Nissen vs. Toupet Fundoplication in the Treatment of Gastroesophageal Reflux Disease

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Gastroesophageal reflux disease (GERD) is a serious phenomenon in pediatric health care. Without proper treatment, complications related to GERD can impede normal development and can lead to multiple hospitalizations and medical conditions. Previously, surgical intervention was limited to one technique, nissen fundoplication; however, the use of various forms of fundoplication surgery, primarily the toupet fundoplication, is currently increasing. Nurses need to be aware of treatment options and care of pediatric patients with severe GERD requiring surgical intervention, including common treatment modalities used prior to surgery and postoperative care necessary to promote positive results following fundoplication surgery.

Gastroesophageal reflux (GER) is a growing phenomenon in pediatric patients that requires much attention. The prevalence of GERD in infants has been reported as high as 20% to 40% (Keady, 2007), with a higher prevalence in premature infants and infants with medical comorbidities (Riffe, Sayre, Waller, Brinker, & Roberts, 2007). Although most cases of infant GERD self-resolve by 1 year of age, if left untreated, GERD can lead to a number of complications, varying from esophagitis, dental erosion, otitis media, bronchitis, recurrent asthma, and failure to thrive (Riffe et al., 2007). These complications can impede normal development and can lead to multiple hospitalizations and medical conditions involving chronic pulmonary and nutrition disorders, as well as dental problems and hearing loss. With better treatment of GERD, the rates and costs of hospitalizations associated with complications can decrease, and a better quality of life for patients and families dealing with GERD can be achieved.

Gastroesophageal reflux (GER) is defined as regurgitation of gastric contents into the esophagus (Riffe et al., 2007), whereas GERD is defined as symptoms or complications of GER (Horvath, Dziechciarz, & Szajewska, 2008). GERD most commonly presents in infancy between 1 to 4 months with symptoms of vomiting, poor weight gain, dysphagia, abdominal pain, irritability, and respiratory disorders (Horvath et al., 2008; Riffe et al., 2007). Depending on the severity of GERD, treatment options range from therapeutic lifestyle changes involving positioning, thickened feeds, and dietary changes, to medical management with the use of proton pump inhibitors or H2 blockers. The persistence of GERD, despite lifestyle and medical treatment or an inability to wean medication doses after optimization of medical management, enhances the likelihood of the patient requiring surgical intervention to achieve proper control of the symptoms associated with GERD. This article focuses on the outcomes associated with two fundoplication surgeries commonly used to treat GERD: nissen fundoplication (NF) and toupet fundoplication (TF).

**Fundoplication Surgery**

Some children continue to have reflux despite lifestyle changes and medical treatment, but do not have severe complications of GERD that affect their health and development. For these children, continued medical management and close observation from a primary care provider is necessary to assess improvement or worsening of their GERD. In other words, not every child with GERD unresponsive to medical treatment requires surgical intervention. However, children who have failed medical therapy and continue to have persistent asthma, recurrent pneumonia, or failure to thrive related to GERD may be appropriate candidates for fundoplication surgery (Riffe et al., 2007). The use of antireflux surgery has been associated with early postoperative ventilator weaning and decreased supplemental oxygen needs in premature infants due to the relationship between respiratory distress and GER (Mattioli et al., 2005). There is also a positive response to surgical treatment in neurologically impaired children with recurrent aspiration and extreme failure to thrive (Goessler, Huber-Zeyringer, & Hoellwarth, 2007). For these children exhibiting persistent reflux symptoms, fundoplication surgery is the remaining treatment option.

**Nissen Fundoplication**

Nissen fundoplication (NF) has historically been the most common surgical treatment of GERD and has become one of the most common operations performed by pediatric surgeons (Lee et al., 2008). The NF is a complete 360° wrap with an antireflux valve created at the fundus of the stomach (see Figure 1). With a complete fundoplication, the created valve inhibits the regurgitation of gastric contents into the esophagus, decreasing or diminishing GER. Following laparoscopic NF, gastric emptying time was found to be accelerated compared to preoperative times, further advocating NF for the improvement in GERD (Pacilli, Pierro, Lindley, Curry, & Eaton, 2008). Although GER symptoms are improved with the surgical intervention of NF, its success and long-term outcomes continue to be debated.
Surgical complications of laparoscopically performed NF include esophageal, pleural, or gastric perforation (Esposito, Montupet, Amici, & Desruelle, 2000; Mattioli et al., 2002). Most often, these complications are identified and repaired during the initial laparoscopic procedure. Occasionally, the surgery needs to be converted to an open procedure to repair the perforation and safely complete the surgery. Initially following NF, patients are at risk for postoperative complications similar to most abdominal surgeries, such as wound infection, sepsis, pneumonia, and rupture of the wound (Kristensen, Avitsland, Emblem, Refsum, & Bjornland, 2007; Mattioli et al., 2005). Postoperative complications specific to NF include dysphagia, dumping syndrome, retching, and gasbloat (Kristensen et al., 2007). Dumping syndrome is characterized by increased gastric emptying time following a meal, which leads to abdominal pain, tachycardia, diaphoresis, and blood glucose instability (Bufler, Ehringhaus, & Koletzko, 2001). Severe retching and gasbloat are very uncomfortable complications of the surgery and often dissipate shortly after the procedure.

The prevalence of surgical and postoperative complications varies widely, with reports of rates ranging from 4% to 22% (Esposito et al., 2000, 2006; Goessler et al., 2007; Kristensen et al., 2007, Mattioli et al., 2002, 2005). One common limitation to analyzing these data for neurologically non-impaired children is the high rate of complications among neurologically impaired patients (Goessler et al., 2007). Patients with neurologic impairment tend to have more postoperative complications and higher recurrence rates of GER (Orenstein & DiLorenzo, 2001); therefore, the inclusion of neurologically impaired and non-impaired patients in a study can affect the outcome findings. These data should be analyzed carefully with respect to the patient population of interest.

In addition to surgical and postoperative complications, the recurrence of GER symptoms has been noted to be a long-term complication of anti-reflux surgery. Rates of recurrence at least two years after NF surgery vary widely from reports as low as 3% to reports as high as 46% (Esposito et al., 2006; Goessler et al., 2007), and again with a higher incidence of GER symptom recurrence in infants and children with neurologic impairment. Rates of patients requiring repeat surgical intervention due to recurrent GERD following NF range from 2% to 14% (Esposito et al., 2006, Kristensen et al., 2007; Mattioli et al., 2002); however, one study reporting a 10% rate of re-operation noted that of the 9 patients requiring surgery, 7 were neurologically impaired (Kristensen et al., 2007). Although it is uncertain as to why outcomes differ between neurologically impaired and non-impaired children, understanding this occurs can assist in determining the initial surgical intervention as well as assessing risks and benefits of surgical intervention.

Despite risks of complication and rates of recurrent GER, positive outcomes for patients receiving antireflux surgery via NF exist. The long-term outcomes of pediatric patients who have received NF surgery have been associated with improved quality of sleep for both the patient and the parent (Kristensen et al., 2007). In addition, parents have reported fewer respiratory symptoms and an overall improved pulmonary status for children receiving NF surgery (Kristensen et al., 2007). These two outcomes have resulted in a high rate of parental satisfaction following NF surgery. Further, neurologically impaired patients have demonstrated fewer symptoms of auto-aggression and agitation following NF surgery (Goessler et al., 2007). These positive outcomes support the use of NF for the surgical treatment of GERD in children.

**Toupet Fundoplication**

Although NF has historically been the most common anti-reflux surgery in pediatrics, there is an increasing interest in alternative forms of surgical intervention. One such method is the toupet fundoplication (TF) (see Figure 2). TF is a partial 270° dorsal wrap creating an adaptable reflux Nissen vs. Toupet Fundoplication in the Treatment of Gastroesophageal Reflux Disease

![Figure 1. Nissen Fundoplication](image1)

![Figure 2. Toupet Fundoplication](image2)
valve that grows and adapts with the patient, allowing restoration of function and decreasing failure rates postoperatively (Montupet, 2002). This valve maintains normal physiologic actions, such as burping and vomiting when necessary, minimizing the postoperative complications of gasbloat and retching that are common with NF (Weber, 1999). Surgical and postoperative complications are similar to those of NF, and rates of complications have been reported lower, ranging from 3% to 8% (Esposito et al., 2006; Weber, 1999).

The recurrence of GER symptoms has been studied in regard to long-term outcomes of anti-reflux surgery. Rates of recurrence of GER following TF range from 1% to 25% (Goessler et al., 2007; Montupet, 2002), with higher rates again associated with neurologically impaired patients. Only one study reviewing repeat surgical intervention following TF due to recurrent GER are commonly reported around 2% (Esposito et al., 2006). It may appear that TF has favorable outcomes for the surgical treatment of GERD; however, many studies analyzing the effects of TF have small sample sizes and limitations related to sample and procedural bias. The lack of sufficient research related to the outcomes of TF for the surgical treatment of GERD may be related to the recent use of this procedure in the pediatric population. Current published research focuses on adult populations, and TF in pediatrics has only recently become a more prevalent and feasible option for pediatric surgeons. Although it appears this procedure is gaining popularity in the pediatric population, this method is still considered a new option for pediatric surgeons. Research studies continue to be conducted to discover the best method of practice as well as success rates when using this surgical technique.

### Nissen Fundoplication vs. Toupet Fundoplication

For a comparison of NF and TF complication rates, see Table 1. It is important to note that one study has shown minimal differences between the rates of recurrent GER symptoms in neurologically normal and impaired patients following antireflux surgery using both NF and TF techniques (Steyaert et al., 2003); however, selection bias must be considered a limitation because the study performed only NF with gastrostomy placement in neurologically impaired patients. Providing a gastrostomy tube minimizes the amount of postoperative gasbloat and retching by allowing the stomach to be vented via the gastrostomy tube. Also of interest is a finding by Goessler et al. (2007) based on a study of outcomes among patients with neurological impairment following fundoplication surgery. This study found a correlation between the type of fundoplication and the amount of time prior to the recurrence of reflux symptoms. Patients receiving NF surgery had a higher rate of recurrent GER (46.1%) compared to TF recipients (25%). However, the onset of reflux symptoms occurred 47 months after NF surgery as opposed to 24 months after TF surgery (Goessler et al., 2007). In other words, NF recipients have a higher chance of experiencing recurrent symptoms of GER, but on average, the patient remains symptom-free for a longer period of time than the patient receiving TF.

Once the surgeon becomes skilled at the technique, the laparoscopic approach has been found to be a safe and effective method of surgery for the pediatric treatment of GERD (Esposito et al., 2000, 2006; Mattioli et al., 2002). The “learning curve” period is often mentioned as a risk for complication of surgery, especially when performed laparoscopically (Esposito et al., 2000, 2006); however, laparoscopic surgery has been associated with better outcomes, including less pain and fewer adhesions than those of the laparotomy technique (Steyaert et al., 2003). Length of surgery and hospital stay for patients following NF and TF are comparable in length when the procedure is done laparoscopically.

Each patient must be individually assessed prior to fundoplication surgery to determine the best option based on current research. Assessing the need for enteral feeding via a gastrostomy tube can be used to assist the decision regarding style of fundoplication surgery. If a child is found to have dysphagia, is at high risk for aspiration, or has feeding intolerances, the use of gastrostomy tubes for feeding and venting the stomach could be helpful in reducing complications, such as gasbloat, retching, and abdominal pain, while optimizing the nutritional status of the patient. Increased morbidity and mortality have been associated with fundoplication surgery in patients with co-morbidities (Kristensen et al., 2007). A thorough medical history and physical assessment would assist in the choice of which surgical procedure is more appropriate. Assessing the surgeon’s experience with the particular fundoplication surgery to be performed may help predict positive outcomes. A surgeon who has gotten through the “learning curve” period may help minimize postoperative complications and improve patient outcomes (Esposito et al., 2006).

### Clinical Implications

From a clinical perspective, when caring for a patient with severe reflux without surgical intervention, implementing reflux precautions may help control symptoms. Positioning the patient with the head of bed elevated at all times, as well as providing a more upright position during feeds and a slightly upright right side-lying position after feeds, may help promote proper digestion while minimizing reflux into the esophagus (Saedon, Gourgiotis, & Germanos, 2007). The use of thickened feeds and specific feeding techniques and positioning guidelines are recommendations a speech therapist could provide to help the patient control reflux symptoms and avoid serious complications (Horvath et al., 2008). Pediatric nurses caring for patients with GERD need to know about medications used to control reflux symptoms. Common medications used to decrease the acidity of gastric contents include proton pump inhibitors (such as omeprazole, lansoprazole, and esomeprazole) and H2 blockers (such as ranitidine, cimetidine, and famotidine). Prokinetic medications (such as erythromycin and metoclopramide) enhance lower esophageal sphincter pressure and increase gastric emptying time (Riffe et al., 2007).

When medical management of GERD fails and surgery becomes neces-

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sary, nurses who are familiar with the patient considering fundoplication surgery and knowledgeable regarding complications and outcomes of possible surgical interventions can assist the family by providing answers to their questions and supporting their concerns related to the procedure. Nurses can further provide education for patients and family members regarding postoperative complications and necessary care that will be performed following fundoplication surgery.

An understanding of common postoperative complications and surgical outcomes is necessary to effectively care for patients postoperatively following fundoplication surgery. Frequent skin and wound assessment and care will identify skin breakdown in its earliest stages, resulting in prompt intervention and possibly preventing postoperative wound infection. A routine respiratory assessment will also help identify pulmonary complications, such as pneumothorax, pneumonia, and atelectasis.

Dumping syndrome is a possible complication of fundoplication surgery. As described earlier, dumping syndrome is characterized by increased gastric emptying time following a meal that leads to abdominal pain, tachycardia, diaphoresis, and blood glucose instability (Bufler et al., 2001). Nurses can anticipate the need to monitor blood glucose levels and vital signs if dumping syndrome is suspected following the procedure. Treatment for dumping syndrome varies and is best managed by a gastrointestinal or endocrine specialist.

With regard to the common postoperative complication of dysphagia, a nurse’s recommendation to involve speech therapy to assess the patient’s ability to swallow postoperatively can lead to the early intervention and recommendations for optimal feeding regimes. Monitoring the patient’s weight postoperatively will also help assess the nutritional status of the patient. Involvement of a dietician or nutrition specialist may be necessary to optimize postoperative care, including wound healing and appropriate caloric needs. Nurses must be able to work closely with the interdisciplinary team to best manage a patient after receiving fundoplication surgery.

In addition to the pediatric patient, nurses must also focus on the family members and caregivers of the patient to promote positive outcomes. Assessing educational and emotional needs of family members and caregivers is an essential aspect of nursing. Teaching caregivers about postoperative complications and providing anticipatory guidance for family members can help the family understand the surgical process and feel better prepared for the postoperative phase. Caregivers should understand how to identify common signs and symptoms of postoperative complications as well as understand the need for follow-up care of their child after fundoplication surgery. Providing family members and caregivers with this information necessary to care for their child with GERD following fundoplication surgery is an essential part of promoting positive postoperative outcomes.

**Implications for Research**

Despite current recommendations and procedures, a great need remains for future research to assess specific short-term and long-term outcomes of pediatric patients with GERD requiring fundoplication surgery. Prospective studies are needed to accurately compare the various procedures available in patients who are neurologically normal or impaired, as well as those with co-morbidities, before adequate recommendations can be made for patients receiving fundoplication surgery. GERD is a very common disease affecting countless infants and children. Complications of GERD can potentially cause life-threatening events and unnecessary hospitalizations. Minimizing subsequent problems associated with GERD through proper treatment and management can improve overall quality of life for patients and families, as well as decrease rates and costs of hospitalizations.

**References**


**Additional Reading**