

Original article

Fundoplication for gastroesophageal reflux in neurologically impaired children: Surgical perspectives

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Background: Gastroesophageal reflux is common in neurologically impaired children due to foregut dysmotility. Most of the patients eventually underwent fundoplication.

Objective: This study aimed to describe clinical data and outcome in children with neurological impairment who underwent fundoplication.

Methods: Patients (0 - 15 years) with neurological impairment undergoing fundoplication between January 2007 and December 2016 were retrospectively reviewed. Demographic data, surgical complications and short-term outcomes were collected and analyzed.

Results: Sixty-five patients (41 boys and 24 girls) underwent open fundoplication over the studied period. There were 21 infants (0 - 1 year, 32.0%), 41 children (1 - 10 years, 63.0%), and 3 adolescents (>10 years, 5.0%). The diagnosis of gastroesophageal reflux was based on impedance/24-hour pH monitoring (42.0%), gastric emptying scan (30.0%), esophagogram (18.0%), or endoscopy with biopsy (10.0%). Indication for fundoplication was refractory to medical therapy in all patients. Thirty-three (50%) of all patients already had gastrostomy performed at least one month prior to fundoplication. Surgical complications occurred in six patients (9.5%) including wound infections in 3 patients (5.0%), wrap failure in 2 patients (3.0%) and splenic injury requiring splenectomy in 1 patient (1.5%). Median follow-up time was 27 months. Postoperative outcome data were available in 50 patients. Thirty-five patients (70.0%) had clinical improvement, based on medical records or diagnostic tools. Redo-fundoplication was performed in 3 patients and all of them were in infancy group.

Conclusions: The majority of neurologically impaired patients had clinical improvement after fundoplication. Wound infection is the most common surgical complication after fundoplication. In addition, infancy was the age group risk for redo-fundoplication.

Keywords: Fundoplication, neurological impairment, children.

Gastroesophageal reflux disease (GERD) is present in up to 75.0% of children with severe retarded children (mentally and physically handicapped children) who had recurrent vomiting.⁽¹⁾ From this group of patients, 44.0% of patients who underwent antireflux operation had neurological impairment, 53.0% of patients underwent Nissen fundoplication were neurologically impaired and 67.5% of patients who

underwent fundoplication for gastroesophageal reflux (GER) were neurologically impaired.⁽²⁻⁴⁾ GERD in neurologically impaired children is difficult to recognize as the symptoms of GER are nonspecific. Therefore, the diagnosis of GERD in neurological impairment is often delayed until severe esophagitis or fatal aspiration pneumonia occurs.⁽⁵⁾ Swallowing problems are the major causes of respiratory tract infection in children with severe neurological disability. This may lead to aspiration pneumonia⁽⁶⁾, which is the most common cause of death in children with neurological impairment.⁽⁷⁾

One of postulated mechanisms causing GERD is lack of coordination of esophageal peristalsis and increased intra-abdominal pressure from increased muscle tone associated with spasticity.⁽⁵⁾

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Complications, failure rates, and mortality rates were dramatically increased in children with neurological impairments who received fundoplication, compared to children without neurological disabilities.⁽⁸⁾ Complication rates varies, depending on several factors including its definition and surgeons' experience on fundoplications.⁽⁹⁾ In a large retrospective study of fundoplication in 7,467 children, 95.0% of neurologically normal children achieved a good-to-excellent outcome compared to 85.0% of neurologically impaired children.⁽²⁾ Another study reported 71.0% of children with profound neurological impairment had recurrence of reflux symptoms after surgery, but operative failure rate was only 25.0% in these children with neurological issues.⁽¹⁰⁾

The objective of this study was to describe clinical data and outcome in children with neurological impairment who underwent open fundoplication at our institution.

Materials and methods

The study has been approved by Institutional Review Board of the hospital (IRB no.143/60). All patients aged 0 - 15 years old with neurological impairment who underwent fundoplication in our institute between January 2007 and December 2016 were retrospectively reviewed. Demographic data of the patients, associated surgical complications and short-term outcome were collected.

Preoperative evaluation data including patient history and investigation for diagnosis of gastroesophageal reflux were collected and analyzed. Indications of fundoplication for GERD and surgical

complications were reviewed. Recurrent GERD was defined as presence of gastroesophageal reflux symptoms and reflux index of higher than 5.0% in 24-hour esophageal pH studies or presence of esophagitis following redo-fundoplication.⁽¹¹⁾ Postoperative outcome was evaluated based on medical records or results of investigations.

Results

Sixty-five neurologically impaired children that underwent fundoplication for GERD between January 2007 and December 2016 were reviewed. All patients underwent open fundoplication with small upper midline incision (typically from xiphoid process to midpoint between xiphoid process and umbilicus), as shown in Figure 1. Male-to-female ratio was 1.7:1 (41 boys: 24 girls). There were 21 infants (0 - 1 year, 32.0%), 41 children (1 - 10 years, 63.0%), and 3 adolescents (> 10 years, 5.0%). The median age of the children was 1.5 years (1 month to 14 years).

All patients had a diagnosis of gastroesophageal reflux confirmed with one or more of the followings investigations: impedance/24-hour pH monitoring (42.0%), gastric emptying scan (30.0%), esophagogram (18.0%), or endoscopy with biopsy (10.0%). A course of medical management with thickened feedings and antireflux medication (acid-lowering agents or prokinetics) failed in all patients which were indication for fundoplication. Gastrostomy was performed in 33 patients (50.0%) before fundoplication. Of these patients, the median time gap between gastrostomy and fundoplication was 12 months (from one month to 72 months).

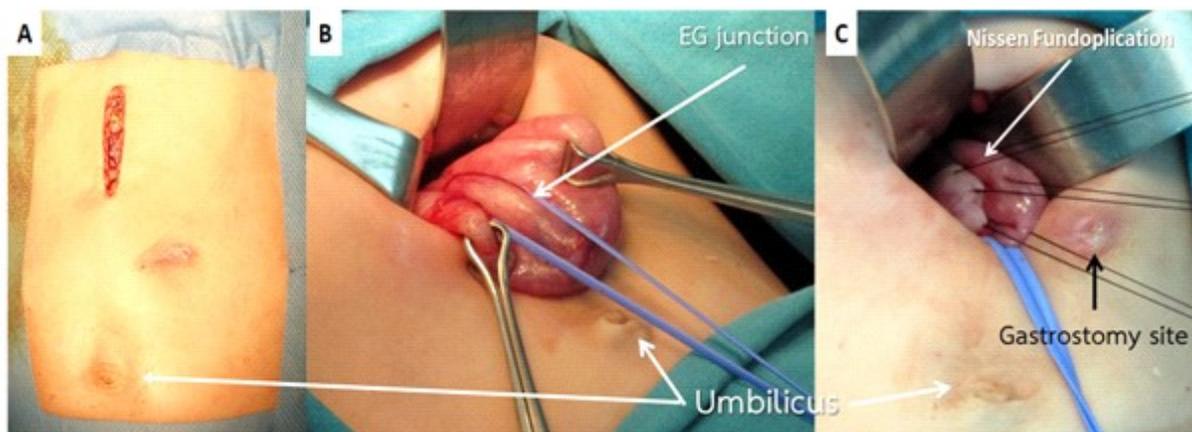


Figure 1. Open Nissen fundoplication shows (A) mini-midline laparotomy incision; (B) mobilization of gastric fundus posterior to intra-abdominal esophagus; and (C) 360 degree wrap of gastric fundus around esophago-gastric junction.

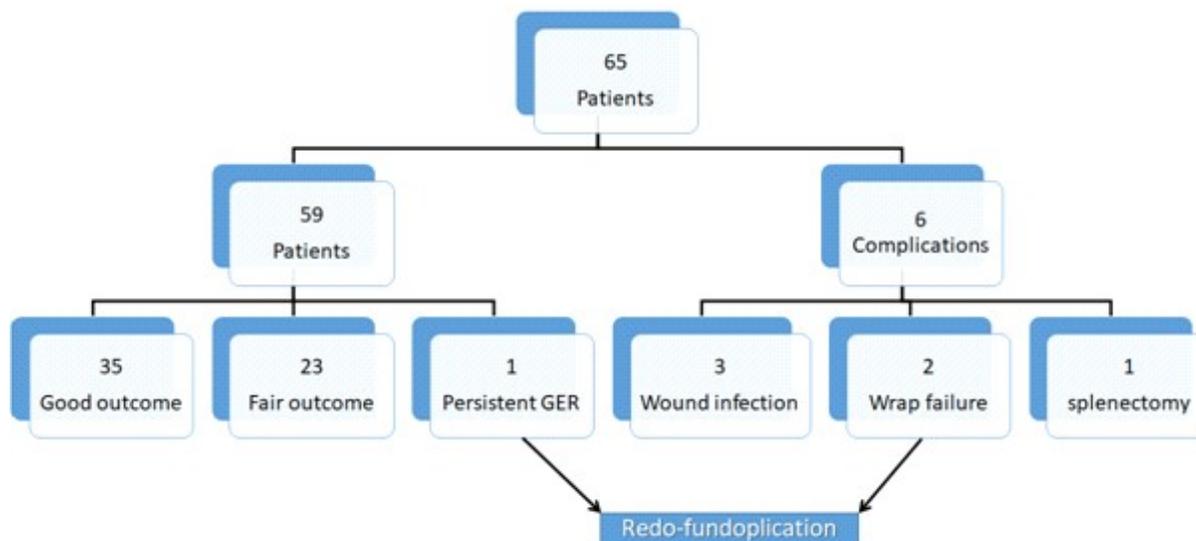


Figure 2. Clinical outcome and complications of neurologically impaired children with GER following fundoplication.

Surgical complications occurred in six patients (9.5%) including wound infections in 3 patients (5.0%), wrap failure in 2 patients (3.0%) and splenic injury requiring splenectomy in 1 patient (1.5%). There was no peri-operative mortality. Postoperative outcome data was available in 50 patients. Based on the medical records or subsequent investigations, 35 patients (70.0%) had significant clinical improvement. Redo-fundoplication was performed in 3 patients in infancy group, and all of these redo-operations were performed within 6 months after first fundoplication. Two patients underwent redo-fundoplication for wrap failure and the other for persistent GER. Overall summary of clinical outcome and complications is shown in Figure 2.

Survival of 54 children (83.0%) has been achieved with the median follow up of 27 months (range, 0.5 month to 10 years). The 11 non-survivors died on average of 14 months following operation, with 80.0% of the deaths occurring within the first year after fundoplication. All deaths were attributed to underlying chronic lung disease and not related to the surgery. The causes of mortality included pneumonia, progressive neurological deterioration, and sudden respiratory arrest.

Discussion

Gastroesophageal reflux is common in neurologically impaired children, most likely because of foregut dysmotility secondary to central neurologic dysfunction.⁽¹²⁾ In this study, the authors

included only patients who had neurological impairment and underwent fundoplication. A number of factors in neurologically impaired children contribute to poor response of medical treatment for GERD. Firstly, lower esophageal sphincter (LES) pressure is considerably reduced. Secondly, the presence of dysmotility of the esophagus leads to reduction in acid clearance. Thirdly, intra-abdominal pressure is increased due to the spasticity of the abdominal musculature. Moreover, other reported factors are scoliosis, recurrent seizures and obliged supine position.⁽¹³⁻¹⁶⁾

Rates of gastrostomy placement and fundoplication operations in children with neurological impairment have increased by 27.1% during the past decade.⁽¹⁷⁾ This was due to increased rate of gastroesophageal reflux, swallowing dysfunction and intolerance gastric feedings. Actually, these might contribute to the decision to perform fundoplication at the same time of gastrostomy tube placement. Protection from aspiration of reflux gastric contents, reducing symptoms of reflux, optimizing nutritional status and improving quality of life are the goals of fundoplication.⁽¹⁸⁾

Interestingly, neurologically impaired infants who had their fundoplications together with gastrostomy did not show any significant reduction in reflux-related admission, compared to those with gastrostomy alone.⁽¹⁸⁾ Therefore, at present, most surgeons did not recommend prophylactic fundoplication for every gastrostomy placement. Nevertheless, in other

studies, some surgeons still suggested fundoplication for children with severe reflux who are having gastrostomy. In addition, an alternative approach which has gained popularity, is the image-guided gastro-jejunal tube which can be inserted under local anaesthesia.⁽¹⁹⁾ In our study, 50.0% of all patients have already had gastrostomy performed prior to fundoplication which is comparable to other studies.

Despite advancement in surgical technology over the past several years, recent studies still continue to show high complication rates in neurologically impaired children with GER. It has been demonstrated that there was a 30.0% recurrent rate of GER and 20.0% mortality rate following fundoplication and also no reduction in aspiration pneumonia.⁽¹¹⁾ Another study claimed that good outcome was achieved in 40.0% after ventral semifundoplication, 46.0% after Nissen fundoplication and 15.0% rate of requiring a second fundoplication.⁽²⁰⁾ Unfortunately, morbidity, mortality, and recurrence rates in neurologically impaired children are worse than those with neurologically normal children. The results of our study are consistent with other studies showing 6.0% redo rate, 9.5% morbidity rate, and 17.0% mortality rate.

Long-term use of proton pump inhibitors (PPIs) has been recommended in neurologically impaired children.^(21,22) In addition, several retrospective studies have compared fundoplication with the gastro-jejunal tube feeding. Those reports found that there was no difference in the cost of each procedure and the overall survival for either technique.^(19, 23, 24) Generally, the comparisons between fundoplication and gastro-jejunal tube feeding in neurologically impaired children would focus on clinical outcome and postoperative complications, including feeding tolerance, nutritional supplement, respiratory problems, and emotional well-being of families or care-takers.⁽²⁵⁾

Conclusion

The majority of neurologically impaired children in this series had clinical improvement after fundoplication. Wound infection was the most common surgical complication. In addition, infancy was the age group risk for redo-fundoplication. Mortality caused by the underlying neurological diseases usually occurred within one year after surgery.

Conflict of interest

The authors, hereby, declare no conflict of interest.

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