HSI Health Sciences Investigations Journal

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ISSN Online 2704-4890 | ISSN Print 2720-7609

Online first publication

Original Research Article

HSI Journal (2024) Volume 6 (Issue 2):927-931. https://doi.org/10.46829/hsijournal.2024.12.6.2.927-931

Open Access

Endoscopic dilation of oesophageal strictures in children: an eight-year experience in a tertiary hospital

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Received September 2024; Revised October 2024; Accepted November 2024

Abstract

Background: Oesophageal strictures in children are either acquired or congenital. The common acquired causes include ingestion of corrosive agents. Oesophageal strictures in children can lead to devastating complications or even death as they pose treatment challenges, especially in developing countries where conservative oesophageal dilation, which may reduce the post-treatment morbidity associated with surgical intervention, is not readily available.

Objective: This study demonstrates the successful management of oesophageal strictures in a low-resource setting.

Methods: This is a retrospective study of 66 consecutive children with oesophageal strictures who were evaluated and had endoscopy oesophageal dilation from February 2016 to February 2024 at the Paediatric Endoscopy Unit of the Korle Bu Teaching Hospital (KBTH), Accra Ghana.

Results: Four hundred and eighty (480) dilation sessions were done in 57 patients. Most of the children were between 1 and 5 years old, and 57.6% (n = 38) were male. Forty-seven (71.2%) of the strictures were due to ingestion of caustic agents. Fifty-one (89.5%) patients had successful dilatation, and six were lost to follow-up. There were three (0.6%) complications of oesophageal perforations.

Conclusion: Oesophageal stricture is common in children, and accidental ingestion of corrosive substances is the most common cause. Endoscopy dilation of oesophageal strictures can safely be done in most children, with excellent outcomes and low complication rates.

Keywords: Oesophagus, children, caustic, stricture

Cite the publication as Afaa TJ, Etwire VK, Odei E, Ayete-Nyampong JB (2024) Endoscopic dilation of oesophageal strictures in children in a tertiary hospital: an eight-year experience in a tertiary hospital. HSI Journal 6 (2):927-931. https://doi.org/10.46829/hsijournal.2024.12.6.2.927-931

INTRODUCTION

Oesophageal strictures in children are either acquired or congenital. The common acquired causes include ingestion of corrosive agents (caustic soda or sodium hydroxide) [1], gastroesophageal reflux disease [2], infections, long-term retention of a foreign body, eosinophilic oesophagitis [3] and secondary surgical causes [4]. The incidence of caustic ingestions causing oesophageal strictures in children varies according to centres and may represent up to 70% of cases [5]. Most children with oesophageal strictures are male, and the median age at presentation is 3 years [6]. Caustic ingestion is a common type of childhood poisoning in Ghana due to improper storage practices [7,8]. Oesophageal strictures could lead to devastating complications or death if not diagnosed and treated early [9]. The strictures result from a series of events that follow the injury to the oesophageal wall [10].

Current treatments include surgery [11], conservative treatment such as endoscopic dilatation [12] and the use of removable self-expanding intraluminal stents [13]. The primary aim of oesophageal dilation is to alleviate symptoms, permit the maintenance of oral nutrition, and reduce the risk of pulmonary aspiration [9]. Conservative

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management significantly reduces the need for surgery and its related complications. In Ghana, surgery [14] was the only therapeutic option until paediatric endoscopy oesophageal dilation services were established at the Korle Bu Teaching Hospital (KBTH) in 2016. This study aims to demonstrate the successful management of oesophageal strictures in a low-resource setting over an eight-year period.

MATERIALS AND METHODS

Study Design

This retrospective study was performed in the Paediatric Endoscopy Unit at Korle Bu Teaching Hospital. The Medical records from the Paediatric Endoscopy Unit were reviewed from 11/02/2016 to 15/02/2024. All children who have had oesophageal dilation during the period were included in the study.

Data Sources

The medical records for patients who have had oesophageal dilation were obtained from the unit. The age, gender, cause of stricture, number of strictures (one or more), number of dilation sessions, and outcomes of the therapy were extracted. This was documented in Excel and later exported to IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA) for analysis.

Dilation

Prior to the oesophageal dilation, a contrast swallow (esophagogram as indicated in Figure 1) was performed on each patient to assess the site of the proximal obstruction, whether the obstruction is complete or not, and the degree of narrowing of the oesophagus. The procedure was explained to the caregivers, and consent was obtained. Patients were requested to fast for 4 and 6 hours for liquid and solid foods to ensure the oesophagus and stomach were empty during the procedure. The patient was put on a cardiac monitor to monitor vital signs continuously before, during, and after the procedure to ensure patient safety. Before the procedure, the oropharynx of the patient was sprayed with topical anaesthesia lidocaine (50 mg). The patient was put in a left lateral position and given intravenous ketamine (1-3 mg/kg), midazolam (300 mcg/kg) for sedation, and intravenous atropine (10-20 mcg/kg) to reduce secretions. Supplemental oxygen was administered by nasal prongs to ensure adequate oxygenation.

Sampling and data collection procedures

The endoscope was introduced into the oesophagus to visualise the stricture. A guide wire was introduced through the endoscope and passed across the stricture (Figure 2) into the stomach. The endoscope was then removed a centimetre at a time whilst the guide wire was pushed in at the same length. A retrograde gastroscopy was done by passing the endoscope through the gastrostomy stoma (done for feeding) to confirm the appropriate placement of the guide wire in the stomach. Once the endoscope was completely removed, the patient was positioned supine, and the neck extended with the chin lifted upwards to straighten the airway and oesophagus. The dilation was done with Savory-Gilliard dilators. The smallest admissible bougie (example size 21 French) was thoroughly lubricated and gradually introduced over the guide wire through the mouth and oropharynx into the oesophagus and stomach. The dilator was left in place for 60 seconds, after which it was removed. The cycle was repeated with the next larger-size dilators. A total of 3 dilators of increasing sizes were used per session.

After the last dilator was removed, the endoscope was reintroduced all the way into the stomach to inspect and deflate the gas introduced during the procedure. The previously strictured areas of the oesophagus were also inspected for the extent of stretch. Intralesional (endoscopy)

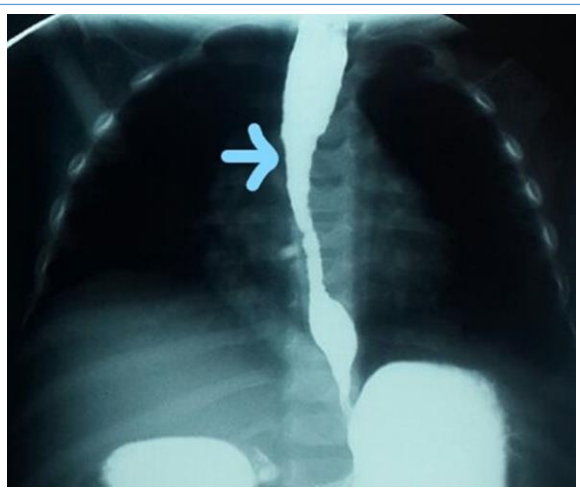

Figure 1. A contrast swallow showing the strictured oesophagus

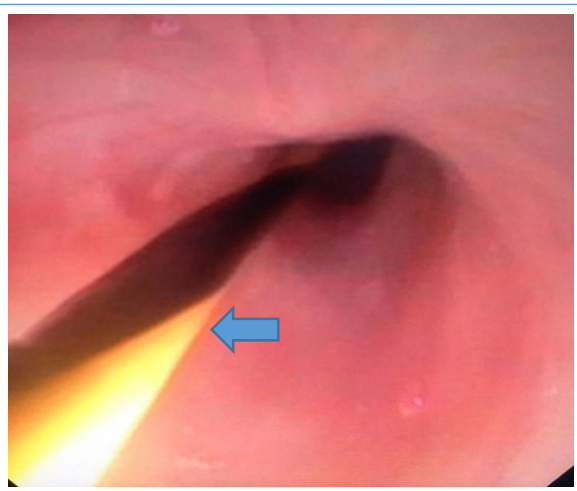

Figure 2. An endoscopy of the strictured oesophagus with a guide wire.

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injection of methylprednisolone 40 mg was given before or after the dilation. After the procedure, each patient was monitored for about 30 minutes to 1 hour in the recovery ward for any adverse event. After full recovery, each patient was given water to drink, scheduled for the next session and discharged. There was an interval of 2 - 4 weeks between sessions during the initial therapy and then increased with ease of dilation until six monthly. Finally, the patients are seen yearly for surveillance endoscopy when no dilation is required. The ideal final diameter of the oesophageal lumen was based on the patient's ability to eat and drink without pain or discomfort and the ability to intubate the oesophagus with the standard gastroscope with ease into the stomach without injury to the oesophagus.

Out of 480 dilations done, we recorded three oesophageal perforations in two patients. These perforations occurred during the injection of steroids in the strictured areas of the oesophagus. The patients were managed conservatively on admission for 48 hours with intravenous antibiotics; nothing was given enterally; intravenous fluids and strict monitoring for symptoms and signs of mediastinitis, subcutaneous emphysema, and oesophageal bleeding were ensured. Dilation sessions were subsequently resumed successfully in these patients after one month. Healing was confirmed by the absence of pain during feeding prior to the resumption of oesophageal dilation.

Statistical analysis

The data was entered and analysed using SPSS® version 25.0. Results were expressed as frequencies and percentages for categorical variables and median and interquartile range (IQR) for continuous variables.

RESULTS

Sixty-six patients were referred for oesophageal dilation during the period. Thirty-eight (57.6%) of the patients were males and 77.3% (n = 51) were between ages 1 and 5. The leading cause of strictures in these patients was caustic soda ingestion (n = 47/66) (Table 1). Not all patients who were referred for oesophageal dilation qualified for the procedure. Nine (13.6%) patients did not have the procedure due to complete occlusion of the oesophagus or inability to pass a guide wire through the stricture (Figure 3). Among the six patients who were lost to follow-up, 5 had only one session of dilation each and one had seven sessions of dilations.

Fifty-seven patients were eligible for oesophageal dilation. A total of 480 dilation sessions were done during the period, with a mean of 8.4 sessions per patient. Thirty-two patients had single stricture, whilst the rest had multiple strictures (Table 2). Fifty-one (89.5%) patients had successful oesophageal dilation, with six lost to follow-up. The only patient who had seven sessions of oesophageal consistently failed to meet scheduled appointments for dilation. She was noticed to have evidence of oedematous malnutrition, for which she was given milk and referred for dietherapy.

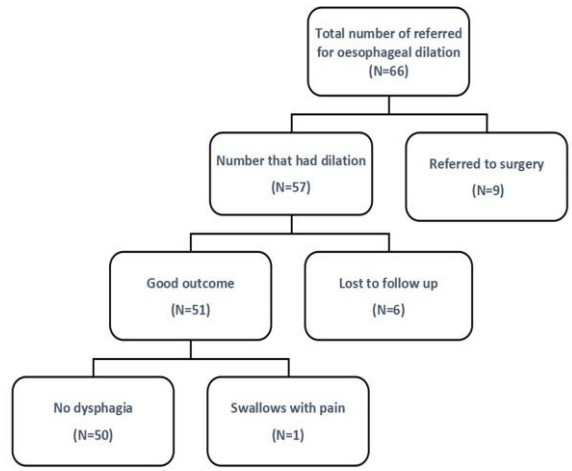

Figure 3. Summary of outcomes of oesophageal dilation

Table 1. Socio-demographics of study participants

Variables	Frequency (%)
Age (years)	
<1	5 (7.6)
1 – 5	51 (77.3)
>5 – 10	7 (10.6)
>10	3 (4.5)
Median age, (IQR)	2.7 (2.4)
Sex	
Male	38 (57.6)
Females	28 (42.4)
Causes of stricture	
Swallowed retained battery	1 (1.5)
Congenital stricture	3 (4.5)
Nail polish remover	4 (6.1)
Post oesophageal atresia repair	5 (7.6)
Bleach (parazone)	6 (9.1)
Caustic soda (sodium hydroxide)	47 (71.2)

Table 2. Number of oesophageal strictures and sessions of dilation

Variables	Frequency (%)
Multiple Strictures	
Yes	25 (43.9)
No	32 (56.1)
Number of dilation sessions	
1-5	23 (40.4
6 - 10	20 (35.1)
>10	14 (24.5)
Median (IQR)	6 (7.0)

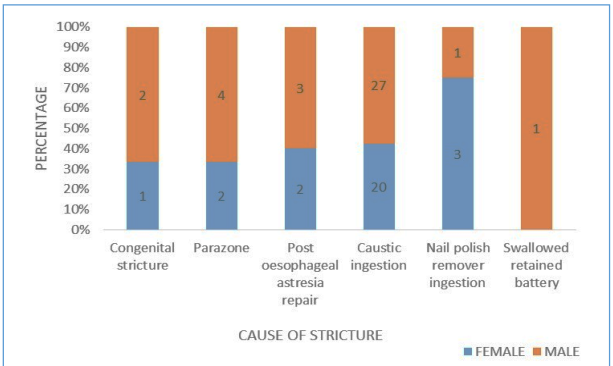

Figure 4. Frequencies of causes of stricture by sex

She also has a gastrostomy tube for feeding. Following the diagnosis of malnutrition, dilation sessions were withheld for her to recover. Following that, she defaulted for four months and a telephone call from the mother confirmed her death due to infection. More males had strictures compared to females. Of all the causes of strictures, only stricture due to nail polish remover was dominated by females with 75% (Figure 4). There were three (0.6%) oesophageal perforations in two patients. One patient has two perforations at different times during the sessions.

DISCUSSION

In 2016, endoscopic oesophageal dilation was performed in Ghana for the first time. Subsequently, 480 endoscopy oesophageal dilations in 57 patients who qualified for the procedure have been carried out. In this study, there was a slight male preponderance of 1.4:1, which is compared with a male-to-female ratio of 3:2 reported by Chih-Feng Chang et al. in Taiwan [15]. The median age in this study was 2.7 years, which is comparable to what was reported internationally. Rafeey et al., in a systematic review and meta-analysis of international literature, reported that children younger than 5 years are the highest-risk group for accidental caustic ingestion [5,6]. Children of these ages are unable to differentiate edible liquids from toxic ones and thus present a case for advocacy as far as domestic accidents are concerned.

The majority (77.3%, n = 51) of our patients were between 1 and 5 years old, and 71.2% developed strictures from ingesting caustic soda, a strong alkaline used domestically to manufacture soap. In poor communities, soap is made domestically using very strong alkalis with unknown pH and stored in single-use water bottles that are not child-proof [8]. Except for the strictures that were due to nail polish removers, all other causes were predominantly in male children due to the adventurous nature of male pre-schoolers. Except for the strictures that were due to nail polish remover, all other causes were predominantly in male children. In this age group, children learn by modelling and exploring their environment. Female children model their mothers and accidentally ingest the nail polish remover when they are not being closely monitored. Male children, being adventurous and exploring their environment, also accidentally ingest the caustic solutions, which appear similar to drinking water.

Oesophageal strictures in children pose a treatment challenge in Ghana. Before the establishment of the paediatric endoscopy unit, surgical intervention by way of oesophageal replacement was the only treatment option with its attendant costs and complications [16]. Surgical treatment is, however, reserved for cases that are impossible to dilate, as was the case in three of our patients who had unsuccessful dilation or complications resulting from dilation [17]. Nine (13.6%) of our patients had complete obstruction and were impossible to dilate. They were referred for surgical intervention. Indeed, the frequently used management modality of oesophageal strictures in children worldwide is endoscopy dilation [12] rather than surgical treatment because it is easy to do and offers great relief of dysphagia with a low rate of complications [9].

Endoscopy dilation can be done using bougies or balloon dilators depending on the physicians' personal preference, experience and availability of equipment [17]. Savary Gilliard dilators or bougies were used in our cohort. Endoscopy dilation is preferred to blind dilatation because the stricture and the mucosa can be directly visualised; the right placement of the guide wire into the stomach can be confirmed; the degree of oesophageal laceration or bleeding or any perforation that may occur during the procedure can be assessed, and adjuvant therapy with steroid injection can be performed [9]. In the absence of a fluoroscope, we confirmed the right placement of the guide wire into the stomach by direct gastroscopy through the gastrostomy opening. Similar to the sedation option used by Johnsen et al. in 47 dilations among 10 Danish children in 1986, [18] we used conscious sedation for the 480 procedures, and these were well tolerated.

The number of dilations to be done in a patient cannot be predetermined [17]. This is guided solely by the clinical progression. We performed an average of 8 dilations per patient, and the number of dilations performed was independent of the number of strictures in each patient. Most patients, therefore, require multiple hospital visits, and these constitute one of the inconveniences associated with oesophageal dilations. However, in the short and long term, endoscopy dilation for oesophageal strictures is safe and should be considered as first-line treatment in affected children in Ghana [1].

Conclusion

Oesophageal strictures in children are not uncommon in Ghana, and most cases result from accidental ingestion of caustic soda. Endoscopy dilation of oesophageal strictures can safely be done in most children, with excellent outcomes and low complication rates.

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DECLARATIONS

Ethical consideration

Ethical approval (KBTH-IRB 000131/2018) was obtained from the Korle Bu Teaching Hospital Institutional Review Board. Informed consent from each patient's caregiver was waivered by the IRB due to the retrospective nature of this study. The authors had no access to information that could identify individual participants. The study was conducted following the principles of the Helsinki Declaration and good clinical practice guidelines.

Consent to publish

All authors agreed on the content of the final paper.

Funding

None

Competing Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Author contributions

TJA was involved in conceptualising, collecting data, and writing and editing the manuscript. VKE collected the data and wrote and edited the manuscript. JBA edited, analysed and interpreted the data. All authors read and approved the manuscript for publication.

Acknowledgement

The staff of the paediatric theatre of Korle Bu Teaching Hospital were of immense help in getting the records up to date.

Availability of data

Data is available upon request to the corresponding author.

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