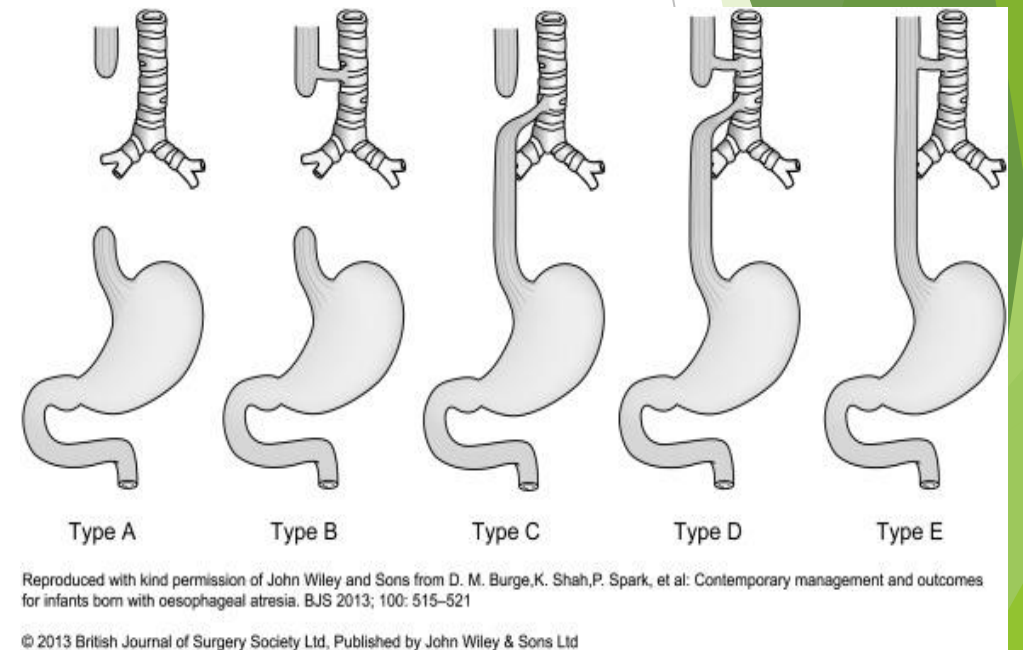


Recurrent TOF (rTOF)

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Introduction

- ▶ OA ± TOF (EA ± TEF) is a fascinating problem
- ▶ Incidence 1:2500/3500
- ▶ sometimes be challenging to repair
- ▶ Infants with gross type C can usually be repaired without significant complications
- ▶ sometimes be challenging to repair
- ▶ survival rate of Gross type C EA/TEF without severe malformation reported in the relevant literature is higher than 90%



Leaking rate post TOF repair & rTOF

- ▶ Leak rate is the expected 15% to 20% TOF repair - (Spitz in 2007)
- ▶ Eventually then increase chance for developed rTOF
- ▶ These symptoms were evaluated with a contrast study looking for reflux and may ended up showing the rTOF
- ▶ K. E. Ghandour, L. Spitz, J. Paed Child Health 1990
275 infants with OA+/- TOF were operated.
22 (8%) developed rTOF.
- ▶ S.W. Bruch et al. JPS 2010
rTOF occur in about 5% to 10% of cases

Pathogenesis of rTOF

- ▶ Technically inadequate closure of original TOF operation
- ▶ Complication of oesophageal anastomosis
ischaemia, leak and, or stricture
- ▶ Tracheal injury at original repair
- ▶ Juxtapositioning of oesophageal and trachea suture line
- ▶ Missed proximal fistula (Gross Type D)
- ▶ Premature/SGA baby
- ▶ Repeating Oesophageal dilatation

M.Zhang et all. JPS 2021

- ▶ 135 rTOF
- ▶ 62(46%) anastomotic leak
- ▶ 77(57%) anastomotic stricture

Symptom & sign rTOF

- ▶ Manifested swallowing difficulties eg dysphagia, feeding refusal
- ▶ Respiratory symptoms coughing, choking, apneic or cyanotic attacks, to recurrent respiratory infections.
- ▶ Symptoms usually occurred relatively soon after the original repair
- ▶ Few pts were late diagnosed after their original diagnosis if the sx were ignored
- ▶ Symptoms are often difficult to distinguish from
 - those of tracheomalacia
 - gastroesophageal reflux (GER)
 - esophageal motility
 - Oesophageal stricture
 - duodenal atresia
- ▶ For asymptomatic its may discovered on routine contrast studies

Diagnosis of rTOF

- ▶ rTOF can be missed quite easily on routine contrast studies
- ▶ Prone pull-back oesophagogram method
- ▶ It must be slow and best is video recording
- ▶ Tube place down to the gastroesophageal junction,
- ▶ Place infant prone position
- ▶ Inject water soluble contrast while is pulled back into the proximal oesophagus
- ▶ Should be do with careful

Kaiyun Hua et all Dis of Esophagus 2020

- ▶ esophagram, positive rate was 85.71% (24/28).
- ▶ Bronchoscopy was performed in all patients and was successful in all cases (100%).

Esophagram showing a recurrent TOF with contrast running off into the distal bronchus.

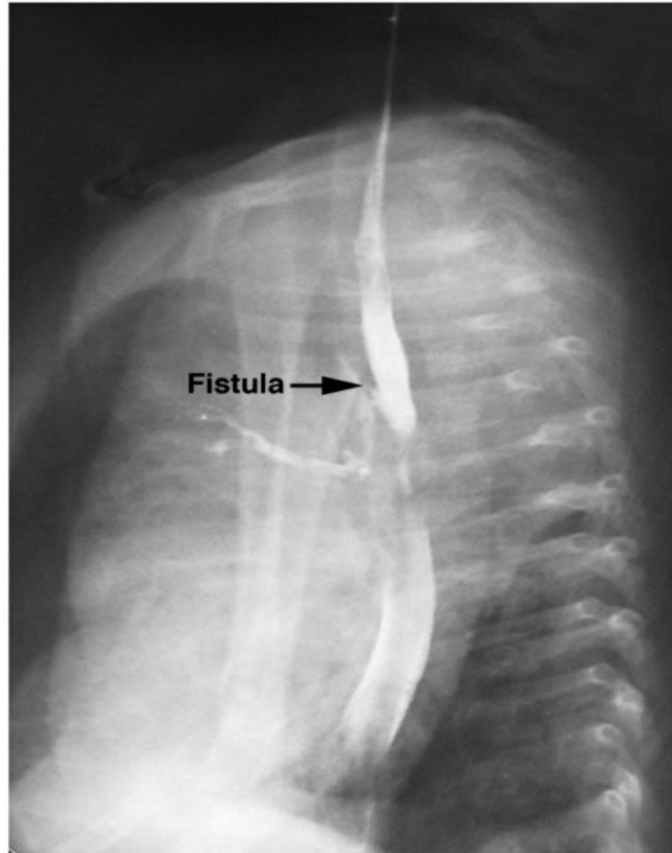


Fig. 1 Esophagram showing a recurrent TEF with contrast

recurrent TOF seen on routine barium swallow.

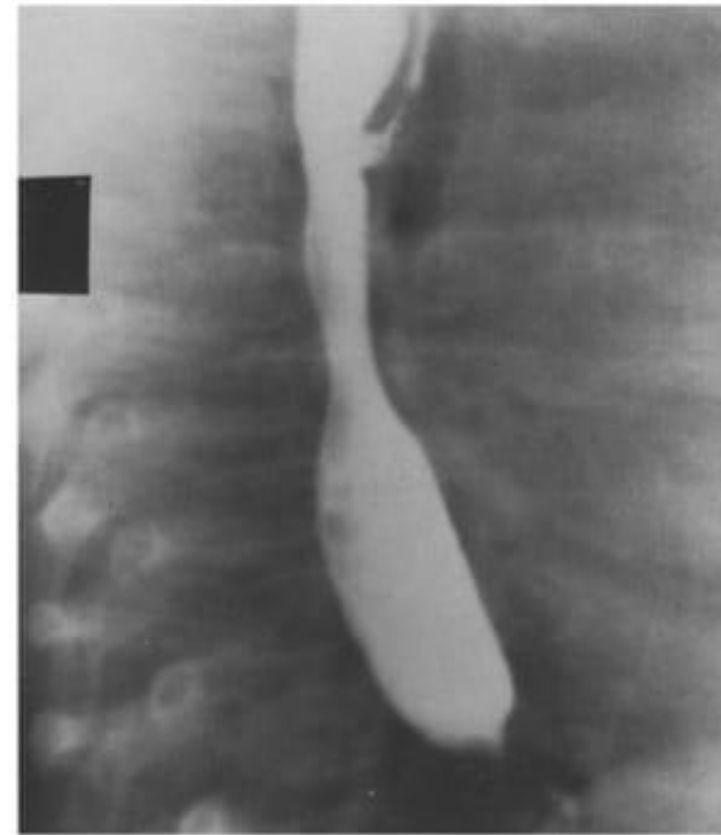
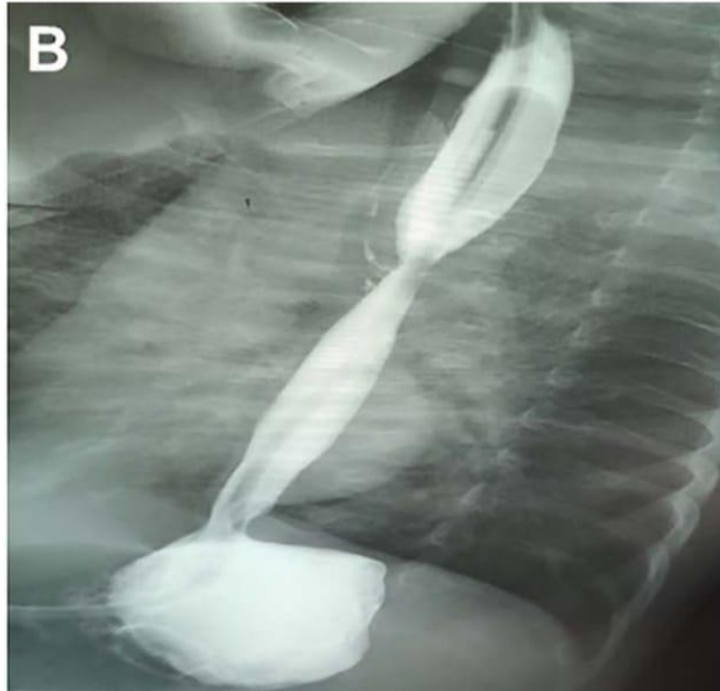
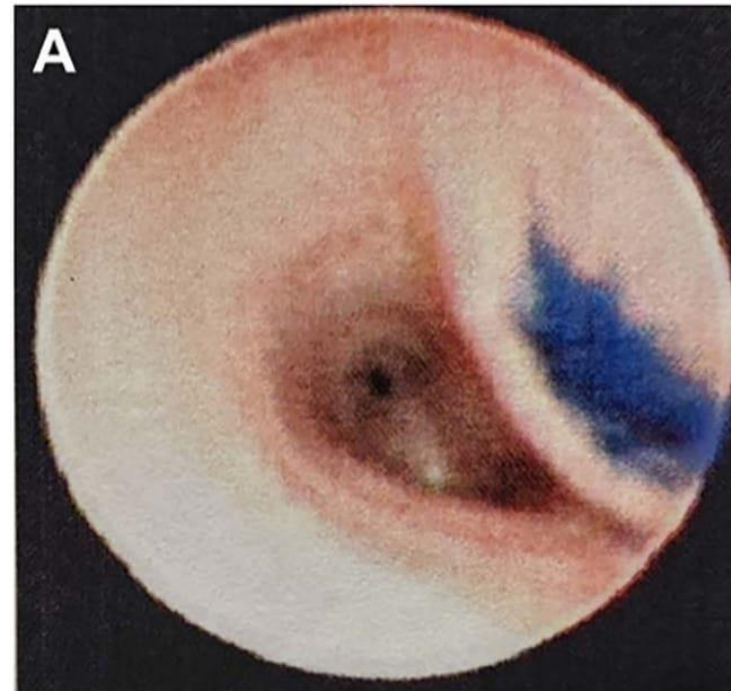


Fig. 3. Recurrent TEF seen on routine barium swallow.

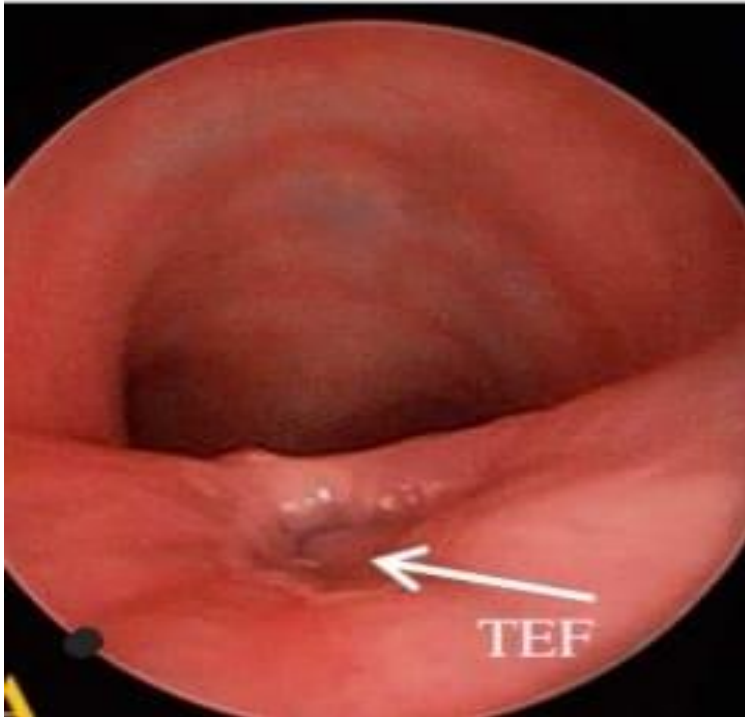
Esophagram shows rTOF complicated by esophageal stricture



Fiberoptic bronchoscopy shows the positive methylthionine chloride



Bronchoscopic image of the recurrent TEF



Methylene blue dye in oesophagus



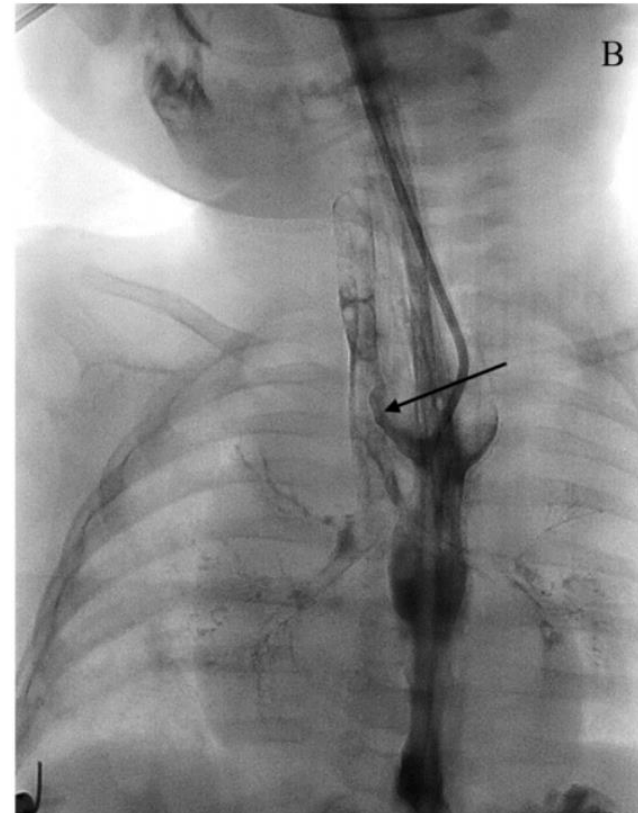
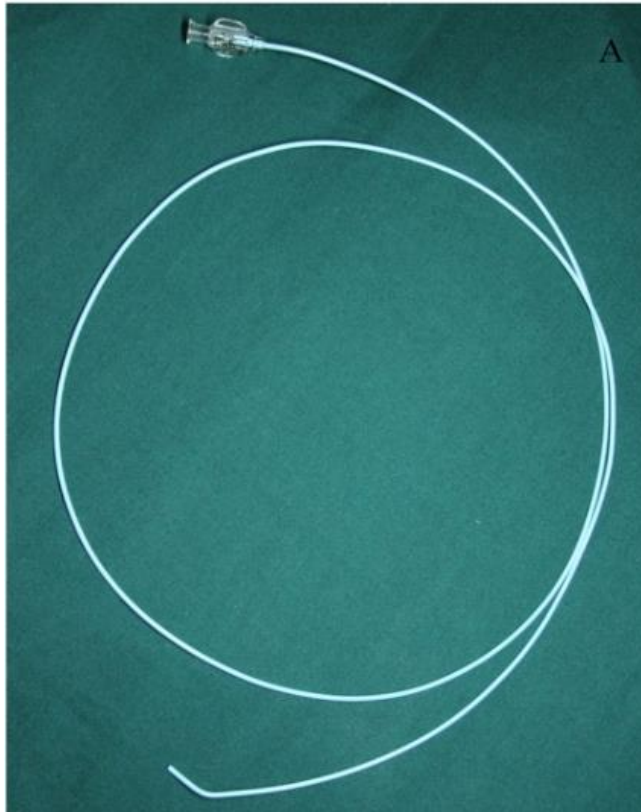
Original Article

Management of recurrent tracheoesophageal fistula after esophageal atresia and follow-up

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Diagnosis rTOF(cont)

W. Bruch et al. JPS 2010

- ▶ 24 child Dx with a contrast study and then confirmed with bronchoscopy
- ▶ 2 child, a dye study was required to confirm the presence of the TOF
- ▶ Most of rTOF were located almost at the site of the original TOF
- ▶ Few of the fistula was found at the site of an injury on the trachea that occurred during the original operation

K. Hua, S. Yang, et al. JPS 2022.

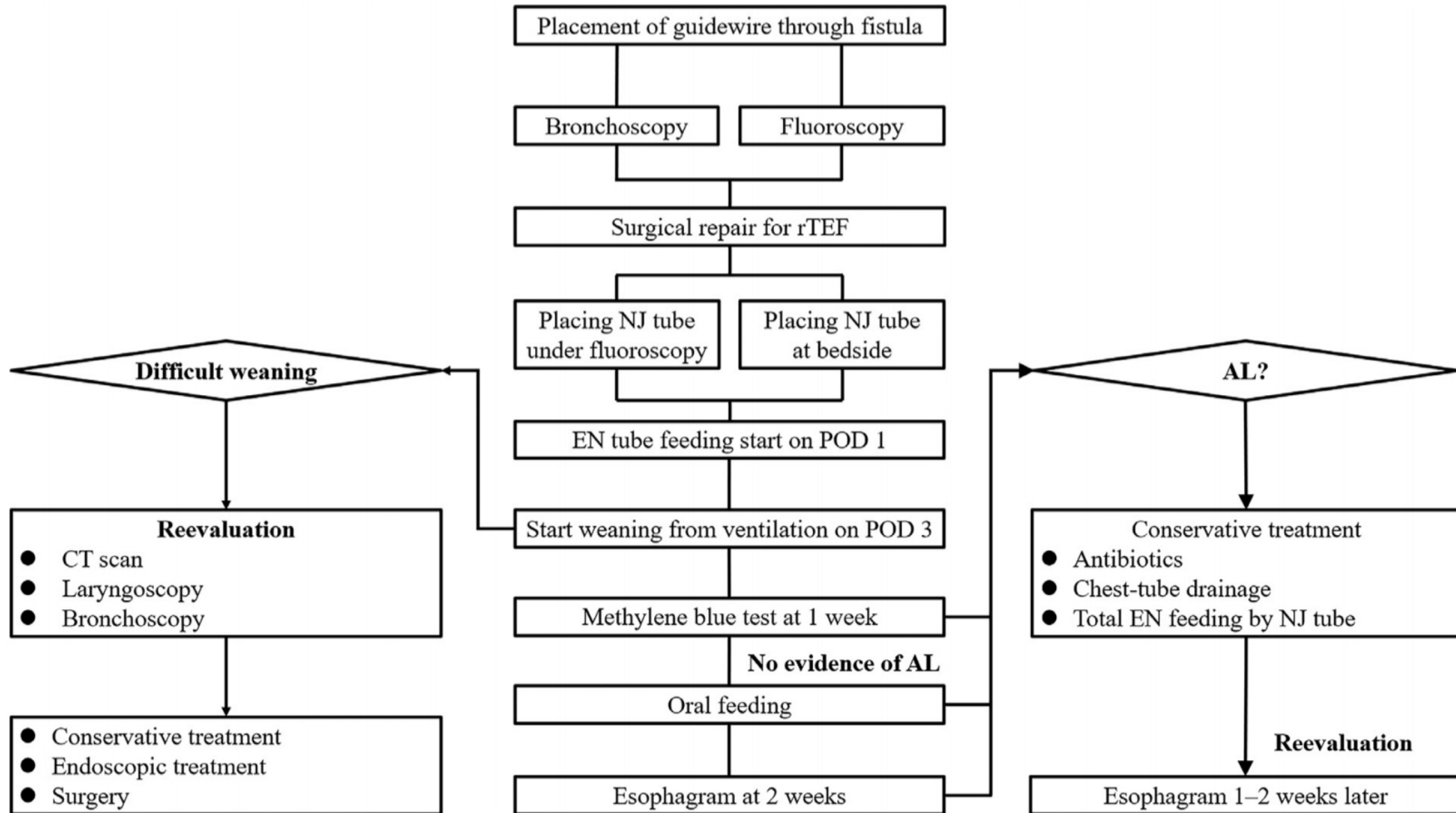
- ▶ 103 of TOF
- ▶ rTOF to
 - the trachea (n = 97, 94.17%)
 - the bronchi (n = 4, 3.88%)
 - lung parenchyma (n = 2, 1.94%)

Treatment after Dx rTOF

- ▶ Once diagnosis was made,
- ▶ Nasogastric tube was placed at the level of the fistula continuously aspirate the contents of the esophagus.
- ▶ May intermittent aspirate if content not too much
- ▶ Oral feeding was immediately ceased
- ▶ Enteral feeding was started via a nasojejunal tube
- ▶ Oral feeding with thickened formula may considered
- ▶ Antiinfection treatments

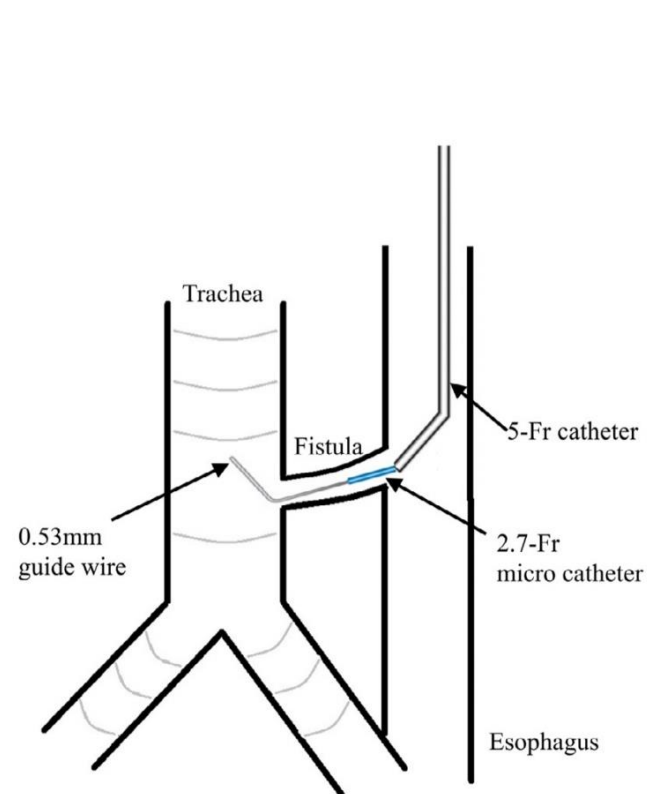
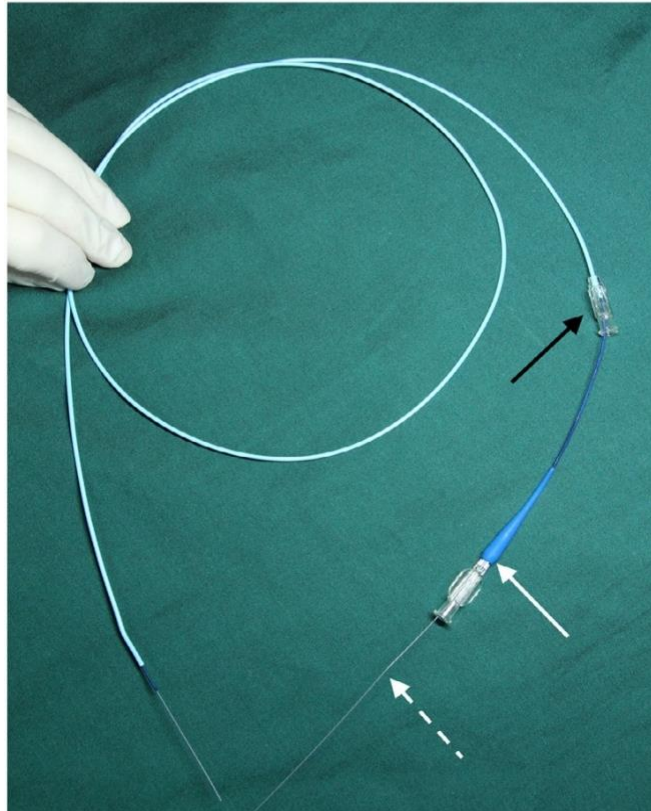
Timing of operation

- ▶ Timing of the operation for rTOF is still controversial.
- ▶ Children under 1 month in age are not recommended for early repair due to inflammation and edema,
- ▶ It may complicate the identification of the fistula.
- ▶ In addition, the tissue is brittle, which can lead to a high probability of re-recurrence.
- ▶ Pulmonary infection and nutritional status are also important factors to consider poor
- ▶ Pneumonia control and severe malnutrition may affect the patient's surgical tolerance and the healing process of the fistula ends.
- ▶ Most cases of pneumonia after rTOF can be controlled, or at least partially controlled, by conservative treatment
- ▶ Some patients show no response, which can be risky for surgery. The timing of such surgery needs to be further explored.



The algorithm of perioperative management in patients with rTEF (recurrent tracheoesophageal fistula). NJ, naso-jejunal; AL, anastomotic leak; EN, enteral nutrition.

Before thoracotomy Introducing guidewire Via bronchoscopy



The placement of a catheter through the fistula

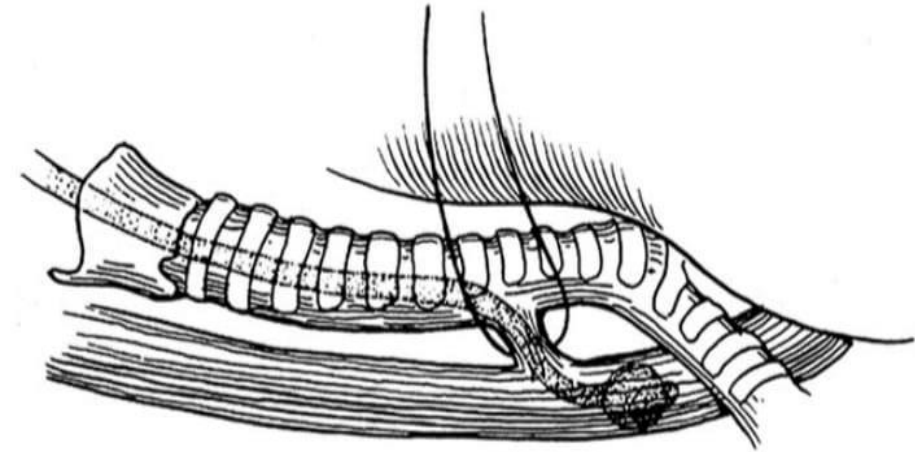
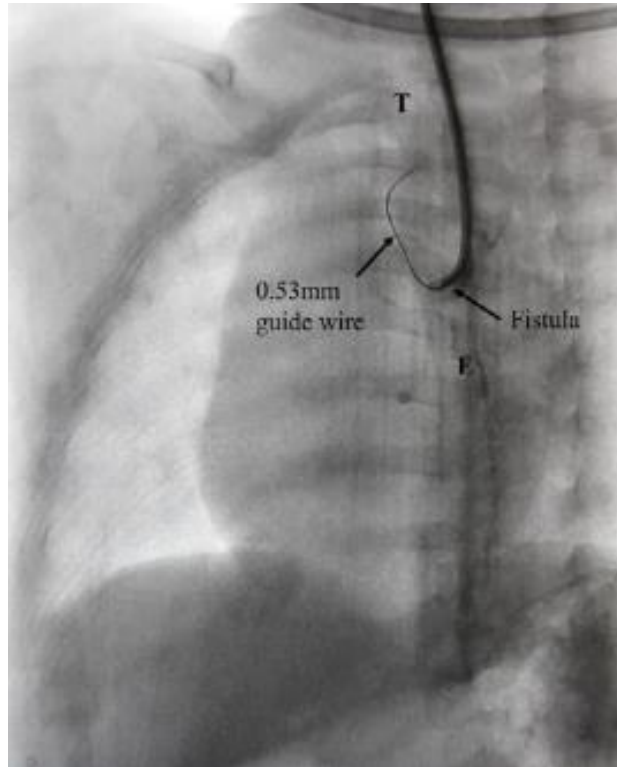


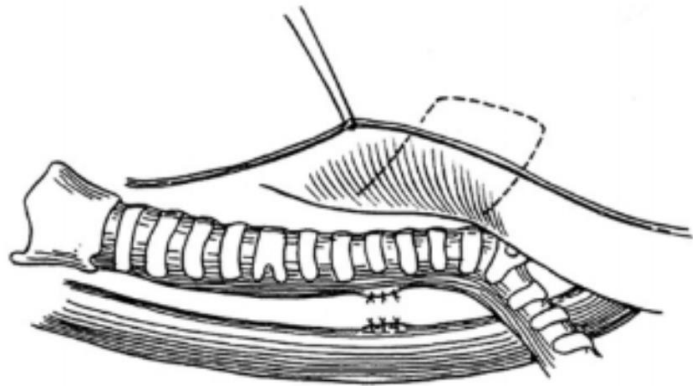
Fig. 2 Depiction of a Fogarty catheter placed through the TEF via bronchoscopy. Having this catheter in place makes locating the fistula at the time of repair much easier.

Operative procedure

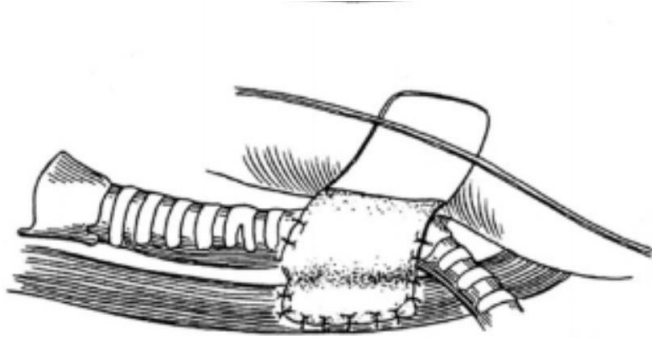
- ▶ Densest scarring is often located in the esophageal anastomosis from the first surgery and around the rTOF.
- ▶ Dissection of esophagus from the cervical pleura and distal parts of the scarring
- ▶ Kept the middle part and the densest part, thus, we could find the rTOF carefully
- ▶ Fistula can be found by palpating the guide wire
- ▶ Area of fistula, the airway end of the fistula can fluctuate with air leaks from ventilation.
- ▶ Proximal and distal esophagus were sling for further exposure of the rTOF.
- ▶ A 5-0 monofilament suture was used to sew up and close the tracheal end of the fistula before cut

Operative procedure(cont)

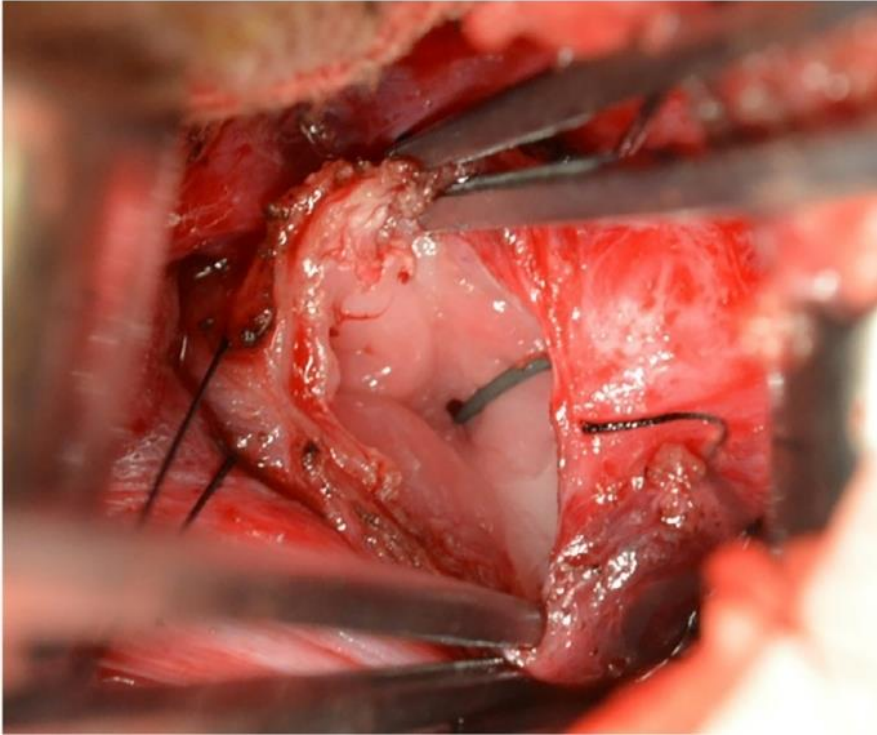
- ▶ Both incised ends of the fistula were closed using interrupted suture
- ▶ Tracheal end of the fistula was sutured twice to ensure that it was closed completely
- ▶ Free part of the prevertebral fascia was placed between the two ends of the fistula to isolate the ends, which is known to prevent re-recurrence of the fistula. After the repair,
- ▶ Inflate the lungs to look for leaking at trachea site,
- ▶ Chest drainage tube was placed



- ▶ repairs entailed locating the fistula
- ▶ separating the trachea from the esophagus sharply
- ▶ Sutured both of fistula
- ▶ Repair with non absorbable or extended absorbable suture



- ▶ Placing some type of tissue between the suture lines to prevent future recurrences.
- ▶ Multiple types of tissue were used for this purpose including
 - pleura
 - pericardium
 - muscle flap
 - lymph nodes
 - omentum via hiatus



- ▶ Guide wire in the rTOF

Postoperatively

- ▶ Keep ventilated n sedated
- ▶ NBM
- ▶ RT tube, if disloughed not reinsert
- ▶ Careful reintubation
- ▶ Look for lung contusion
- ▶ Chest physio to encourage lung expansion
- ▶ Look for leaking ie chest tube or other parameter
- ▶ Lung infection
- ▶ Contrast study

Post op complication

For oesophageal complication

- ▶ Leaking
- ▶ Stricture
- ▶ Trachea injury
- ▶ Recurrent fistula

S.W. Bruch et al. JPS 2010

Contrast postoperatively-25 childrens

7 leaks, 5 being minor and resolving
by the next contrast study

4 strictures

3 resulted in a second TOF

K. Hua, S. Yang, Q. Tao et al. JPS 2022.

103 rTOF

- ▶ 13 leak, 39 stricture
- ▶ 11 patients developed recurrence
- ▶ Five patients were cured after repeated thoracoscopic.
- ▶ One patient experienced a third rTOF after surgery
- ▶ During a median of 33 months of follow-up,
87 patients survived,
10 were lost to follow-up
6 died (severe Pneumonia n resp failure)

K. E. GHANDOUR, L. SPITZ, J. Paediatr, Child Health 1990

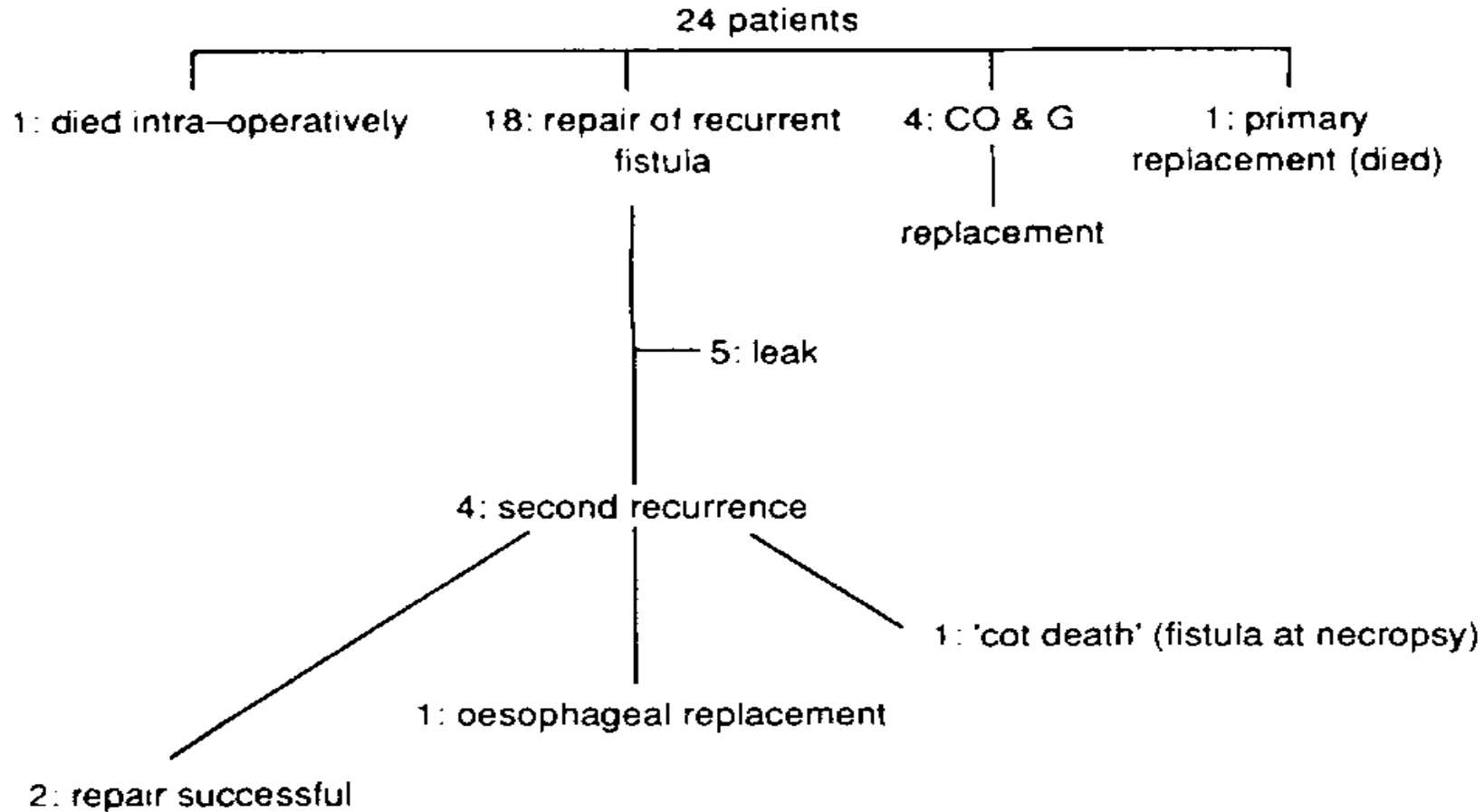


Fig. 1 Operative results in 24 infants with recurrent tracheo-oesophageal fistula. CO & G, cervical oesophagostomy and gastrostomy.

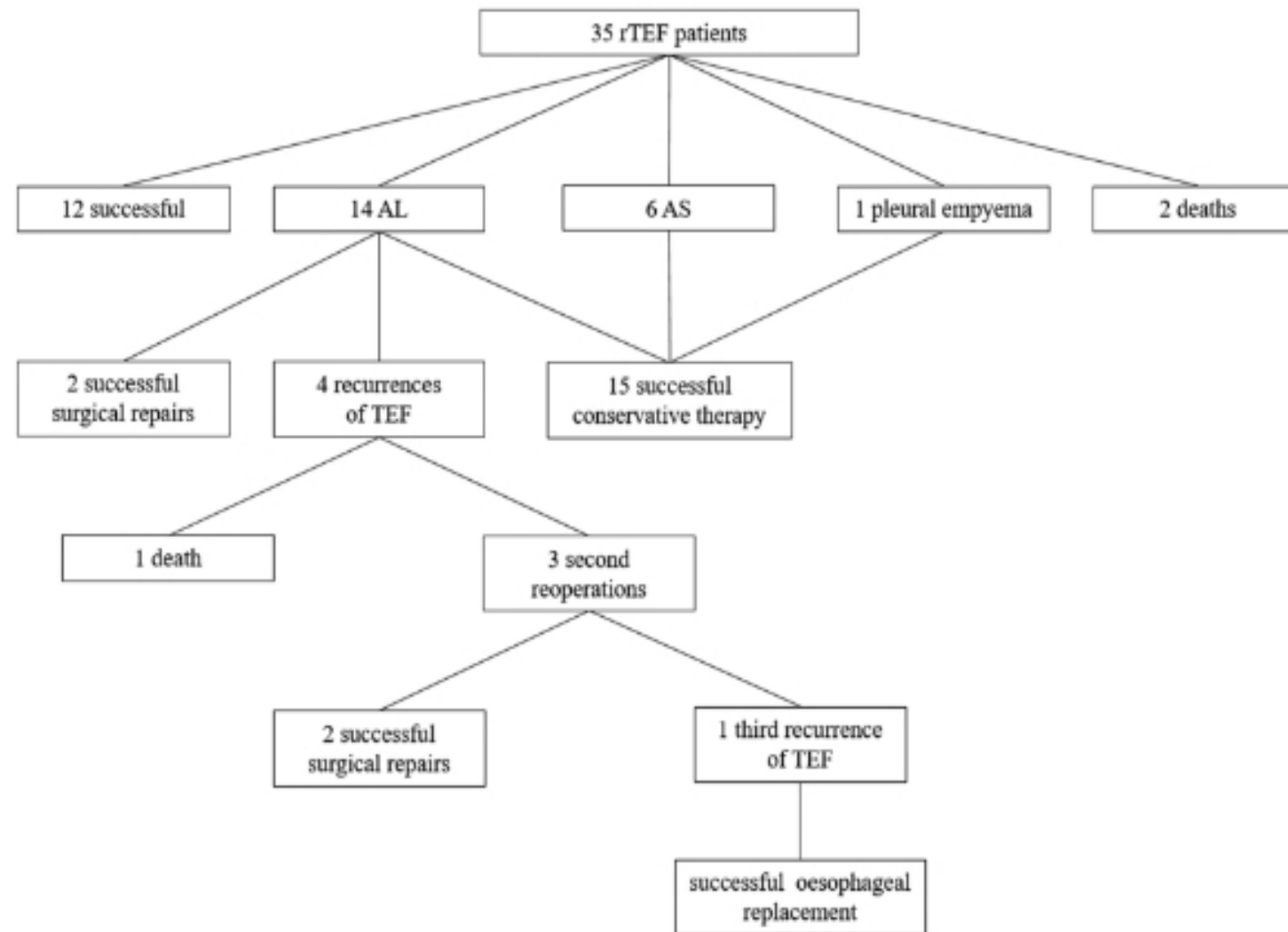


Fig. 2 Flow diagram illustrating the outcomes of all 35 patients. AL, anastomotic leak; AS, anastomotic stricture.

Follow up

- ▶ Look pathological gastroesophageal reflux (GER)
- ▶ Do contrast study and esophageal pH monitoring.
- ▶ GER - treated with proton pump inhibitors
- ▶ If worsen eventually underwent fundoplication.
- ▶ Growth was evaluated during follow-up
- ▶ centiles of all survivors
- ▶ Feeding-related problems (such as a prolonged mealtime refusal to eat coughing during feeding vomiting
- ▶ severe respiratory complications such as persistent coughing recurrent pneumonia asthma

Take home messages

- ▶ 1st operation of OA need to do meticulously to prevent rTOF
- ▶ Contrast study post repair is indicated for early diagnosis
- ▶ rTOF is no easy to diagnosis ie if we think there is rTOF further evaluation need to do
- ▶ Operation of rTOF is challenging and risk of morbidity & mortality is high
- ▶ Follow up of rTOF need to be manage in multidiscipline team

Thank You

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the frame, creating a modern, layered effect against the white background.