We describe three male neonates where infant feeding tube (IFT) passed 18–20 cm in the upper esophageal pouch. A blunt-tipped red rubber catheter confirmed esophageal atresia (EA) with long upper pouch in all three cases. Definitive management revealed EA with tracheoesophageal fistula and long overlapping upper esophageal pouch consistent with Kluth Type IIIb variant in two patients. Importance of using red rubber catheter at the pediatric practice instead of IFT is stressed.

**Keywords:** Esophageal atresia, Kluth Type IIIb, long overlapping upper pouch, red rubber catheter

**INTRODUCTION**

Esophageal atresia (EA) is checked by passing a 10Fr infant feeding tube (IFT) from mouth to the stomach. If the tube does not pass beyond 10–13 cm, a diagnosis of EA is assumed, and radiographs are taken to establish the diagnosis.[1] On the other hand, if the tube passes beyond the usually encountered obstruction in EA, the diagnosis is ruled out.[2,3] We describe our experience with EA with tracheoesophageal fistula (TEF) and long overlapping upper esophageal pouch, along with mini-review of literature.[3-8]

**CASE REPORTS**

**Case 1**

A 2-day-old term male baby, weighing 2100 g, presented with excessive salivation and vomiting after attempted feeds. IFT passed approximately 20 cm giving false impression that the tip is in the stomach while it remained coiled up in the long, dilated upper esophageal pouch. As the symptoms persisted, pediatric surgical opinion was sought; radiographs with red rubber catheter **in situ** confirmed the presence of obstruction at T8/T9 vertebral level [Figure 1]. Esophagogram revealed upper pouch at a T5 vertebral level [Figure 1]. Thoracotomy was performed through the right fifth intercostal space. It confirmed elongated, dilated, upper pouch with overlapping of both segments with features consistent with Kluth Type IIIb variant. There was presence of thin lower end along with fibromuscular strands between the two segments as shown in the diagrammatic representation [Figure 1]. Fistula ligation and end-to-end esophageal anastomosis was performed. Outcome was favorable.

**Case 2**

A 9-day-old preterm male (twin) baby, weighing 1500 g, presented with severe respiratory distress with subcostal recession. There was a history of vomiting after attempted feeds. IFT test was done and it passed 18 cm in the long upper pouch. A radiograph with the red rubber catheter revealed obstruction at T8 vertebral level. The neonate was resuscitated and treated for severe acute pneumonia but had unfavorable outcome, before surgical intervention could be contemplated.

**Case 3**

A 1-day-old term male baby, weighing 2800 g, presented with excessive salivation from the mouth. IFT went up to 20 cm and remained coiled up in the long upper pouch. Radiographs with red rubber catheter showed the presence of obstruction at T6/T7 vertebral level [Figure 2]. Operative findings were similar to Case 1 except there was absence of fibromuscular...
strands between the segments [Figure 2]. Outcome was favorable.

**Discussion**

Pitfalls of its using IFT in diagnosing EA are: (i) IFT may coil up in the upper pouch giving a false impression that it has been passed down into the stomach. Therefore, its tip should be confirmed with radiographs. (ii) Accidental transtracheal gastric intubation through TEF. (iii) It may pass up to a significant length in the elongated, overgrown upper esophageal pouch (as seen in our cases). This leads to delayed diagnosis, and therefore, its use is to be deprecated in ruling out EA; instead use of no. 10 sterile, blunt-tipped red rubber catheter cannot be overemphasized shortly after birth. This test should be performed by trained personnel, taking care to prevent esophageal injury or perforation. For prematures, smaller sized catheter must be used.

The overgrown upper esophageal pouch is extremely rare and is seen with: (a) Kluth Type I3 – extremely long upper esophageal blind pouch with agenesis of distal esophagus, Durston (1670), (b) Kluth Type IIIb6 – EA with distal TEF and a long upper esophageal blind pouch with overlapping of the segments, Dafoe and Ross (1960), (c) Kluth Type V5 – long overlapping of the upper esophageal blind pouch and distal esophagus with sharing of common muscular wall along practically whole segment of duplication, Yahr et al. (1962). Lower esophageal web is a sub-type of Kluth Type VIII2 EA in which obstructing mucous membrane (membranous stenosis) is present in lower one-third of the esophagus. Kluth Type VIII5 is also known as lower esophageal ring due to muscular hypertrophy at the distal end of the esophagus.

These two types would also mimic long upper esophageal pouch. During a 7-year period from 2010 to 2016, a total of 1554 neonates with EA were managed at our institute. Only three neonates had overgrown (long) upper esophageal pouch while Kluth Type IIIb6 variant could be confirmed intraoperatively in two. Summary of all cases reported in the literature is described in Table 1. Red rubber catheter confirmed the level of esophageal obstruction in all the three patients. Esophagogram should be performed, especially in cases with diagnostic dilemma, long upper pouch, and ruling out upper pouch fistula. It also helps in deciding the surgical approach. Esophagogram must be performed both with and without red rubber catheter in situ. The level of upper pouch without the catheter was higher than with catheter in situ (Case 1). In contrast study with IFT or catheter in situ, the upper pouch was reaching the diaphragm. This change in the level of upper pouch may be due to the elastic recoil of the dilated upper pouch in Kluth Type IIIb6 variant. If the level of upper pouch is observed to be same in both the radiographs (with and without catheter), other possibilities such as esophageal stenosis and web (absence of recoil) may also be considered.

Preoperative esophago-bronchoscopy helps to identify proximal fistula and ruling out web. Filston et al. recommended routine preoperative endoscopy in all neonates with EA despite a radiologically gasless abdomen to rule out distal TEF.
Table 1: Clinical profile, management, and outcome of patients with esophageal atresia Kluth Type IIIb, and comparison with the earlier reported cases

| Particulars                  | Case 1                  | Case 2                  | Case 3                  | Yhoshu et al. | Kondo et al. | Rathod et al. | Rathod et al. | Dafoe and Ross |
|------------------------------|-------------------------|-------------------------|-------------------------|---------------|--------------|---------------|---------------|----------------|
| Age and sex (male/female)    | 3 days, male            | 9 days, male            | 1 day, male             | Polyhydramnios | Polyhydramnios | Polyhydramnios | Polyhydramnios | Polyhydramnios |
| Antenatal diagnosis          | Polyhydramnios          | Nil                     | Nil                     | Absent gastric bubble | Absent gastric bubble | Absent gastric bubble | Absent gastric bubble | Absent gastric bubble |
| Chief complaints             | Excessive salivation    | Respiratory distress    | Excessive salivation    | -              | Excessive salivation | Excessive salivation | Excessive salivation | Difficulty in breathing |
|                             | Vomiting after attempted feeds | pneumonia (twin‑female pneumonia, NNJ) | Vomiting after attempted feeds | -              | Vomiting after attempted feeds | Vomiting after attempted feeds | Vomiting after attempted feeds | - |
| Coiling of 10 Fr IFT from the lower lip | 20 cm                    | 18 cm                   | 20 cm                   | 18 cm                  | 25 cm                  | >20 cm                  | -                 |
|                             | Coil‑up catheter in esophagus | Coil‑up catheter in esophagus | Coil‑up catheter in esophagus | Coil‑up catheter in esophagus | Coil‑up catheter in esophagus | Coil‑up catheter in esophagus | Coiling in the mouth | - |
| Upper pouch (measured by 10 Fr IFT) | T8                      | T8                      | T8                      | T8                      | T8                      | T8                      | -                 |
|                             | Vertebral level          | Vertebral level         | Vertebral level         | Vertebral level        | Vertebral level         | Vertebral level         | Just above diaphragm |
| Upper pouch (measured by RRC) | T8/T9                   | T8                      | T6/T7                   | T8                      | T8                      | T8                      | -                 |
|                             | Vertebral level          | Vertebral level         | Vertebral level         | Vertebral level        | Vertebral level         | Vertebral level         | Lower than usual |
| Esophagogram (upper pouch vertebral level) | T5                      | Nil                     | Nil                     | Nil                     | Long, dilated          | Long, dilated          | Long dilated just above diaphragm |
|                             |                         | Cardiac murmur          | Acute pneumonia         | Just above the diaphragm | Small ASD PDA          | Double‑outlet right ventricle vertebral body ribs | Lower one-third of the thorax |
| Associated anomalies/ comorbidities | Nil                    | Nil                     | Nil                     | Fistula posteriorly at level of carina | Fistula not identified | Fistula not identified | Fistula not identified |
| Preoperative esophago‑bronchoscopy | Right 5th ICS | Right 5th ICS | Right 5th ICS | Right 5th ICS | Right 5th ICS | Right 5th ICS | Right 5th ICS |
| Thoracotomy                  | Right 5th ICS           | Right 5th ICS           | Right 5th ICS           | Right 5th ICS         | Right 5th ICS         | Right 5th ICS         | Right 5th ICS |
| Upper pouch                  | Elongated               | Elongated               | Elongated               | Elongated             | Elongated             | Elongated             | Elongated             |
|                             | Dilated colon‑like      | Redundant               | Elongated               | Close to the diaphragm | Elongated             | Elongated             | Dilated up to diaphragm |
| Fistula level                | Trachea                 | Trachea                 | Trachea                 | Carina                | Trachea               | Trachea               | Trachea               |
| Overlapping                  | 2.5 cm                  | 3 cm                    | 3 cm                    | 3 cm                  | 3 cm                  | 3 cm                  | 3 cm                |
| Postoperative complications  | Nil                     | Nil                     | Nil                     | Ventilatory support -5 days | Nil                  | Nil                  | Nil                  |
| Outcome                      | Favorable               | Favorable               | Favorable               | Favorable             | Favorable             | Favorable             | Favorable             |
| NNJ: Neonatal jaundice, IFT: Infant feeding tube, ICS: Intercostal space, T: Thoracic, RRC: Red rubber catheter, ASD: Atrial Septal Defect, PDA: Patent Ductus Arteriosus

Right posterolateral thoracotomy has the advantage of identifying the anatomical details and ease of repair. Knowledge of this entity could have prevented unnecessary initial gastrostomy with retrograde esophagography as reported by Kondo et al. In the presence of fibromuscular strands between the two segments, the dissection must be done meticulously for the preservation of the vascularity of the ends. Operative procedure is easy in terms of dissection and mobilization of upper pouch. Anastomosis is tension free and favorable outcome is expected if associated cardiac anomalies, sepsis, and pneumonitis are absent.
**Conclusion**

Kluth Type IIIb6 EA is very rare. There is usually a delay in diagnosis as IFT passes for a considerable distance and gets lodged in the elongated upper pouch, giving the false impression of lying in the stomach. Importance of using red rubber catheter at the pediatric practice is stressed for preventing the delayed diagnosis and unfavorable outcome.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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