



## Italian multicenter survey on laparoscopic treatment of gastro-esophageal reflux disease in children

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### Abstract

**Background:** Skepticism is still present today about the laparoscopic treatment of gastro-esophageal reflux (GER) in children. We present the prospective experience and short-term results of eight Italian pediatric surgical units.

**Methods:** We included all the children with complicated GER, operated after January 1998 by single surgeons from eight different centers. Diagnostic aspects, type of fundoplication, and complications were considered. All the patients were followed for a minimum period of 6 months in order to detect complications or recurrences.

**Results:** 288 children were prospectively included. Mean age was 4.8 years (3 m–14 y). Nissen fundoplication was done in 25%, floppy Nissen in 63%, Toupet in 1.7%, and anterior procedures (Lortat Jacob, Thal) in 10%. Gastrotomy was associated, if neurological impairment or feeding disorders were present. Mean follow-up was 15 months and reoperation was necessary in 3.8% of cases.

**Conclusions:** This experience underlines that minimal invasive access surgery in children is safe and that the laparoscopic approach is considered in eight centers the golden standard for surgical repair of gastro-esophageal reflux disease maintaining the same indications and techniques of the open approach.

**Key words:** Laparoscopy — Nissen — Rossetti — Fundoplication — Gastro-esophageal reflux

In the last years the minimal invasive access procedures have become frequent also in pediatric patients [1, 2, 4–6, 8]. However, there are still doubts, particularly in the treatment of gastro-esophageal reflux, because many surgeons do not agree with this approach even if many publications demonstrated its good outcome also in young patients [3, 7, 9].

The authors present the surgical experience and short-term results of eight Italian pediatric surgical units in the laparoscopic treatment of gastro-esophageal reflux (GER) to demonstrate the safety and feasibility of this approach in children.

### Materials and methods

A multicenter survey was carried out. Eight surgeons, coming from eight different pediatric surgical units with a long experience in laparoscopic surgery, prepared a form to be filled in during the procedure. A summary of the collected data was analyzed in double-blind manner.

Inclusion criteria were age less than 14 years, operation performed after January 1998 by a single surgeon in each center, and minimum postoperative period of 6 months.

Diagnostic aspects were considered for all the patients including main symptoms (esophagitis, hiatal hernia, asthma, infections), associated disease (mainly neurological impairment and repaired esophageal atresia), and examinations performed to confirm the diagnosis (pHmetry, barium meal X-ray, endoscopy, bronchoalveolar lavage, gastric emptying time, manometry).

The kind of gastropexy performed was considered, focusing on details such as short gastric vessel ligation, lesser omentum resection, hiatoplasty, and gastric drainage (nasogastric tube and gastrostomy). Type of gastropexy included the 360° wrap (Nissen or Nissen–Rossetti) and the partial gastropexy, mainly posterior (Toupet) or anterior and lateral (Thal, or Lortat Jacobs).

All the patients were followed for a minimum period of 6 months, undergoing clinical evaluation and, in case of symptoms, barium meal

**Table 1.** Diagnosis and symptoms of patients from eight different Italian pediatric centers

		Siena	Bari	Catanzaro/Napoli	Ancoona	Cosenza	Brescia	Genova	Bologna
Total operated patients		15	17	71	22	18	27	63	55
Age at operation (years):	Average	5.9		5.7	3.2	4.2	5	6	3.6
	Min		0.9	0.5	0.6		0.3	0.6	
	Max		11	14	14		14	14	
Main symptoms:	Esophagitis	9	17	60	13	18	19	26	20
	Hiatal hernia	10	3	33	15	3	12	3	5
	Asthma	6	2	10	1	3	2	23	6
	Lung infections	9	8	23	6	1	2	8	23
Associated diseases:	Neurological imp.	9	1	12	7	2	10	3	29
	TEF	0			2		2	2	6
	Other	0		8				5	3
Diagnostic examinations:	pHmetry	15	17	67	19	18	17	59	40
	Endoscopy	15	17	46	22	18	25	59	9
	Upper GI tract X-ray	15	17	70	22	18	12	63	53
	Tracheoscopy			0				31	
	BAL			0				31	
	Gastric emptying time			18		13	2		
	Manometry	11	17	32				59	

**Table 2.** Type of surgery and short-term results

		Siena	Bari	Catanzaro/ Napoli	Ancona	Cosenza	Brescia	Genova	Bologna
Number of patients		15	17	71	22	18	27	63	55
Type of fundoplication	Nissen	11		25	4	3	27		2
	Floppy Nissen		7	46	1	15		63	50
	Toupet	4							1
			10		17				2
	Anterior gastropexy		Lortat J.		Thal				Thal
Short gastric vessel resection	No	No	No	No	No	No	No	If necessary	No
Lesser omentum resection	No	Yes	Yes	Yes	Yes	Yes	No	No	No
Nasogastric tube	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Gastrostomy		Neuro	Neuro	Neuro	Neuro	Neuro	Neuro	Neuro	Neuro
	Follow-up	Months	9	20	16	16		20	6
	Redo	1		2	2		2	1	3
		GER		GER	GER		GER	Stenosis	1 Stenosis 2 GER

X-ray and pH analysis to detect complications or recurrences. Minor symptoms such as mild dysphagia or pain were not evaluated.

## Results

Data are shown in detail for each center in Tables 1 and 2.

In summary, 288 children were included. Mean age was 4.8 years (3 m–14 y). Esophagitis was the main symptom in 182 cases (63%), asthma in 53 (18%), respiratory infections in 80 (28%). Hiatal hernia was present in 84 (29%) and associated diseases in 101 (35%), namely neurological impairment in 73 (25%) and previous TEF in 12 (4%).

Esophageal pHmetry was performed in 252 cases (89%), endoscopy in 211 (74%), upper GI tract barium meal X-ray in 270 (94%), gastro-duodenal transit time in 33 (12%), and respiratory tract endoscopy in 31 (11%).

Nissen fundoplication was done in 72 cases (25%), floppy Nissen–Rossetti in 182 (63%), Toupet in 5 (1.7%), and anterior procedures in 29 (10%). Sectioning of the

lesser omentum was routinely performed in all the cases of four centers and no resection of the short gastric vessels was performed in six centers. The nasogastric tube was maintained for at least 24 hours in six centers. Gastrostomy was always associated, if neurological impairment or feeding disorders were present.

Intraoperative complications included one case of esophageal perforation, one of gastric perforation, and one pleural opening. All the complications were successfully treated during the same procedure.

Correlation between type of surgery (subgroups) and outcome was not evaluated. Mean follow-up was 15 months (6–54). Eleven children (3.8%) needed reoperation, 2 of them for stricture of the wrap and 9 for recurrence of GER.

## Discussion

Aim of this survey was to demonstrate the feasibility and safety of the laparoscopic approach in pediatric patients. All the centers maintained the same inclusion

criteria and the same technical details as in open surgery in the patients operated through the minimal invasive laparotomic approach.

The experience of the different centers showed a great variability in indication and procedure, and a similar outcome.

In some centers the main indication was the presence of atypical symptoms, such as asthma and aspiration. Neurological impairment was not so frequent as in the general experience, and it was very infrequent in some centers.

Diagnosis was obtained by clinical evaluation, pH analysis, and barium meal X-ray. Manometric study was performed routinely in one center in order to detect lower esophageal sphincter incompetence and antroduodenal motility disorders.

Gastric emptying studies were performed in few centers only in case of X-ray evidence of delayed gastric emptying or endoscopic evidence of biliary fluid in the stomach.

The most frequent procedure was 360° modified Rossetti–Nissen wrap. Preservation of the hepatic branches of the vagus to caudatus liver segment was stressed by few centers. Preservation of this structure can improve duodenal motility and reduce downward slipping of the wrap.

Analysis of subgroups was not performed because of a great variability of surgical details and too many biases in the evaluation of results.

Gastrostomy was performed in case of neurological impairment because of the increased risk of failure related to gastric emptying disorder.

Only in two cases the nasogastric tube was removed after awakening: no related complications were experienced. In five cases it was necessary to insert it again because of gastric distension.

No major complications were experienced in all the centers.

The incidence of recurrence (3.8%) was similar to that observed in the open approach in each center. However, the follow-up was too short to provide definitive results. Actually, long-term results are not shown, which is a limitation of this study because of the well-known risk of recurrence of GER many years after surgery.

In this multicenter survey there is another bias related to the inclusion criteria: it is known that neurologically impaired children have more risk of developing

recurrence because of motility disorders. This information stresses the need of an accurate preoperative work-up to reduce the risk of recurrence that is more frequently related to gastric emptying delay more than to the type of the wrap. However, long-term functional complications are more likely related to type of gastropepy and to indications than to type of approach.

## Conclusions

Neither major complications nor high recurrence rate were experienced in a 3-year survey period. This short-period experience underlines that minimally invasive access surgery in children is safe and that, in eight Italian centers of pediatric surgery, the laparoscopic approach is routinely used for surgical repair of gastroesophageal reflux disease maintaining the same indications and techniques as of the open approach.

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