The Surgical Management of Gastroesophageal Reflux Disease in Children

Jennifer Bruny, MD
Department of Pediatric Surgery
The Children’s Hospital of Denver
The University of Colorado Health Sciences Center
Definitions

- Gastroesophageal reflux
  - Effortless regurgitation or back-flow of gastric contents into the esophagus

- Gastroesophageal reflux disease
  - Reflux with complications
Complications of Reflux

- Failure to thrive/anemia
- Esophagitis
- Barrett’s esophagus
- Asthma
- Aspiration pneumonia/pneumonitis
- Dental decay
- Stricture
Spectrum of patients

- Neonates and infants
  - Chalasia

- Congenital malformations
  - Tracheoesophageal fistula
  - Congenital diaphragmatic hernia
  - Laryngomalacia

- Neurologic impairment

- Pulmonary disease
  - Bronchopulmonary dysplasia
  - Asthma
Natural history of chalasia

1. Overall Symptoms by Age

![Graph showing symptoms by age](image)
Diagnosis

- Feeding refusal/crying during or after feeds
- Emesis
- Position
  - Arch back
  - Turn head
- Asthma
Diagnosis

- **Upper GI contrast study**
  - Rule out malrotation, vascular ring, ect

- **pH probe**

- **EGD**
  - With Biopsy
Treatment

- **Lifestyle measures**
  - Protein hydrolysate formula (allergies)
  - Thicken formula (rice cereal)
  - Decrease volume
  - Upright positioning
  - Eliminate environmental tobacco smoke
Treatment

- Pharmacotherapy
  - H2 blocker
  - Proton pump inhibitors
  - Motility agents

- Surgical therapy
  - Fundoplication
    - Nissen, Toupet, Thal
    - Open vs. laparoscopic
  - Gastro-jejunostomy tube
  - Jejunal feeding tube
  - Stretta
  - Gastric outlet procedures
  - Gastro-esophageal disconnect
Children are not little adults

Table 3. Long-term Outcomes of GERD in the Medical and Surgical Treatment Groups

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Medical Treatment Group</th>
<th>Surgical Treatment Group</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRACI score while taking medication, mean (SD)</td>
<td>83.1 (13.7) [n = 74]</td>
<td>78.7 (9.5) [n = 29]</td>
<td>.07</td>
</tr>
<tr>
<td>GRACI score while not taking medication, mean (SD)</td>
<td>96.7 (21.4) [n = 68]</td>
<td>82.6 (17.5) [n = 27]</td>
<td>.003</td>
</tr>
<tr>
<td>Endoscopic grade of esophagus, mean (SD) %</td>
<td>1.89 (1.15) [n = 63]</td>
<td>1.80 (0.95) [n = 20]</td>
<td>.76</td>
</tr>
<tr>
<td>24-h esophageal pH &lt;4, mean (SD) %</td>
<td>31.0 (61.6) [n = 38]</td>
<td>17.1 (41.1) [n = 10]</td>
<td>.50</td>
</tr>
<tr>
<td>Using antireflux medications regularly, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any antireflux medication</td>
<td>92 [n = 90]</td>
<td>62 [n = 37]</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Proton pump inhibitors</td>
<td>64 [n = 89]</td>
<td>32 [n = 37]</td>
<td>.002</td>
</tr>
<tr>
<td>Histamine2 receptor blockers</td>
<td>65 [n = 88]</td>
<td>41 [n = 37]</td>
<td>.02</td>
</tr>
<tr>
<td>Prokinetics</td>
<td>15 [n = 86]</td>
<td>8 [n = 36]</td>
<td>.39</td>
</tr>
<tr>
<td>≥1 Antireflux operation since end of original study, %</td>
<td>10 [n = 90]</td>
<td>16 [n = 38]</td>
<td>.38</td>
</tr>
<tr>
<td>Treatment for esophageal stricture since end of original study, %</td>
<td>8 [n = 90]</td>
<td>14 [n = 37]</td>
<td>.46</td>
</tr>
</tbody>
</table>

*GERD indicates gastroesophageal reflux disease; GRACI, Gastroesophageal Reflux Disease Activity Index. Numbers in brackets are the sample sizes for each outcome.

In laparoscopic fundoplication, a new valve is constructed by wrapping the upper portion of the stomach around the lower end of the esophagus, as shown in the above image.
Outcomes of Nissen Fundoplication

  - 11 years
  - 1050 patients
  - Age 5 days to 18 years
  - Follow-up 6 months to 10 years
  - 8 intra-operative complications
    - Perforation/blood loss
  - 4% post-op complications
    - Dysphagia
  - 3% recurrence of reflux symptoms
    - Wrap dehiscence or migration
Outcomes of Fundoplication

  - Combined data from 7 centers
    - 7467 patients <18 years old
  - 44% neurologically impaired
  - Neuro normal
    - 95% good to excellent results
    - 4% complications
  - Neuro impaired
    - 85% good to excellent results
    - 12% complications
Neurologic impairment

- Langer, et al. (Toronto)
  - 107 children
  - 44 with documented GER
    - 33 antireflux procedure
  - 50 patients Gastrostomy tube only
    - 22 developed symptomatic GER
      - 17 underwent anti-reflux procedure
Neurologic impairment

- Kawahara, et al. (Japan)
  - 56 laparoscopic fundoplications
    - Emesis controlled
      - Recurrence in 10 (18%)
    - Respiratory symptoms
      - Improvement in 50%
Esophagogastric disconnect

- 27 patients
- Age 6 months to 40 years
- One leak

*Table 1. Late Complications (>30 days)*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Count</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small bowel obstruction</td>
<td>4</td>
<td>(1 reoperation, 2 mortalities)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Paraesophageal hernia</td>
<td>1</td>
<td>(reoperation)</td>
</tr>
<tr>
<td>Gastrostomy misplacement</td>
<td>1</td>
<td>(reoperation, mortality)</td>
</tr>
<tr>
<td>Enterocolitis</td>
<td>1</td>
<td>(reoperation)</td>
</tr>
</tbody>
</table>
Respiratory disease

- 500 patients
  - Apena, cyanosis, SID 36%
  - Asthma 28%
  - Recurrent pneumonia 13%

- Age 1 month to 20 years

- 30% severe reflux, 30% moderate

- 8 weeks medicaal therapy and lifestyle modifications

- 80% of patients symptoms resolved
Respiratory disease

- 1989 Am J Surgery (Minneapolis)
- 51 pts < 2 years old
  - Recurrent aspiration pneumonia
    - 91% no repeat episodes
  - Persistent bronchopulmonary dysplasia
    - 83% improvement
  - Apnea
    - 88% no repeat episodes
Steroid dependent reactive airway disease

- Rothenberg 1997
  - 56 patients RAD and GERD
  - Average age 7 years, wt 20 kg
  - 48 pts subjective improvement in respiratory symptoms
  - 50 pts weaned of steroids
    - 4 decreased dose
Conclusions

- When patients are medically refractory
  - Surgical treatment is effective

- Respiratory pts and neurologically impaired
  - Earlier progression to surgical treatment
  - Alternatives to fundoplication
Conclusions

- Patient selection is critical
  - Not mutually exclusive options

- Improvements in surgical technique
  - Minimal dissection
  - Extra stitches