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Feasibility of Endless String with self-bougienage as an alternative to coloplasty in corrosive esophageal stricture

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Title: Feasibility of Endless String with self-bougienage as an alternative to coloplasty in corrosive esophageal stricture.

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Abstract

Purpose:

Refractory corrosive esophageal strictures often require esophagocoloplasty which is associated with significant morbidity. The present study evaluates clinical efficacy of Endless

String (ELS)-guided Savary-Gilliard (SG) dilation followed by self-bougienage in corrosive esophageal stricture patients with failed endoscopy therapy.

Methodology:

Patients with passable, permeable long-segment, refractory corrosive strictures underwent ELS-guided dilation followed by supervised, then independent, daily self-bouginage. Follow-up included contrast studies (barium or water-soluble), evaluation of weight, dysphagia, and quality of life (WHO-QOL). Non responsive and non -compliant cases proceeded to esophagocoloplasty. Self-dilatation tapered upon sustaining 12-mm esophageal diameter for six months with ELS removed if patients remained asymptomatic after one year of self-dilation.

Results:

ELS inserted in 26 of 58 patients referred for esophagocoloplasty. After excluding two patients lost to follow-up, 24 patients were analysed. Normal swallowing restored in 38% (22/58) patients after mean duration of 6.6 months and mean of 9 sessions (range, 5–14). Dysphagia improved to grade I–II in 92% (22/24) of patients, accompanied by mean body weight increase from 35.98 kg to 41.47 kg. Complications included localized pain in seven (29.1%), recurrent dysphagia in three (12.3%), and salivary fistula following cervical exploration in two (8.3%). Two patients required coloplasty; one due to non-compliance and another secondary to false passage created during self-dilation. Overall, WHO quality of life scores improved in all the domains.

Conclusion:

ELS-guided dilation followed by self-bougienage for select subgroup of patients achieves sustained luminal patency, significantly relieves dysphagia, improves quality of life, and successfully averts need for esophagocoloplasty in compliant patients.

Keywords: Endless string, Self-bougienage, Coloplasty, Corrosive Stricture

Statements and Declarations:

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript. No funding was received for conducting this study.

Manuscript:

Introduction

Corrosive oesophageal stricture commonly presents with dysphagia, it being present in 80% of cases who develop a stricture. Dysphagia usually presents within two months and at times even earlier in case of severe injury[1]. The goal of corrosive oesophageal stricture management is three-fold; to overcome the symptoms of dysphagia, to prevent strictures from recurring and to ensure a good quality of life post treatment[2]. The management strategy of corrosive stricture varies from conservative approach of endoscopic dilatation to an aggressive strategy of surgery in form of colonic interposition[3]. Management of Corrosive oesophageal stricture requires clinical acumen and experience to decide an optimal treatment strategy, to ensure a good quality of life post treatment. A subgroup of patients with recurrent or refractory esophageal stricture after endoscopic dilatation are referred for surgical management like coloplasty, which is the standard of care[4]. However, coloplasty is associated with morbidity including anastomosis leak, stricture, intestinal obstruction, conduit necrosis and mortality[5]. Besides, after coloplasty native esophagus cannot be evaluated for esophageal carcinoma, though the risk is very low

(0.3- 3.2%)[5],[6]. Endless string (ELS) guided bougie dilatation followed by self- bougienage, is a technique described in literature by Bapat et al in the management of corrosive esophageal stricture (CES)[7]. The present study evaluates the efficacy of ELS guided Savary Gillard (SG) dilatation followed by self-bougienage in patients referred for coloplasty after failed endoscopic management. This is a relatively less aggressive approach which overcomes the morbidity of coloplasty.

Material and Methods

This is a retrospective analytical study of prospectively maintained data of patients presenting with corrosive stricture of oesophagus presenting in our department from 2014 to 2023. Patients were evaluated using a standardized protocol comprising clinical history and examination, grading of dysphagia (as per Sugahara et al)[8], initial imaging (Barium Swallow, CECT with air swallow), upper GI endoscopy findings. Corrosive strictures were evaluated with respect to its site (cervical, thoracic or entire oesophagus, with stomach involvement if any), number of strictures (single or multiple), extent of stricture (short segment <5 cm or long segment >5 cm) and grade of stricture (high grade or low grade). Patients pre and post intervention changes in dysphagia grade, body weight, and quality of life (QOL) as per WHOQOL-BREF assessment was noted[9]. A subgroup of patients with passable permeable **(Figure1)**, long segment, refractory or recurrent esophageal stricture were considered for ELS guided dilatation. Patients with high cervical esophageal stricture were excluded from the study. ELS was inserted with the help of upper GI endoscopy assisted guidewire and retrieved surgically or in patients with failure to pass guidewire with endoscopy were subjected to either cervical exploration or retrograde bougie assisted passage of ELS during surgery **(Figure 2)**. This was followed by serial dilatation **(Figure 3)** using SG polyvinyl bougies (from 6 to 12 mm in diameter)[10]. Dilatation was considered adequate when 12mm SG dilator could be passed easily or with minimal resistance through the stricture and the patients were able to take

their normal oral diet without any discomfort. Following achieving diameter of 12 mm, patients were taught self-dilatation (SG 12), initially under supervision **(Figure 4)** in the outpatient department and once patients were doing self-dilatation satisfactorily, they were encouraged to do unsupervised self-dilatation at home daily. Follow up of the patients included regular visits initially every month for first 6 months, thereafter every three months and later bi-annually. Barium swallow/water soluble non-ionic contrast study was done in all patients, at 3 months and 6 months or when patient complained of dysphagia. Non responders, non-compliant (who required frequent supervised dilatation) or who develop complications of self-dilatation were subjected to coloplasty. Patients who were able to maintain esophageal diameter of 12 mm for 6 months, frequency of self-dilatation was decreased and if patient remained asymptomatic at the end of 1 year on self-dilatation, ELS was removed. The "Endless String" (ELS) technique is an established standard practice at our institution for the management of corrosive esophageal strictures. The present study represents a retrospective observational analysis of patients who underwent this routinely performed procedure as part of standard clinical care. As no deviation from standard treatment protocols was involved and no experimental intervention was introduced, formal approval from the Institutional Ethics Committee was not sought, in accordance with institutional policies for retrospective studies, patient confidentiality was strictly maintained, and informed consent for the procedure was obtained from all patients at the time of treatment.

Results

During the study period from 2014 to 2023, a total of 58 patients with corrosive esophageal stricture (CES) were referred for esophagocoloplasty. Of these,26 patients (44.8%) were considered feasible for Endless String (ELS) guided dilatation **(Figure 5)**. Two patients (7.7%) were lost to follow up before adequate oesophageal stricture dilatation and were excluded from

the analysis. The final study cohort therefore comprised 24 patients. The age of the patients ranged from 15 to 55 yrs, with equal sex distribution (12 males [50%] and 12 females [50%]). The intent of ingestion was suicidal in 13 patients (54.16%) and accidental in 11(45.83%). Eight patients (33.33%) had grade VI dysphagia, five (20.83%) had Grade V dysphagia, ten (41.66%) had Grade IV, and one patient (4.16%) Grade III dysphagia. Grade VI and V dysphagia was present in 13 patients (54.16%), all of whom required feeding jejunostomy for nutritional support. On barium swallow the site of CES was lower cervical oesophagus in one patient (4.16%), midthoracic esophagus in nine (37.50%) and combined cervical and thoracic in 14 patients **(Table1)**. Concomitant Gastric corrosive stricture was seen in 11patients (45.83%). Long segment strictures were present in 17 patients (70.83%).All the patients had undergone prior a trial of endoscopic dilatation. Endoscopic dilatation was not feasible in 17 patients (70.83%), failed in six patients (25%), and resulted in esophageal perforation in one patient (4.16%). In five patients (20.83%) ELS was inserted with the help of previously endoscopically placed guidewire. In 19 patients (79.16%) ELS was inserted following surgery, including cervical esophageal exploration in five patients (20.83%) retrograde insertion via gastric opening in 14 patients. Additional surgical procedure was required in 11 patients with concomitant gastric corrosive stricture as shown in (**Table 2)**. One patient (4.16%) underwent total gastrectomy with Esophagojejunostomy (EJ), seven patients (29.16%) underwent distal gastrectomy with Roux En Y gastrojejunostomy (GJ) and three patients (12.5%) underwent only Roux En Y GJ. A mean of nine sessions (range 5-14) of Savary Gillard bougie dilatation were required to achieve a 12 mm esophageal diameter. Normal swallowing was achieved in a mean duration of 6.6 months. Once the patients achieved esophageal stricture dilatation of 12 mm and were on regular self-dilatation with 12 mm SG dilator, 92% patients (n=22/24) had improvement in dysphagia from initial grades of IV-VI to post intervention grade of I-II; The remaining two patients (8%), who had limited improvement (from grade V &VI to grade IV),

subsequently required coloplasty as shown in Alluvial plot **(Figure 6)**. Mean body weight increased from 35.98 kg pre-intervention (25th–75th percentile: 33.5–39.2 kg) to 41.47 kg post-intervention (25th–75th percentile: 38.3–44.2 kg), indicating a consistent upward shift in the overall distribution as shown in Box -and-Whisker plot **(Figure 7).**Procedure related complications were, seven patients (29.1%) had local pain. Three patients (12.3%) had recurrent dysphagia during follow up which were managed with supervised in hospital SG dilatation Two (8.3%) of the five patient who required cervical exploration for ELS insertion developed salivary fistula which were persistent even after 12 weeks and required surgical closure **(Table 3)**. Two patients (8.3%) out of 24 patients who underwent ELS dilation, subsequently required coloplasty during follow up, one was non-complaint to self-dilatation and second patient developed false passage (**Figure 8)** in esophagus after 5 weeks of self-dilatation. In the initial days of self-dilatation, most of our patients reported increased psychological stress of daily dilatation and fear of complications. However, during follow up they reported good self-esteem, bodily image and appearance (Psychological health): less interference with daily and social activity (social relationship); homely environment while doing self-dilatation (physical health); reduced hospital visits and healthcare cost (Environment) in accordance with WHOQOL-BREF assessment.

Discussion

Corrosive esophageal stricture is common in India. It has a wide impact affecting not only physical and mental health, but also Quality of life and at times even social isolation. It is commonly seen in younger individuals, in our study most of the patients were young with mean age of 26.3 years, which is in accordance with the study by Saluja et al[11]. However, Cheng et al in their study have reported more than 50% of patients were above 40years[12]. CES are usually long segment, tight, eccentric and multiple[13]. In our study too, 70.83% (17 patients)

had long CES. Endoscopic dilatation is considered as the first line treatment for corrosive oesophageal stricture, with surgery being reserved for failed endoscopic dilatation[14]. Endoscopic dilatation can be done safely 4 to 6 weeks after corrosive ingestion and continued at 2 weekly intervals. It can be done using either bougie (most commonly SG dilators) or CRE ballon dilator[15]. A variable outcome following endoscopic dilatation has been reported in literature, with success varying from 40 to 90% and its association with higher rate of recurrence[16],[17]. The higher incidence of recurrence in patients with tight stricture is due to the dense cicatrisation that ensues following the ingestion of corrosive. Surgery in form of coloplasty, remains the only option for the patients of refractory or recurrent oesophageal stricture. Coloplasty is associated with a high incidence of complications (24 to 30%) including anastomotic leaks, pulmonary complications, sepsis and also a compromised quality of life[4],[5],[18],[19]. ELS guided dilatation has been described in literature by Bapat et al, with reasonable success. The striking feature of this technique is its safety, its success overcoming the need of surgery and the Quality of life it offers. The pre-requisite for the stricture to qualify for endless string dilatation is that it should be passable, permeable stricture as described by Bapat et al. In 26 patients with these characteristics of stricture, we performed ELS guided dilatation. The method of insertion of ELS was as described in the protocol, a method which has been published earlier by our group by Kurunkar et al[8]. In the present study, 70.8% (17/24) had long segment oesophageal stricture (>5cm). Patients with long segment stricture (>5cm) required an average of 10 sessions of dilatation, while those with short segment (<5cm) required only 7 sessions to achieve 12mm diameter with adequate dysphagia relief. The reason for long duration (6.6 months) required to achieve normal swallowing in the present study could be attributed to the fact that our majority of the patients had Grade IV (42%) and VI (33%) dysphagia a finding in accordance to other published studies[20],[21]. Besides 70.8% had long segment oesophageal stricture (>5cm). Broor et at in his series of 17 patients and

Guitron et al in his series of 24 patients have also reported higher sessions of endoscopic dilatation, 16 sessions and 14 sessions respectively, to achieve adequate relief of dysphagia[22],[23]. All patients achieving oesophageal luminal diameter of 12 mm with ELS guided SG dilatation were taught self-dilatation using SG dilators (10 ,12 no). They were motivated to do so regularly (once daily) to maintain 12 mm diameter of oesophageal lumen. This protocol led to success in 22/58 (38%) patients **(Figure 9)** maintaining a good swallow function obviating the need of coloplasty. No other complications like perforation of oesophagus, aspiration were observed following self-dilatation in our study except 2 who required coloplasty subsequently (1 non-compliant,1 false passage)During follow-up, patients reported improvements across several domains of the WHOQOL-BREF assessment reflecting a homely environment during self-dilatation and reduced interference with social activities. This observation underscores the importance of supervised dilatation prior to initiating self-domiciliary dilatation. The key to consistent successful self-dilatation is to always keep the patient motivated and reinforcing the appropriate technique of self-dilatation during follow up.

Conclusion

Endless String (ELS) guided Savary Gillard (SG) dilatation followed by self-bougienage in a select subgroup of patients with oesophageal corrosive stricture achieves successful esophageal luminal patency with relief of dysphagia obviating the need of coloplasty in compliant patients.

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Tables:

Table 1 : Characteristics of corrosive stricture (n=24).

Variables	**Values(n=24)**	**Percentage (%)**
Sex ratio (Male: Female)	12:12	
Intent of ingestion		
suicidal	13	54.1
accidental	11	45.8
Grade of Dysphagia*		
Grade I /II	Nil	0
Grade III	1	4.16
Grade IV	10	41.67
Grade V	5	20.83
Grade VI	8	33.33
Location of stricture		
Lower cervical	1	4.16
Midthoracic	9	37.5
Combined cervical and thoracic	14	58.3
Concomitant gastric stricture	11	45.8

*Sugahara S, Ohara K, Yoshioka H. Improvement of swallowing function in patients with esophageal cancer treated by radiology. Jpn Soc Cancer Ther.1996;31:1124-30

Table 2: Interventions done in 24 patients

Intervention	Patients(n=24)
Endoscopic assisted ELS insertion	5
Surgery Assisted ELS insertion	
Bougie assisted	14
Cervical exploration	5
Surgeries done for concomitant gastric stricture(n=11)	
Total Gastrectomy + Esophagojejunostomy	1
Distal Gastrectomy + Roux En Y Gastrojejunostomy	7
Roux En Y Gastrojejunostomy	3

Table 3: Complications of ELS guided SGE dilatation and self-dilatation

Complications	Patients (n)	Percentage (%)
Early		
Local pain	7	29.1
Long term		
Recurrent dysphagia	3	12.3
Salivary fistula	2	8
Failed dilatation	1	4.1
False passage (self-dilatation	1	4.1

Figure Legends:

Figure 1: Water soluble contrast showing passable permeable, long segment CES.

Figure 2: ELS across from nose (long arrows) to abdomen (short arrow).

Figure 3: Dilatation of CES with ELS guided SG dilator .

Figure 4: Supervised self-dilatation.

Figure 5: Flowchart Showing total 58 patients of CES

Figure 6: Alluvial Plot of dysphagia grade improvement (initial grade to 6 months post Intervention).

Figure 7: Box-and-Whisker Plot showing improvement in body weight.

Figure 8: Water soluble contrast showing CES(a) and false passage(b) as a complication of self-dilatation.

Figure 9: Water soluble contrast showing improvement in CES diameter with ELS guided SG dilatation followed by Self-bougienage (a-c before 6 months), images of same patient (d e) at 8 months of self-bougienage.

Figures:

Figure 1:



Figure 2:



Figure 3 :



Figure 4:



Figure 5:

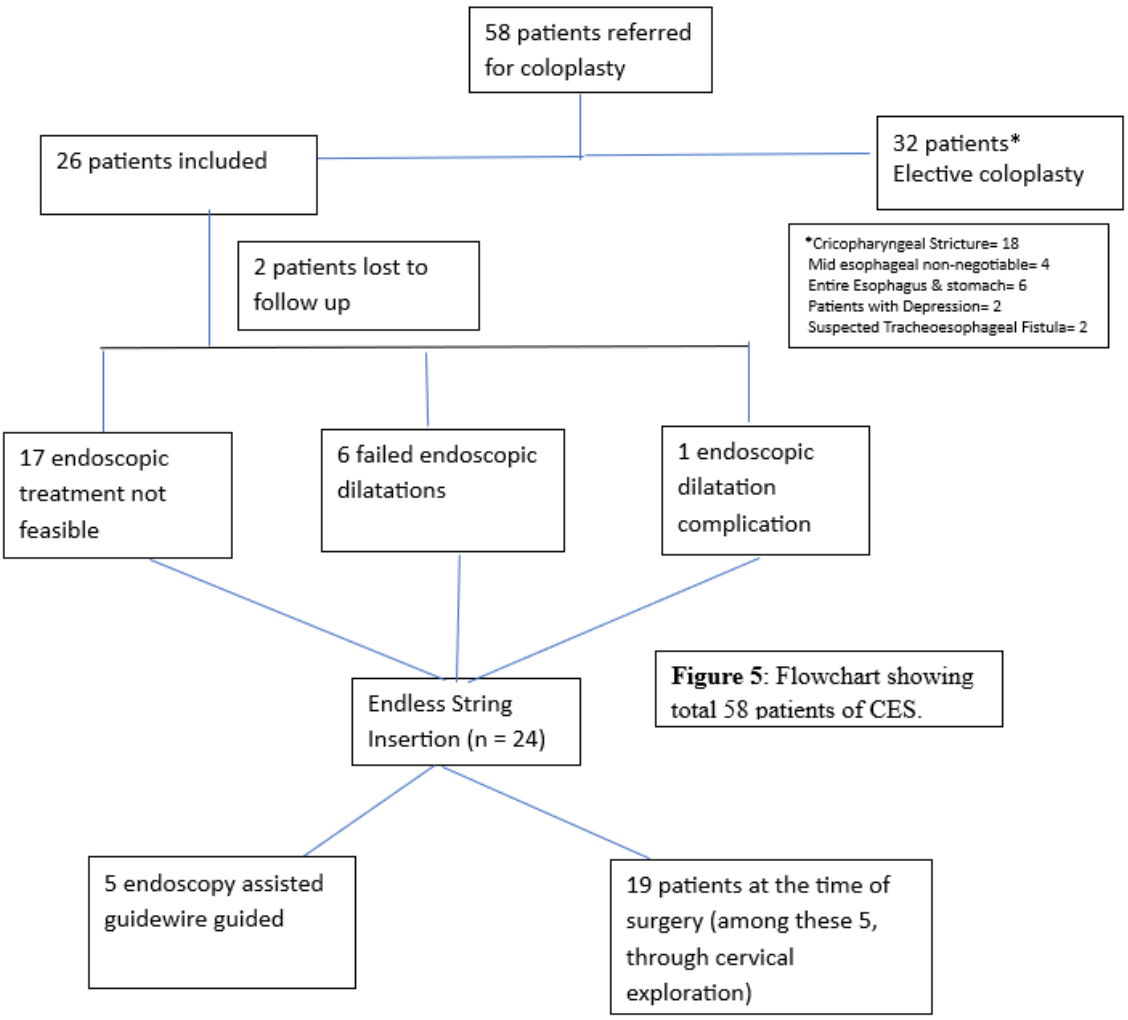


Figure 5: Flowchart showing total 58 patients of CES.

Figure 6:

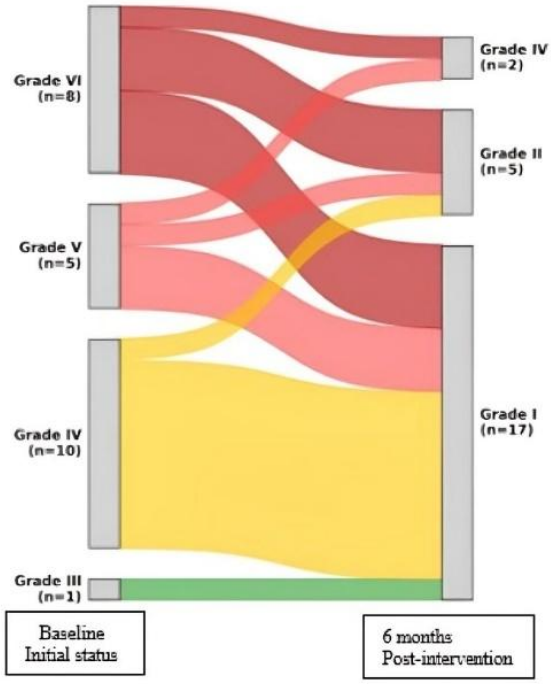


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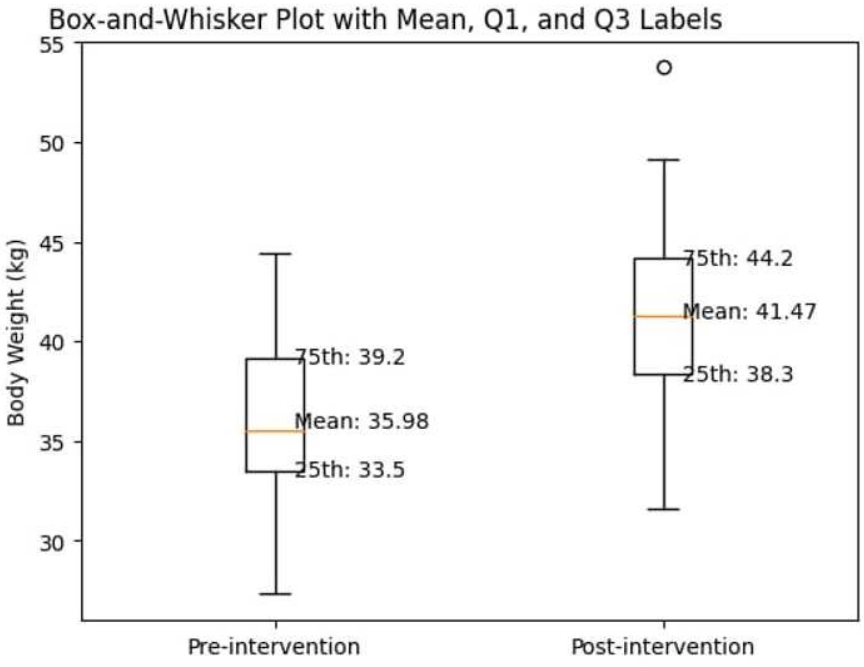


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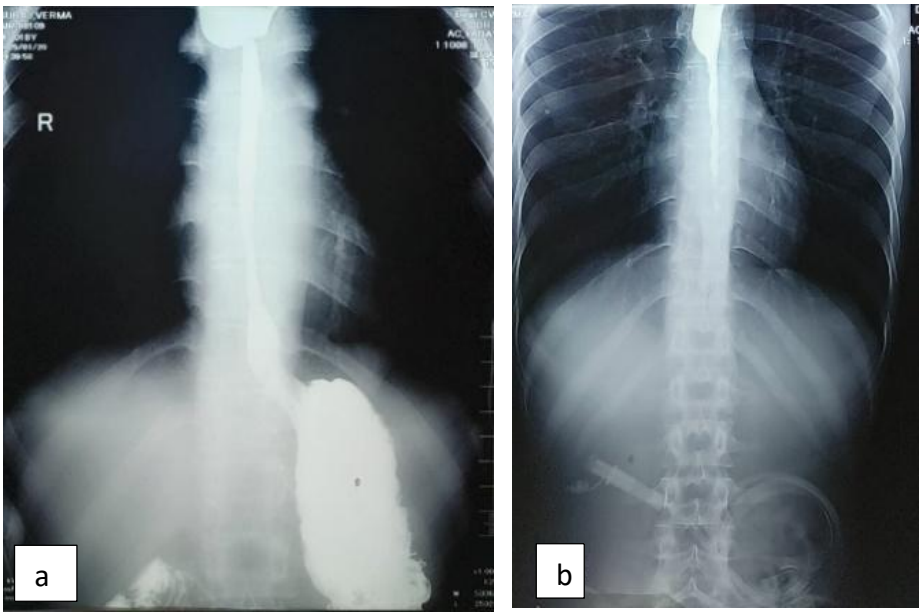
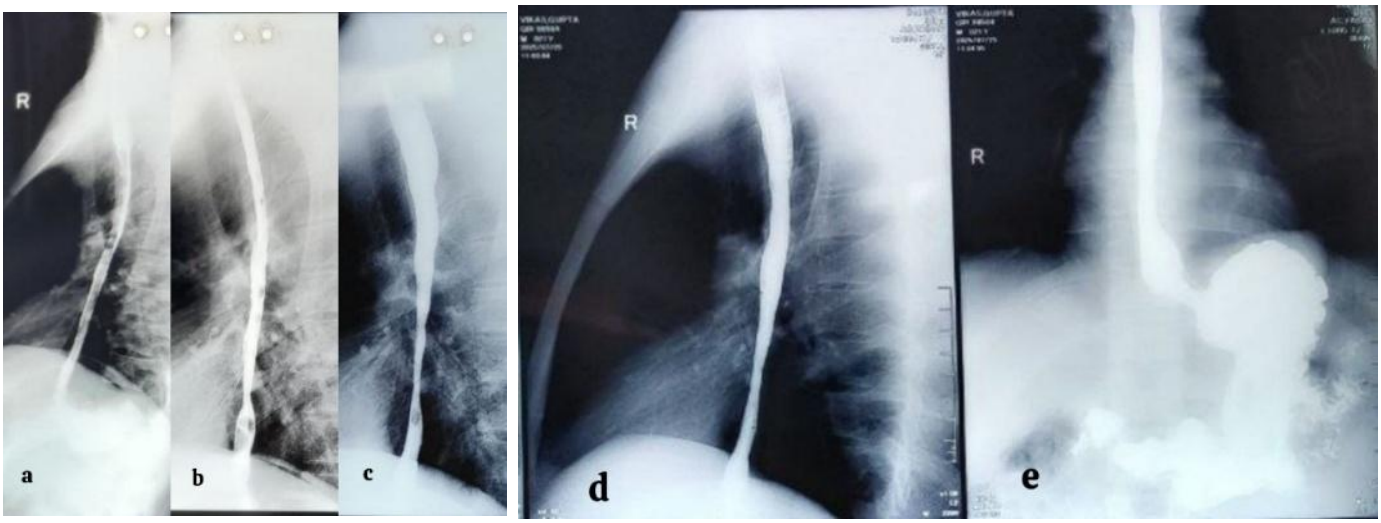


Figure 9:



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