

# Using the Evidence in Pediatric Surgery

## Gastroesophageal Reflux

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## **Gastroesophageal Reflux**

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### **TABLE OF CONTENTS**

#### PREOPERATIVE EVALUATION

[What is the best way to diagnosis gastroesophageal reflux in children?](#)

[What are the indications for fundoplication in children with gastroesophageal reflux?](#)

[Should gastric emptying studies be performed preoperatively in patients undergoing a fundoplication?](#)

#### INTRAOPERATIVE DECISION-MAKING

[Can a laparoscopic fundoplication be performed safely in patients with single-ventricle physiology?](#)

[What techniques can be used to prevent wrap transmigration/hiatal hernia?](#)

[Can re-do fundoplication and hiatal hernia repair be performed laparoscopically?](#)

[Should mesh be used as part of the repair?](#)

[Can a laparoscopic fundoplication be performed after previous abdominal procedures?](#)

[How does laparoscopic compare to open or robotic fundoplication?](#)

#### EXPECTED OUTCOMES

[Which type of fundoplication has the best outcomes?](#)

[What is appropriate follow-up following fundoplication?](#)

[Do neurologically impaired children do worse than neurologically normal children following fundoplication?](#)

[How effective is a fundoplication?](#)

#### MISSION AND DISCLAIMER

#### HELPFUL LINKS

#### ADDITIONAL REFERENCES

## I. PREOPERATIVE EVALUATION

### What is the best way to diagnosis gastroesophageal reflux in children?

Determining the severity of gastroesophageal reflux disease (GERD) is an important step in identifying which patients will benefit from a fundoplication. Although the clinical history is essential in the preoperative evaluation, there is less consensus about a single best diagnostic study.

[Valusek](#)<sup>1</sup> (level 3 evidence) showed that preoperative *upper gastrointestinal radiography* (UGI) identified an unexpected anatomic abnormality (primarily malrotation) in four percent, but was a poor study for documenting pathologic GER.

*Gastric emptying scans* are helpful in identifying patients with delayed gastric emptying, but not helpful for measuring the severity of GERD.

*Twenty-four hour pH monitoring* has been considered the gold standard, but can be problematic with patients on antireflux medication or who have non-acid reflux. Symptoms don't always correlate with pH probe reflux episodes. [Wilson](#)<sup>2</sup> (level 3) studied patients who required a gastrostomy and had a positive pH study. Only 7% (two of 28) subsequently required antireflux surgery due to symptomatic GERD that was resistant to medical therapy.

Recognizing the shortfalls of a pH study, [Rosen](#)<sup>3</sup> (level 3) sought to correlate *multichannel intraluminal impedance* (MII) and other studies with outcome after fundoplication. The only significant difference between the patients that did and did not improve was a higher percentage of full column GER on the preoperative UGI study in the improved group. There was no significant difference between the groups with respect to the proportion of patients that had normal or abnormal pH-probe results, normal or abnormal MII results, or positive or negative symptom indices.

*Esophagoscopy with biopsy* provides the most sensitive and specific evaluation of esophageal inflammation. [Salvatore](#)<sup>4</sup> (level 2) identified concordance in 19 of 45 children undergoing MII-pH and esophageal biopsy.

Numerous clinical tests have attempted to identify those patients in whom GERD is the cause of their *respiratory symptoms* to help predict those that will improve with an antireflux procedure. [Ramaiah](#)<sup>5</sup> (level 3) looked at correlating hypopharyngeal and distal esophageal pH with reflux-related respiratory disease. There was no significant difference in the hypopharyngeal pH data in those patients with positive distal pH monitoring with or without respiratory symptoms. In those patients whose distal pH monitoring was negative, there was an increase in hypopharyngeal acid exposure in children with respiratory symptoms, although it was unknown if the hypopharyngeal reflux was secondary to the respiratory symptoms. Therefore, they concluded that hypopharyngeal pH monitoring does not help differentiate those patients with GERD and respiratory symptoms.

The *lipid laden macrophage index* (LLMI) has been used in clinical decision-making. [Rosen](#)<sup>6</sup> (level 3) evaluated 50 patients who underwent pH-MII testing and bronchoscopy with LLMI testing and failed to show a correlation between LLMI and pH-multichannel intraluminal impedance reflux events. Furthermore, in 13 patients who underwent fundoplication, there was no significant difference in the LLMI findings in patients with or without symptomatic improvement.

Compared to a control group, [Farrell](#)<sup>7</sup> (level 3) identified a significantly higher median *gastric pepsin level in bronchoalveolar lavage* (BAL) in patents with GERD-related aspiration. The authors concluded that the detection of pepsin in BAL fluid is sensitive and specific for diagnosing pulmonary aspiration.

## Summary

There is little evidence to support placing confidence in a single diagnostic study to determine the severity of gastroesophageal reflux in children.

## References

1. [Valusek PA, St Peter SD, Keckler SJ, et al. Does an upper gastrointestinal study change operative management for gastroesophageal reflux? J Pediatr Surg. 2010 Jun;45\(6\):1169-72.](#)
2. [Wilson GJP, van der Zee DC, Bax NMA. Endoscopic gastrostomy placement in the child with gastroesophageal reflux: Is concomitant antireflux surgery indicated? J Pediatr Surg 2006;41:1441-1445](#)
3. [Rosen R, Levine P, Lewis J, et al. Reflux events detected by pH-MII do not determine fundoplication outcome. J Pediatr Gastroenterol Nutr 50:251-255, 2010](#)
4. [Salvatore S, Hauser B, Devreker T, et al. Esophageal impedance and esophagitis in children: any correlation? J Pediatr Gastroenterol Nutr. 2009 Nov;49\(5\):566-70.](#)
5. [Ramaiah RN, Stevenson M, McCallion WA. Hypopharyngeal and distal esophageal pH monitoring in children with gastroesophageal reflux and respiratory symptoms. J Pediatr Surg 2005;40:1557-1561](#)
6. [Rosen R, Fritz J, Nurko A, et al. Lipid-laden macrophage index is not an indicator of gastroesophageal reflux-related respiratory disease in children. Pediatrics 2008;121:879-884](#)
7. [Farrell S, McMaster C, Gibson D, et al. Pepsin in bronchoalveolar lavage fluid: A specific and sensitive method of diagnosing gastro-oesophageal reflux-related pulmonary aspiration. J Pediatr Surg 2006;41:289-293](#)

**What are the indications for fundoplication in children with gastroesophageal reflux?**

Operative management of GERD is usually reserved for failure of medical management and for complications of GERD such as failure to thrive and respiratory symptoms.

Given the *possible broader indications* with the advent of laparoscopic fundoplication, [Lasser](#)<sup>1</sup> (level 3) evaluated children undergoing antireflux procedures using data from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample between 1996 and 2003 and did not find a significant increase in the total number of antireflux procedures over this time period, although there was an increase in antireflux procedures in infants. This age group had more complex medical conditions which may have caused this rise. They found a decrease in the percentage of neurologically impaired children undergoing antireflux procedures that may have been due to a reappraisal of prophylactic concomitant fundoplication when a gastrostomy is needed. Neurologically impaired children undergoing fundoplication and gastrostomy were shown to have a higher morbidity and mortality.

[Tovar](#)<sup>2</sup> (level 4) examined the experience with indications for fundoplication over fourteen years and found no shift in the indication or number of fundoplications with the introduction of the laparoscopic approach. In the majority of patients, an antireflux operation was indicated after failure of medical treatment. Exceptions were patients with a hiatal hernia, peptic stricture, Barrett's esophagus, and apparent life-threatening events (ALTE) where a reflux operation was indicated as a primary treatment.

[Valusek](#)<sup>3</sup> (level 4) reviewed 81 patients who underwent fundoplication with an *ALTE associated with GER* as the indication. During the median follow-up of 1738 days, three patients (4%) had a recurrent ALTE event (two with transmigration of the wrap and one with pyloric stenosis). 88% of patients were taking antireflux medications at the time of their initial ALTE spell which indicates medical management is not effective in these

patients. The authors concluded that fundoplication in patients with ALTE and GER is effective in preventing recurrent ALTE.

### **Summary**

There is little evidence that the indications for fundoplication have changed with the increased use of laparoscopy. Fundoplication may be indicated as primary therapy for children with GERD and ALTE.

### **References**

1. [Lasser MS, Liao JG, Burd RS. National trends in the use of antireflux procedures for children. Pediatrics 2006;118:1828-1835](#)
2. [Tovar JA, Luis AL, Encinas JL, et al. Pediatric surgeons and gastroesophageal reflux. J Pediatr Surg 2007;42:277-283](#)
3. [Valusek PA, St. Peter SD, Tsao K, et al. The use of fundoplication for prevention of apparent life-threatening events. J Pediatr Surg 2007;42:1022-1025](#)

**Should gastric emptying studies be performed preoperatively in patients undergoing a fundoplication?**

Identification of *delayed gastric emptying (DGE)* on a gastric emptying study (GES) has been used as an indication for performing a gastric emptying procedure (GEP) at the time of fundoplication. [Struijs](#)<sup>1</sup> (level 4) performed a retrospective review of 76 patients who underwent fundoplication. Thirty-nine patients underwent a preoperative GES and DGE was diagnosed in 11 (28%). Developmentally delayed patients were more likely to have GES. A GEP was performed in 15 patients in this study. There was no difference in outcomes including the need for anti-GERD medications at one year for children who did or did not undergo a preoperative GES or GEP.

[Estevão-Costa](#)<sup>2</sup> (level 3) compared pre- and postoperative gastric emptying with fundoplication. Postoperative half-emptying time was significantly improved. The proportion of patients with DGE went from 55 to 9%. They concluded that concomitant drainage procedures were unnecessary.

**Summary**

There is little evidence supporting the need for preoperative gastric emptying studies or performing a drainage procedure at the time of initial fundoplication.

**References**

1. [Struijs MC, Lasko D, Somme S, et al. Gastric emptying scans: unnecessary preoperative testing for fundoplications? J Pediatr Surg 2010;45:350-354](#)
2. [Estevão-Costa J, Fragoso AC, Prata MJ, et al. Gastric emptying and antireflux surgery. Pediatr Surg Int. 2010 Aug 25. \[Epub ahead of print\]](#)



## II. INTRAPERATIVE DECISION-MAKING

### **Can a laparoscopic fundoplication be performed safely in patients with single-ventricle physiology?**

As the outcome for children with hypoplastic left heart syndrome (HLHS) improves, fundoplication is increasingly being considered in patients with HLHS and symptoms of gastroesophageal reflux disease due to the risk of reflux-related code events.

It is proposed that infants with HLHS and other severe congenital cardiac conditions are at a higher risk of complications from GERD, including failure to thrive, aspiration, and ALTE spells. [Cribbs<sup>1</sup>](#) (level 4) retrospectively reviewed 112 patients with congenital heart disease who underwent fundoplication and were able to show adequate weight gain at the expense of a 28% complication rate. There was one immediate perioperative death and a 59% five year survival for patients with single ventricle physiology.

[Slater<sup>2</sup>](#) (level 4) reported a retrospective review of 13 laparoscopic procedures in 12 patients with HLHS after their first or second stage cardiac palliation procedure. The authors report six post-operative complications, but no peri-operative mortality.

Both studies stress the use of experienced cardiac anesthesia and recovery teams.

### **Summary**

Laparoscopic fundoplication can be performed in patients with single ventricle physiology, albeit with a significant complication rate.

### **References**

1. [Cribbs KR, Heiss KF, Clabby ML, et al. Gastric fundoplication is effective in promoting weight gain in children with severe congenital heart defects. J Pediatr Surg 43:283-289, 2008](#)

2. [Slater B, Rangel S, Ramamoorthy C, et al. Outcomes after laparoscopic surgery in neonates with hypoplastic left heart syndrome. J Pediatr Surg 42:1118-1121, 2007](#)

**What techniques can be used to prevent wrap transmigration/hiatal hernia?**

Transmigration of the wrap through the esophageal hiatus, found in up to forty percent of patients following both open and laparoscopic Nissen fundoplication often requires a re-do fundoplication.

[St. Peter<sup>1</sup>](#) (level 3) retrospectively compared extensive laparoscopic esophageal mobilization without placement of esophagocrural sutures to minimal esophageal dissection with esophagocrural sutures and reported a decreased transmigration rate from 12% to 5% with minimal esophageal dissection and the use of esophagocrural sutures.

[Nadler<sup>2</sup>](#) (level 4) retrospectively evaluated patients with familial dysautonomia and noted that those patients who underwent an open Nissen fundoplication with a reinforced suture line, posterior gastropexy, and placement of a superior anchoring suture were less likely to require a re-operation for recurrent reflux.

**Summary**

Minimal esophageal dissection with the placement of esophagocrural sutures decreases the rate of transmigration of the wrap after fundoplication.

**References**

1. [St. Peter SD, Valusek PA, Calkins CM, et al. Use of esophagocrural sutures and minimal esophageal dissection reduces the incidence of postoperative transmigration of laparoscopic Nissen fundoplication wrap. J Pediatr Surg 2007;42:25-30.](#)
2. [Nadler EP, Leung S, Axelrod FB, et al. A reinforced suture line prevents recurrence after fundoplication in patients with familial dysautonomia. J Pediatr Surg 2007;42:653-6.](#)

**Can re-do fundoplication and hiatal hernia repair be performed laparoscopically?  
Should mesh be used as part of the repair?**

Redo fundoplication may be indicated in children with symptomatic wrap transmigration, recurrent symptoms that fail to respond to maximum medical therapy, or dysphagia not successfully treated with balloon dilatation.

Historically, the second fundoplication was traditionally performed via laparotomy. [Lopez](#)<sup>1</sup> (level 4) retrospectively described a conversion rate of ten percent for redo laparoscopic fundoplication in children. [Celik](#)<sup>2</sup> (level 4) found that 89% of their patients underwent successful laparoscopic completion of their second fundoplication and 68% underwent successful laparoscopy for a third fundoplication.

[St Peter](#)<sup>3</sup> (level 4) retrospectively describes decreasing the rate of recurrent wrap transmigration from 31% to zero by using biosynthetic mesh (Surgisis, Cook, Inc., Bloomington IN) to reinforce the hiatal repair.

### **Summary**

Redo fundoplication can be performed laparoscopically. The use of biosynthetic mesh to reinforce the hiatal repair during redo fundoplication may reduce the rate of further recurrence.

### **References**

1. [Lopez M, Kalfa N, Forgues D, et al. Laparoscopic redo fundoplication in children: Failure causes and feasibility. J Pediatr Surg 2008;43:1885-90.](#)
2. [Celik A, Loux TJ, Harmon CM, et al. Revision Nissen fundoplication can be completed laparoscopically with a low rate of complications: A single-institution experience with 72 children. J Pediatr Surg 2006;42:2081-5.](#)
3. [St. Peter SD, Ostlie DJ, Holcomb GW. The use of biosynthetic mesh to enhance hiatal repair at the time of redo Nissen fundoplication. J Pediatr Surg 2007;42:1298-1301.](#)

**Can a laparoscopic fundoplication be performed after previous abdominal procedures?**

[Barsness](#)<sup>1</sup> (level 4) retrospectively reviewed 45 patients undergoing laparoscopic fundoplication after a previous open abdominal operation with a mean operative time of 161 minutes. There were three perioperative complications indicating that previous open operations are no longer a contraindication to the laparoscopic approach. [Barsness](#)<sup>2</sup> (level 3) also retrospectively compared 14 infants undergoing laparoscopic versus open fundoplication after neonatal laparotomy with no statistical difference in outcome parameters except for an earlier return to enteral feeds in the laparoscopic group. [Lintula](#)<sup>3</sup> (level 4) reviewed ten children with previous gastrostomy to eight children without previous gastrostomy who subsequently underwent laparoscopic fundoplication and found that a previous gastrostomy does not appear to preclude a safe and effective laparoscopic Nissen fundoplication in children.

**Summary**

Previous open abdominal procedures, including gastrostomy, don't preclude performance of a laparoscopic fundoplication.

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1. [Barsness KA, St. Peter SD, Holcomb GW, et al. Laparoscopic fundoplication after previous open abdominal operations in infants and children. J Laparoendosc Adv Surg Tech A 2009;19 Suppl 1: S47-49.](#)
2. [Barsness KA, Feliz A, Potoka DA, et al. Laparoscopic versus open Nissen fundoplication in infants after neonatal laparotomy. JSLS 2007;11:461-465.](#)
3. [Lintula H, Antila P, Kokki H. Laparoscopic fundoplication in children with a preexisting gastrostomy. J Laparoendosc Adv Surg Tech A 2003;13:381-385.](#)

**How does laparoscopic compare to open or robotic fundoplication?**

Laparoscopic fundoplication has several advantages when compared to an open approach. [Ostlie](#)<sup>1</sup> (level 3) compared open with laparoscopic fundoplication and reported that the traditional higher expenses from a longer operative time for laparoscopy were offset by other financial benefits such as a shorter length of stay, reduced discomfort as evidenced by lower narcotic charges, and an earlier time to initial feeding and time to full feeds.<sup>4</sup>

[Albassam](#)<sup>2</sup> (level 3) compared 25 robotic to 25 laparoscopic fundoplications in children. There were no significant differences in outcomes measured between the two groups. [Meehan](#)<sup>3</sup> (level 4) reviewed 50 consecutive robotic fundoplications identifying the steep learning curve but with acceptable results. [Lehnert](#)<sup>4</sup> compared ten robotic to ten laparoscopic Thal fundoplications. They noted the significantly longer set-up time was offset by decreased time spent in discrete steps in the operation.

**Summary**

Robotic fundoplication has similar outcomes to laparoscopic fundoplication, but a learning curve and increased set-up times should be expected.

**References**

1. [Ostlie DJ, St. Peter SD, Snyder CL, et al. A financial analysis of pediatric laparoscopic versus open fundoplication. J Laparoendosc Adv Surg Tech A 2007;17:493-496.](#)
2. [Albassam AA, Mallick MS, Gado A, et al. Nissen fundoplication, robotic-assisted versus laparoscopic procedure: a comparative study in children. Eur J Pediatr Surg 2009;19:316-319.](#)
3. [Meehan JJ, Meehan TD, Sandler A. Robotic fundoplication in children: resident teaching and a single institutional review of our first 50 cases. J Pediatr Surg 2007;42:2022-2025.](#)

4. [Lehnert M, Richter B, Beyer PA, et al. A prospective study comparing operative time in conventional laparoscopic and robotically assisted Thal semifundoplication in children. J Pediatr Surg 2006;41:1392-1396.](#)

### III. EXPECTED OUTCOMES

#### **Which type of fundoplication has the best outcomes?**

[Esposito](#)<sup>1</sup> (level 3) retrospectively analyzed 238 neurologically normal children who underwent laparoscopic Nissen, Toupet, and Thal fundoplications. Seven patients developed postoperative dysphagia (four Nissen, two Toupet, and one Thal) and all spontaneously resolved their symptoms in the first six months after surgery. There was no difference in morbidity or symptoms at five years. They concluded that the three fundoplication techniques are comparable, and the choice to perform one procedure over the others should be based on the surgeon's experience.

[Wagener](#)<sup>2</sup> (level 3) focused on the Watson fundoplication, which is a 120 degree anterolateral wrap, hypothesizing that the Watson partial fundoplication provided less postoperative dysphagia and gas bloat symptoms. Over a 7 year retrospective chart review, 76 patients underwent open Nissen fundoplication and 55 patients underwent open Watson fundoplication. There were no significant differences in complications, postoperative symptoms, or clinical outcome.

[Liu](#)<sup>3</sup> (level 4) evaluated the effect of not dividing the short gastric vessels during fundoplication, retrospectively reviewing 365 laparoscopic Nissen-Rossetti fundoplications. Nine children (2.5%) required a total of 12 esophageal dilations for dysphagia/gas bloat. None of these patients underwent a concomitant gastrostomy at the time of the fundoplication, but three of these patients with neurologic impairment went on to require a gastrostomy. The authors commented that the patients with dysphagia did improve with time. Thirteen patients (3.6%) had recurrence of their reflux symptoms, and two of these developed wrap disruptions. The authors concluded that laparoscopic Nissen fundoplication without short gastric vessel division had acceptable outcomes, especially in children undergoing simultaneous gastrostomy.

Esophagogastric dissociation has been described by Morabito both as an alternative to repeated fundoplication and a primary surgical treatment in neurologically



impaired children. In a series of 26 patients, three patients suffered perioperative complications, there were four late deaths unrelated to the procedure and 24 had improved weight gain.

### **Summary**

No evidence shows significant improvement in outcome over the Nissen fundoplication. All operations are probably effective when performed by an experienced surgeon.

### **References**

1. [Esposito C, Montupet Ph, van Der Zee D, et al. Long-term outcome of laparoscopic Nissen, Toupet, and Thal antireflux procedures for neurologically normal children with gastroesophageal reflux disease. Surg Endosc 2006;20:855-858](#)
2. [Wagener S, Sudhakaran N, Cusick E. Watson fundoplication in children: A comparative study with Nissen fundoplication. J Pediatr Surg 2007;42:1098-1102](#)
3. [Liu DC, Lin T, Slatter MB, et al. Laparoscopic Nissen fundoplication without division of short gastric vessels in children. J Pediatr Surg 2006;41:120-125](#)
4. [Morabito A, Lall A, Lo Piccolo R, et al. Total esophagogastric dissociation: 10 years' review. J Pediatr Surg. 2006 ;41:919-22.](#)

**What is appropriate follow-up following fundoplication?**

When routinely obtaining an upper gastrointestinal series postoperatively in order to evaluate transmigration of the wrap as a cause for recurrent reflux, [St. Peter<sup>1</sup>](#) (level 3) identified a 12% transmigration rate in patients with extensive esophageal mobilization.

**Summary**

Routine postoperative radiographic evaluation of fundoplication can identify transmigration in patients who have minimal or no symptoms.

**Reference**

1. [St. Peter SD, Valusek PA, Calkins CM, et al. Use of esophagocrural sutures and minimal esophageal dissection reduces the incidence of postoperative transmigration of laparoscopic Nissen fundoplication wrap. J Pediatr Surg 2007;42:25-30.](#)

**Do neurologically impaired children do worse than neurologically normal children following fundoplication?**

[Goessler](#)<sup>1</sup> (level 4) retrospectively reviewed the effect of epilepsy on fundoplication outcomes in neurologically impaired children. There was no difference in complications or recurrence of GERD in those children with or without epilepsy.

[Novotny](#)<sup>2</sup> (level 3) sought to evaluate patients undergoing percutaneous endoscopic gastrostomy (PEG) in whom the initial clinical assessment did not indicate the need for a concomitant antireflux procedure and went on to require fundoplication later. The authors retrospectively compared patients who underwent PEG alone with patients who underwent PEG and then subsequently required fundoplication. Corroborating the conclusion of [Wilson](#) discussed earlier, 44 out of 863 patients (5%) required Nissen fundoplication after a previous PEG. The only significant difference in those that needed a subsequent fundoplication was a higher proportion of cerebral palsy.

**Summary**

Epilepsy does not affect outcome following fundoplication. The presence of cerebral palsy may contribute to the need for subsequent fundoplication after percutaneous gastrostomy placement.

**References**

1. [Goessler A, Huber-Zeyringer A, Hoellwarth ME. Does epilepsy influence the outcome of antireflux procedures in neurologically impaired children? \*Pediatr Surg Int\* 2006;22:485-490.](#)
2. [Novotny NM, Jester AL, Ladd AP. Preoperative prediction of need for fundoplication before gastrostomy tube placement in children. \*J Pediatr Surg\* 2009;44:173-177.](#)

**How effective is a fundoplication?**

In averaging the results from 21 studies, [Goldin](#)<sup>1</sup> (level 3) noted an improvement in symptoms in 87%. To more accurately assess the long-term outcomes of fundoplication, they evaluated the effect that fundoplication has on subsequent reflux related hospital admissions. A decreased hospital admission rate in children under four years of age was noted, although there are unchanged numbers of admissions for older children. Older children with developmental delay had an increased number of admissions following fundoplication.

[Lee](#)<sup>2</sup> (level 3) reported that the overall number of patients requiring hospital admission for aspiration pneumonia, other pneumonias, respiratory distress or apnea, and failure to thrive are similar before and after undergoing a Nissen fundoplication. They make the interesting observation that the decreased rate of post-fundoplication admissions was offset by the number of admissions in patients who had not required admission prior to fundoplication. They confirmed the increased hospitalization rate for patients with neurologic impairment.

[Boesch](#)<sup>3</sup> (level 4) reviewed 25 patients with cystic fibrosis undergoing fundoplication and noted that although 28% were able to discontinue their antireflux medications, 48% developed recurrent reflux and there was little benefit for either nutritional or pulmonary outcomes.

**Summary**

Children under four years of age should be expected to have a lower reflux-related hospitalization rate after fundoplication. Older patients, especially those with neurologic impairment, should expect a higher rate of postoperative hospitalizations.

**References**

1. [Goldin AB, Sawin R, Seidel KD, et al. Do antireflux operations decrease the rate of reflux-related hospitalizations in children? Pediatrics 2006;118:2326-2333.](#)

2. [Lee SL, Shabatian H, Hsu J, et al. Hospital admissions for respiratory symptoms and failure to thrive before and after Nissen fundoplication. J Pediatr Surg 2008;43:59-65.](#)
3. [Boesch RP, Acton JD. Outcomes of fundoplication in children with cystic fibrosis. J Pediatr Surg. 2007 Aug;42\(8\):1341-4.](#)

#### IV. MISSION AND DISCLAIMER

**Using the evidence in Pediatric Surgery** is a program designed to help practicing pediatric surgeons incorporate the available medical literature into the care of their patients. Each issue contains a concise, clinical problem-based review of the evidence for a selected topic limited to peer-reviewed articles pertaining to human pediatric subjects published within the last five years.

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## V. HELPFUL LINKS

### Pathways / guidelines

1. [IPEG guidelines for the surgical treatment of pediatric gastroesophageal reflux disease \(GERD\). J Laparoendosc Adv Surg Tech A. 2009 Apr;19 Suppl 1:x-xiii.](#)
2. [Kane TD, Brown MF, Chen MK; Members of the APSA New Technology Committee. Position paper on laparoscopic antireflux operations in infants and children for gastroesophageal reflux disease. American Pediatric Surgery Association. J Pediatr Surg. 2009 May;44\(5\):1034-40.](#)
3. [Vandenplas Y, Rudolph CD, Di Lorenzo C, et al. Pediatric gastroesophageal reflux clinical practice guidelines: joint recommendations of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition \(NASPGHAN\) and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition \(ESPGHAN\). J Pediatr Gastroenterol Nutr. 2009 Oct;49\(4\):498-547.](#)

### Evidence based medicine

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[Introduction to Evidence Based Medicine tutorial 2](#)

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