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SURGICAL ENDOSCOPY
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Does pneumatic dilatation affect the outcome of laparoscopic cardiomyotomy?

K. Dolan, K. Zafirellis, A. Fountoulakis, I. G. Martin, S. P. L. Dexter, M. Larvin, M. J. McMahon

Division of Surgery, Leeds Institute for Minimally Invasive Therapy, The General Infirmary at Leeds, Great George Street, Leeds LS1 3EX, United Kingdom

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Abstract

Background: Controversy surrounds the choice of laparoscopic cardiomyotomy as the primary treatment for achalasia or a second-line treatment following the failure of nonsurgical treatment. Laparoscopic cardiomyotomy can be more difficult technically following pneumatic dilatations. The aim of this study was to compare the outcome obtained with primary laparoscopic cardiomyotomy to that achieved when the procedure is performed following failed pneumatic dilatation.

Methods: Laparoscopic cardiomyotomy was performed in seven patients following a median of four pneumatic dilatations (group A) and in five patients as their primary treatment (group B). Outcome was measured using manometry, a modified DeMeester symptom scoring system, and a quality-of-life questionnaire.

Results: There were no significant differences between groups A and B in sex, age, preoperative modified DeMeester score, or mean barrier pressure. Six of seven group A patients had evidence of periesophageal and submucosal fibrosis at surgery, but this condition was not seen in group B patients. The operative time was slightly longer in group A patients. There was no difference in complication rates (one primary hemorrhage in group A and one esophageal perforation in group B), and both groups had a significantly improved modified DeMeester score at 6 weeks and at long-term follow-up (median, 26 months). Eleven of 12 patients said that they would choose laparoscopic cardiomyotomy as their primary treatment if newly diagnosed with achalasia.

Conclusions: Laparoscopic cardiomyotomy is safe and effective as a primary or second-line treatment following pneumatic dilatations in patients with achalasia.

Key words: Laparoscopic cardiomyotomy — Achalasia — Pneumatic dilatations — Manometry — DeMeester score — Quality of life

Correspondence to: K. Dolan

Achalasia is a neuropathic disorder of the esophagus characterized by progressive loss of peristalsis and incomplete or absent relaxation of the lower esophageal sphincter. Treatment is aimed at symptomatic relief by disruption of the lower esophageal sphincter, achievable in >85% of patients by surgical cardiomyotomy [4, 7]. Historically, surgical cardiomyotomy necessitated a laparotomy or thoracotomy, resulting in a prolonged recovery period. Consequently, pneumatic dilatation of the esophagus performed on a day-case basis became the primary treatment of achalasia in the 1980s [12]. However long-term symptomatic relief is achieved in only 70% of patients who undergo pneumatic dilatation, and there is a 3–10% risk of esophageal perforation [4, 9, 16, 17].

Laparoscopic cardiomyotomy was first performed in 1991 [19]; since that time, it has been shown to have a success rate similar to open cardiomyotomy but with less morbidity, a shorter hospital stay, and an earlier return to routine activity [5]. Symptomatic relief obtained from cardiomyotomy is more common and longer-lasting than that achieved with medical treatment, pneumatic dilatation, or the injection of botulinum toxin [1, 15]. Despite these studies, patients continue to be treated primarily with pneumatic dilatation and or botulinum toxin injection, even though a number of patients in whom these methods fail are eventually referred for surgical cardiomyotomy. It has been suggested that both pneumatic dilatation and botulinum toxin injection cause submucosal and periesophageal fibrosis, which may render surgical cardiomyotomy technically more difficult [1, 3].

This is the first study to compare the short- and long-term outcomes of laparoscopic cardiomyotomy as a primary treatment or as a second-line treatment following the failure of pneumatic dilatation.

Patients and methods

Between 1993 and 1999, 12 patients with a clinical and manometric diagnosis of achalasia underwent laparoscopic cardiomyotomy. Group A consisted of seven patients who were referred for persistent or recurrent symp-

Table 1. Modified DeMeester symptom scoring system

Symptom	Score	Description
Dysphagia	0	None
	1	Occasional transient episodes
	2	Require liquids to clear
	3	Impaction requiring medical attention
Heartburn	0	None
	1	Occasional brief episodes
	2	Frequent episodes requiring medical treatment
	3	Interference with daily activities
Regurgitation	0	None
	1	Occasional episodes
	2	Predictable by posture
	3	Interference with daily activities, aspiration

toms following pneumatic dilatations (median, 4; range, 2–5): group B was comprised of five patients referred for primary surgical treatment.

All patients underwent preoperative endoscopy and esophageal manometry, which was performed in the supine position using a triple-lumen water-perfused catheter and the station pull-through method. Symptoms were assessed in the clinic using a modified DeMeester symptom scoring system (Table 1) [8].

Laparoscopic cardiomyotomy and a simultaneous antireflux procedure were completed in all patients. The cardiomyotomy extended proximally up the esophagus for at least 6 cm and distally on the stomach for 2 cm. Dor hemifundoplication, the antireflux procedure performed routinely along with cardiomyotomy at our institution, was performed in nine patients. Three group A patients in whom reflux was a significant symptom underwent a Nissen fundoplication as their antireflux procedure.

Laparoscopic cardiomyotomy was performed by 2 surgeons during the study period. M.J.M. handled four group A cases and two group B cases; I.G.M. treated three cases in each group. Although neither had performed laparoscopic cardiomyotomy prior to the beginning of the study, each had extensive experience in advanced laparoscopic procedures, including antireflux surgery. Therefore, there were no significant differences in surgical experience between group A and group B cases.

Patients were reviewed 6 weeks postoperatively and then at 6-month intervals. A modified DeMeester score was calculated for their first postoperative and most recent clinic visits. Median follow-up is presently 40 months for group A patients and 18 months for group B patients. In August 2000, each patient completed a quality-of-life questionnaire designed specifically for patients with treated achalasia [10]. This questionnaire uses five categories—namely, social activities, family relationships, athletic activities, travel experience, and housework—to assess quality of life. It asks patients whether their treatment has restricted, improved, or not changed these categories in their lives.

Group A and group B patients were compared using Fisher's exact test and the Mann-Whitney U test. The Wilcoxon signed rank test was used to compare the preoperative modified DeMeester score with scores at 6 weeks and at the patients' last clinic visit.

Results

Group A and group B patients were similar in terms of age, sex ratio, preoperative modified DeMeester score, and preoperative mean barrier pressure (Table 2).

Six of seven group A patients had evidence of periesophageal and submucosal fibrosis at surgery, whereas fibrosis was not seen in group B patients ($p = 0.01$, Fisher's exact test). Group A patients had a slightly longer operating time than group B patients ($p = 0.15$, Mann-Whitney U test) and a slightly longer hospital stay ($p = 0.34$, Mann-Whitney U test) (Table 2).

There were two complications, one in each group. One group A patient required a blood transfusion postoperatively, presumably due to a primary hemorrhage. This was the first laparoscopic cardiomyotomy performed at the General Infirmary at Leeds. As a result of five previous pneumatic dilatations performed over the preceding 18 months, extensive periesophageal and submucosal fibrosis was detected at surgery. This patient was discharged on postoperative day 10. The second complication was an esophageal perforation in a group B patient. The perforation was recognized at surgery and sutured laparoscopically. Following a normal Gastrografin swallow on day 3, the patient was recommenced on diet and discharged on postoperative day 5.

In both groups, the modified DeMeester score improved significantly from a preoperative median of 4 to a 6-weeks postoperative median of 0 ($p = 0.02$, Wilcoxon signed rank test). At long-term follow-up, the median modified DeMeester score of 1 remains significantly better than the preoperative score in both groups ($p = 0.03$, Wilcoxon signed rank test).

Unfortunately, only four patients consented to postoperative manometry. In these cases, the mean barrier pressure decreased from a preoperative median of 30 mmHg to a postoperative 8 mmHg ($p = 0.07$, Wilcoxon signed rank test).

All five patients in group B and three of seven group A patients reported an improvement in their social activities following surgery, whereas two of seven group A patients stated that their social activities were restricted. Two group A and two group B patients said that they could travel more following surgery. There were no significant changes in the other categories of the quality-of-life questionnaire (Table 3).

A single patient regretted surgery because he felt that his social and athletic activities had been restricted by the operation. This was the first laparoscopic cardiomyotomy of the series and the patient who had required a postoperative transfusion. His modified DeMeester score improved from a preoperative 4 to 1 at 6 weeks postoperatively, but his symptoms recurred 5 years after his surgery. He refused further manometry and did not want any further treatment, either medical or surgical. The remaining 11 patients said that they would choose a laparoscopic cardiomyotomy as their primary treatment if newly diagnosed with achalasia, including six patients who had had pneumatic dilatations prior to laparoscopic cardiomyotomy.

Discussion

Controversy has persisted for many years over whether surgical cardiomyotomy should represent the primary treatment of achalasia or be restricted to those patients in whom pneumatic dilatations or botulinum toxin injections have failed [4, 13, 14]. Because it was necessary to perform a laparotomy or thoracotomy along with surgical cardiomyotomy in the 1980s, most patients were treated by pneumatic dilatation [12]. The advent of laparoscopic cardiomyotomy in 1991 [19] added a new dimension to the controversy. A number of studies have shown that laparoscopic cardiomyotomy is safe and effective and that it is associated with minimal discomfort and a short hospital stay [2, 6, 11].

In our study, complications were encountered in two patients. A single perforation occurred in 12 patients, or 8.3%—a rate similar to the 7.8% calculated in a meta-analysis of 14 published series [18]. This meta-analysis also

Table 2. Comparison of laparoscopic cardiomyotomy in patients with previous dilatations (group A, $n = 7$) and as a primary procedure (group B, $n = 5$)

Factor	Group A	Group B	Test	p value
Male: female	5:2	3:2	Fisher exact	0.69
Age (yr)	50 (21–62)	36 (28–65)	Mann-Whitney U	0.79
Duration of symptoms (mo)	36 (12–108)	36 (12–60)	Mann Whitney U	0.64
Periesophageal fibrosis (mo)	6	0	Fisher's exact	0.01
Operation time (min)	130 (80–360)	85 (80–110)	Mann-Whitney U	0.15
Hospital stay (d)	4 (3–10)	3 (3–5)	Mann-Whitney U	0.34
Follow-up (mo)	40 (18–88)	18 (12–28)		
Antireflux procedure (n)	4 Dor, 3 Nissen	5 Dor		
DeMeester score				
Preoperative	4 (3–6)	4 (4–7)	Mann-Whitney U	0.27
6 weeks postoperatively	0 (0–3)	0 (0)	Mann-Whitney U	0.27
Last clinic visit	1 (0–4)	1 (0–2)	Mann-Whitney U	0.53
Mean barrier pressure				
Preoperative (mmHg)	30 (20–48)	26 (20–38)	Mann-Whitney U	1.0
Postoperative (mmHg)	8 (6–14)	Not available		

Table 3. Quality of life following laparoscopic cardiomyotomy in patients with previous dilatations (group A) and as a primary procedure (group B)

Category	Group A	Group B
Social activities	$3 = \uparrow, 2 = \rightarrow, 2 = \downarrow$	$5 = \uparrow$
Family relationships	$7 = \rightarrow$	$1 = \uparrow, 4 = \rightarrow$
Athletic activities	$1 = \uparrow, 6 = \rightarrow$	$5 = \rightarrow$
Travel experience	$2 = \uparrow, 5 = \rightarrow$	$2 = \uparrow, 3 = \rightarrow$
Housework	$7 = \rightarrow$	$5 = \rightarrow$
Surgery as primary treatment	6 of 7	5 of 5

$\uparrow$ represents improvement, $\downarrow$ a deterioration, and $\rightarrow$ no change

reported that significant bleeding required conversion to an open procedure in 1%. Bleeding that required transfusion occurred in one of our 12 patients (8.3%), but this patient did not require conversion or re-operation. Indeed, neither of our complications resulted in re-operation or significant morbidity. Laparoscopic cardiomyotomy at the General Infirmary at Leeds led to a significant and sustained improvement in symptoms, as revealed by the modified DeMeester scoring system, and a reduction in the median barrier pressure measured by esophageal manometry. More than half of our patients reported an improvement in their social activities, but almost all of them thought that the questions on the quality-of-life questionnaire were not relevant to their condition. As a result, we are no longer using this questionnaire. Currently, we rely on the modified DeMeester symptom scoring system as the subjective outcome measure of surgery.

The median hospital stay was 4 days. Our study thus confirmed the short hospital stay for laparoscopic cardiomyotomy described in previous studies, as well as the safety and efficacy of the procedure [2, 6, 11].

However, none of the earlier series specifically questioned the safety of laparoscopic cardiomyotomy following failed pneumatic dilatations. Laparoscopic cardiomyotomy in a series of 10 patients with a minimum of two previous dilatations was reported to be "difficult and bloody" due to the presence of periesophageal fibrosis; this difficulty was reflected in an esophageal perforation rate of 30% [3]. In another series, 22 patients with achalasia were given a choice of treatment—namely, between laparoscopic cardiomyotomy and botulinum toxin injection [1]. Patients were told that if the injection failed, surgery would be available. Four of 22 patients chose laparoscopic cardiomyotomies, all of which were performed without complications and with excellent relief of symptoms. Eighteen patients received botox injections. So far, 14 of them have required further treatments for symptom recurrence, including five who requested surgery after a median of four injections. Again, these laparoscopic cardiomyotomies were technically more difficult due to fibrosis and took significantly longer than primary laparoscopic cardiomyotomy. An esophageal perforation occurred in one of five patients who underwent surgery after primary medical treatment failed. Hence, both of these studies suggest that laparoscopic cardiomyotomy is technically more difficult following failed dilatation or botox injection and that it is associated with an esophageal perforation rate of 20–30%.

In our series, periesophageal fibrosis detected in all but one patient who had had previous pneumatic dilatations, and laparoscopic cardiomyotomy took slightly longer in these cases. However, this may have been due to the fact that group A included three patients who had a Nissen fundoplication rather than a Dor hemifundoplication. Nissen fundoplication was performed in patients for whom reflux constituted a significant part of the symptom complex. The more significant reflux in group A patients may have been the result of previous pneumatic dilatations. There was no difference in the complication rate between primary laparoscopic cardiomyotomy and laparoscopic cardiomyotomy performed following pneumatic dilatation. Both short- and long-term symptom relief was excellent in patients treated primarily by laparoscopic cardiomyotomy and good in patients with previous dilatations. All but one of our patients said that they would choose laparoscopic cardiomyotomy as their primary treatment if newly diagnosed with achalasia, including seven patients who underwent both dilatations and surgery.

This preliminary study indicates that laparoscopic cardiomyotomy can be performed safely and successfully as a primary or second-line treatment following previous dilatations. However, the presence of periesophageal fibrosis resulting from pneumatic dilatations has the potential to make the procedure more difficult. Our patients indicated that

they would prefer surgery as their primary treatment. We therefore recommend that laparoscopic cardiomyotomy be used as the first-line treatment for achalasia.

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