

# Outcome of laparoscopic Nissen fundoplication in patients with disordered preoperative peristalsis

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## Abstract

**Background**—A 360° or Nissen fundoplication remains controversial in patients with disordered peristalsis, some surgeons preferring a partial wrap to minimise postoperative dysphagia.

**Aim**—To evaluate symptoms and manometric outcome in patients with disordered peristalsis after Nissen fundoplication.

**Patients**—In an initial series of 345 patients studied prospectively, 31 patients who had undergone a Nissen fundoplication had disordered peristalsis. Using preoperative manometry, patients were classified as: equivocal primary peristalsis (eight patients); abnormal primary peristalsis (four patients); abnormal maximal contraction pressure (13 patients); abnormal primary peristalsis and maximal contraction pressure (six patients).

**Methods**—Postoperatively, patients underwent a barium meal, oesophageal manometry and standardised clinical review by a blinded scientific officer.

**Results**—Twenty eight (90%) patients had satisfaction scores of at least 8 out of a maximum of 10 and all would undergo surgery again. Whereas 15 (48%) patients had dysphagia scores greater than 4/10 preoperatively, only two (6%) had these scores at one year. Improved peristalsis was seen in 78% of postoperative manometric studies, and mean preoperative lower oesophageal sphincter pressure increased from 6.6 (range 0–21) mm Hg to 19 (4–50) mm Hg.

**Conclusions**—These results are similar to the overall group of 345 patients and suggest that disordered peristalsis, and possibly even absent peristalsis, is not a contraindication to Nissen fundoplication as performed in these patients.

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Keywords: laparoscopic, Nissen, fundoplication, peristalsis, motility, manometry.

Antireflux surgery is a well established treatment for reflux disease and represents the only means of cure. The laparoscopic approach has greatly lessened the procedure's morbidity, most of which is wound related and its efficacy is now well established.<sup>1 2</sup> The use of a 360° wrap remains controversial in patients with disordered peristalsis, some surgeons preferring a partial or modified wrap to avoid

postoperative dysphagia.<sup>3–6</sup> Dysphagia occurs in most patients immediately after fundoplication and is present at three months in 10–40%.<sup>7 8</sup> By one year this has reduced to less than 10%.<sup>1 7</sup> This study examines the incidence of symptoms, including dysphagia, and patient satisfaction after laparoscopic fundoplication in patients with disordered peristalsis.

## Methods

Since the introduction of laparoscopic Nissen fundoplication in this unit in 1990, all patients have been studied prospectively.

## Manometry

The manometry was carried out in standard fashion after an overnight fast, with an eight lumen water perfusion catheter, incorporating a Dent sleeve sensor (Dent Sleeve, Adelaide, SA, Australia) with signals recorded on a polygraph chart recorder (model 7D, Grass Instrument Company, MA, USA). The manometric tube had side holes located at 5 cm intervals above the Dent sleeve to enable determination of motility responses of the oesophageal body. The lower oesophageal sphincter was located by the station pull through technique and the sleeve was positioned at the lower oesophageal sphincter. Each lumen of the catheter was connected in series with a pressure transducer (Statham P231D, Gould Inc, Oxnard, CA, USA) and was constantly perfused with degassed distilled water at 0.5 ml/min by a low compliance pneumohydraulic pump (Arndorfer Medical Specialties, Greendale, WI, USA).

After introduction of the catheter nasally and an adaption period, a five minute resting lower oesophageal sphincter pressure was measured during a relatively stable period, free of interference by dry swallows. Oesophageal sphincter measurements were taken every 15 seconds at the end of expiration, the pressure calculated in relation to intragastric pressure, and a median sphincter pressure determined.

After determining baseline pressures, the amplitude and success of primary peristalsis, and residual relaxation (nadir) pressure of the lower oesophageal sphincter were measured during at least 10 swallows of 5 ml water boluses at 30 second intervals. Oesophageal body contraction pressures were calculated in the same respiration phase with reference to absolute zero for successful wet swallows and the mean was determined. Peristaltic success was defined as a wet swallow propagating the oesophageal body by primary peristalsis, and

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peristaltic failure as a failure to produce a contraction amplitude  $\geq 10$  mm Hg at two or more recording sites.

Manometric data were analysed for the occurrence of failed primary peristalsis or hypotensive (sometimes called feeble) peristalsis in the distal oesophagus. Abnormal primary peristalsis was defined as less than 50% of water swallows progressing through the whole oesophagus. A value between 50% and 70% was regarded as equivocal primary peristalsis. A mean contraction amplitude  $< 25$  mm Hg in the distal oesophagus was regarded as abnormal.

#### Patients

These criteria, which have been described previously,<sup>9,10</sup> identified 31 patients with disordered peristalsis who underwent a laparoscopic Nissen fundoplication and who could be categorised in four groups.

*Equivocal primary peristalsis*—primary peristalsis  $> 50\%$  and  $< 70\%$  of swallows propagated, maximum contraction pressure  $> 25$  mm Hg.

*Abnormal primary peristalsis*—primary peristalsis  $< 50\%$  of swallows propagated, maximum contraction pressure  $> 25$  mm Hg.

*Abnormal maximal contraction pressure*—primary peristalsis  $> 50\%$  of swallows propagated, maximum contraction pressure  $< 25$  mm Hg.

*Abnormal primary peristalsis and maximal contraction pressure*—primary peristalsis  $< 50\%$  of swallows propagated and maximum contraction pressure  $< 25$  mm Hg.

#### Surgery

The operative technique has been described in detail previously<sup>2</sup> and entails the laparoscopic construction of a short (2–3 cm) loose 360° fundoplication, calibrated over a 52FG bougie within the lumen of the oesophagus. Three or four interrupted prolene sutures were used to secure the fundoplication.

#### Follow up

Preoperative assessment and postoperative clinical follow up utilised a standardised questionnaire, administered by a scientific officer three, 12, and 24 months after surgery. Visual analogue scales were used to assess heartburn (0=no heartburn, 10=severe heartburn), dysphagia (0=no dysphagia, 10=severe dysphagia), as well as patient satisfaction with the procedure (0=completely dissatisfied, 10=completely satisfied). A dysphagia score  $> 3$  was regarded as troublesome dysphagia. The presence or absence of gas bloat, ability to burp

and to relieve gastric distension, as well as the patient's willingness to undergo the same procedure again under similar preoperative circumstances, were also determined. Between three and four months after surgery, patients were encouraged to undergo further oesophageal manometry examination. Endoscopy was reserved for symptomatic patients with clinical indications.

#### Results

Eighteen male and 13 female patients with a median age of 45 (range 33–81) were studied. No patient has been lost to clinical follow up, with 11 (36%) patients having been followed up for more than two years, 19 (61%) for 12 months, and one (3%) for six months. Postoperative manometry has been performed on 17 (55%) patients.

#### *Equivocal primary peristalsis (n=8)*

At one to two years six patients had satisfaction scores of at least 9 (Table), and would choose to undergo the procedure again. Four patients had a preoperative dysphagia score  $> 3$ , but by 12 months only one of these still had a score  $> 3$ . One patient with a satisfaction score of 6 developed abdominal pain two months after the operation and was found to have retroperitoneal fibrosis requiring ureterolysis. She would still choose to undergo the operation again. The last patient had a satisfaction score of zero with a reflux score of 10. Although it seems probable that the wrap has failed, the patient, who has serious psychiatric problems, was not prepared to be reinvestigated. No other patient was troubled by bloating or reflux at one year. Two patients underwent postoperative manometry, with a rise in primary peristalsis in one patient and a fall in the other (Table and Fig 1).

#### *Abnormal primary peristalsis (n=4)*

All patients in this group had an excellent symptomatic outcome at 12 to 24 months, with satisfaction scores of 9 or 10 and no reflux (Table). All would undergo the operation again given similar preoperative circumstances. Three of the four patients had a preoperative dysphagia score  $> 3$ , but no patient complained of dysphagia, bloating, or reflux one year after the operation.

Postoperative manometry was available on two patients whose primary peristalsis had recovered, in the first patient from 40% preoperatively to 70%, and in the second patient from 10% preoperatively to 100% (Table and Fig 1).

#### *Abnormal maximum contraction pressure (n=13)*

Eleven patients 12 months after surgery and one at six months were virtually symptom free, with satisfaction scores of at least 8 (Table). All 12 would choose to undergo the operation again, and no patient had residual reflux or was troubled by bloating. Seven of the group had

Preoperative and postoperative manometry data, and symptom scores for all 31 patients (the greater of the dysphagia scores (for liquids and solids) is recorded)

Patient group	PP		MCP		LOS Postop	Nadir Postop	Dysphagia		Satisfaction
	Preop	Postop	Preop	Postop			Preop	Postop	
Equivocal PP only (n=8)	60	100			19	5	0	0	10
	60	40			32	13	5	8	6
	60						0	3	9
	60						0	0	10
	60						7	1	10
	60						4	0	10
	50						0	3	0
	50						5	0	10
Abnormal PP only (n=4)	40	70			26	3	0	3	9
	30						10	0	9
	30						8	0	9
	10	100			25	-2	5	3	10
Abnormal MCP only (n=13)			21	23	19	19	10	0	8
			20	31	9	-4.5	6	4	8
			15	12	10	7	0	0	10
			22	12	11	-2.5	3	0	10
			10	23	44	30	7	0	10
			19	53	20	13	0	3	10
			24	71	10	8	8	2	9
			19	34	16	12	2	1	9
			18	11	4	-3.5	5	2	4
			22	22	5	2	6	0	10
			15	58	15	6	0	2	10
			20				4	0	10
		22				0	0	10	
Abnormal PP and MCP (n=6)	40	100	21	60	50	18	10	0	10
	30	40	25	120	15	1	0	0	10
	0		10				0	0	10
	0		15				5	3	10
	0		0				0	3	10
	20		20				10	0	10

PP=primary peristalsis; MCP=maximum contraction pressure in the distal oesophagus; LOS=lower oesophageal sphincter pressure; nadir=nadir pressure; Preop=preoperative; Postop=postoperative.

a preoperative dysphagia score >3, but by 12 months only one of these still had a score >3. Postoperative manometry was carried out on 11 patients in this group with seven patients showing a higher than preoperative value, three patients a lower value, and one remaining unchanged (Table and Fig 2).

One patient had a satisfaction score of 4 and would not choose to undergo the procedure again. She denied dysphagia or reflux symptoms but had become intolerant of a variety of foods and developed tremors and palpitations which she attributed to the operation. Her operation had entailed division of short gastric vessels and hiatal repair. A barium meal and repeat endoscopy nine months later disclosed normal postfundoplication appearances. Postoperative manometry and pH studies showed evidence of a

very loose wrap, low contraction pressure, and equivocal reflux (Table). Postoperatively, oesophageal emptying was 53 seconds – within the normal range. The patient has been assessed by a cardiologist and a neurologist and her symptoms are thought to be related to anxiety.

*Abnormal primary peristalsis and maximum contraction pressure (n=6)*

This group included three patients with an adynamic oesophagus. Two year clinical follow up data were available for four patients, including those with an adynamic oesophagus. At three and 12 months, satisfaction scores were all 10, with no reflux. Three of the six

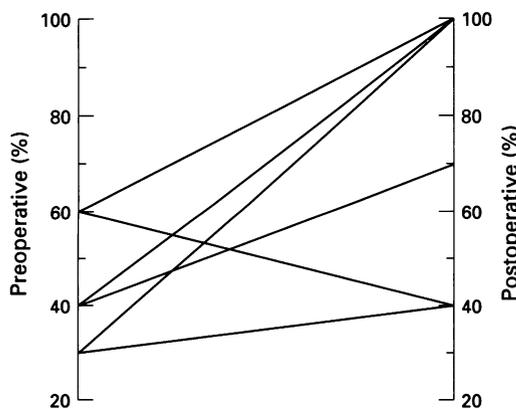


Figure 1: Primary peristalsis, measured preoperatively and at least three months postoperatively, in patients with equivocal abnormal preoperative primary peristalsis.

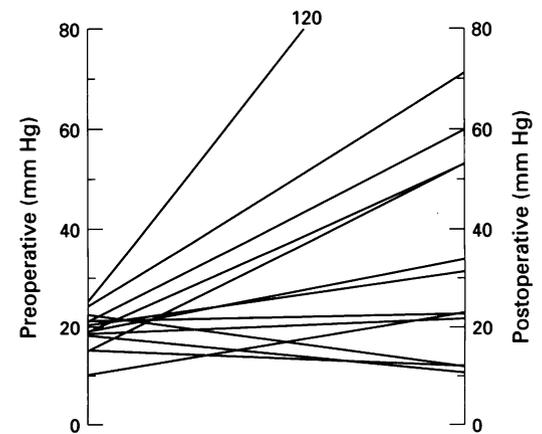


Figure 2: Maximum contraction pressures in the distal oesophagus, measured preoperatively and at least three months postoperatively, in patients with abnormal preoperative maximum contraction pressures.

patients had a preoperative dysphagia score >3, but 12 months after the operation no patient complained of dysphagia, bloating or reflux. Postoperative manometry in two patients showed an improvement in both primary peristalsis and contraction amplitudes (Table and Figs 1 and 2). The three patients with an adynamic oesophagus declined postoperative manometry.

Analysis of all 31 patients showed median postoperative values of 16 (range 4–50) mm Hg for basal lower oesophageal sphincter pressure, and 6 (range –4.5 to 30) mm Hg for nadir lower oesophageal sphincter pressure. Twenty eight (90%) patients had satisfaction scores of at least 8 and all would undergo surgery again. Seventeen (54%) patients had dysphagia scores of >3 preoperatively but only two (6%) patients had persistence of this symptom at one year.

### Discussion

This study presents the first prospective data of patients with disordered peristalsis undergoing laparoscopic fundoplication. Even in the era of open fundoplication, there was a paucity of prospective data and most published work was retrospective. Motility disturbances associated with gastro-oesophageal reflux disease were originally described by Olsen and Schlegel<sup>11</sup> and impaired volume clearance was suggested by Stanciu and Bennett.<sup>12</sup> Kahrilas *et al*<sup>13</sup> defined "peristaltic dysfunction" as either failed propagated peristalsis, or peristaltic sequences with feeble contractions. They suggested that between 25% and 50% of patients with peptic oesophagitis have peristaltic dysfunction. Although our experience suggests a lower prevalence, the true incidence is probably masked by differences in study population and manometric selection criteria.

The surgeons were not blinded to the preoperative manometric findings, but the operation aimed at creating a short, loose fundoplication was carried out in a standard fashion for each patient. The fundoplication was always done with a 52 French gauge bougie in the oesophagus to ensure the looseness of the wrap, and no other manoeuvres were added in any patient to ensure a particularly loose wrap. A subgroup of patients did have short gastric vessel division within the context of a prospective randomised trial, rather than to try and achieve a particularly loose wrap. The results of this trial have shown division of these vessels make no difference to symptoms or manometric outcome.<sup>13a</sup>

Detection of a severe motility disturbance in patients referred for anti-reflux surgery is considered mandatory by most surgeons. There is a belief that a total fundoplication will be followed by obstructive symptoms. Recently de Meester's group reported successful outcomes from open Nissen fundoplications in over 50 patients with mild non-specific motility disorders.<sup>14</sup> Although none of their patients had postoperative manometry, symptom outcome was excellent. However, their patients all

had considerably milder disorders of peristalsis than the patients in this study, and their manometric selection criteria for a Nissen fundoplication would have excluded almost all our patients with disordered primary peristalsis from undergoing this operation.

Evidence has been produced suggesting that oesophageal motor impairments are not reversible after surgery,<sup>15–18</sup> although some recent data indicated that a substantial improvement can occur in some cases.<sup>9, 19</sup> Our study had a high rate of postoperative manometry (56%) and there was an improvement in the manometry findings of 12 patients, a slight deterioration in three, and no change in two. Whereas these data, combined with the low level of postoperative dysphagia, suggest improved motility after surgery, the few patients preclude any firm conclusion.

The data presented suggest that disordered peristalsis (excluding achalasia) is not a contraindication for a 360° loose laparoscopic fundoplication, with the incidence of dysphagia being improved by surgery. Preoperative dysphagia is increasingly being recognised as a common symptom in gastro-oesophageal reflux disease<sup>20</sup> with 30–40% of patients in our overall experience reporting this symptom (unpublished data). The 54% incidence of preoperative dysphagia in our patients reflects their preoperative peristaltic dysfunction but this fell to 6% one year after operation. Two patients had an imperfect clinical outcome, but neither have dysphagia as a significant symptom. Overall patient satisfaction in this study group is similar to the 91% satisfaction score seen in a series of 345 patients who have undergone laparoscopic fundoplication in this unit and who have also been subject to prospective analysis.

Our findings suggest that a 360° fundoplication performed over a large bougie, either with or without division of short gastric vessels, is appropriate treatment for gastro-oesophageal reflux even when the patient has disordered oesophageal peristalsis.

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