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Endoscopic fragmentation of an obstructive esophageal stone with pneumatic lithotripsy and holmium: YAG laser: A case report

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Abstract
As esophageal foreign bodies are frequently encountered in the emergency department, here we represent an unique case of a chronic obstructive esophageal stone infiltrating the thoracic esophageal wall causing chest discomfort and dysphagia over years, highlighting the multidisciplinary and minimally invasive approach by using combination of pneumatic lithotripsy and holmium: YAG laser to fragment the esophageal stone and retrieve it piecemeal with no post procedural complications signifying its efficacy and safety.

Keywords: Esophageal stone, pneumatic lithotripsy, holmium: YAG laser

Introduction
Esophageal foreign bodies, a frequent clinical occurrence, can manifest through a range of symptoms including dysphagia, chest discomfort, vomiting, cough, and dyspnea [1]. While the majority of ingested foreign bodies (80%-90%) pass spontaneously, around 10%-20% of cases require an endoscopic procedure, and fewer than 1% necessitate surgical intervention. Although various items can be swallowed, typical accidental ingestions in the esophagus include food boluses (primarily meat), fish or chicken bones, dentures, and coins [2]. Large foreign bodies in the gastrointestinal tract may lead to more clinical complications like perforation, aortic injury, mediastinal abscess or airway obstruction and are challenging to manage [1].
We present a rare case of a large stone embedded in the mid and lower thoracic esophageal wall that was successfully removed piecemeal utilizing rigid esophagoscope by pneumatic lithotripsy and completed by flexible ureteroscopy with holmium: YAG laser through a multidisciplinary approach.

Case report
A 72 year old male presented with long standing retrosternal pain along with back pain, nausea and dysphagia for more than 6months. No hemetemesis or significant weight loss. In the past he underwent percutaneous transluminal coronary angioplasty for LAD and RCA occlusion and laparoscopic cholecystectomy for acalculous cholecystitis with no relief of above symptoms. He presented to us with dysphagia and a previous report of suboptimal esophagogastroduodenoscopy (EGD) and biopsy report suspecting it to be an esophageal malignancy.
The patient's persistent symptoms despite previous interventions suggest the need for a comprehensive re-evaluation of his condition. A diagnostic assessment with imaging procedures and an upper endoscopy was performed. Given his age and medical history, it was imperative to investigate both cardiac and gastrointestinal etiologies, to rule out the possibility of pain being referred from these organ systems.
EGD was performed- scope passed upto 32 cms, large hard foreign body seen ulcerating from the esophageal wall. Piecemeal breaking of foreign body and extraction was attempted with limited success. In following days EGD was reattempted- Few fragments broken and cap assisted removal attempted but fragments could not pass the upper oesophageal sphincter and the procedure was abandoned.

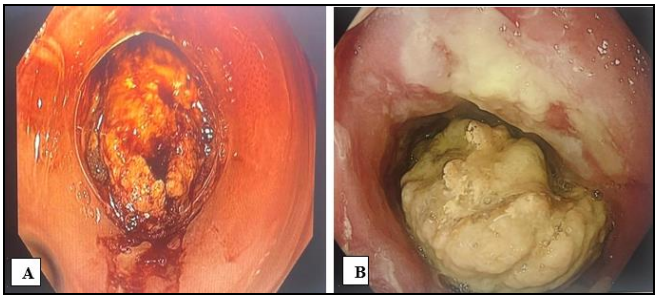

Fig 1: A and B showing Endoscopic images of large hard foreign body occluding esophageal lumen with ulceration.

CECT of Chest and Whole abdomen suggested diffuse circumferential enhancing wall thickening with luminal narrowing involving thoracic esophagus from D4-D10 vertebral level. Large hyperdense foreign body seen in the lumen at level of left atrium, size of foreign body approximately 3.7 cm in craniocaudal (CC) dimension and thickness approximately 1.6 cm. Few subcentimetre sized enlarged paraesophageal lymph nodes noted.

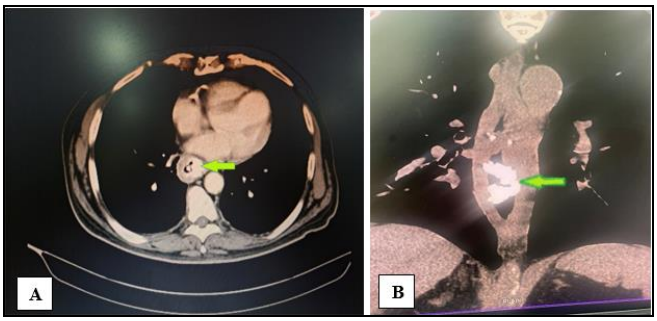

Fig 2: CT scan- (A): Axial section showing diffuse circumferential enhancing wall thickening with luminal narrowing in thoracic esophagus just posterior to left atrium (Green arrow). (B): Coronal section of esophageal foreign body (green arrow).

Upon repeatedly asking the patient as we look at the size and chronicity of the condition, he reluctantly reported history of chewing chicken bones since childhood till this age signifying its chronicity and wall infiltration with esophageal luminal narrowing.

All routine preoperative investigations was done and patient underwent Rigid esophagoscopy the upper limit of esophageal foreign body was 32-33 cm using conventional graspers attempt was made to break it with minimal success as it was very hard in consistency. We requested the Urosurgery team, to use a pneumatic lithotripter for fragmentation of this and achieved considerable success. However for the distal part of the esophageal foreign body rigid scope could not be advanced further owing to it limited length so we resorted to flexible ureteroscope using holmium-YAG laser for complete fragmentation. The entire procedure rigid endoscope was used to guide the lithotripter and the laser to prevent esophageal wall injury. Fragments retrieved piecemeal endoscopically were sent for histopathology and chemical analysis. The entire procedure took 8hours owing to the hardness and size of the foreign body. Post procedure, flexible scope passed suggested multiple ulcers at Gastro-esophageal junction (GEJ) between 30-38cm with nodularity, pangastritis with small ulcers in fundus and antrum, sample for biopsy and rapid urease test (RUT) taken. Patient was shifted to intensive care unit and recovery was uneventful.

Fig 3: Extracted Fragments of esophageal foreign body

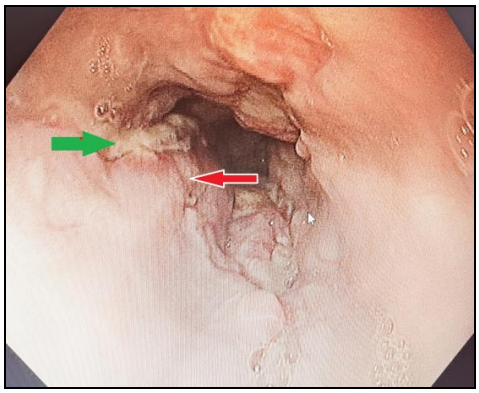

Fig 4: Post procedure endoscopy showing multiple nodularity (red arrow) and ulceration (green arrow) at gastroesophageal junction.

Histological examination of fragments revealed calcifications s/o esophageal stone. In chemical analysis, calcium oxalate monohydrate and carbonate apatite levels were high.

Biopsy from ulcer edges showed hyperplastic squamous epithelium with chronic inflammation. No evidence of granuloma or malignancy. RUT was negative for H. pylori.

Follow up endoscopy was planned after 4 weeks and showed healed mucosa.

Discussion

Endoscopic retrieval of foreign bodies from the esophagus is a highly secured procedure that results in minimal discomfort, achieving a success rate of over 90%, which makes it the preferred method for addressing such medical conditions**.** Food bolus obstructed in the esophagus can be pushed into the stomach gently, while inappropriate foreign bodies cannot be pushed into the stomach [1]. Standardized endoscopic techniques including grasping forceps, polypectomy snares, Dornier-type stone retrieval baskets, retrieval snare net, transparent cap-fitting device have been used to remove foreign bodies from the esophagus [3].

In our case, the push and retrieve technique could not be done as the foreign body had irregular edges and was infiltrating the oesophageal wall, after multiple failed attempts in stone extraction with esophagoscope, pneumatic lithotripsy was done to fragment it and removed as piecemeal. Intracorporeal pneumatic lithotripter converts kinetic energy to mechanical strain, passes through probe via rigid scope to disintegrate the calculi. Advantages being less heat generation at tip and less tissue damage with faster removal of stones [4]. As the rigid ureteroscope could not be

advanced further due to it short length, Flexible ureteroscopic fragmentation was done using Ho: YAG laser. It is used in minimally-invasive surgeries for urinary disorders with the pulsed emission at a wavelength of 2.1 μm, holmium laser can instantly heat up and shatter objects. The holmium laser is considered very safe due to its energy being largely absorbed by water, with a penetration depth limited to 0.5 mm, ensuring minimal damage to tissues. Similarly, Yang *et al* utilised holmium: YAG laser for fish bone removal from esophagus suggested its feasibility and effectiveness for breaking the bone and endoscopic retrieval [1].

Alternative to usual endoscopic stone retrieval Song *et al* used laser lithotripsy to treat huge incarcerated esophageal bezoar to prevent esophageal perforation and risk to injure blood vessels [5]. Similar to this case as the stone was for longer duration large in size causing wall thickening of thoracic esophagus risk for injury to nearby tissues was high.

Mangs *et al* similarly, used holmium laser to fragment a chicken bone piece lodged in distal esophagus with pulse energy setting for the laser at 1.2 J energy and 10 Hz frequency to fragment it into two pieces and was endoscopically retrieved. Finally, endoscopic assessment of the esophagus showed a perforation of a decubitus ulcer (<10 mm) and endoscopic closure of perforation was done [6]. In our case post stone retrieval endoscopy only showed multiple ulcers at GEJ with nodularity and pangastritis and was managed conservatively.

Two cases of phytobezoar one in a 78 year old man post bilroth I partial gastrectomy and a 53 year old female with a gastric band for treatment of obesity, showed a large phytobezoar (8cm in diameter) in the proximal gastric pouch, Grande *et al* managed both the patients with holmium laser fragmentation with no post procedural complications concluding the safety, effectiveness and rapid approach for massive gastric bezoars or other foreign bodies [7].

Lam *et al* reported using Ho: YAG laser in management of an impacted denture in esophagus. Guided with endoscopy, disimpacting the denture in stomach it was fractured in 3 pieces with Ho: YAG laser before its retrieval without any complications signifying the safety and efficacy of this procedure [8].

Conclusion

Endoscopic management remains a feasible option in such select cases with appropriate expertise. Given the size and the calcific consistency of the esophageal stone, we used a combination of pneumatic lithotripsy as well as holmium: YAG laser and endoscopic retrieval of fragments completely with no complications and complete resolution of patient's symptoms. However using this technique is lengthy and requires advanced endoscopic and multidisciplinary expertise but provides greater benefit in terms of tissue preservation, reduced recovery time, safety as well as efficacy in expert hands. The holmium: YAG laser with its limited penetration reduces the risk of esophageal perforation with its associated complication and can be used more often for bones or calcified esophageal foreign body.

Conflict of Interest

Not available

Financial Support

Not available

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