

Management of the Caustic Strictures
of the Esophagus in Children: Six Years'
Experience in a Developing Country
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Article Information

Received date: Feb 27, 2017

Accepted date: Mar 13, 2017

Published date: Mar 16, 2017

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CC-BY 4.0Keywords Caustic esophageal
stenosis; Esophageal dilation;
Esophagocoloplasty; Surgery; Children

Abstract

Background: In developing countries, most of esophageal burns are seen at the step of caustic stenosis which is frequent, and their treatment is grafted with difficulties associated with lack of therapeutic means. We aim to take stock of accidental circumstances, therapeutic and evolutionary aspects of cases we treated during six years' experience.**Materials and Methods:** It was a retrospective study over 6 years in the Pediatric Surgery Department of Lomé, involved children treated for esophageal caustic stenosis. Savary-Gilliard dilators were used for dilations by laryngoscopy. Endoscopy was not available on-site. Therapeutic results were assessed on the quality of the oral feeding recovery and were considered successful in case of normal oral total swallowing; average in case of semi-solid food swallowing and bad in case of important dysphagia sequelae or death.**Results:** During 6 years, 18 cases of caustic stenosis of esophagus were treated in 10 boys and 08 girls with average age of 5.03 years. Ingestion was accidental in 17 cases and intentional in 1 case. Caustic agents were a base in 17 cases and a hydrochloric acid in 1 case. UGI was implemented in 17 children. Stenosis were in the middle third in 10 children, the upper third in 5 children, the lower third in 1 child, the esophageal mouth in one child and a triple stenosis layered in 1 child. Fifteen children were treated by esophageal dilations, one had esophagocoloplasty, one is waiting for esophagocoloplasty and one was transferred to Switzerland for a pharyngo-oesophagoplasty. Results were good in 16 cases and bad in 1 case. In the latest case, the result will be appreciated after the oesophagoplasty.

Introduction

In developing countries esophageal caustic injuries cases are admitted most of times at the state of stricture [1,2]. Management of Caustic Strictures of Oesophagus (CSO) requires repeated dilations, implementation of prosthesis or surgery. Following endoscopic dilation, approximately one-third of patient's develop recurrent strictures after dilation and others have refractory strictures requiring multiple dilations [3,4]. Several studies have shown that progressive dilation of strictures resulted in effective relief of dysphagia in approximately 85% of cases, with a low rate of complications. However, 30% of patients require repeat dilation in 1 year despite optimal acid suppression therapy [5]. When esophageal dilatation is not possible or fails to provide an adequate esophageal caliber in the long-term, esophageal replacement should be considered. Mortality and morbidity of oesophageal replacement are low in expert hands [6,7] and most surgical series report a good-to-excellent outcome in 77% of cases, with the range being 43-90% [5]. CSO requires chronic management as esophageal neoplasms may develop as a late complication of caustic injury at a rate 1000-3000 times higher than expected in patients of a similar age [8] and have actually been reported only 1 year after ingestion [9]. Mortality and morbidity rates are reported to be less than 0.5% and 20%, respectively [5].

In developing countries [1,2], the CSO are frequent, and their treatment is grafted with difficulties associated with lack of therapeutic means. The objective of this study is to present the diagnostic, therapeutic and evolutionary aspects of the CSO treated in children and to suggest a therapeutic method adapted to our environment after 6 year experience.

Materials and Methods

This is a retrospective study of 18 children with esophageal strictures submitted to dilations and or surgery over 6 years in the Pediatric Surgery Department of Lomé between 1st January 2010 and

Table 1: Distribution of the children to the sex and the age.

	2.5 to 6	7 to 12	13 to 16	Total
Girls	4	2	2	8
Boys	4	4	2	10
Total	8	6	4	18

31st December 2015. Children of both sexes, from 0 to 15 years were concerned. The Pediatric Surgery Department of Lomé was the only one of Togo a western country of Africa.

The assessment consisted of the review of epidemiological (frequency, age, sex, the circumstances of ingestion, the nature of the product ingested, the period between the ingestion and the treatment), diagnostic (functional signs, fibroscopy signs and Upper Gastro Intestinal (UGI)), therapeutic (type of treatment, duration of the treatment) and evolutionary (healing, sequelae or death) parameters.

The instrumental dilation by the dilators of Savary-Gilliard and oesophagocoloplasty were used. We didn't have fibroscopy on-site, neither in the operating room nor within the hospital. After the dilation, patients remained under observation at the department at fewer 24 hours. The ideal final diameter of the esophageal lumen was based on patient. Symptoms and nutritional history. Relief of dysphagia during outpatient follow-up is used as clinical parameters to determine the response to the treatment. So the results of the treatment were assessed on the quality of the oral feeding recovery and were considered successful in case of healing without sequelae (normal oral feeding); average in case of minor sequelae with moderate dysphagia (semi-solid food) and bad in case of important dysphagia sequelae (oral feeding impossible) or death.

Results

Epidemiological aspects

During 6 years, 18 children of average age of 5.03 years with extremes of 1.5 and 14 years were treated in the Pediatric Surgery Department in Lomé for COS. The hospital rate was 3 cases per year. Table 1 presents the distribution of the children to the sex and the age. The recent weight of children before caustic ingestion was known to the parents in 6 cases; in the other cases, we estimated these weights according to the age in order to appreciate the weight loss.

The ingestion was accidental in 17 cases and intentional in 1 case.

In the case of accidental ingestion, children had mistaken the ingested product for water in 7 cases, for drink in 5 cases and for traditional medicine in 3 cases. In 2 cases, the product had been ingested by curiosity. Ingestions had taken place in the room in 13 cases, in the kitchen in 2 cases and at the rubbish dump in 2 cases.

Table 3: Distribution of the strictures to the esophageal location and the type of type.

	Dilation	OCP'done	Waiting for OCP	Transferred for pharyngocoloplasty	Total
Upper third	5	0	0	0	5
Middle third	8	1	1	0	10
Lower third	1	0	0	0	1
Layeredstricture	1	0	0	0	1
Esophageal mouth	0	0	0	1	1
Total	15	1	1	1	18

OCP =oesophagocoloplasty.

Table 2: Distribution of the children to the circumstances of ingestions, sex and nature of ingested products.

	Boys		Girls		Total (n=18)
	Bases	Acids	Bases	Acids	
Accidental ingestion (n=17)	10	0	7	0	17
Intentional ingestion (n=1)	0	0	0	1	1

In the case of intentional ingestion, the 13-year-old girl knew well the caustic nature of the product. She ingested it after she had failed for her First Degree Certificate Exam to escape the punishment of her parents. That was a suicide attempt.

The nature of the caustic product is presented in Table 2. The quantity of the product ingested was specified in 13 cases and not in 5 cases. In the cases where it was specified, it was "a sip" of which the volume was estimated at 10 ml in 11 cases and a "small glass" of which the volume was estimated at 50 ml in 2 cases.

The time when the ingestion occurred was unprecised in any case. The average time for admission into the hospital was 64 days after ingestion with extremes of 13 and 210 days. No child was admitted into the hospital during acute burn.

Before their admission into the hospital, all children had been to other health centers: 11 had been to 2 Social Health Centers (SHC) one after another, 4 to a Regional Hospital (RH), 2 to private clinic in Lomé and 1 to Campus Teaching Hospital of Lomé. In all cases the average time of first consultation was 19 days with extremes of 13 and 34 days.

Diagnostic aspects

All the children were received at the hospital at the stage of esophageal stenosis. The functional sign was dysphagia of progressive installation in all the cases. That was 13 cases of solids dysphagia and 5 cases of total dysphagia. There was a weight loss in all children with an average weight loss of 26.17% and some extremes of 6.7% and 33%.

The oeso-gastro-duodenal fibroscopy was carried out in 4 children within an average period of 47 days (range of 34 days and 180 days). This revealed the presence of esophageal stenosis in 4 cases. No child had undergone fibroscopy during acute stage; therefore the graduation according to the classification of the caustic oesophagitis has not been established.

The UGI was implemented in 17 children. That was not done with a child because he showed a complete stenosis of esophageal mouth; which did not allow us to run that test. Out of the 17 cases, the UGI showed regular stenosis in 7 cases and irregular stenosis in 10 cases. Table 3 presents location of the stenosis which had average length

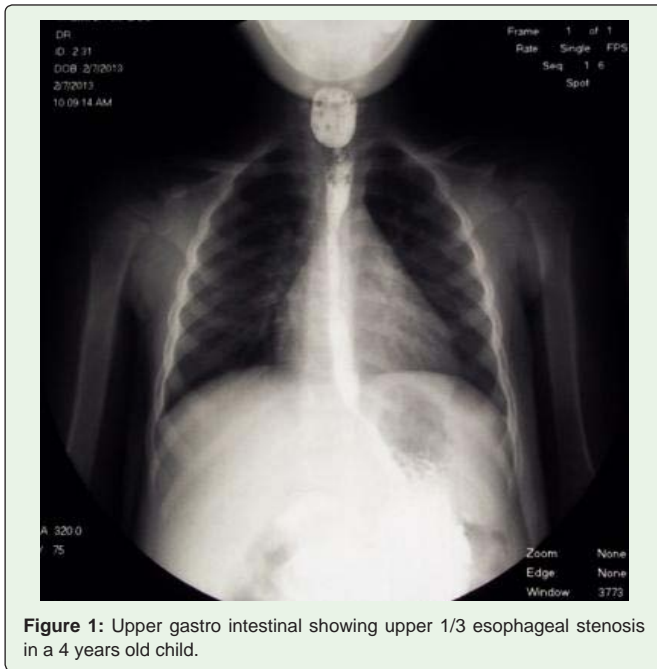


Figure 1: Upper gastro intestinal showing upper 1/3 esophageal stenosis in a 4 years old child.

of 3.3 cm and a range between 2.5 cm and 5 cm. The stenosis was very tight in 4 children and has barely let the opaque contrast product through. Figure 1 shows a stenosis of upper 1/3 of the esophagus in a 4 years old child.

Therapeutic aspects

Before admission to SOTH: Thirteen children had had at home, oral administration of red oil in the minutes after the accident. All the children had been to other health centers before being admitted to SOTH. The acute stage of esophageal burn would have been treated there without detailed traceability. Treatment in health centers had consisted of corticoid injections, painkillers and antibiotics, except at the Campus Teaching Hospital where a child had benefited from gastric lavage with physiologic serum by a nasogastric tube.

At the SOTH: At the University hospital, 15 children were treated by esophageal dilations (Table 3). A child had a retrograde surgical opening of the esophageal mouth followed by the dilation of the esophageal mouth and esophagus; one had an oesophagocoloplastie and the last child had been expecting an oesophagocoloplastie.

The esophageal dilations were made without endoscopy in all cases. The period between the injection of the caustic and the first dilation was on average 2.8 months with extremes of 1 and 7 months. Savary-Gilliard's dilators were used and dilation sessions were separated from 7 to 10 days. Esophageal dilations had enabled to give a complete remission of dysphagia with normal swallowing in 12 cases after on average of 5 sessions of dilation. The average duration of the dilation period was 3.2 months. In 3 cases the esophageal caliber obtained and that enabled optimal deglutition had to be maintained by additional sessions of dilation after respectively 6 and 8 sessions carried out. These 3 children had intermittent esophageal blocking in average of 3 per week.

A little girl of 2 years old had a complication during the first dilation: it was an esophageal perforation with right hydro-

pneumothorax and mediastinitis. After the esophageal dilation she had a high fever to 39° 5 c, a right chest pain and a respiratory distress on the 2nd day. A chest x-ray noticed a giant hydro pneumothorax, a right lung completely retracted at the hilum and a left deflection of the mediastinum (Figure 2). We proceeded immediately to a right pleural drainage which brought air and a whitish liquid similar to porridge. Seven days after, the pleural drain dried up. The UGI didn't show any fistula. Liquid swallowing was possible. Esophageal dilation was repeated 6 weeks later. Altogether five esophageal dilations were performed to get a durable normal deglutition.

The case of full mouth esophageal stenosis has been identified by an unsuccessful attempt of UGI implementation. He first had a feeding jejunostomy. Then, he received a retrograde esophageal mouth opening. After a left cervical oesophagotomy, plier was introduced in the proximal esophagus to the oropharynx and stenosis of esophageal mouth opened under laryngoscopic control. Then a nasogastric tube was placed. A session of esophageal mouth dilation and esophagus was carried out in ten days. Despite the dilation sessions that followed, mouth esophageal had lost its flexibility and had become rigid. It stenosed between two dilations. We had stopped the dilation and the child was fed by the jejunostomy until his transfer to Switzerland for a pharyngo-oesophagoplasty.

In the 2 cases of tight stenosis of the thoracic esophagus, the esophageal dilation attempt had failed. Actually it was about a boy of 3 years old and a 13 years old girl. The first case had been given an oesophagocoloplasty; the transplant colon transverse has been placed in the stratum of the distal esophagus removed. He died after surgery probably by cardio-respiratory failure. The 13-years-old girl received a feeding gastrostomy. It was a surgical gastrostomy with Foley's catheter. The porridge mainly made of local cereals and fish was put in his diet. She is expecting oesophagocoloplasty. Altogether, the results were good in 16 cases and bad in 1 case. In the latter case, the result will be appreciated after the oesophagocoloplasty.

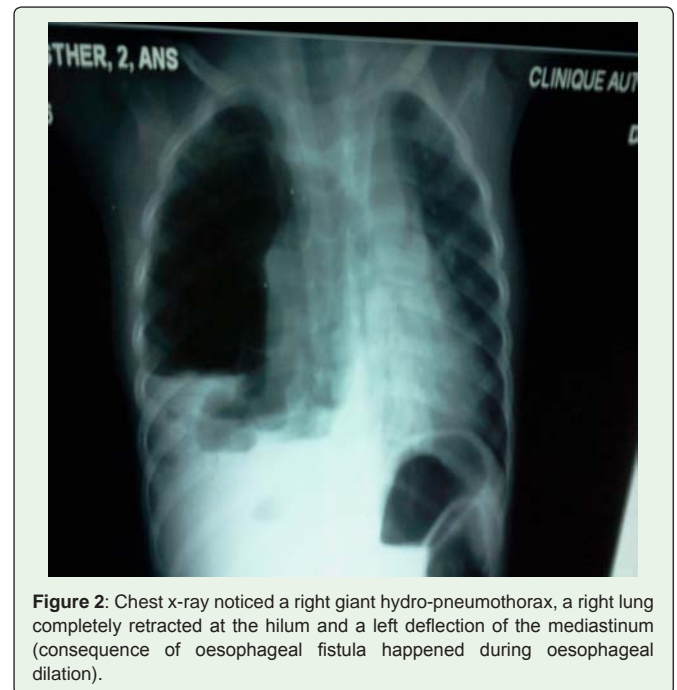


Figure 2: Chest x-ray noticed a right giant hydro-pneumothorax, a right lung completely retracted at the hilum and a left deflection of the mediastinum (consequence of oesophageal fistula happened during oesophageal dilation).

Discussion

The ingestion of caustic product is a great source of esophagus stenosis lesion of which the treatment is variously considered by the authors. In our study, we recorded a frequency of 3 cases per year. Not only is this frequency hospital, but also underestimated, because the Pediatric Surgery unit in which the study is carried out is located in the far south of the country and represents a serious problem of accessibility to parents. Moreover, there are in other parts of our country, hospitals that are able to take care of no complicated CSO cases. Besides, serious cases that would require a sustained recovery would not be sent to our unit at the SOTH. Finally, there is no anti-poison Center in Togo that would take census of all cases of caustic ingestion as in United States where that Center records 17000 cases of caustic ingestion in children by year [10]. All these factors make that we cannot extrapolate the frequency recorded in our study on the nationwide scale.

Sereme M. and Coll. [2] had found a frequency of 4 cases per year in Burkina Faso and think that this frequency would be due to the wrong therapeutic itinerary of patients, and the strong influence of traditional medicine in our societies (financial and cultural reason: low socio-economic level of the patients). Several studies noticed that ingestion of corrosive substances are still increasing in developing countries [11,12], related to the social, economic, and educational variables and mainly to a lack of prevention [13,14].

In our study, the average age of the children was 5.03 years old. This is comparable to that of Mekki [15], who had found an average age of 5 years old in Tunisia. In France the average age of affected children is 2 years old. The cases beyond 7 years old reported are exceptional [16].

The relative high of the average age in our study is related to the fact that in our developing countries, children separate late from their parents particularly their mothers. They are therefore monitored until school age that is on average 5 to 6 years old. It is also the age when child develops curiosity by taking great risks that he/she doesn't even know. According to Sereme M. et al. [2], the Caustic stenosis of esophagus is by excellence pathology of the small child, who tends to carry everything in his mouth for taste curiosity and to satisfy his/her hunger.

There is a clear male predominance in the caustic ingestion in France with a sex ratio of 1.5 [12]. In the Bittencourt [17] study in Brazil, it was noticed a slight female predominance (56% of girls with sex ratio = 0.75), as in our study with 8 boys and 10 girls (sex ratio=0.8). However, in the study of Touchene and al. [18], and Ganga et al. [5] it was found an equal distribution of sex. We could not find a plausible explanation to this random distribution of sex.

We noticed 17 cases of accidental ingestion. These data are comparable to those of Huet [19] who thought that the caustics ingestions in children are almost always accidental. This poses the problem of the protection of corrosive products and especially the regulation of their use. Worldwide, children represent 80% of the ingestion injury population globally, primarily due to accidental ingestion [20-22] regardless of the country. However we should not forget the possibility of suicide attempt in the big child from seven years old, with the same drawback as in adults, related to the amount of the caustic ingested. The case of criminal ingestion occurred in our

study with a teenager. The parents' responsibility seems once again to be questioned here because this teenager wanted to escape from the parents' punishment. In addition she didn't pay the corrosive product. She was able to get it easily at home. This drama could have been avoided if one could moderate punishments and protect these dangerous products. The nature of the caustic is a significant parameter in assessing the consequences of ingestion. The chemicals to which children have access in and around the house are the first cause of oesophageal lesions in the countries with high economic incomes as well as in the poorest ones. Only that the substances used are different: in the developed countries, the washing powders, the bleaches and the by-product of ammonia are most concerned. In under developed countries, potash or soda hypochlorite, soda hydroxide (caustic soda) are commonly used to manufacture soap and textiles. In our study, the bases were on the front line. Unlike in France where bleach was the most ingested liquid [16], caustic soda came first in our study; and in almost all cases, it was children whose mothers had this liquid as an ingredient for soap making. But a case of a 4 years old girl attracts our attention, she had ingested a product normally used by her mother for nail care and subsequently had a stenosis of esophageal mouth whose care is further in Switzerland. It is quite sure that the user of the product did not know its corrosive nature and its dangerousness, and had let it within the reach of her little daughter. The fact of having 17 cases of bases out of 18 as cause of burns may also explain the absence of gastric lesions in children of our study, for it is described that gastric acidity tamponed by the bases reduces the effect of the bases on the mucous membrane of the stomach.

The average period for admission in SOTH in our study was more than 2 months. That fact may seem surprising, but real. That may be related to the poor economic conditions of the parents who finally resorted to consult at the hospital after unsuccessful try of traditional therapy remedies which are relatively cheaper but unfortunately less effective. This delay in consultation can also be due to the inaccessibility of the specialized unit that is all grouped at the SOTH. This inaccessibility is both spatial and financial. Moreover this delay also justifies the progressive stage, whereby our patients were examined and therefore the esophageal stenosis stage at which the diagnoses were made.

At the stenosis, the dysphagia dominates the clinical picture and is a posteriori confirmation of the mucous membrane burn. After the ingestion of the caustic substance, occurs necrosis more or less extended on the surface and in the depth of the inner coating of the esophagus. It is complicated with vascular thrombosis and sometimes with bleeding. The local inflammatory reaction is important at this point [23]. Finally, we have the definitive fibrous cicatrization with a gradual replacement of the muscular by Collagen fibers that result in stenosis in cases of deep esophageal burns. The pathological mucous and parietal cicatrization is progressive for several months, which explains the occurrence of late esophageal stenosis with dysphagia [23]. In our study, dysphagia was the first evocative sign of esophageal stenosis, reported by all our children. It was progressive, so it was solids in 13 cases, and total in 5 cases. In Mali, S. Yena et al. [24], noticed that patients constantly came in surgery at a late stage after installation of the consequences of dysphagia in 76.3% of cases. That is where optimal initial support/treatment in a medical environment to reduce the inflammatory reaction, metabolic complications and a progression to a tight stenosis find its entire relevancy [25]. In our

areas caustic ingestion is neglected and patients do practice self-medication (drink abundant water or red oil, vomiting...) exposing them to the burns worsening.

The UGI is an excellent medical test in case of caustic esophageal stenosis. When it is performed, it enables to locate the stenosis, to precise their spread and severity [26,27].

As soon as the stenosis is formed, the dilation must be carried out from the 20th day after the accident [15]. The number of sessions by patient varies considerably (from 01 to 42 sessions) with an average of 10 to 20 sessions. The duration of this treatment varies from six months to two years [15]. In our study, the period between the caustic ingestion and the first dilation session is on average 2.8 months whereas in Sohan [28] one, the dilation had started at least 3 to 4 weeks after the caustic ingestion. This difference is due to the late arrival of the cases to the hospital where the x-ray checkup follows the prescriptions before performing the dilation.

The literature data show no significant difference in terms of effectiveness and complication between dilation by plug and by balloon, however this remains the most expensive [15]. Several types of dilators were used in the literature. In Tunisia M.Mekki [15] had used only the Rig flex balloon dilator. But in our study we used Savary-Gilliard dilators.

We didn't also result in using a flexible endoscope; all our dilations were made based on laryngoscopy.

Five sessions of dilations on average were carried out in this study by patient, which is inferior to the other studies. But in literature in general, there is not a standard number of dilations to be performed.

The rate and the number of dilation sessions are impossible to determine in advance for it depends on the type of the caustic, the aspect of stenosis in the UGD or the endoscopic aspect. Indeed, each case has its own particularity and the reaction to dilation varies considerably from one person to another, or even in the same person [28]. It is generally agreed that a dilation session should not exceed three (03) sessions of the dilator and the interval between sessions must be between 10 days and 1 month [16].

Sereme M. et al. [2] in Burkina Faso had performed a session of dilation every two weeks. In ours, the sessions of dilation was performed every 7 to 10 days, then every 15 to 20 days; however it was separated of 3 weeks in 1 case. The results were not disappointing.

The duration of the patients' treatment by dilation varies from one study to another according to the indication of dilation and the severity of the stenosis.

It was on average 6.8 months in the study of F.Huet [19]; 35.9 months in the one of Sohan [27] and 5 months in that of Mekki [15]. In ours the average duration was 3.2 months.

M.Mekki [15] had a considerable rate of good results (80%) with the dilation. The only case of failure was observed in a child who had a double esophageal stenosis. No complications cases were noticed in his study. S. yena et al. [24] in Mali got 77 cases that is 1% of success among dilated patients by the bougie of Rehbein. In ours, 16 out of 18 children had benefited from the dilation sessions with complete remission. Our results are not far from those of literature especially in term of the quality of our equipment in dilation material. But we had

recorded a case of complication with esophageal perforation which recovery was favorable. Although the dilators of Savary-Gilliard are flexible and seem less traumatic, this type of complication is not to be excluded since the dilation was performed without endoscope in our study. We advised oesophagoplasty to 3 children who didn't make it with the dilation. This operation consists in replacing the esophagus, in order to restore the continuity of digestion in case of prior resection, or a stenosis inaccessible to endoscopic dilation [29].

CSO requires chronic management as esophageal neoplasms may develop as a late complication of caustic injury at a rate 1000-3000 times higher than expected in patients of a similar age [8] and have actually been reported only 1 year after ingestion. The reported incidence ranges from 2% to 30%, with an interval from 1 to 3 decades after ingestion [30]. Cancer Patients of our series need to be following for long-time.

We can therefore notice that the CSO C in children is caused in our study by avoidable burns. The initial support/treatment in health centers where we can't trace could also contribute. We insist on the parents' sensitization to fight against preventable burns and the medical personnel to fight against preventable caustic stenosis of esophagus. The majority of children treated for caustic stenosis of esophagus in our study are cured by instrumental dilation. In the case of intermittent blockings that could be treated by removable esophageal endoprosthesis; maintain by dilation enables them to eat. The case of death after the oesophagocoloplasty shows the difficulties in carrying out this surgery, especially in terms of resuscitation, which remains a challenge even though mortality and morbidity of that technique are low in expert hands [6,7].

Conclusion

The potential seriousness of caustic ingestion requires an early and specialized treatment. The time of the intervention is the main prognostic factor, as well as the nature and the quantity of the product ingested. Once the stenosis is formed, instrumental esophageal dilatation is effective, certain and simple. Never forget the potential evolution to cancer in one to fifty years. In our study the majority of COS had benefited from the dilation and the results were satisfactory, nevertheless, the best treatment for the COS in children population is and remains the prevention, by keeping caustic products out of reach of children.

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