Oesophageal corrosive injuries in children: a forgotten social and health challenge in developing countries
Sandro Contini, Alim Swarray-Deen & Carmelo Scarpignato

Introduction
An unsafe environment is a substantial risk factor for child injury and violence, therefore representing a significant cause of child death and disability especially in developing countries, where 95% of all child injury deaths occur. Among those injuries that are caused by an unsafe environment, the accidental ingestion of corrosive substances is declining in high-income countries but not in developing countries, where it is quite significant, especially among illiterate people with poor socioeconomic status. Nevertheless, information about prevention, management and outcome of these common accidents in children of low- and lower-middle income countries is scarce.

The Italian nongovernmental organization, Emergency, is currently running five surgical centres in Afghanistan, Cambodia and Sierra Leone, mainly for the surgical treatment of war and civilian trauma injuries. In the first years of Emergency’s work in Sierra Leone, which began in November 2001, an unexpectedly high number of children were admitted after accidental caustic injuries, most of them having been treated at home or by local doctors, often resulting in oesophageal perforation and death. Between December 2005 and June 2008, 148 children were admitted to the hospital for accidental caustic soda ingestion. To meet this increasing medical need, at the end of 2005 the hospital was supplied with paediatric and adult upper gastrointestinal fibre-optic endoscopes and with dilatation devices (Savary bougies, balloon catheters) to manage these injuries either in the acute or in the late phase when severe oesophageal strictures can occur. Stimulated by this high number of patients, a medical literature review was performed from 1990 to 2007 (inclusive) for papers about caustic ingestion coming from low- or lower-middle income countries. The data sources included four independent databases: MEDLINE, EMBASE, SciELO and LILACS.

Situation analysis
Only 37 papers were found concerning corrosive ingestion in children of low- and lower-middle income countries. Ninety-four per cent were published by referral hospitals and 59% came from Africa. Only eight papers concerned the specific epidemiology of caustic ingestion. Children aged less than 5 years were most frequently injured (80%), and boys exceeded girls (70%). The most reported corrosive agent was caustic soda, followed by kerosene, sodium hypochlorite and generic household chemicals. The ingestion of acid was more common in India than in other countries. Corrosive ingestion accounted for 0.3% of paediatric admissions in the Gambia and for 0.5% in Nigeria, thus amounting to a 0.84% of total childhood mortality in that country. Death rates ranged

Problem
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Approach
To address this challenging, unmet medical need, we started a humanitarian programme in Sierra Leone. By reviewing the current literature from developing countries and our own experience in the field, we developed a flowchart for management of this clinical condition.

Local setting
This injury is underreported in developing countries. Data available are heavily skewed towards well-resourced centres and do not reflect the entire reality of the condition. Late oesophageal strictures are usually severe. Parent’s lack of knowledge, crowded living conditions and availability of chemicals in and around houses account for most ingestions. The widespread lack of any preventive measures represents the strongest risk factor.

Relevant changes
Timely admission was observed in 19.5% of 148 patients studied. A gastrostomy was performed on 62.1% of patients, 42.8% had recurrent strictures and 19% are still on a continuous dilatation programme. Perforation and death rate were respectively 5.6% and 4%.

Lessons learned
The majority of oesophageal caustic strictures in children are observed late, when dilatation procedures are likely to be more difficult and carry a significantly higher recurrence rate. Gastrostomy is necessary to maintain adequate nutritional status but mothers need training in feeding techniques. Both improvement in nutritional status and sustained oesophageal patency should be the reference points to a successful dilatation.

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from 0 to 11.9% (mean 4.1%) although the rate of late oesophageal strictures can reach 50% in the presence of early severe oesophageal lesions.11,12

This type of injury is largely unreported in developing countries and its true prevalence simply cannot be extrapolated from random articles or personal experience. The data available are heavily skewed towards well-resourced centres and do not reflect the entire reality of the condition. District hospitals probably observe most of these children, but their caseload is largely unknown. Sometimes children may not arrive at the hospital, either because they are too ill and die, they live too far away or their lesions are not severe. Occasionally families cannot afford the cost of long-term and complex therapies. With such a lack of data, it is hard to estimate, even roughly, the proportion of patients who do not seek medical care from hospitals.

Most ingestions are due to parents’ lack of knowledge of the hazards of corrosive substances kept in the house, crowded living conditions in slums and the availability of chemicals in and around the houses, combined with the natural curiosity of children. The widespread lack of any preventive measures is the strongest risk factor for these injuries.

**Approach**

All children admitted for caustic ingestion before December 2005, and still being followed up, were recalled to assess them endoscopically and to submit them to a dilatation, if needed. While the programme was aimed at treating children coming from areas nearby, a progressive increase in admissions was observed as patients were referred by international nongovernmental organizations from distant towns or villages.

Patients admitted soon after injury (48–72 hours after ingestion), and with absent or mild oesophageal lesions at endoscopy, were usually discharged. Children with more severe oesophageal findings or severe dysphagia were admitted and a second endoscopic examination/dilatation, was scheduled after 3 weeks. The most significant therapeutic option in the acute post-injury phase was a surgical gastrostomy, performed in children unable to swallow liquids or saliva, to achieve adequate nutritional support. When patients arrived at the hospital after a delay of 72 hours to 3 weeks after ingestion, endoscopy was not carried out due to the high risk of perforation. A gastrostomy was performed in the presence of severe dysphagia or after an unsuccessful dilatation attempt in children admitted late, i.e. at more than 3 weeks after the injury, with swallowing problems. The first dilatation was always carried out at least 3 weeks after ingestion. This management strategy is represented in Fig. 1.

Dilatations were performed at 7–10 day intervals, usually by means of rigid Savary bougies (93.6%), while balloon dilatation was employed only in a few patients (9.6%) that we treated at the beginning of our research project. Guide wires and dilators were preferably introduced through the gastrostomy (if performed) by a retrograde approach. The gastrostomy was removed after a period of at least 8–12 months without dysphagia. Mandatory reference points for a successful outcome were considered to be: a longlasting oesophageal patency together with an improvement in nutritional status, assessed by weight-for-height parameters13 (if < 80%, an increase to > 80%; if > 80, increase of 1 standard deviation). A training programme for gastrostomy and post-dilatation feeding was carried out with the patients’ mothers to help meet these requirements.

**Results**

From December 2005 to July 2008, 148 children (aged 14 months to 15 years; mean 4.5 years; 58.4% males) were admitted for accidental caustic ingestion. Only 29 of these (19.5%) were admitted early; two of them (6.8%) with severe respiratory tract damage leading to death. Twenty showed mild or no lesions and were discharged. All other children (119) were admitted several days, weeks, even months after ingestion, complaining of severe dysphagia. Overall, 126 children were submitted to dilatation, with a mean of 4.9 (range: 1–23) procedures per child. A gastrostomy was done on 92 of 126 children (i.e. 73%).

Recurrent strictures were experienced in 54 of 126 (42.8%), and were significantly more frequent in late oesophageal narrowing.14 Twenty-four (19%) children are still on a continuous dilatation programme. In 3 patients it was not possible to overcome the stricture and two of them were sent for oesophageal replacement elsewhere. Perforation was observed in seven patients (5.6%) with two deaths, both after balloon dilatation. Successful (as defined previously) dilatations were

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**Fig. 1. Flowchart for the management of corrosive ingestions in children, adopted at the Emergency Surgical Center in Goderich, Sierra Leone**
obtained in 96 children (i.e. 76%). The total death rate was 4% (5/126).

Discussion

Corrosive ingestions by children in developing countries have some peculiar features (Box 1). The most frequently ingested substances, such as caustic soda, have a powerful solvent action that results in very serious injuries, as confirmed by 73% of children needing gastrostomy feeding, in sharp contrast with the 11% of severe injuries reported in a multicentric study from a high-income country.15 Many injuries do recur, with one-fifth of patients still requiring a continuous dilatation programme. Unfortunately, long-term dilatation programmes are very challenging in low-income countries. Repeated hospital visits cost money, may result in loss of work for parents and neglect of other children at home. After the first few visits to the hospital, the parents may get exhausted and start feeling frustrated. These socioeconomic and psychological factors must then be taken into account in the long-term follow-up.

Patients are frequently treated at home by traditional therapies, by witch doctors or by physicians working in district hospitals without specific expertise in the field. They may require several days of travel to reach the hospital, meaning timely evaluation and treatment of these accidents is unlikely. Furthermore, frequently children are admitted when the stricture is already well established. Late dilatations are more difficult and followed by a significantly higher recurrence rate than early procedures.13 A delayed presentation and treatment has been considered a strong predictor for a future oesophageal replacement.16

Gastrostomy is necessary to feed patients and to keep them alive. However, feeding through gastrostomy or after dilatation may be followed by progressive malnutrition due to the inability of the families to nourish children properly and the lack of appropriate feeding solutions. Mothers should be trained and helped in feeding techniques. Moreover, gastrostomy is useful for a retrograde dilatation, as it is less risky and also provides the option to leave a string running through the stricture, from the gastrostomy through the nose. This is particularly helpful in cases of severe stricture that are difficult to overcome using guide wires.

When evaluating the outcome of treatment, both an improvement in nutritional status and sustained oesophageal patency, with an adequate lumen to guarantee normal food intake for growth and development, should be the reference points to a successful dilatation. Defining risk factors and groups at risk, providing appropriate education and enforcing regulations for manufacturers of household products would certainly help to reduce significantly the number of fatalities. Governments should play their role in educating people, but their efforts (if any) may be unsuccessful due to the high rate of illiteracy and to poorly resourced health systems. Even humanitarian organizations could make efforts in this direction but, again, there has not yet been enough focus on the seriousness of the problem. ■

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Résumé

Lésions corrosives de l’œsophage chez l’enfant : un problème social et sanitaire oublié dans les pays en développement

Problématique Vivre dans un environnement dangereux est un facteur de risque de traumatismes de violence pour les enfants. Parmi les traumatismes pouvant résulter d’un environnement dangereux, l’ingestion accidentelle de substances corrosives tient une place importante, en particulier dans les pays en développement où elle fait généralement l’objet d’une sous-notification.

Démarche Pour faire face au défi que représente ce besoin médical non satisfait, nous avons lancé un programme humanitaire au Sierra Leone. En examinant la littérature provenant actuellement des pays en développement et l’expérience que nous avons acquise dans ce domaine, nous avons mis au point un organigramme pour la prise en charge de cette situation clinique.

Contexte local Ce type de traumatisme est insuffisamment notifié dans les pays en développement. Les données disponibles sont fortement biaisées par la présence de centres disposant de ressources satisfaisantes et ne reflètent pas complètement la réalité de ce problème de santé. Les sténoses oesophagiennes tardives sont habituellement graves. Le manque de connaissances des parents, la vie dans des conditions de surpeuplement et la disponibilité de produits chimiques à l’intérieur et autour des maisons sont responsables de la plupart des ingestions. L’absence totale de mesure préventive un peu partout est le facteur de risque le plus important.
Resumen

Lesiones corrosivas del esófago en los niños: un problema social y sanitario desatendido en los países en desarrollo

Problema
Un entorno inseguro es un factor de riesgo de violencia y lesiones para los niños. Una causa importante de ese tipo de lesiones es la ingestión accidental de sustancias corrosivas, sobre todo en los países en desarrollo, donde muchos de esos casos no se notifican.

Enfoque
A fin de responder a esa necesidad médica desatendida, pusimos en marcha un programa humanitario en Sierra Leona. Analizando la bibliografía actual relativa a los países en desarrollo y nuestra propia experiencia en ese campo, elaboramos un diagrama de flujo para el manejo de este cuadro clínico.

Contexto local
Este tipo de lesiones no se notifican lo suficiente en los países en desarrollo. Los datos disponibles están muy sesgados hacia los centros ricos en recursos y no reflejan toda la realidad de esa enfermedad. Las estenosis esofágicas tardías son por lo general graves. La falta de conocimientos de los progenitores, el hacinamiento y el acceso a productos químicos en los hogares y en sus alrededores explican la mayoría de las ingestiones. La falta generalizada de cualquier medida preventiva es el mayor factor de riesgo.

Cambios destacables
El 19,5% de los 148 pacientes estudiados fueron ingresados a tiempo. En un 62,1% de los casos se practicó una gastrostomía, el 42,8% presentaron estenosis recurrentes, y un 19% siguen todavía un programa de dilatación progresiva. Las tasas de perforación y de mortalidad fueron respectivamente del 5,6% y el 4%.

Enseñanzas extraídas
La mayoría de las estenosis esofágicas por sustancias cáusticas en los niños se observan tardíamente, cuando los procedimientos de dilatación suelen ser más difíciles y se asocian a una tasa de recaídas considerablemente mayor. Se requiere una gastrostomía para mantener un estado nutricional adecuado, pero hay que adiestrar a las madres en las técnicas de alimentación. La mejora del estado nutricional y una permeabilidad esofágica sostenida deben ser los criterios de referencia para determinar el éxito de la dilatación.
References


