

CORROSIVE INJURIES OF THE OESOPHAGUS AND THE STOMACH IN CHILDREN

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Abstract

Corrosive injuries of the upper gastrointestinal tract in children are among the most serious and relatively frequent conditions with complicated treatment and long-term or permanent consequences. We observed a set of patients at our department (hereinafter referred to as KDCHOT FN Brno) between 01/01/2003 and 31/12/2007. During the period of 5 years, we treated 120 children with various degrees of corrosive injury of the upper digestive tract (oral cavity, pharynx, oesophagus, and stomach) or with suspected injuries of this type. In more than one third of the patients out of a total of 120, following ingestion of an allochthonous substance no signs of damage to the skin or the mucous membrane were found on ear, nose and throat examination. Fifty-nine patients exhibited 1st-degree burns according to the classification below, 15 patients exhibited 2nd-degree burns of the oesophagus or the stomach, and only in 2 patients we observed 3rd-degree burns of the oesophagus with complicated treatment. Complete healing occurred in all patients; patients with 3rd-degree burns achieved complete healing after a series of oesophageal dilatations.

With regard to our experience showing that minimal damage to the oral cavity, pharynx, and proximal oesophagus is frequently associated with significantly more serious burns of the distal oesophagus and stomach, we regard oesophagogastroscopy and verification of the condition of oesophageal and gastric mucosa as necessary in terms of diagnostic standards for this type of injury in children.

Key words

Burns, Oesophagus, Stomach, Gastrofibroscopy

INTRODUCTION

A corrosive injury of the upper gastrointestinal tract (GIT) is an injury of tissues caused by various agents resulting mainly in burns. According to the method of ingestion, skin in the area of the mouth, GIT mucosa or both may be affected. Burns cause necrosis of varying levels, depending on the concentration and exposure time of the chemical substance. The classification of caustic burns draws on the classification of burns (1):

1st degree: erythema and mucosal oedema;

2nd degree: mucosal ulceration, fibrin generation, and bleeding;

3rd degree: severe ulceration and deep necrosis of the whole wall with possible perforation, mediastinitis and peritendinitis; scar tissue occurs (2).

The symptoms reflect reaction to pain and correspond with the location of the burns. They may even lead to acute haemodynamic instability of the organism.

GIT burns after ingestion of an unknown substance are among the most frequent injuries in toddlers and during middle childhood.

Corrosive oesophagitis

Ingestion of acid solution, lye or a similar substance may cause extensive burns of oesophageal mucosa leading to corrosive oesophagitis. Strong lyes induce destruction of the mucosa by means of colliquative necrosis resulting in protein and collagen decomposition, fat saponification, tissue dehydration, vessel thrombosis, and possibly causing severe penetration injury (3). The consequences of this oesophageal injury include extensive necrosis with possible perforation, mediastinitis, and formation of a tracheo-oesophageal fistula. The burns may extend to the stomach wall and perforation and diffuse peritendinitis may consequently occur. In the late stage, the development of strictures that cannot be dilated is common. Acids induce coagulative necrosis accompanied by eschar formation protecting deep tissue layers from further damage.

In this retrospective study, we list all cases of chemical substance ingestion in children treated at KDCHOT FN Brno during a period of 5 years and we also report on the results of the treatment.

MATERIALS AND METHODS

Our set was based on a selection of patients from the hospital information system between 01/01/2003 and 31/12/2007, with the age of the patients ranging from 1 to 5 years at the time of injury, average 2.1 years (*Tab. 1*). All the patients were examined by an ear, nose and throat (ENT) specialist and an experienced surgeon performed flexible endoscopic oesophagogastrosocopy under general anaesthesia. Profound knowledge and extensive experience are necessary not only to evaluate the findings but also to prevent possible iatrogenic perforation (4, 5). Local symptoms in easily accessible areas of the digestive canal during ENT examination can help estimate the probable degree of burns. We are looking for inflammatory oedema of lips, the oral cavity, tongue, and oropharynx. Endoscopy is used to assess the colour of the mucosa, its structure and pathological changes, and to determine the degree of damage (see above).

Other symptoms that we focus on are related to the degree of burns of the oesophagus and to the reaction of intrathoracic organs in the area (thoracic pain, dysphagia, increased salivation). The development of inflammatory reaction in the mediastinum may be accompanied not only by retrosternal pain, but also by high body temperature, breathing disturbance with stridor in tracheobronchial obstruction, and signs of shock. In case of burns of the stomach wall and its perforation, the clinical picture is defined by the symptoms of diffuse peritoneal inflammation, sudden pain in the epigastric region, and peritoneal irritation.

The patients were included in our set after dispensarisation on the basis of outpatient examination, excluding 2 patients with 3rd-degree burns who were still in dispensarisation care.

Table 1
Distribution of the patients by age and gender

Age	Boys	Girls
1-2 years	37	31
2-3 years	18	16
3-4 years	6	5
4-5 years	4	3

Table 2
Results of endoscopic examination in per cent

Degree of burns of upper GIT	Incidence (%)
Negative finding	37
1st degree	49
2nd degree	12.5
3rd degree	1.5

Table 3
Agents inducing GIT injuries

Allochthonous substance	Percentage of patients from our set of 120 patients
Detergents - acid solutions	26 %
Lyes - especially "Krtex"	17.5 %
Savo	12.5 %
Potassium permanganate	12 %
Washing machine detergents	7 %
Various disinfectants (H ₂ O ₂ , etc.)	3 %
Other: copper sulphate, solvents, diluents, mordants, detergents, herbicides, cosmetics	22 %

RESULTS

In our set of 120 treated patients who ingested unidentified quantity of allochthonous substance we recorded interesting results (*Tab. 2*). In 44 patients, the endoscopic finding in the oesophagus and the stomach was negative, 59 patients exhibited 1st-degree burns according to the above classification, 15 patients showed 2nd-degree burns of the oesophagus or stomach, and in only 2 patients we found 3rd-degree burns of the oesophagus with complicated treatment. Complete healing without the necessity of subsequent intervention treatment occurred in all patients except for 2 patients with 3rd-degree burns.

In one case we recorded a combination of 1st-degree burns of the upper GIT and 3rd-degree burns of the skin on the abdomen in a 3-year-old boy after lye ingestion (*Fig. 1*). *Tab. 3* states the most frequent agents inducing burns. Acids found in detergents significantly prevail. Fortunately, their concentration is usually low and they did not cause burns exceeding the 1st degree in our set of patients.



Fig. 1

Third-degree burns of the skin on the abdomen in a 3-year-old boy after lye ingestion

DISCUSSION

The percentage of lye is remarkably high, particularly of one representative commonly used in numerous households (“Krték”). It is a concentrated solid lye which induced the most serious 2nd- and 3rd-degree burns in our set (*Figs 1, 2*). Other agents with significant percentage did not cause major burns or subsequent complications in our set.

The whole set of 120 patients underwent early ENT examination. We observed several cases where no visible damage in the ENT region was found and despite this fact, corrosive damage to the oesophageal mucosa occurred. We thus perform acute endoscopic examination during hospitalisation in case of slightly positive ENT findings or any signs of ingestion of allochthonous substance. This examination was conducted in all patients included in our set within 12 hours (6, 7). At our department, we have been using flexible paediatric endoscopes which are considered as standard examination instruments. We do not perform neutralisation of the stomach contents. Routine blood tests and urinalysis are also included as standard examination procedures used to verify the function of the liver and the excretory system. Passage of the oesophagus is performed with postponement in patients with dysphagia or odynophagia. In patients with oesophageal stenosis, a series of oesophageal dilatations with elastic bougies is conducted on a long-term basis (8).

Pharmacological therapy is indicated according to the degree of burns.

In 1st-degree burns, antacids are administered on a short-term basis, possibly in combination with antibiotics.

2nd-degree burns require long-term administration of antacids, antibiotics, H₂ blockers supplemented with proton pump inhibitors, and bolus administration of corticoids; a nasogastric tube is inserted and parenteral nutrition is administered through the central venous catheter on a short-term basis.

In 3rd-degree burns, we indicate a long-term two-stage corticoid therapy, long-term administration of antacids, antibiotics and H₂ blockers supplemented with proton pump inhibitors followed by the treatment of oesophageal stenosis with dilatations in a non-acute stage after approximately 3 weeks (9) (*Fig. 3*). Corticoids are administered immediately using a bolus, then after 7 – 10 days on a long-term basis, depending on the condition of the oesophageal mucosa, in order to reduce oesophageal stricture formation. Despite the application of pharmacological therapy, we observed cicatricial strictures in the oesophagus in patients with 3rd-degree burns.

Within our set of 120 patients, more than one third of the patients exhibited no signs of damage to the skin or mucosa after ingestion of allochthonous substance and, despite this fact, ENT examination was performed. If the finding was negative and the child showed no signs of burns in the oral part of GIT, the agent was regarded as a less aggressive substance and, after short-term observation, the patient was discharged without the necessity of subsequent therapy. According to the legitimate representatives, there might not have been any ingestion.



Fig. 2
Passage of the oesophagus - stenosis



Fig. 3
Passage of the oesophagus - state after dilatation therapy

CONCLUSION

Corrosive injuries of the oesophagus and the stomach in children have been repeatedly documented as the most frequent injuries in toddlers. Fortunately, the results of our study indicate that minor degrees of burns that heal without consequences are represented more significantly. We observed a number of cases where minimal damage to the oral cavity, pharynx and proximal oesophagus occurred after ingestion of solid lye, whereas serious degrees of burns were found in distal oesophagus and the stomach. Consequently, in suspected burns of GIT we regard it necessary to perform endoscopic examination and verification of the condition of the mucosa in the oesophagus and the stomach by a diagnostician in a clinical workplace (10).

REFERENCES

1. Šnajdauf J, Cvachovec K, Trč T. Dětská traumatologie [Paediatric traumatology]. 1st ed. Praha: Galén, 2002: 180 pp.
2. Zeman M, et al. Speciální chirurgie [Special surgery]. 2nd ed. Praha: Galén, 2004: 575 pp.
3. Osman M, Russell J, Shukla D, et al. Responses of the murine esophageal microcirculation to acute exposure to alkali, acid, or hypochlorite. *J Pediatr Surg* 2008; 43 (9): 1672-1678.
4. Hahn A, et al. Otorinolaryngologie a foniatrie v současné praxi [Otorhinolaryngology and phoniatrics in contemporary practice]. Praha: Grada, 2006: 392 pp.
5. Keil R, et al. Gastroskopie [Gastrosocopy]. Praha: Maxdorf, 2006: 173 pp.
6. Janousek P, Kabelka Z, Rygl M, et al. Corrosive injury of the oesophagus in children. *Int J Pediatr Otorhinolaryngol* 2006; 70 (6): 1103-7. Epub 2006 Mar 30.
7. Janoušek P, Jurovčík M, Grabec P, et al. Corrosive oesophagitis in children following ingestion of sodium hydroxide granules - a case report. *Int J Pediatr Otorhinolaryngol* 2005; 69 (9): 1257-1260.
8. Lahoti D, Broor SL. Corrosive injury to the upper gastrointestinal tract. *Indian J Gastroenterol* 1993; 12 (4): 135-141.
9. Baskin D, Urganci N, Abbasoglu L, et al. A standardised protocol for the acute management of corrosive ingestion in children. *Pediatr Surg Int* 2004; 20: 824-828.
10. Keh SM, Onyekwelu N, McManus K, et al. Corrosive injury to upper gastrointestinal tract: still a major surgical dilemma. *World J Gastroenterol* 2006; 12 (32): 5223-5228.

