



Laparoscopic versus open Nissen fundoplication in children: A systematic review and meta-analysis



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ABSTRACT

Purpose: To systematically review and meta-analyze studies that have compared the clinical outcomes of laparoscopic and open Nissen fundoplication on children.

Methods: Online databases were searched to identify studies that have compared the laparoscopic Nissen fundoplication (LNF) and open Nissen fundoplication (ONF) on children, looking specifically for operative time, time to full feed, redo fundoplication rates and total postoperative complications including wound infection, retching, and airway complications.

Results: Of those 916 patients in the 9 selected studies, 557 and 359 patients had undergone LNF and ONF, respectively; and LNF had significant longer operative time and less total postoperative complications including retching and airway complications than ONF. However, no significant difference in time to full feed, wound infection, and redo fundoplication rates was found between LNF and ONF in children.

Conclusion: LNF is a safe, feasible, and effective surgical procedure alternative to ONF for gastroesophageal reflux in children. Compared with ONF, LNF has the advantage of less total postoperative complications including retching and airway complications. In addition, LNF is comparable to ONF in terms of time to full feed, wound infection, and redo fundoplication rates. Therefore, we conclude that LNF should be regarded as an acceptable option for children.

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First described in 1956 [1], Nissen fundoplication is one surgical option for managing gastroesophageal reflux disease (GERD) with high success rates both in adults and children [2,3]. Traditional open Nissen fundoplication (ONF) is always associated with postoperative complications including retching, gas bloating, dumping syndrome and recurrence [4]. Nowadays, more and more pediatric surgeons are adopting laparoscopic Nissen fundoplication (LNF) for children with GERD, as described in 1991 by Dallemagne and quickly introduced in pediatric surgery in 1993 [5,6].

LNF can shorten the length of hospital stay and reduce the risk of complications over ONF among the adult patients [7]. However, children may react differently to the surgery trauma of the LNF procedure when compared with adults [8], and its outcomes may differ in children from adults. For instance, most children have more severe comorbidities than adults when they receive Nissen fundoplication.

Here, we have performed a systematic review and meta-analysis to compare LNF with ONF for children with gastroesophageal reflux disease.

1. Materials and methods

1.1. Search strategy

We systematically searched the published literatures from the EMBASE, MEDLINE, and Web of Science from December 1993 to December 2015 with individual search term or in combination. The following search terms were used: (fundoplication[Title/Abstract] OR nissen[Title/Abstract] OR antireflux surgery[Title/Abstract]) AND (laparoscopic[Title/Abstract] OR children[Title/Abstract] OR infant[Title/Abstract] OR infants[Title/Abstract] OR pediatric[Title/Abstract] OR pediatrics[Title/Abstract]). Relevant reviews and meta-analysis were also carefully read for additional articles.

1.2. Study selection

Clinical trials comparing LNF and ONF in children and infants were included regardless of prospective or retrospective studies. Inclusion criteria were as follows: (1) clinical studies that compared laparoscopic versus open Nissen fundoplication between 1993 and 2015; and (2) children who suffered from gastroesophageal reflux which was

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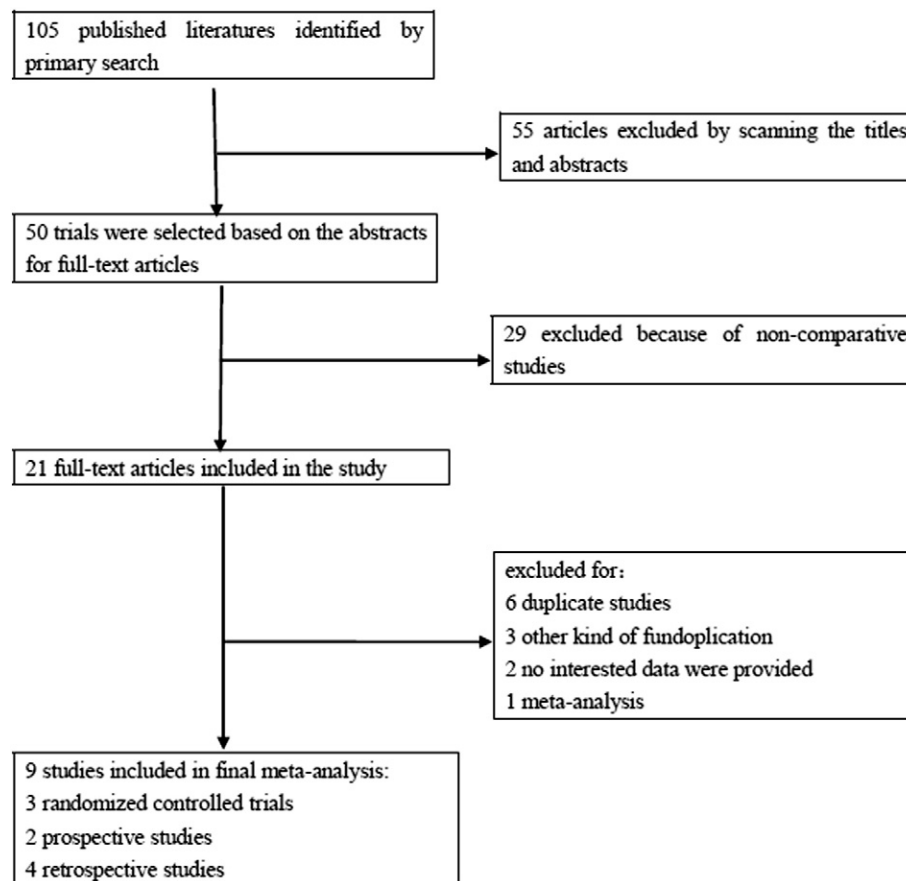


Fig. 1. Diagram of workflow in the systematic review and meta-analysis.

refractory to medical treatment or when complications arose. Exclusion criteria were as follows: (1) no open Nissen fundoplication as a control; (2) other kind of fundoplication procedure except Nissen fundoplication; and (3) studies with duplicate publications. For those studies with multiple publications of the same series, we selected the later publication for long-term outcome comparison.

1.3. Data extraction

Each included article was independently reviewed by two researchers, and a third researcher would confirm the data extraction in case of any discrepancies. Outcome variables were operative time, length of hospital stay, time to full feed, redo fundoplication rates and total postoperative complications including wound infection, retching and airway complications. Some studies reported operative time, length of hospital stay, and time to full feed but no standard deviations and were excluded from further analysis.

1.4. Statistical analysis

Statistical analyses were performed using Review Manager (RevMan) software (ver. 5.3). Weighted mean differences and odds ratios were used for the analysis of continuous and dichotomous variables, respectively. The confidence interval (CI) was set at 95% and the statistical heterogeneity was assessed with the χ^2 test and the I^2 index. A random-effects model was used for all the outcomes.

2. Results

Twenty one of the 105 publications identified from the primary search were retrieved for full text review and 9 studies (3 randomized controlled trials, 2 prospective and 4 retrospective studies) with 916 children participating (557 LNF, 359 ONF) met our total inclusion criteria (Fig. 1). Table 1 summarized the basic demographic data from each of the 9 studies, including age, weight and male/female sex ratio.

Table 1
Demographic data, age, male/female, and weight (kg) in LNF and ONF.

Author	Group		Age (y)		Male/female		Weight (kg)	
	LNF	ONF	LNF	ONF	LNF	ONF	LNF	ONF
Pacilli et al. [9]	15	16	7.5 (0.3–18.6)	4.3 (0.4–16)	9:6	7:9	16 (4.7–43.4)	11.1 (4–37)
Papandria et al. [10]	17	22	6.6 ± 5.3	6.3 ± 3.6			6.3 ± 2.6	5.8 ± 2.0
Fyhn et al. [11]	44	44	4.7 (0.2–15.4)	3.5 (0.1–14.2)	25:19	31:13		
Díaz et al. [12]	306	150	0.5 (0.08–5)	0.5 (0.08–5)	185:121	81:69		
Somme et al. [13]	39	14	(0.04–1)	(0.04–1)	33:20	33:20	(1.8–8.3)	(1.8–8.3)
Barsness et al. [14]	12	14	0.04	0.04			5.2	5.7
Copeland et al. [15]	50	50	8.9 ± 5.9	7.1 ± 4.6			33 ± 24	24 ± 17
Mattioli et al. [16]	49	17	6.3	5.0			25 (9–71)	28 (8–80)
Thatch et al. [17]	25	32	0.22 ± 0.02	0.21 ± 0.03			3.82 ± 0.24	3.49 ± 0.20

LNF, laparoscopic Nissen fundoplication; ONF, open Nissen fundoplication.

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