting Results of Internet ESurveys (CHERRIES) [9].

Questionnaire design

The study steering committee developed the questionnaire using a brainstorming process followed by a web-based remote discussion to identify the components and topics to include. The technical functionality of the electronic questionnaire was beta tested before the invitations were sent.

The survey comprised 24 multiple and single choice questions, divided into five areas (informed consent, demographics, adherence to the guidelines, preoperative assessment and diagnostic strategies, and therapeutic strategies) addressing the diagnostic and therapeutic pathways for patients with CI (Supplementary material 1). It considered which recommendations or guidelines the WSES guidelines [5], the SIED recommendations [10], or those from the French Society of Digestive Endoscopy (SFED) [11]. Data were requested as a single response or by evaluating its effectiveness by giving a point from 1 (not appropriate) to 5 (very appropriate). The estimated time of completion of the questionnaire was 10 min. The study was supervised and officially endorsed by the Italian Society of Endoscopic Surgery and New Technologies (SICE), the Italian Society of Digestive Endoscopy (SIED), the World Society of Emergency Surgery Italian Chapter (WSESit), and the Italian Society of Surgical Endoscopy and Digestive Diseases (ISSE).

Circulation

The survey was developed using Google Forms Survey® (Google; Mountain View, CA, USA) and disseminated through the SICE, SIED, WSESit, and ISSE mailing lists and social media (Twitter, Facebook, LinkedIn, Instagram). Online access was granted from March 7th, 2024, to April 7th, 2024.

Ethics

Participation was voluntary and addressed to surgeons, gastroenterologists, and endoscopists regardless of their experience, position, or the center's volume. Written informed consent was obtained from each respondent. No economic benefits were granted to the participants.

Statistical analysis

The population has been categorized based on the following criteria: region of the workplace (North, Middle, and South Italy), hospital type (Non-academic, Academic, Private, Accredited Private Hospital), number of beds (1–100, 101–500, 501–1000, > 1000), specialty (General and Emergency Surgery, Endoscopy, Gastroenterology), number of patients evaluated per year (none, < 10, between 10 and 20, > 20), number of patients operated on per year (none, 1–10%, 10–20%, > 20%), and whether the hospital has a specific pathway for caustic ingestion. Each category was compared for the 24 survey questions using the Chi-squared or Fisher's exact test. A *p* value lower than 0.05 was considered statistically significant. Statistical analysis was performed using SPSS v23.0 (IBM Corp, Armonk, New York, USA).

Results

General results

General characteristics

Overall, 240 subjects answered to the survey, corresponding to 22.1% of the total members of the scientific societies involved. The distribution of the participants across Italy is shown in Fig. 1. One-hundred thirty-one (54.5%) respondents evaluated fewer than ten, 82 (34.2%) evaluated 10–20, and 27 (11.3%) evaluated more than 20 CI patients per year. A hospital-approved standardized diagnostic-therapeutic protocol was followed by 130 (54.2%) respondents, with international WSES and Italian SIED recommendations followed by 133 (55.2%) and 83 (34.4%) respondents, respectively.

Diagnostic strategies

Upper-GI endoscopy was indicated in all the patients by 152 (63.3%) respondents, while 88 (36.7%) recommended it based on clinical conditions, with 139 (58%) recommending Upper-GI endoscopy within 12 h of presentation. The Zargar classification was consistently noted in Upper-GI endoscopy

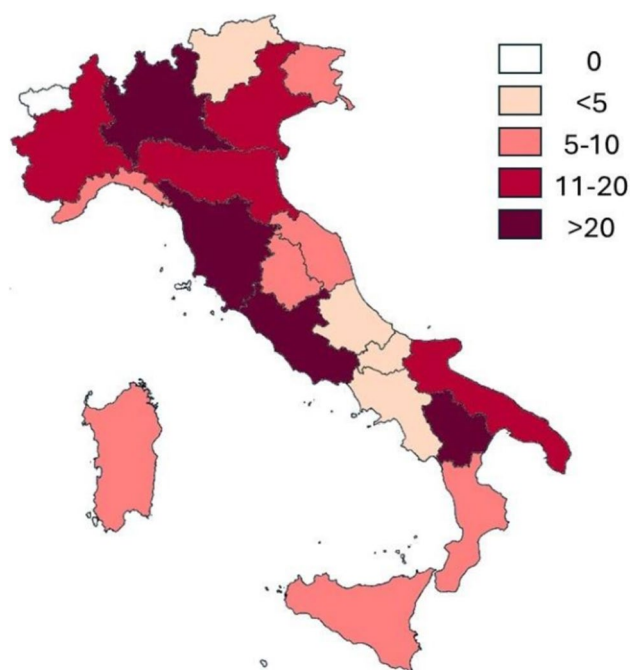


Fig. 1 Contribution of responders to the survey according to the region of provenance. The different colors correspond to the number of responders

reports by 115 (47.9%) respondents. A CT scan was recommended for all the patients by 131 (54.6%) respondents, with the WSES radiological classification noted often or sometimes by 142 (59.1%) respondents. The Upper-GI endoscopy, Zargar Classification, and contrast-enhanced CT scans were considered highly useful by 180 (75.9%), 193 (80.4%), and 198 (82.5%) respondents, respectively.

Treatment strategies

When considering treatment, 214(89.2%) respondents were guided by Upper-GI endoscopy plus contrast-enhanced CT, with nearly half (144–47.5%) depending on the specific case for the timing of diagnostic tests. A multidisciplinary approach and centralization to a trauma center were deemed highly useful by 222 (92.5%) respondents, while dietary and psychiatric counselings were considered useful by 198 respondents (82.6%). Updated guidelines were rated as highly useful by 205 (85.5%) respondents. Antibiotics were administered based on the degree of lesion by 187 (77.8%) respondents, with 50 (20.9%) always administering them. Emergency surgery was performed by 186 (77.6%) respondents for patients with transmural necrosis or signs of perforation. Minimally invasive surgery was considered appropriate by 113 respondents (47%), with 106 (44.3%) supporting diagnostic laparoscopy in doubtful cases. Only 33 (14.16%) considered esophagojejunal anastomosis safe and feasible initially, while 152 (66.9%) supported derivative

Table 1 General respondents' characteristics

Workplace	n. 163 (%)
Northern Italy	63 (38.7)
Middle Italy	59 (36.2)
Southern Italy	41 (25.1)
Hospital type	
Non-Academic Hospital	91 (55.8)
Academic Hospital	57 (35.0)
Private Hospital	3 (1.8%)
Accredited Private Hospital	12 (7.4)
Hospital size (beds number)	
1–100	10 (6.1)
101–500	66 (40.5)
501–1000	42 (25.8)
> 1000	45 (27.6)
Department	
General and Emergency Surgery	94 (57.7)
Endoscopy and Gastroenterology	69 (42.3)
Number of patients evaluated per year	
None	4 (2.4)
< 10	82 (50.3)
10–20	56 (34.4)
< 20	21 (12.9)
Number of patients operated per year	
None	42 (25.8)
< 10%	86 (52.8)
10–20%	14 (8.6)
> 20%	21 (12.9)
I do not know	17 (10.4)
Specific pathway for caustic ingestion	
No	92 (56.4)
Yes	44 (27.0)
I do not know	27 (16.6)

surgery in case of resection. Only 163 (67.9%) respondents answered to all the questions and were used for the further analysis.

Respondents' characteristics

The general characteristics of the respondents are summarized in Table 1.

Groups' analyses

The results are reported according to the following categories: region of the workplace (North, Middle, and South), hospital type (Non-academic, Academic, Private, Accredited Private Hospital), number of hospital beds (1–100, 101–500, 501–1000, > 1000), specialty (General and Emergency Surgery, Endoscopy, Gastroenterology), number of patients

with CI evaluated per year (none, < 10, between 10 and 20, > 20), number of patients operated on per year (none, 1–10%, 10–20%, > 20%), and whether the hospital has a specific pathway for CI (yes, no, "I don't know").

1. Regional differences in diagnosis and treatment of CI in Italy

The comparative analysis of the regional differences in the diagnosis and treatment of CI in Italy (Table 2) showed that the reporting of the WSES classification was least frequent in Northern Italy compared with the Southern ($p=0.039$), with Middle Italy showing a balanced approach. Combined use of Upper-GI endoscopy and contrast-enhanced CT scan was predominant in all the regions, with Middle Italy showing the highest adherence ($p=0.033$). (Supplementary material 2).

2. Diagnosis and treatment across different hospital types

The comparative analysis of the different diagnostic and treatment pathways across the different hospital types (Table 3) showed that the involvement of a multidisciplinary team for CI patients was considered very useful across all hospital types, especially in academic and accredited private hospitals ($p=0.013$). More frequently than others, non-academic hospitals found the Zargar classification useful, while private hospitals showed less consensus ($p=0.030$).

A stronger inclination toward performing a CT scan in academic and accredited private hospitals, with more varied practices in non-academic and private hospitals, was found ($p=0.018$). Finally, the predominant approach across all hospital types was to administer antibiotics based on the degree of injury, with private hospitals showing more deviation in practice ($p=0.004$). (Supplementary material 3).

3. Diagnosis and treatment across different hospital sizes

The comparative analysis of the diagnostic and treatment pathways across different hospital sizes (Table 4) showed that perception of CT scan's usefulness varied across hospital sizes, with smaller hospitals showing more variable responses ($p=0.029$). Most of the respondents preferred surgery for patients with transmural necrosis, with the highest agreement in hospitals with 101–500 beds ($p=0.020$). Regarding the appropriateness of minimally invasive surgery for the treatment of CI with transmural necrosis, a trend toward moderate agreement was found in larger hospitals, while smaller hospitals tend to view it as more appropriate ($p=0.030$). (Supplementary material 4).

4. Diagnosis and treatment of caustic ingestion across different surgical and medical specialties

The comparative analysis of the different diagnostic and treatment pathways for CI patients (Table 5) showed that

Table 2 Regional variations in diagnostic and therapeutic approaches to caustic ingestion in Italy

N	Question	P value		
10	In the contrast-enhanced CT scan, how often is the radiological classification proposed by WSES, which stratifies the extent of damage based on the degree of contrast uptake of the viscera and particularly the esophagogastric portions, reported?	Northern Italy (63) n (%)	Middle Italy (59) n (%)	Southern Italy (41) n (%)
	Never	33 (52.4)	24 (40.7)	14 (34.1)
	Sometimes	23 (36.5)	25 (42.4)	12 (29.3)
	Often	6 (9.5)	10 (16.9)	13 (31.7)
	Always	1 (1.6)	0	2 (4.9)
	Conclusion	Reporting of the WSES classification is least frequent in Northern Italy and most frequent in Southern Italy, with Middle Italy showing a balanced approach		
13	Based on the clinical evaluation of the patient and the diagnostic tests performed, which guide your choice of therapeutic treatment (Non-operative management vs. surgical intervention):			
	EGDS only	6 (9.5)	0	0
	Contrast-enhanced CT scan only	5 (7.9)	3 (5.1)	3 (7.3)
	EGDS + contrast-enhanced CT scan	52 (82.5)	56 (94.9)	38 (92.7)
	Conclusion	Combined use of EGDS and contrast-enhanced CT scan is predominant in all regions, with Middle Italy showing the highest adherence		

Table 3 Variations in diagnostic and therapeutic approaches to caustic ingestion by hospital type in Italy

N	Question					P value
2	Based on your experience, do you find the involvement of other specialists (anesthesiologist, toxicologist, otolaryngologist, endoscopist, surgeon) useful during the diagnostic-therapeutic pathway for patients with caustic ingestion? (rating from 1 (not useful) to 5 (very useful))	Non-academic hospital (91) n(%)	Academic hospital (57) n(%)	Private hospital (3) n(%)	Accredited private hospital (12) n(%)	0.013
	1	1 (1.1)	0	0	0	
	2	0	1 (1.8)	0	0	
	3	4 (4.4)	2 (3.5)	2 (66.7)	2 (16.7)	
	4	15 (16.5)	8 (14.0)	0	2 (16.7)	
	5	71 (78.0)	46 (80.7)	1 (33.3)	8 (66.7)	
Conclusion	Involvement of other specialists is generally considered very useful across all hospital types, especially in academic and accredited private hospitals					
7	How do you rate the usefulness of the Zargar classification for the endoscopic stratification of injury severity? (rating from 1 (not useful) to 5 (very useful))					0.030
	1	0	1 (1.8)	0	1 (8.3)	
	2	2 (2.2)	2 (3.5)	0	0	
	3	8 (8.8)	15 (26.3)	2 (66.7)	3 (25.0)	
	4	34 (37.4)	18 (31.6)	1 (33.3)	5 (41.7)	
	5	47 (51.6)	21 (36.8)	0	3 (25.0)	
Conclusion	Non-academic hospitals find the Zargar classification most useful, while private hospitals show less consensus					
8	During the diagnostic phase, is a contrast-enhanced CT scan performed:					0.018
	On all patients	41 (45.1)	30 (52.6)	1 (33.3)	6 (50.0)	
	On no one	1 (1.1)	1 (1.8)	1 (33.3)	0	
	Based on clinical and endoscopic findings	0	1 (1.8)	0	0	
	Based only on clinical findings	49 (53.8)	25 (43.9)	1 (33.3)	6 (50.0)	
Conclusion	Strong inclination toward CT scans in academic and accredited private hospitals, with more varied practices in non-academic and private hospitals					
18	Which patients with caustic ingestion require antibiotic therapy:					0.004
	All	11 (12.1)	11 (19.3)	0	1 (8.3)	
	None	1 (1.1)	1 (1.8)	1 (33.3)	0	
	Based on the degree of injury	79 (86.8)	45 (78.9)	2 (66.7)	11 (91.7)	
Conclusion	Predominant approach across all hospital types is to administer antibiotics based on the degree of injury, with private hospitals showing more deviation					

there was a clear preference for the WSES guidelines among general and emergency surgeons, while gastroenterologists and endoscopists predominantly follow the SIED recommendations ($p < 0.001$). Most surgeon and gastroenterologist found the involvement of other specialists, including anesthesiologists, toxicologists, otolaryngologists, endoscopists, and surgeons, very useful during the diagnostic-therapeutic pathway for patients with CI ($p = 0.009$). General and emergency surgeons preferred to perform Upper-GI endoscopy within the first 6 h, while gastroenterologists preferred a case-by-case approach or within the first 12 h ($p = 0.028$). For Upper-GI endoscopy (EGDS), gastroenterologists reported more consistently the Zargar classification compared to general and emergency surgeons ($p < 0.001$). General and emergency surgeons were much more likely to

perform contrast-enhanced CT scans on all patients, whereas gastroenterologists primarily based their decision on clinical findings ($p < 0.001$). Surgeons declared that the WSES radiological classification was reported more frequently compared with gastroenterologists, while gastroenterologists declared that it was never reported ($p = 0.023$). General and emergency surgeons were more likely to initially use a contrast-enhanced CT scan compared to gastroenterologists, while gastroenterologists preferred to determine the investigation on a case-by-case basis more often than general and emergency surgeons ($p = 0.001$).

Gastroenterologists overwhelmingly recommended antibiotic therapy based on the degree of injury, while a significant proportion of general and emergency surgeons believed that all patients required antibiotic therapy

Table 4 Variations in diagnostic and therapeutic approaches to caustic ingestion by hospital capability (bed numbers) in Italy

N	Questions	<i>P</i> value			
12	Do you believe that a contrast-enhanced CT scan is useful and necessary as the only diagnostic investigation to adequately guide the therapeutic choice for patients with caustic ingestion? (rating from 1 (not useful) to 5 (very useful))				
		1–100 (10) n(%)	101–500 (66) n(%)	501–1000 (42) n(%)	> 1000 (45) n(%)
	1	2 (20.0)	4 (6.1)	1 (2.4)	0
	2	0	11 (16.7)	7 (16.7)	7 (15.6)
	3	4 (40.0)	17 (25.8)	9 (21.4)	17 (37.8)
	4	3 (30.0)	25 (37.9)	10 (23.8)	15 (33.3)
	5	1 (10.0)	9 (13.6)	15 (35.7)	6 (13.3)
Conclusion	Perception of CT scan's usefulness varies across hospital sizes, with smaller hospitals showing more varied responses				
20	Patients with clinical and radiological signs of esophageal or intraabdominal visceral perforation require emergency surgery. According to current classifications, which patients would go to surgical intervention?				
	Both	0	11 (16.7)	5 (11.9)	5 (11.1)
	None	1 (10.0)	4 (6.1)	6 (14.3)	6 (13.3)
	Mucosal necrosis (Zargar 3a-WSES 2)	1 (10.0)	0	0	0
	Transmural necrosis (Zargar 3b-WSES 3)	8 (80.0)	51 (77.3)	31 (73.8)	34 (75.6)
Conclusion	Majority prefer surgery for patients with transmural necrosis, with highest adherence in hospitals with 101–500 beds				
21	Based on your experience, do you consider minimally invasive surgery (laparoscopy, thoracoscopy) appropriate for the surgical treatment of patients with caustic ingestion with transmural necrosis and hemodynamic stability? (rating from 1 (not appropriate) to 5 (very appropriate))				
	1	0	4 (6.1)	6 (14.3)	1 (2.2)
	2	0	1 (1.5)	2 (4.8)	5 (11.1)
	3	3 (30.0)	29 (43.9)	14 (33.3)	20 (44.4)
	4	7 (70.0)	16 (24.2)	11 (26.2)	9 (20.0)
	5	0	16 (24.2)	9 (21.4)	10 (22.2)
Conclusion	Trend toward moderate appropriateness in larger hospitals, while smaller hospitals tend to view it as more appropriate				

($p < 0.001$). Gastroenterologists largely considered inappropriate to initiate antibiotic therapy regardless of injury degree, while surgeons showed a more varied response range, with significant portions considering it more appropriate ($p < 0.001$). Surgeons generally rated minimally invasive surgery as more appropriate for diagnostic purposes in uncertain cases compared to gastroenterologists ($p < 0.001$). Surgeons generally rate minimally invasive surgery as more appropriate for diagnostic purposes in uncertain cases compared to gastroenterologists ($p < 0.001$). Furthermore, surgeons are more likely to consider the diversion stoma plus feeding jejunostomy as very appropriate compared to gastroenterologists, who more frequently rate it as moderately appropriate ($p < 0.001$). (Supplementary material 5).

5. Diagnosis and treatment across different hospitals according to patient volume

The comparative analysis of the different diagnostic and treatment pathways across different hospitals according to patient volume (Table 6) showed higher adherence to WSES guidelines among respondents who see less than ten patients per year ($p = 0.028$). Trend toward performing CT scans among those seeing less than ten patients, with a balanced approach in those seeing more patients ($p < 0.001$). Varying degrees of acceptance based on patient volume, with a trend toward moderate appropriateness in most cases, were found regarding the diagnostic value of minimally invasive surgery in doubtful cases where neither Upper-GI endoscopy nor CT scan allows better definition

Table 5 Variations in diagnosis and treatment of caustic ingestion across different surgical and medical specialties in Italy

N	Questions	<i>P</i> value	
1	In your clinical practice, which of the following recommendations do you apply in the diagnostic and therapeutic pathway for patients with caustic ingestion?	<0.001	
	General/emergency surgery (94) n(%)	Gastroenterology and endoscopy (69) n(%)	
	Esophageal emergencies: WSES guidelines (2019)	68 (72.3)	8 (11.6)
	Foregut caustic injuries: results of WSES consensus conference. (2015)	3 (3.2)	0 (0)
	SIED recommendations 2019	9 (9.6)	59 (85.5)
	SIED and indications from the local poison control center	0 (0)	1 (1.4)
	French Society of Digestive Endoscopy guidelines	1 (1.1)	0 (0)
	None	13 (13.8)	1 (1.4)
Conclusions	There is a clear preference for the WSES guidelines among general and emergency surgeons, while gastroenterologists and endoscopists predominantly follow the SIED recommendations		
2	Based on your experience, do you find the involvement of other specialists (anesthesiologist, toxicologist, otolaryngologist, endoscopist, surgeon) useful during the diagnostic-therapeutic pathway for patients with caustic ingestion? (rating from 1 (not useful) to 5 (very useful))	0.009	
	1	0 (0)	1 (1.4)
	2	0 (0)	1 (1.4)
	3	4 (4.3)	6 (8.7)
	4	8 (8.5)	17 (24.6)
	5	82 (87.2)	44 (63.8)
Conclusions	Most surgeon and gastroenterologist find the involvement of other specialists very useful in managing caustic ingestion cases		
5	If performed, what is the timing during which patients undergo EGDS?	0.028	
	Within the first 6 h	30 (31.9)	9 (13)
	Within the first 12 h	27 (28.7)	26 (37.7)
	Between 12 and 24 h	12 (12.8)	9 (13)
	After 24 h	3 (3.2)	0 (0)
	Case-by-case basis	21 (22.3)	25 (36.2)
	I don't know	1 (1.1)	0 (0)
Conclusions	General and emergency surgeons prefer to perform EGDS within the first 6 h, while gastroenterologists prefer a case-by-case approach or within the first 12 h		
6	In the EGDS report, how often is the Zargar classification reported for stratifying caustic injuries?	<0.001	
	never	9 (9.6)	1 (1.4)
	sometimes	31 (33)	2 (2.9)
	often	21 (22.3)	11 (15.9)
	always	31 (33)	55 (79.7)
	depends on the endoscopist	1 (1.1)	0 (0)
	I don't know	1 (1.1)	0 (0)
Conclusions	Gastroenterologists report more consistently the Zargar classification compared to general and emergency surgeons		
8	During the diagnostic phase, is a contrast-enhanced CT scan performed:	<0.001	
	On all patients	66 (70.2)	12 (17.4)
	On no one	2 (2.1)	1 (1.4)
	Based on clinical and endoscopic findings	0 (0)	1 (1.4)
	Based only on clinical findings	26 (27.7)	55 (79.7)

Table 5 (continued)

N	Questions	P value	
Conclusions	General emergency surgeons are much more likely to perform contrast-enhanced CT scans on all patients (70.2%), whereas gastroenterologists primarily base their decision on clinical findings (79.7%)		
10	In the contrast-enhanced CT scan, how often is the radiological classification proposed by WSES, which stratifies the extent of damage based on the degree of contrast uptake of the viscera and particularly the esophagogastric portions, reported?	0.023	
	never	38 (40.4)	33 (47.8)
	sometimes	30 (31.9)	30 (43.5)
	often	24 (25.5)	5 (7.2)
	always	2 (2.1)	1 (1.4)
Conclusions	Surgeons declared that the WSES radiological classification is often reported (25.5%) compared to gastroenterologists (7.2%), while gastroenterologists declared that it is never reported (47.8%)		
14	Which investigation do you consider most useful initially in evaluating a patient with caustic ingestion?	0.001	
	First EGDS	15 (16)	4 (5.8)
	First contrast-enhanced CT scan	46 (48.9)	21 (30.4)
	Case-by-case basis	33 (35.1)	44 (63.8)
Conclusions	General emergency surgeons are more likely to initially use a contrast-enhanced CT scan (48.9%) compared to gastroenterologists (30.4%), while gastroenterologists prefer to determine the investigation on a case-by-case basis (63.8%) more often than general emergency surgeons (35.1%)		
18	Which patients with caustic ingestion require antibiotic therapy:	<0.001	
	All	22 (23.4)	1 (1.4)
	None	2 (2.1)	1 (1.4)
	Based on the degree of injury	70 (74.5)	67 (97.1)
Conclusions	Gastroenterologists overwhelmingly recommend antibiotic therapy based on the degree of injury (97.1%), while a significant proportion of general emergency surgeons (23.4%) believe all patients require antibiotic therapy		
19	On a scale from 1 (not appropriate) to 5 (very appropriate), do you consider it appropriate to initiate antibiotic therapy in patients with caustic ingestion regardless of the degree of injury?	<0.001	
	1	28 (29.8)	46 (66.7)
	2	20 (21.3)	9 (13)
	3	21 (22.3)	8 (11.6)
	4	16 (17)	4 (5.8)
	5	9 (9.6)	2 (2.9)
Conclusions	Gastroenterologists largely consider it inappropriate to initiate antibiotic therapy regardless of injury degree (66.7% rated it as 1), while surgeons have a more varied response, with significant portions considering it more appropriate (17.0% rated it as 4 and 9.6% as 5)		
22	Do you believe that minimally invasive surgery can have a diagnostic value in some doubtful cases where neither EGDS nor CT allows better definition of the severity of esophagogastric lesions in a hemodynamically stable patient? (rating from 1 (not appropriate) to 5 (very appropriate))	<0.001	
	1	2 (2.1)	12 (17.4)
	2	13 (13.8)	19 (27.5)
	3	29 (30.9)	21 (30.4)
	4	33 (35.1)	14 (20.3)
	5	17 (18.1)	3 (4.3)
Conclusions	Surgeons generally rate minimally invasive surgery as more appropriate for diagnostic purposes in uncertain cases compared to gastroenterologists		
23	In hemodynamically stable patients undergoing total gastrectomy with esophageal preservation, do you consider to perform an esophagojejunal anastomosis in the first instance safe and feasible? (rating from 1 (not appropriate) to 5 (very appropriate))	0.019	

Table 5 (continued)

N	Questions	P value
1	17 (18.1)	4 (5.8)
2	18 (19.1)	19 (27.5)
3	42 (44.7)	41 (59.4)
4	14 (14.9)	5 (7.2)
5	3 (3.2)	0 (0)
Conclusions	Surgeons are more divided on the safety and feasibility of esophagojejunal anastomosis, with some rating it higher, while gastroenterologists predominantly rate it as moderately appropriate (rating 3)	
24	Do you believe that the diversion stoma (cervical esophagostomy, Petzer esophagostomy, gastrostomy) plus feeding jejunostomy is indicated in patients undergoing resective surgery in an emergency setting? (rating from 1 (not appropriate) to 5 (very appropriate))	< 0.001
2	3 (3.2)	3 (4.3)
3	17 (18.1)	35 (50.7)
4	32 (34)	23 (33.3)
5	42 (44.7)	8 (11.6)
Conclusions	Surgeons are more likely to consider the diversion stoma plus feeding jejunostomy as very appropriate (44.7%) compared to gastroenterologists (11.6%), who more frequently rate it as moderately appropriate (rating 3, 50.7%)	

of the severity of CI lesion in hemodynamically stable patients ($p=0.036$).

Regarding the safety and feasibility of performing an esophagojejunal anastomosis in hemodynamically stable patients undergoing total gastrectomy with esophageal preservation, the results demonstrated general agreement on the moderate appropriateness of the procedure, though opinions varied significantly among respondents who evaluated a higher volume of patients (> 10) ($p=0.005$). In response to whether diversion stoma plus feeding jejunostomy is indicated in patients undergoing resective surgery in an emergency setting, practitioners who see none to ten patients per year rated the procedure as more appropriate, while those with higher patient volumes (> 10) tended to rate it with moderate appropriateness ($p=0.015$). (Supplementary material 6).

6. Diagnosis and treatment of caustic ingestion across different hospitals according to the number of patients underwent surgery per year

The comparative analysis of the different diagnostic and treatment pathways of CI across different hospitals according to the number of patients undergoing surgery per year (Table 7) showed a higher adherence to the WSES guidelines across all groups. SIED recommendations were followed more by those that do not perform any surgery per year, while the French Society of Digestive Endoscopy recommendations were infrequently used across all groups ($p<0.001$).

Regarding the usefulness of contrast-enhanced CT scans in guiding therapy for patients with caustic ingestion, there is a general trend toward high usefulness ratings, particularly among practitioners seeing less than 10% of patients, while those treating more patients annually (more than 20%) expressed a broader range of opinions ($p<0.001$). Asking how often the WSES radiological classification is reported in contrast-enhanced CT scans, practitioners seeing higher patient volumes ($> 20\%$) reported using the WSES classification more frequently, while those with fewer patients reported it less often ($p=0.014$). Concerning the most useful initial investigation for evaluating patients with caustic ingestion, practitioners seeing fewer patients ($< 10\%$) preferred contrast-enhanced CT scans and case-by-case evaluations, while those seeing more than 20% of patients annually leaned toward performing EGDS first ($p=0.011$). Regarding the safety and feasibility of performing an esophagojejunal anastomosis in hemodynamically stable patients undergoing total gastrectomy with esophageal preservation, there was a general trend toward moderate appropriateness, especially among those seeing $< 10\%$ of patients. However, opinions varied, with some practitioners managing $> 20\%$ of patient volumes expressing more skepticism about the procedure's safety and feasibility ($p=0.043$). (Supplementary material 7).

7. Diagnosis and treatment across different hospitals according to the presence of a specific pathway

The comparative analysis of the different diagnostic and treatment practices across different hospitals according to

Table 6 Variations in Diagnostic and therapeutic approaches to caustic ingestion by number of patients with caustic ingestion seen per year in Italy

N	Questions	P-value			
1	In your clinical practice, which of the following recommendations do you apply in the diagnostic and therapeutic pathway for patients with caustic ingestion?	0.028			
		None (4) n(%)	< 10 (82) n(%)	10—20 (56) n(%)	> 20 (21) n(%)
	Esophageal emergencies: WSES guidelines (2019)	2 (50.0)	48 (58.5)	21 (37.5)	5 (23.8)
	Foregut caustic injuries: results of WSES consensus conference. (2015)	0	0	2 (3.6)	1 (4.8)
	SIED recommendations 2019	1 (25.0)	25 (30.5)	28 (50.0)	14 (66.7)
	SIED and indications from the local poison control center	0	0	0	1 (4.8)
	French Society of Digestive Endoscopy guidelines	0	1 (1.2)	0	0
	None	1 (25.0)	8 (9.8)	5 (8.9)	0
Conclusion	Higher adherence to WSES guidelines among those seeing fewer patients				
8	During the diagnostic phase, is a contrast-enhanced CT scan performed:	0.000			
	On all patients	1 (25.0)	52 (63.4)	19 (33.9)	6 (28.6)
	On no one	1 (25.0)	0	2 (3.6)	0
	Based on clinical and endoscopic findings	0	0	1 (1.8)	0
	Based only on clinical findings	2 (50.0)	30 (36.6)	34 (60.7)	15 (71.4)
Conclusion	Trend toward performing CT scans among those seeing fewer patients, with a balanced approach in those seeing more patients				
22	Do you believe that minimally invasive surgery can have a diagnostic value in some doubtful cases where neither EGDS nor CT allows better definition of the severity of esophagogastric lesions in a hemodynamically stable patient? (rating from 1 (not appropriate) to 5 (very appropriate))	0.036			
	1	0	2 (2.4)	9 (16.1)	3 (14.3)
	2	1 (25.0)	10 (12.2)	13 (23.2)	8 (38.1)
	3	2 (50.0)	30 (36.6)	14 (25.0)	4 (19.0)
	4	0	28 (34.1)	14 (25.0)	5 (23.8)
	5	1 (25.0)	12 (14.6)	6 (10.7)	1 (4.8)
Conclusion	Varying degrees of acceptance based on patient volume, with a trend toward moderate appropriateness in most cases				
23	In hemodynamically stable patients undergoing total gastrectomy with esophageal preservation, do you consider to perform an esophagojejunal anastomosis in the first instance safe and feasible? (rating from 1 (not appropriate) to 5 (very appropriate))	0.005			
	1	0	13 (15.9)	8 (14.3)	0
	2	3 (75.0)	17 (20.7)	14 (25.0)	3 (14.3)
	3	0	39 (47.6)	28 (50.0)	16 (76.2)
	4	0	11 (13.4)	6 (10.7)	2 (9.5)
	5	1 (25.0)	2 (2.4)	0	0
Conclusion	General agreement on moderate appropriateness, with varied opinions among those seeing more patients				
24	Do you believe that the diversion stoma (cervical esophagostomy, Petzer esophagostomy, gastrostomy) plus feeding jejunostomy is indicated in patients undergoing resective surgery in an emergency setting? (rating from 1 (not appropriate) to 5 (very appropriate))	0.015			
	2	0	5 (6.1)	1 (1.8)	0
	3	0	19 (23.2)	20 (35.7)	13 (61.9)
	4	1 (25.0)	28 (34.1)	19 (33.9)	7 (33.3)
	5	3 (75.0)	30 (36.6)	16 (28.6)	1 (4.8)
Conclusion	Higher appropriateness ratings among practitioners seeing fewer patients, while those seeing more patients tend to rate it moderately				

Table 7 Variations in diagnostic and therapeutic approaches to caustic ingestion by number of patients underwent surgery for caustic ingestion in Italy

N	Questions	P value				
1	In your clinical practice, which of the following recommendations do you apply in the diagnostic and therapeutic pathway for patients with caustic ingestion?	0.000				
	None (42)	1–10% (86)	10–20% (14)	> 20% (4)	I don't know (17)	
	Esophageal emergencies: WSES guidelines (2019)	13 (31.0)	51 (59.3)	7 (50.0)	3 (75.0)	2 (11.8)
	Foregut caustic injuries: results of WSES consensus conference. (2015)	0	1 (1.2)	2 (14.3)	0	0
	SIED recommendations 2019	24 (57.1)	29 (33.7)	2 (14.3)	0	13 (76.5)
	SIED and indications from the local poison control center	0	0	0	0	1 (5.9)
	French Society of Digestive Endoscopy guidelines	0	0	1 (7.1)	0	0
	None	5 (11.9)	5 (5.8)	2 (14.3)	1 (25.0)	1 (25.0)
Conclusion	Higher adherence to WSES guidelines among those seeing fewer patients. SIED recommendations are followed more by those seeing fewer patients, while the French Society of Digestive Endoscopy recommendations are infrequently used across all groups					
9	How do you rate the usefulness of a contrast-enhanced CT scan in guiding the therapy of patients with caustic ingestion? (rating from 1 (not useful) to 5 (very useful))	0.000				
	2	0	0	0	1 (25.0)	0
	3	7 (16.7)	13 (15.1)	3 (21.4)	0	2 (11.8)
	4	21 (50.0)	26 (30.2)	8 (57.1)	2 (50.0)	9 (52.9)
	5	14 (33.3)	47 (54.7)	3 (21.4)	1 (25.0)	6 (35.3)
Conclusion	There is a general trend toward high usefulness ratings for CT scans, particularly among those seeing fewer patients, while those seeing more patients annually have a broader range of opinions					
10	In the contrast-enhanced CT scan, how often is the radiological classification proposed by WSES, which stratifies the extent of damage based on the degree of contrast uptake of the viscera and particularly the esophagogastric portions, reported?	0.014				
	never	27 (64.3)	35 (40.7)	2 (14.3)	0	7 (41.2)
	sometimes	11 (26.2)	33 (38.4)	8 (57.1)	1 (25.0)	7 (41.2)
	often	3 (7.1)	17 (19.8)	3 (21.4)	3 (75.0)	3 (17.6)
	always	1 (2.4)	1 (1.2)	1 (7.1)	0	0
Conclusion	The use of the WSES radiological classification is more frequent among practitioners seeing a higher volume of patients, with those seeing fewer patients reporting it less frequently					
14	Which investigation do you consider most useful initially in evaluating a patient with caustic ingestion?	0.011				
	First EGDS	4 (9.5)	8 (9.3)	3 (21.4)	3 (75.0)	1 (5.9)
	First contrast-enhanced CT scan	16 (38.1)	40 (46.5)	4 (28.6)	0	7 (41.2)
	Case-by-case basis	22 (52.4)	38 (44.2)	7 (50.0)	1 (25.0)	9 (52.9)
Conclusion	Preference for first CT with contrast and case-by-case evaluation among those seeing fewer patients, while those seeing more patients annually prefer EGDS first					
18	Which patients with caustic ingestion require antibiotic therapy:	0.006				
	All	5 (11.9)	13 (15.1)	5 (35.7)	0	0
	None	1 (2.4)	1 (1.2)	0	1 (25.0)	0
	Based on the degree of injury	36 (85.7)	72 (83.7)	9 (64.3)	3 (75.0)	17 (100.0)
Conclusion	The majority of practitioners, regardless of patient volume, recommend antibiotic therapy based on the degree of injury					

Table 7 (continued)

N	Questions	P value				
20	Patients with clinical and radiological signs of esophageal or intraabdominal visceral perforation require emergency surgery. According to current classifications, which patients would go to surgical intervention?	0.043				
	Both	3 (7.1)	13 (15.1)	1 (7.1)	3 (75.0)	1 (5.9)
	None	5 (11.9)	9 (10.5)	3 (21.4)	0	0
	Mucosal necrosis (Zargar 3a-WSES 2)	0	1 (1.2)	0	0	0
	Transmural necrosis (Zargar 3b-WSES 3)	34 (81.0)	63 (73.3)	10 (71.4)	1 (25.0)	16 (94.1)
Conclusion	Most practitioners, regardless of patient volume, consider transmural necrosis (Zargar 3b-WSES 3) as a significant criterion for surgical intervention					
23	In hemodynamically stable patients undergoing total gastrectomy with esophageal preservation, do you consider to perform an esophagojejunal anastomosis in the first instance safe and feasible? (rating from 1 (not appropriate) to 5 (very appropriate))	0.043				
	1	7 (16.7)	10 (11.6)	2 (14.3)	1 (25.0)	1 (5.9)
	2	16 (38.1)	13 (15.1)	2 (14.3)	2 (50.0)	4 (23.5)
	3	18 (42.9)	48 (55.8)	5 (35.7)	1 (25.0)	11 (64.7)
	4	1 (2.4)	12 (14.0)	5 (35.7)	0	1 (5.9)
	5	0	3 (3.5)	0	0	0
Conclusion	General trend toward moderate appropriateness, especially among those seeing fewer patients. There is notable variability in opinions, with some practitioners seeing higher volumes of patients expressing more skepticism about the safety and feasibility of the procedure					

Table 8 Variations in diagnostic and therapeutic approaches to caustic ingestion by the presence of a specific hospital pathway in Italy

N	Questions	P value		
10	In the contrast-enhanced CT scan, how often is the radiological classification proposed by WSES, which stratifies the extent of damage based on the degree of contrast uptake of the viscera and particularly the esophagogastric portions, reported?	0.000		
		No (92) n(%)	Yes (44) n(%)	I don't know (27) n(%)
	Never	48 (52.2)	10 (22.7)	13 (48.1)
	Sometimes	35 (38.0)	14 (31.8)	11 (40.7)
	Often	8 (8.7)	18 (40.9)	3 (11.1)
	Always	1 (1.1)	2 (4.5)	0
Conclusion	More frequent use of the WSES classification among practitioners who follow the specific pathway, with those unsure or not following the pathway reporting it less frequently			

the presence of a specific pathway for CI patients (Table 8) showed that the use of the WSES classification was more frequent among the practitioners who followed a specific pathway, with those unsure or not following the pathway reporting it less frequently ($p < 0.001$). (Supplementary material 8).

Discussion

CI is a rare but potentially devastating event that imposes significant burdens on health systems worldwide and requires a multidisciplinary approach involving various

specialties [11]. Given the low incidence of CIs, clinicians often have limited personal experience, leading to uncertainty about the best clinical practices. This uncertainty results in significant variations in patient management and reported outcomes globally.

In the present survey, the majority of respondents (54.5%) evaluated fewer than ten CI patients annually, underscoring the need for centralizing care in expert centers. While 54.2% followed a standardized protocol, adherence to the WSES and SIED guidelines was moderate, suggesting a need for more widespread guideline integration.

There was considerable variability in the use of Upper-GI endoscopy and CT scan. While 63.3% recommended

endoscopy for every patient, others based this decision on clinical conditions. CT scans were preferred by 54.6% of respondents, with a majority finding Upper-GI endoscopy and CT scans highly useful for guiding treatment decisions. A multidisciplinary approach was highly valued (92.5%), reflecting the complexity of CI management. Dietary and psychiatric counseling were also deemed useful by 82.6% of the respondents, emphasizing the need for comprehensive patient care. Urgent surgery for severe cases was supported by 77.6% of respondents, with a growing acceptance of minimally invasive surgery (47%). Antibiotic use varied, with 77.8% basing administration on the degree of the lesions. General results highlighted a strong demand for updated guidelines (85.5%), reflecting the need to standardize diagnostic and therapeutic approaches to reduce variability and improve patient outcomes.

The comparative analyses revealed that regional differences significantly impacted the adoption of standardized practices, such as the reporting of the WSES radiological classification and the combined use of diagnostic tools like Upper-GI endoscopy and CT scan, suggesting regional disparities that could influence patient outcomes. Hospital type and size also played crucial roles in the management of CI. Academic and accredited private hospitals were more likely to involve multidisciplinary teams and performed contrast-enhanced CT scans, reflecting better resource availability and adherence to advanced diagnostic protocols. Conversely, non-academic hospitals exhibited more varied practices, particularly regarding the use of diagnostic tools and adherence to endoscopic classifications like Zargar's one. Smaller hospitals showed more variability in their diagnostic approaches, indicating a potential gap. Specialty-specific practices significantly influence guideline adherence and the perceived usefulness of diagnostic procedures.

This study highlighted also the difference in management between surgeons and gastroenterologists. General and emergency surgeons predominantly preferred the WSES guidelines, while gastroenterologists and endoscopists adhered to SIED recommendations. Surgeons tended to perform endoscopies within the first 6 h, whereas gastroenterologists preferred a more flexible approach, either on a case-by-case basis or within the first 12 h. General and emergency surgeons were more likely to perform contrast-enhanced CT scans on all patients, while gastroenterologists based their decision primarily on clinical findings. Surgeons reported the WSES radiological classification more frequently than gastroenterologists, who often do not report it at all. Surgeons preferred initial use of contrast-enhanced CT scans, whereas gastroenterologists preferred to determine the investigation method on a case-by-case basis. These findings underscore significant specialty-based differences in managing caustic ingestion with on one hand the predominant diagnostic role of gastroenterologists and on the other the

determination of the surgeon of having to surgically treat a very critical condition with significant relics. Therefore, the importance of suggesting the need for more standardized guidelines to harmonize these practices.

According to SIED recommendations [10], endoscopy should be performed in all patients with CI. In contrast, WSES guidelines [5] and SFED recommendations [11] recommend endoscopy only when CT is not feasible, emphasizing its role in predicting injury severity rather than guiding surgery. Endoscopy's limitation in assessing necrosis depth can lead to inappropriate management decisions, making contrast-enhanced CT a critical diagnostic tool within 3–6 h post-ingestion [1, 12, 13]. The Italian recommendations reserve thoracic and abdominal CT scans for patients with clinical signs of perforation [10]. This disparity in guidelines contributes to the heterogeneity observed in clinical practices among respondents. CT scan is preferred over endoscopy for assessing gastro-oesophageal injuries due to its ability to provide a more accurate assessment of necrosis depth. Studies from high-volume centers support the use of CT in improving survival, functional outcomes, and reducing management costs by better selecting patients for surgery [14, 15]. While it is important to maintain a high degree of suspicion during workup, it should be emphasized that upwards of 10–30% of patients may not have damage to the esophagus or stomach; accordingly, one could argue that routine endoscopy may be unnecessary [16, 17]. The high interobserver agreement between radiologists on CT assessments further supports its reliability. Regarding the timing of endoscopy, WSES recommends performing it within 6–24 h to avoid underestimating lesions, while SIED suggests within 12 h [10, 11]. Survey responses reflected this variability, with one-third recommending individualized timing. The Zargar classification [15] is widely accepted for endoscopic stratification of injury severity, but its inconsistent use indicates a need for better training. The grade of injury based on careful endoscopic assessment and physical examination appears to be closely correlated with the development of subsequent complications and eventual mortality [18–24]. While III degree burns generally suggest the need for urgent surgical intervention, it should be noted that gastrectomy or esophagectomy based on endoscopy findings alone may lead to 10–15% unnecessary surgical procedures [1, 25, 26]. Despite these findings and the correlation of the burn depth to outcome, it is interesting to note that < 50% of our respondents stated that they consistently used the injury grading assessment.

Operational management knowledge shows that most patients with CI are managed non-surgically initially [20]. There was general agreement by all respondents that signs of peritonitis with presence of pneumoperitoneum or perforation and transmural necrosis are indications for immediate surgical intervention. While most respondents performed

laparotomy, initial laparoscopy was also mentioned as a viable alternative in the hemodynamically stable patient, but it is clearly operator-dependent based on the skill set and experience of the surgeon, as thorough exploration of the stomach and duodenum may be quite difficult for the novice laparoscopist. With sufficient skill, however, laparoscopy can be a valuable adjunct for the assessment of grade 2 or higher gastric injuries [27–29] accordingly, and avoidance of gastric resection may be possible in the absence of significant damage [30]. The need for emergency esophagogastric anastomosis is rare. An additional feeding jejunostomy might prove lifesaving in such cases for the purpose enteral feeding, since definitive reconstruction is possible only when injury is healed and patient is stabilized. With the exception of high-volume centers, skepticism is expressed about the possibility, as reported by some authors [1], of initially creating an esophagogastric anastomosis.

This is the first Italian survey to provide real-life data highlighting the variability of CI management practice by comparing the attitude of gastroenterologists, endoscopists, and surgeons. The survey provides for the first time a map of the Italian perspective in the management of CI and offers opportunities to advance the field. In fact, the survey covers a wide range of diagnostic and therapeutic practices, offering a detailed view of current clinical approaches showing the different variability that exists between the various centers during the diagnostic and therapeutic phase and on which it is possible to improve, drastically reducing the variability of diagnostic and therapeutic management that has emerged. Nevertheless, the survey has limitations, because responses may be subject to self-reporting bias, where participants might overstate adherence to guidelines or best practices. Many respondents evaluate fewer than ten patients with CI annually, potentially limiting the generalizability of their responses and underscoring the need for centralized care in expert centers. Moreover, the survey focuses on practices rather than patient outcomes, making it difficult to directly correlate practices with clinical effectiveness. It will therefore be necessary to compare these results with the short- and long-term outcomes of patients. Future research is needed to standardize the clinical approach of this condition through international surveys to evaluate the clinical approach in the field of IC worldwide and clinical studies with a higher level of evidence.

Conclusion

This survey confirms that the management of patients with IC requires close multidisciplinary collaboration between the various specialists involved and the need for shared international multisocieties guidelines.

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