Laparoscopic fundoplication in infants with life-threatening gastroesophageal reflux disease and associated anomalies as a predictor for surgical intervention

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ABSTRACT

Gastroesophageal reflux disease (GERD) is most commonly seen in infancy. The symptoms abate without treatment in 60% of infants by the age of 6 months while approximately 90% of infants have complete resolution of symptoms by the age of 8–10 months. Infants with severe or life-threatening complications of pathological GERD that is unresponsive to medical therapy can be considered for surgical therapy despite their comorbid illnesses and increased risk for morbidity and mortality. The main type of anti-reflux surgery is fundoplication particularly laparoscopic Nissen fundoplication. Here, we describe a case series of four infants with life-threatening aspiration pneumonia who underwent laparoscopic Nissen fundoplication with gastrostomy button insertion in a single center performed by a single surgeon for complications arising from severe GERD, not responding to medical therapy. Out of four infants, three had complete resolution of symptoms and are thriving well highlighting the vital role played by this novel surgery in treating such infants after failed medical management. However, one infant died of severe morbidity in the post-operative period.

Key words: *Aspiration pneumonia, Gastroesophageal reflux disease, Infants, Laparoscopic fundoplication*

Gastroesophageal reflux disease (GERD) is most commonly seen in the infancy, with a peak at 1–4 months. However, it can be seen in children of all ages, even healthy teenagers [1]. Approximately, 85% of infants vomit during the 1st week of life, and 60–70% manifest clinical GER at the age of 3–4 months. Symptoms abate without treatment in 60% of infants by the age of 6 months, when these infants begin to assume an upright position and eat solid foods. Resolution of symptoms occurs in approximately 90% of infants by the age of 8–10 months [2].

The distinction between the physiologic and pathologic GER in infancy and childhood is determined by the number and severity of reflux episodes, and by the presence of reflux-related complications, including failure to thrive, erosive esophagitis, esophageal stricture formation, and chronic respiratory disease [3]. There is a strong correlation between severity of GERD in neurologically affected children, cardiac, and genetic anomalies [4].

Fundoplication is ideal for the treatment of GERD refractory to medical therapy or resulting in recurrent aspiration, apnea episodes (sudden infant death syndrome or acute life-threatening events), reactive airway disease, failure to thrive, esophagitis, and stricture formation [5]. Laparoscopic Nissen fundoplication in children to treat GERD was first reported in 1991 by Dallemagne *et al*. [6]. The prognosis is considered excellent. However, the surgical morbidity and mortality are higher in patients who have complex medical problems in addition to GER [7]. The literature on the outcome of laparoscopic anti-reflux surgery performed in infants with regard to efficacy, recurrence, and complications is limited [8].

We present our experience with the management of four such patients in their infancy who had associated anomalies and were operated for severe GERD with life-threatening complications, and non-responsive to medical therapy.

CASE SERIES

We reviewed the case records of four infants ranging from 1 to 11 months of age, who underwent Laparoscopic Nissen Fundoplication (LNF) in a single center by a single surgeon for complications arising from severe GERD not responding to medical therapy. A questionnaire was filled up with various parameters for analysis. The parameters analyzed were demographics, investigation, comorbid association, surgical parameters, and post-operative period with follow-up.

All the infants presented with vomiting, aspiration pneumonia and failure to thrive as their chief complaints. They were

managed for varying period of time ranging from 1 to 10 months before it was labeled as complicated life-threatening GERD and they were referred to the pediatric surgeon for anti-reflux surgery (Table 1).

Before surgery, all patients underwent contrast swallow and follow through (Fig. 1) for documenting reflux before surgery. There were two babies with severe aspiration pneumonia who underwent milk scan showing tracer activity in the lungs, whereas two babies were premature and had feeding difficulty since birth. All babies had some or the other developmental anomalies (Table 2).

Table 1: Demographics of children with GERD

	Age (Months)/Sex	Weight	Presentation
Case 1	1 m/F	1.5 kg	Apneic episode with feeds
Case 2	11 m/M	3.5 kg	Aspiration pneumonia
Case 3	3 m/M	2 kg	Vomiting and aspiration
Case 4	7 m/M	2.7 kg	Recurrent pneumonia

GERD: Gastroesophageal reflux disease

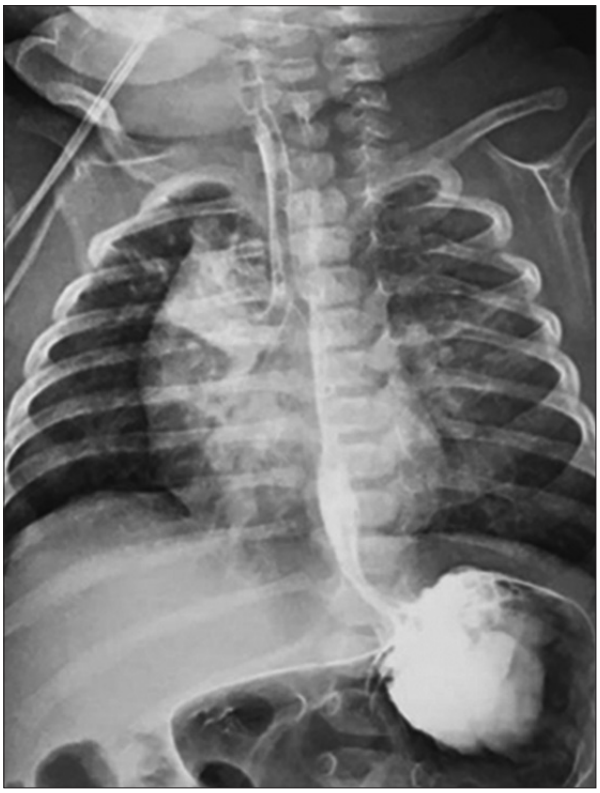

Figure 1: Barium swallow showing GERD

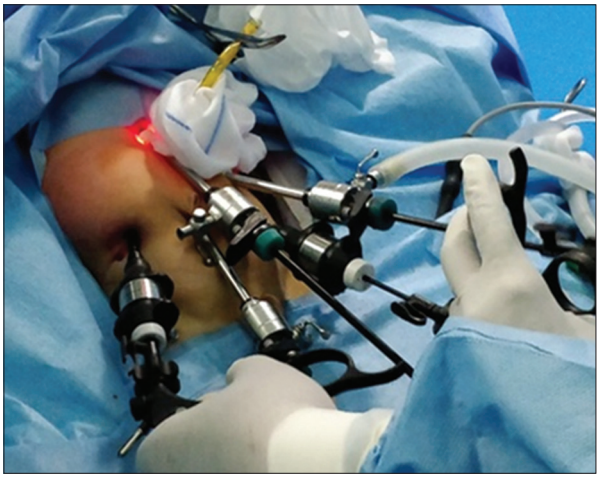

Figure 2: Port positions for LNF

All four infants underwent LNF with gastrostomy button insertion by five port technique. The optical port was a 5/10 mm 30° telescope and two pararecti ports 3/5 mm for working instruments (Fig. 2); one epigastric port for liver retraction and left iliac fossa port for stomach retraction. A standard NF with hiatus closure (Fig. 3) and feeding gastrostomy (Fig. 4) button was inserted as most of the infants had feeding issues. Before fundoplication, the distal esophagus was fully mobilized; the distal 3 cm of the esophagus was repositioned back into the abdomen. Both vagal nerves were identified and a cruroplasty was performed routinely.

The operating time was 78–98 min with a mean of 88 min (Table 3). Laparoscopic surgery in sick babies with life-threatening pulmonary complications posed major anesthetic risk. The intraoperative period had problems such as retracting

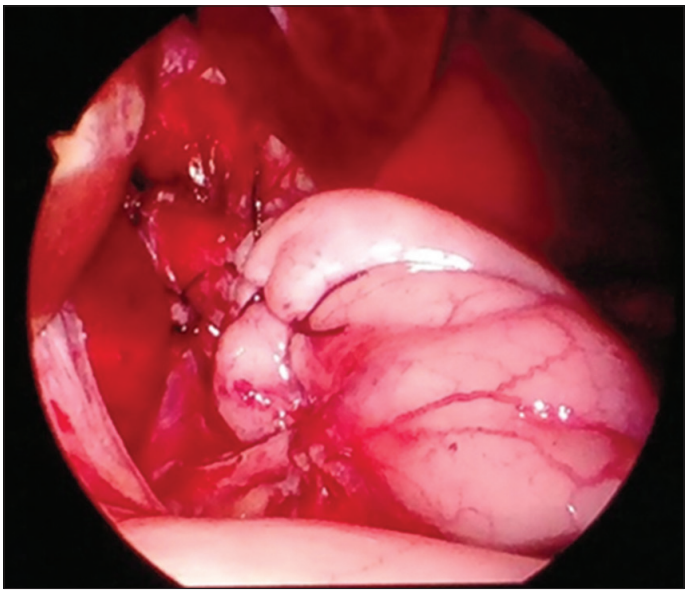

Figure 3: Laparoscopic view of completed hiatus closure with fundoplication

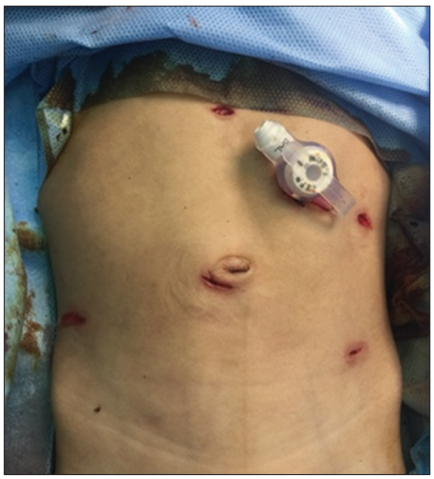

Figure 4: Intraoperative view of port position and feeding gastrostomy

Table 2: Investigation and comorbid association of babies with GERD

Case	Contrast Study	Milk Scan	Associated anomalies	Previous intervention	Surgery
Case 1	Barium swallow	Not done	Generalized hypotonia and seizure disorder	Gastrostomy tube feeding	LNF with button
Case 2	Barium swallow	Positive	Pierre Robin sequence and swallowing incoordination	Undergone PEG due to failure to thrive in an outside hospital	LNF with button
Case 3	Barium swallow	Not done	CHARGE syndrome with ASD and VSD	Feeding tube insertion	LNF with button
Case 4	Barium swallow	Positive	Epilepsy	Nil	LNF with button

GERD: Gastroesophageal reflux disease

Table 3: Operative data

	Duration	Ports	Intraoperative problems	Gastrostomy
Case 1	98 min	5	Maintaining CO_2	Yes
Case 2	92 min	5	Liver falling	Yes
Case 3	78 min	5	Liver Injury	Yes
Case 4	84 min	5	Hiatus dissection	Yes

Table 4: Post-operative details and follow-up

Case	Feeding	Post-operative issues	Discharge	Follow-up
Case 1	After 48 h	Had seizures requiring change of antiepileptics	2 months	Feeds partially through button and partly orally
Case 2	72 h	Soakage from gastrostomy site	15 days	Feeding on own and stopped using button.
Case 3	Could not be initiated	Could not be weaned off ventilator for 7 days	Not discharged	Died
Case 4	48 h	Gastrostomy site discharge	1 month	Feeding through button.

bulky left lobe of liver, injury to liver during port insertion, hiatus dissection, and maintaining CO_2 but was aptly managed.

Postoperatively, all babies were on ventilator ranging from 1 to 7 days. Feeds could be started through the gastrostomy button after 48 hrs in two infants, 72 hrs in one infant, and could not be initiated in one infant who had a very stormy post-operative period and succumbed after 7 days of ventilation. Postoperatively, all the three babies who survived had resolution of symptoms with no subsequent vomiting, clearing of their chest infections, and weight gain. The longest follow-up was 14 months with a mean of 11.3 months in an infant who had gained from 1.5 to 4.45 kg (Table 4).

DISCUSSION

According to the current guidelines, anti-reflux surgery should be reserved for severe relapsing cases and for patients at a high risk of long-term GERD complications. Children, in which GERD is associated with respiratory comorbidities including asthma and aspiration pneumonia, should be considered for surgery [9]. LNF has largely replaced open NF as the preferred operative approach in children who have normal esophageal body peristalsis [10,11]. The indication for surgery in all our patients was respiratory comorbidities.

In a study by Rosales *et al*., all infants including preterm had at least one medical problem such as developmental delay, seizures, hydrocephalus, chronic lung disease on ventilator support, and congenital heart disease along with GERD and the most common reason for surgery was improvement of respiratory function. After failed medical management, 84 infants were taken up for LNF with mean operative time of 116.26 min, mean time to reach goal feeds was 4.62 days, median hospital stay after surgery was 14 days, and there were total of five deaths. Our study had a decreased operative time and early initiation of post-operative feeding as compared to their study [12].

Similarly, a study by Leung *et al.* is comparable to our study in which infants underwent LNF for symptomatic GERD with a mean operating time of 157 min, and average duration of hospital stay being 10 days with no recurrence of symptoms on follow-up [13].

In the present study, reflux and respiratory symptoms significantly decreased after LNF, in spite of severe morbidity in the pre-operative period. This short-term success rate is similar to other prospective studies by Kubiak *et al*. and Soyer *et al*. in pediatric anti-reflux surgery [14,15]. All our patients showed significant recovery in the post-operative period with regard to their tolerance to feeds, resolution of vomiting, and respiratory symptoms.

Most of the patients with GERD are neurologically impaired, and unfortunately, as demonstrated in a review by Vernon-Roberts *et al*., there are no data in the literature on the comparable risks or benefits of either treatment, and we are subsequently unable to provide recommendations on the best approach in this group of children [16]. The severity and complications of GERD are higher and more prevalent among neurologically impaired children. It has been shown that the prevalence of erosive esophagitis among these children is 30–70% compared with just 5% in children without neurological defects. This group of children needs prolonged medication and needs surgery more often than children without neurological impairment [17]. In a series of 19 infants with severe respiratory symptoms associated with the presence of both congenital heart disease and gastroesophageal reflux as presented by Weesner *et al*. Down's syndrome or central nervous system disease was present in 12 of the 19 infants. Medical therapy alone was successful in only one of the 19 patients showing the significance of anti-reflux surgery in these infants [4]. In our series, all children had either neurological disorder or other associated anomalies. We found a 100% correlation of infants with GERD

and associated developmental anomalies that developed life-threatening respiratory complications as a predictor of surgery.

CONCLUSION

Infants with severe life-threatening GERD are best managed by laparoscopic Nissen fundoplication who tolerate the procedure well and show significant improvement in the post-operative period. The incidence of associated anomalies is significantly higher in such infants. The threshold for surgery should be low in such infants with GERD as they rarely respond to medical management.

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