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Single Case

The Impact of Caustic Ingestion on Nutritional Status: Case Report

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Keywords

Caustics · Alkali ingestion · Clinical nutrition · Enteral nutrition · Body composition measurement

Abstract

Introduction: Caustic injuries remain a major public health concern. Nutritional status plays a pivotal role in determining the outcome. Unfortunately, nutritional care guidelines are not widely implemented in clinical practice, and decisions are often based on prior experience and local policies. ***Case Presentation:*** We present the case of an 83-year-old man who accidentally ingested alkali, resulting in severe caustic injury and subsequent complications that further deteriorated his nutritional status. The management of esophageal strictures necessitated constant adjustments to the nutritional strategies employed. The clinical evaluation revealed protein and energy malnutrition, accompanied by type 2 intestinal failure. However, with individually tailored parenteral nutritional therapy, a significant improvement in the patient's nutritional status was observed. ***Conclusion:*** Recognizing that caustic injuries increase metabolic demands, a comprehensive and active nutritional assessment is crucial, focusing on the need for adequate energy, high protein intake, and an appropriate feeding route. In cases of acute or prolonged type 2 intestinal failure with insufficient oral or enteral nutrition, parenteral feeding should be the primary therapy. Effective management of caustic injuries requires a multidisciplinary and multicenter approach, integrating nutritional evaluation, including body composition measurements, into the clinical algorithm. Early initiation of nutritional therapy is vital to prevent chronic intestinal failure.

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Introduction

Caustic ingestions remain a worldwide public health problem. Caustic is a xenobiotic that causes tissue damage upon direct contact with it. Caustic substances are ubiquitous in the domestic environment, industrial settings, and laboratories. They are generally divided into acids and bases (alkali). Caustic ingestion is associated with high morbidity and mortality. The effects of ingestion are immediate and delayed. The main delayed complications include stricture formation that leads to malnutrition and the long-term risk of developing a malignant transformation [1].

Caustic-induced gastrointestinal injuries are classified according to the endoscopic *Zargar* classification into stages 0 (normal), 1 (mild changes), 2 (ulceration), 3 (necrosis), and 4 (perforation) [1]. Caustic agent damages the digestive tract and alters the normal physiology of feeding. It increases the risk of malnutrition, which is associated with a poor prognosis. Therefore, one of the most crucial aspects that affect a favorable outcome is the nutritional status of the patient [2]. Prevention of malnutrition is frequently neglected in clinical practice. There are a lack of scientific data and professional guidelines in this field of clinical nutrition. The nutritional treatment of these patients is highly dependent on the knowledge of local health personnel, practices, and policies [1–3].

Case Report

We present the case of an 83-year-old man with a history of recurrent cholangitis and hepaticojejunal anastomosis due to iatrogenic damage to the bile duct after cholecystectomy 8 years before caustic ingestion. In addition to arterial hypertension and carotid artery disease, no other medical conditions or psychiatric disorders were known. In mid-summer 2022, the patient presented at the regional emergency center with newly onset chest pain. The patient self-reported that he ordered apple juice from a bar that was served by the bar staff. The liquid was actually an improperly stored drain cleaner near the bar counter. The product was later identified as an inorganic hydroxide. Immediately after taking a sip, he felt a sudden pain in the mouth, followed by a pain along the esophagus. The patient stated that within half an hour he left for the nearest emergency center. At the regional emergency center 1 h later, he received intravenous hydration, analgesia, antiemetic, and proton pump inhibitor. Due to a progressive worsening of pain and the need for a multidisciplinary approach, he was transferred to the University Medical Center of Ljubljana in the next 6 h.

Clinical examination revealed hoarse voice, edematous lips, tongue, and pharynx, and hemoptysis. Opioid analgesia was prescribed. Food intake by mouth was restricted. Seven hours after ingestion, an esophagogastroduodenoscopy showed extensive necrosis of the esophagus and stomach, classified as *Zargar* 3B injury (shown in Fig. 1). Urgent CT showed no perforation but identified minor fluid around the lower part of the esophagus, prompting the administration of a broad-spectrum antibiotic. Clarity on contrast enhancement of the esophageal/gastric wall was inconclusive.

The second day, he was transferred to the Department of Gastroenterology. Total parenteral nutrition (TPN) was started with 1,500 mL of OLIMEL N9E® (27.5% glucose solution, 14.2% amino acid solution, 20% lipid emulsion; energy value 1,600 kcal) per day, with the addition of vitamins and trace elements. The fifth day after ingestion, he was transferred to the Center for Clinical Toxicology and Pharmacology. TPN with 1,477 mL of SmofKabiven® (12.7% glucose solution, 5.1% amino acid solution, 20% lipid emulsion; energy value 1,600 kcal) with micronutrients was continued daily. There was a transient delirious episode that required the temporary use of benzodiazepines. On the 10th day, a liquid diet was started in

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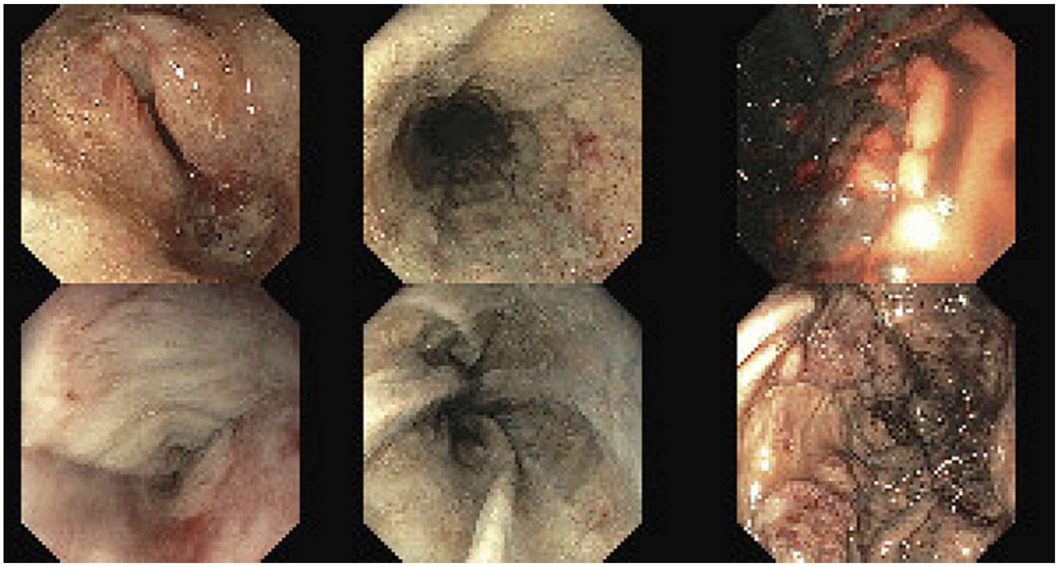

Fig. 1. Esophagogastroduodenoscopy performed 7 h after ingestion showing Zargar 3B injury and severe hemorrhagic necrosis of the stomach.

addition to parenteral feeding. Due to persistent dysphagia and odynophagia on day 13, a barium-contrast study was performed. It showed general esophageal dysmotility and diffuse stricture, with a residual lumen of 4–8 mm (Fig. 2). During the study, an aspiration of the contrast agent occurred and antibiotic treatment was reintroduced. Two weeks after ingestion, parenteral nutrition was stopped and normal feeding was possible. The patient was discharged the 21st day after the event. Due to the esophageal stricture and dysphagia, he was referred to the thoracic surgeon for a planned surgical intervention.

One week after discharge, he was admitted to the regional hospital because the swallowing problems were getting worse and he also complained of new pain in the upper abdomen. Alternately, he received mixed food, which was well tolerated, and parenteral nutrition, which was gradually discontinued. After 5 days, he was discharged home with high-protein nutritional supplements. After an additional 5 days, he was hospitalized in the Department of Thoracic Surgery of the University Medical Center Ljubljana. Endoscopic dilation of esophageal stricture was attempted. Due to progressive dysphagia and persistent chest pain after the procedure, a CT scan was performed showing a perforation (shown in Fig. 3). TPN and broad-spectrum antibiotics were introduced again. Two weeks later, a balloon gastrostomy with gastropexy was performed. A barium-contrast study of gastrostomy showed stalling of the contrast media in the gastric fundus and only after surgical jejunostomy enteral nutrition was resumed. Another attempt at endoscopic dilation was unsuccessful. Aspiration pneumonia and urinary tract infection co-occurred. Feeding-associated abdominal pain and nausea progressively worsened. CT results showed no apparent small intestine damage. Reoperation was performed with repair of the jejunostomy and Braun enteroenterostomy due to jejunal adhesions. Subsequently, the tube feed was well tolerated.

During these periods, no systematic nutritional evaluation was described. Feeding regimes were adjusted mainly to problems with the feeding route, not to his metabolic demands.

In the regional hospital, the control endoscopy was prematurely terminated due to severe esophageal stenosis and a successful endoscopic dilation of the esophagus was performed. In addition to jejunostomy feeding, parenteral feeding with SmofKabiven® 1,477 mL was introduced. The patient developed a depression adjustment disorder. Due to feeding-associated

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Fig. 2. On the 13th day after ingestion, a barium swallow study was performed, which showed diffuse stricture of the esophagus.

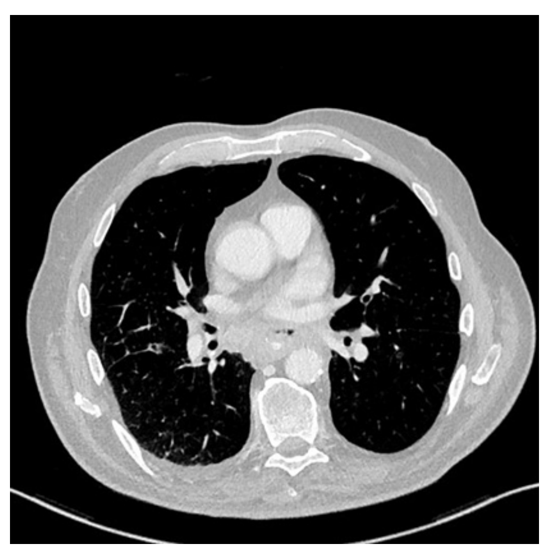

Fig. 3. CT scan showing perforation of the esophagus with pneumomediastinum after endoscopic dilation of the esophageal stricture.

abdominal pain, nausea, and vomiting, he was transferred to the Department of the Clinical Nutrition of Institute of Oncology Ljubljana. A detailed nutritional evaluation was performed, including measurements of body composition with bioimpedance (Quadscan 4000, Bodystat®) and densitometry (HologiC, Horizon W®). Resting energy expenditure was measured with an indirect calorimetry device (Cosmed Q-NRG®). The patient had lost 21 kg of body mass in the last 5 months. A loss of muscle mass and fat reserve was observed, and he was unable to walk. Due to food leakage through the gastrostomy and type 2 intestinal failure with cachexia, enteral nutrition was discontinued and TPN was introduced. Regular measurements of body composition with bioimpedance were used to monitor nutritional and fluid status. Body composition measurements with the bioimpedance analyzer are shown in Table 1.

The patient was diagnosed with COVID-19 and placed in isolation. Relatives were educated on how to administer parenteral nutrition. He was discharged on the 19th day of hospitalization and walking. His per oral intake was nil. An outpatient clinic checkup occurred 11 days after discharge. The patient had lost 1 kg of body mass since discharge, mainly due to a decrease in total body water of 1.2%. The water in the third compartment also decreased. It is important to understand that the fat-free mass index (FFMI), which represents the amount of lean mass, was on the higher side because the percentage of total body water was relatively high. On checkup in the outpatient clinic after 83 days, the percentage of total body water and fat-free mass index both decreased. In this case, it reflected low muscle mass, which is a marker of malnutrition [4, 5]. Taking into account the recent COVID-19 infection, the phase angle of 2.4° was a relatively good value. The second checkup was 83 days after COVID-19-positive results and after short hospitalization in a regional hospital due to urinary tract infection. Bioimpedance measurements revealed a reduction in body weight, mainly due to a decrease in total body water. The phase angle increased and remained relatively stable throughout the follow-up period. The patient was constantly improving his physical and psychological functioning. He received adequate support from family members who assisted him with daily physical activities.

Discussion

After caustic ingestion, metabolic demands increase and a hypercatabolic state ensues. Secondary malnutrition can occur due to ingestion and absorption mechanisms [6, 7]. Early endoscopy and CT, by providing rapid access to diagnostic and prognostic data, reduce the time patients have to go without nutritional support and allow more accurate treatment regimens [1].

Important late complications of caustic injury are esophageal strictures, which significantly limit quality of life and affect feeding ability. Strictures are rare in injuries up to level 2A, but are present in 30–70% of level 2B injuries [8]. They usually occur up to 2 months after ingestion. Repeated endoscopic dilations and/or mechanical stent insertion are often required, as seen in our patient. A greater number of procedures increase the risk of complications such as perforation and infection [1]. Caustic injuries prolong the orocecal and esophageal transit time and gastric emptying time. Esophageal dysmotility and gastroesophageal reflux disease have been described [6, 9]. Those with a higher grade of injury are at risk of developing esophageal carcinoma.

Caustic injuries up to *Zargar* 2A in most cases do not require special medical nutritional measures [3]. These patients should start a liquid diet as soon as they begin to swallow normally. Oral feeding should be restricted to patients with grade 2B injuries for variable periods of time. Oral liquids are allowed after the first 48 h if the patient is able to swallow saliva. If patients cannot tolerate oral liquids, early enteral feeding should be administered

Table 1. Regular bioimpedance measurements

Day of hospitalization/after COVID-19-positive result	Body mass, kg	Fat, %	Fat-free mass index (FFMI)	Total body water, %	Phase angle, °
1 (first measurement)	71.3	23.8	16.2	62.7	2.5
3	75.2	23.7	17.1	61.8	2.4
5	75.2	24.9	16.9	60.5	2.4
8	73.5	20.7	17.4	65.6	2.1
10	75.7	19.4	18.2	66.7	2.6
12	75.5	22.6	17.4	63.0	3.0
15	76.5	24.2	17.3	61.0	2.4
18	76.0	22.8	17.5	62.8	2.2
19	COVID-19-positive test				
11 (checkup after COVID-19)	75	24.0	17.0	61.6	2.4
83 (checkup after COVID-19)	70.7	28.1	15.2	58.0	2.6

The height of the patient was 183 cm. Appendicular lean mass at admission was 5.05 kg/m^2. Resting energy expenditure (REE) was 1,380 kcal per day. Normal values: fat – 17–21%; fat-free mass index (FFMI) – 17–18; and total body water – 55–65%.

through a nasogastric/jejunal tube, gastrostomy or jejunostomy, and, as a last resort, TPN. Patients with grade 3 and 4 injuries are best treated in monitored care units. Feeding must progress orally as tolerated, with the use of distal feeding tubes or parenteral nutrition when severe injuries prevent oral feeding [1, 3]. It is necessary to actively monitor nutritional status and, depending on metabolic requirements, adapt the regimen and the type of nutrition.

The early transition to oral feeding is one of the main nutritional goals. Oral feeding with a consequent increase in saliva secretion and esophageal motility can help with esophageal debridement and reduce the development of infection and strictures [10]. In the case of unbridgeable strictures, a rapid change in the feeding method is necessary. The use of a nasogastric tube in caustic injuries is controversial. Some centers and national guidelines advise against this because of the possibility of perforation [2]. The nasogastric tube can serve as a stent to maintain luminal integrity, minimize stricture formation, and provide a continuous route for enteral nutrition. Others speculate that prolonged use of the tube could actually promote stricture formation. The feeding by a nasogastric tube for longer periods may not be well tolerated, and the use of feeding gastrostomy may be more effective in achieving an acceptable nutritional status. Furthermore, gastrostomy allows for a retrograde approach to dilation, which is usually easier and safer [2]. Similarly, jejunostomy feeding is as effective as nasogastric tube in maintaining nutrition in patients with severe corrosive injury, and the rate of development of stricture is similar [11]. The documented benefits of proper nutritional status after caustic injury include a reduction in infections, a reduced risk of developing aspiration pneumonia, and a reduced risk of pulmonary embolism [7].

After admission to the Department of Clinical Nutrition, the patient met the criteria for severe malnutrition according to the Global Leadership Initiative on Malnutrition Criteria and sarcopenia criteria according to the revised European consensus on definition and diagnosis. Furthermore, type 2 intestinal failure was identified [12, 13]. Anthropometric examinations with BMI allow quick but too superficial insight into the patient's nutritional status. For a patient with such a serious impairment in nutritional status, a clinical nutritional evaluation with body composition should be performed. Methods of measuring body composition, such as bioelectrical impedance analysis, in combination with laboratory results and indirect calorimetry allow for more precise adjustment of the nutritional regime and monitoring of nutritional treatment. Bioelectrical impedance analysis should be interpreted individually, and fluid status should be taken into account. A very useful parameter is the phase angle, which reflects the functional status and is a well-recognized marker to evaluate the severity of malnutrition [14, 15].

The patient was treated in various institutions and departments. The use of each type of nutritional support appeared to depend on the experience and policy of the health team. Specialized clinical nutritional care, including measurement of body composition, was carried out relatively late in the process. As the patient was old and had lost 21 kg, the energy and protein support during the first phase of treatment was probably underestimated. This led to severe malnutrition and contributed to poor tolerance to jejunal feeding and prolonged intestinal failure type 2. Based on evidence from the literature and clinical course, the decision to enteral feed our patient probably should have been made more quickly and should have been supported with partial parenteral nutritional support.

The patient was at higher nutritional risk due to a history of recurrent cholangitis and hepaticojejunal anastomosis. With further complications due to dysphagia, odynophagia, nausea, vomiting, structural changes of the digestive tract, infectious complications, and complications related to procedures, his nutritional status worsened further. The nutritional treatment of these patients is demanding and requires specialized knowledge of clinical nutrition. Psychological and psychiatric disorders significantly influence motivation and the daily food schedule.

The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000537796).

Conclusions

Treatment of caustic injuries requires an intensive multidisciplinary and multicenter approach. Special attention should be paid to nutritional status, which significantly affects the outcome. An initial and continuous active evaluation of the patient's nutritional status and monitoring of nutritional therapy are necessary. The use of body composition measurements, such as bioelectrical impedance analysis, should be a part of the clinical algorithm for caustic injuries. High protein and adequate energy intake are crucial to cope with the catabolic consequences of the hypermetabolic state after caustic injury and concomitant complications during treatment. Early peroral and enteral feeding has priority over parenteral feeding, which should only be used as a bridging or last resort option. The participation of the patient's relatives is essential.

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Statement of Ethics

Ethical approval is not required for this study in accordance with local or national guidelines. Written informed consent was obtained from the patient for the publication of the details of their medical case and their accompanying images.

Conflict of Interest Statement

The authors report that they do not have declared interest.

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Author Contributions

All authors contributed to the article conception, design, and data collection. The first draft of the manuscript was written by GR. All authors commented on previous versions of the manuscript. NRK took the lead in interpreting body composition measurements.

Data Availability Statement

The medical data used in this study are stored in a health institution and are not publicly available on legal or ethical grounds. All data generated or analyzed during this study are included in this article and its online supplementary material files. Further inquiries can be directed to the corresponding author.

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