

# Nutritional management in an elderly man with esophageal and gastric necrosis after caustic soda ingestion: a case report

Mariangela Rondanelli,<sup>1</sup>  
 Gabriella Peroni,<sup>1</sup>  
 Alessandra Miccono,<sup>2</sup> Fabio  
 Guerriero,<sup>3</sup> Davide Guido,<sup>3,4</sup>  
 Simone Perna<sup>1</sup>

<sup>1</sup>Department of Public Health, Neuroscience, Experimental and Forensic Medicine, Endocrinology and Nutrition Unit, University of Pavia, Azienda di Servizi alla Persona di Pavia, Pavia, <sup>2</sup>Department of Clinical Sciences, Faculty of Medicine and Surgery, University of Milano-Bicocca, Milan, <sup>3</sup>Azienda di Servizi alla Persona di Pavia, <sup>4</sup>Department of Public Health, Neuroscience, Experimental and Forensic Medicine, Biostatistics and Clinical Epidemiology Unit, University of Pavia, Pavia, Italy

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Correspondence: Simone Perna  
 Department of Public Health, Neuroscience, Experimental and Forensic Medicine, Section of Human Nutrition and Dietetics, University of Pavia, Azienda di Servizi alla Persona di Pavia, Via Emilia 12, Pavia, Italy  
 Tel +39 382 38 1706  
 Email [simoneperna@hotmail.it](mailto:simoneperna@hotmail.it)

**Abstract:** The ingestion of corrosive industrial chemical agents, such as caustic soda, that are mostly used for household cleaning, usually occurs accidentally or for suicidal purposes. Multiple protocols are based on documented success in preventing impending complications. In this study, we present a case of a 70-year-old man who swallowed caustic soda in a suicide attempt, causing a development of strong esophageal and gastric necrosis with subsequent gastrectomy and digiunostomy. Initially, the recommended nutritional approach was via percutaneous endoscopic jejunostomy by a polymer and high-caloric formula, with an elevated content of soluble fiber. After 5 months, the medical team removed the percutaneous endoscopic jejunostomy and the patient switched from enteral to oral nutrition. In this step, it was decided to introduce two oral, high-caloric supplements: an energy supplement in powder, based on maltodextrin, immediately soluble in foods or in hot/cold drinks and a high-energy and protein drink, enriched with arginine, vitamin C, zinc, and antioxidants. Oral administration (per os) was well tolerated by consuming homogenized food mixed in water. After 1 month, the patient was discharged from the hospital and was able to eat a regular meal.

**Keywords:** nutritional management, enteral nutrition, gastric necrosis, esophageal necrosis, nutritional supplementation, elderly, caustic soda ingestion

## Introduction

Caustic soda is an alkaline-based substance. Tissue contact with alkaline pH leads to liquefactive necrosis. Distal esophageal injury is more likely after ingestion of liquids, rather than solids, as they travel further.<sup>1</sup> The immediate injury consists of acute necrosis, hyperemia, and edema of the aerodigestive tract, leading to vascular thrombosis. In all, 2–4 days post injury, the superficial layer of necrotic mucosa will be sloughed. First, this may lead to either perforations or scarring and, second, contractures due to fibroblast regeneration and production of collagen. Some patients develop long-term problems, principally oral, pharyngeal, and esophageal strictures. Treatment schemes for caustic injuries vary, and no consensus exists. Multiple protocols were formulated based on documented success in preventing impending complications, although a paucity of randomized trials have assessed any of these interventions.<sup>2</sup> These patients develop malnutrition if they do not follow a personalized nutritional support, but no guidelines are available. A key point is the fitting choice of a main nutritional support via percutaneous endoscopic gastrostomy/percutaneous endoscopic jejunostomy (PEJ) or nasogastric tube. Another aspect to consider is the use of specific formulas to integrate the fitting nutritional needs for each patient. Hence, the monitoring must be considered to determine the transition from enteral to oral nutrition and the route of administration of the food more adequately.



Given this background, this paper reports the nutritional management of an elderly man who swallowed caustic soda in a suicidal attempt, causing the development of strong esophageal and gastric necrosis with subsequent gastrectomy and digiunostomy.

## Case report

A 70-year-old man was hospitalized in the Institute of Geriatric Rehabilitation Santa Margherita, Pavia, on August 1, 2013, with this admission diagnosis: patient with PEJ from April 2013, esophageal and gastric necrosis from caustic soda ingestion with results of gastrectomy and jejunostomy. In conjunction with a clinical evaluation based on patient history, it was taken into account a depressive syndrome, total esophagectomy, pharyngolaryngectomy, pharyngeal-colon-ileal anastomosis, bearer of tracheostomy, and with an history of previous cholecystectomy and appendectomy. Written informed consent was obtained from the patient as well as this case report was performed according to the Declaration of Helsinki and approved by Institute of Geriatric Rehabilitation Santa Margherita institutional review board.

### First stage of nutritional intervention

At the initial nutritional assessment on admission, the patient was categorized as “patient with a severe malnutrition”, with serum albumin of 3.15 mg/dL, body mass index (BMI) of 17.3 kg/m<sup>2</sup> (50 kg for 1.70 m), Mini Nutritional Assessment (MNA) equal to 10 points, and weight loss of ~5.2% in the previous 6 months. The score of Activities of Daily Living (ADL) was 2 points, which showed that nutritional difficulties restricted the ability to perform self-care activities. In particular, the patient was not able to maintain an independent life, such as needs help in bathing and in moving from

bed to chair. Other parameters, at baseline and in the time progression, are shown in Table 1.

The nutrition support team recommended to continue the use of the PEJ; therefore, the patient received a polymer and high-caloric formula, with an elevated content of soluble fibers from partially hydrolyzed guar gum (PHGG) (500 mL ×2, 1.5 kcal/mL, 6.0 g proteins/100 mL, 18.3 g carbohydrates/100 mL, 5.9 g lipids/100 mL, and 2.2 g PHGG/100 mL), indicated for patients with a sole source of nutrition on medical grounds (eg, short bowel syndrome), following total gastrectomy and disease-related malnutrition. Other nutritional characteristics of this formula are listed in Table 2. The elected speed of the enteral nutrition (EN) was 80 mL/h, because the patient was already under artificial nutrition from April 2013. The formula was well tolerated during hospitalization (2 months), there were no episodes of diarrhea or vomiting, and the weight remained stable.

### Second stage of nutritional intervention

The patient was again hospitalized on November 5, 2013, for a medium-/long-term complication, which was local infection, pain, diarrhea, and malnutrition. At the nutritional assessment, the following parameters were detected: serum albumin of 3.76 mg/dL, BMI of 17.3 kg/m<sup>2</sup> (50 kg for 1.70 m, weight stable), and MNA equal to 13 points. There was no weight loss between the two admissions; then the nutrition support team recommended to continue the use of the polymer and high-caloric formula, with an elevated content of soluble fiber, PHGG (500 mL ×2). The elected speed of the EN was 60 mL/h (initially decreased due to diarrhea) and was recommended to increase the speed of 20 mL/h up to 120 mL/h, given the good tolerance of the patient to the formula in the previous admission. The patient responded well and continued this formula, by increasing the speed for 1 month.

**Table 1** Progression of clinical and laboratory parameters of the patient

Parameters	First stage – August 2013	Second stage – November 2013	Third stage – December 2013	Reference standard values
Body weight, kg	50	50	50	53.5–72
BMI, kg/m <sup>2</sup>	17.3	17.3	17.3	18.5–24.9
Total protein, g	6.1	6.9	6.1	6.0–8.2
Serum albumin, g/dL	3.15	3.76	3.34	3.5–4.8
Cholesterol, mg/dL	136	156	144	<200
Lymphocyte, 10 <sup>3</sup> /μL	1.95	1.72	1.93	0.8–3.6
Glycemia, mg/dL	111	93	78	70–110
MNA score	10	13	16	>23.5
ADL score	2	–	5	0–6

**Abbreviations:** BMI, body mass index; MNA, Mini Nutritional Assessment; ADL, activities of daily living.

**Table 2** Nutritional info concerning enteral nutrition formula

Typical values	Per 100 mL	Per 500 mL
<b>General</b>		
Energy, kJ/kcal	649/155	3,245/775
Protein (16% kcal), g	6	30
Carbohydrates (47% kcal), g	18.3	91.5
Sugars, g	1.6	8.0
Lactose, g	<0.05	<0.25
Fat (34% kcal), g	5.9	29.5
Saturates, g	1.9	9.5
MCT, g	1.4	7
Monounsaturates, g	2.5	12.5
Polyunsaturates, g	1.1	5.5
Fiber (3% kcal), g	2.2	11
Soluble, g	2.2	11
<b>Vitamins</b>		
A, µg	160	800
β-carotene, µg	38	190
D, µg	2.2	11
K, µg	11	55
C, mg	16	80
B1 (thiamin), mg	0.22	1.1
B2 (riboflavin), mg	0.26	1.3
B6, mg	0.27	1.35
Niacin, mg	3	15
Folic acid, µg	45	225
B12, mg	0.58	2.9
Pantothenic acid, mg	0.92	4.6
Biotin, µg	7	35
E, mg	2.9	14.5
<b>Minerals</b>		
Sodium, mg/mmol	120/5.22	600/26.1
Chloride, mg/mmol	150/4.23	750/21.15
Potassium, mg/mmol	135/3.46	675/17.3
Calcium, mg/mmol	80/2	400/10
Phosphorus, mg/mmol	75/2.42	375/12.10
Magnesium, mg/mmol	30/1.25	150/6.25
Iron, mg	1.6	8
Zinc, mg	1.8	9
Copper, µg	240	1,200
Iodine, µg	22	110
Selenium, µg	10	50
Manganese, mg	0.36	1.8
Chromium, µg	15	75
Molybdenum, µg	20	100
Fluoride, mg	0.16	0.8
<b>Other nutrients</b>		
Choline, mg	57	285
Water, g	76	–
Osmolarity, mOsm/L	389	–
Osmolarity, mOsm/kg	440	–

**Abbreviation:** MCT, medium chain triglyceride.

### Third stage of nutritional intervention

On December 10, 2013, a computed tomography was performed to exclude the presence of adhesions and the regular passage of the bolus.

Hence, the medical team removed the PEJ, and the patient switched from EN to oral nutrition. At the nutritional assessment, the serum albumin was 3.34 g/dL, the BMI was 17.3 kg/m<sup>2</sup> (50 kg for 1.70 m, weight stable), and the MNA was equal to 16 points. Other parameters are shown in Table 1. The patient reported that he began to do breakfast with a cup of milk and rusks, eating fruits and vegetables two times a day, and meat and fish every day.

Generally, the risk of decline in ADL increases markedly in this stage, then, the nutrition support team decided to introduce two oral high-caloric supplements: an energy supplement in powder, based on maltodextrin, immediately soluble in foods, hot/cold drinks, and sweet/savory drinks (six servings a day with the measuring cup; 5 g for three measuring cups in the first course at lunch and three measuring cups in the first course at dinner, 120 kcal) and a liquid energy–protein supplement (a formula with high energy, protein, and enriched with arginine, vitamin C, zinc, and antioxidants).

After 1 month, on January 15, 2014, the patient was discharged from the institute and was able to eat a regular meal instead of artificial nutrition. The ADL score of 5 points showed that the patient was able to undertake self-care.

In summary, the progression in time of the nutritional intervention from artificial to oral nutrition is shown in Table 3.

### Discussion

The ingestion of corrosive industrial chemical agents, such as caustic soda, that are mostly used for household cleaning, usually occurs accidentally or sometimes for suicidal purposes. Nutritional interventions in these situations may be important for life expectancy. At the first stage, nutritional management must be set up on EN. In a patient with esophageal and gastric necrosis, the use of a high-protein-specific formula with a similar caloric percentage of fat and carbohydrates brings about an improvement in both nutritional status and biochemical parameters.

This formula should bring about at least 150% of recommended daily amount (RDA) intake in vitamin C (systemic inflammation and damage attenuations both in vivo and in vitro);<sup>3</sup> 100% of RDA intake in vitamin D (effects on the biomarkers of inflammation and endothelial activation [high sensitivity C-reactive protein and endothelin-1] and flow-mediated dilation);<sup>4</sup> and 150% of RDA of folate, vitamins B1, B2, and B12. As shown in a recent study, these vitamins decrease the marked inflammation and apoptosis, despite activation of repair machinery.<sup>5</sup> In addition, the intake of

**Table 3** Progression of nutritional support of the patient

Hospital stay	Clinical aspects	Oral diet	Enteral feeding/ONS
August 2013	No episodes of diarrhea or vomiting; weight remained stable	–	Jejunal feeding: polymeric, high-caloric formula with an elevated content of soluble fiber partially hydrolyzed guar gum (PHGG) with a speed of 80 mL/h
November 2013	No episodes of diarrhea or vomiting; weight remained stable	–	Jejunal feeding: polymeric, high-caloric formula with an elevated content of soluble fiber PHGG with an initial speed of 60 mL/h and up to 120 mL/h
December 2013	Subjective well-being	Regular meal: through the consume of homogenized fish (four times per week), poultry meal (three times per week), and fruits and vegetables	Two high-caloric supplements: an energy supplement in powder based on maltodextrin and a high-energy and protein drink, enriched with arginine, vitamin C, zinc, and antioxidants

**Abbreviation:** ONS, oral nutritional supplements.

minerals, zinc in particular, might suppress the generation of inflammatory cytokines and reactive oxygen species damage.<sup>6</sup> The advantage of this approach is its safety in terms of infection. For the first 3 months, the EN infusion speed should be stable at ~80 mL/h. In this case report, the best improvements are highlighted 3 months later, when the infusion speed was set up to 120 mL/h, in the absence of diarrhea. Most previous works concerning the characteristics and the EN infusion speed have concentrated on the risk of infectious of diarrhea, due to either the enteral feeding equipment or the sterility of the formula.<sup>7</sup>

In our study, after 4 months, we removed the PEJ and we decided to introduce two oral, high-caloric daily supplements: an energy supplement in powder, based on maltodextrin, immediately soluble in foods (or in hot/cold drinks) and a high-energy and protein drink, enriched with arginine, vitamin C, zinc, and antioxidant. Previous to our experience and considering the literature, absorption of glucose and fat from the maltodextrin diet was significantly greater than that from the glucose diet, whereas absorption of protein was only slightly enhanced.<sup>8</sup> In addition, introducing different antioxidants such as  $\alpha$ -,  $\beta$ -,  $\gamma$ -carotene, lycopene, luteina, and zeaxantina may improve tissue repairing process.<sup>9</sup>

Initially, we considered a supplementation of omega 3, following The American Dietetic Association Guidelines that recommend consuming 500 mg/d of a combination of EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid).<sup>10</sup> However, this procedure caused side effects, including upset stomach, loose stools, and belching. In addition to this, oral administration was well tolerated, thanks to consuming of homogenized fish (four times per week), poultry meal (three times per week), and fruits and vegetables every day, all

diluted in water. In scientific literature, there are no guidelines for the nutritional support of patients with gastric and esophageal necrosis due to ingestion of corrosive industrial chemical agents for suicidal purpose. The correct choice of the most appropriate nutritional support varies from patient to patient, and many factors are determined. By using a personalized formula, through PEJ, the weight loss could reduce for some patients, preventing the transition to cachexia. Moreover, the choice of specific nutrients allows to repair tissues with necrosis and to decrease the inflammatory state. In all patients with no adhesions and the regular passage of the bolus, the removal of the PEJ is indicated, with the combination of homogenized meal and dietary supplements.

## Conclusion

In conclusion, this is the first case of a nutritional approach to follow patients with esophageal and gastric necrosis; it allows reducing the risks of malnutrition or infection, which can lead to negative outcome of the patient.

## Disclosure

The authors report no conflicts of interest in this work.

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