



# Postoperative Results After Laparoscopic Approach for Treatment of Large Hiatal Hernias: Is Mesh Always Needed? Is the Addition of an Antireflux Procedure Necessary?

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Laparoscopic approach has been suggested as the definitive treatment for large hiatal hernias. Reinforcement of the hiatoplasty and the need to perform antireflux surgery is still undergoing discussion. The purpose of this study was to evaluate the postoperative results, with special emphasis on the recurrence rate and reflux after surgery comparing the use or not of mesh reinforcement. This prospective study included 81 patients with a complete evaluation through a clinical questionnaire, barium sulfate radiologic evaluation, endoscopy, manometry, and 24-hour intraesophageal pH monitoring before and after a hiatoplasty with an antireflux procedure. Mesh reinforcement was used in 23 patients. Postoperative complications occurred in 11 patients (13.6%), without mortality. Recurrent hernia was observed in 10 patients without mesh reinforcement (12.3%), whereas those with mesh reinforcement showed no hiatal hernia recurrence ( $P = 0.33$ ). Normal resting lower esophageal sphincter pressure was obtained after fundoplication in 87.2% of patients, and abnormal acid reflux was observed in 12.8% of patients after surgery. In conclusion, mesh reinforcement in patients with large Type IV could prevent recurrent hiatal hernias, and an antireflux procedure must be performed in order to avoid postoperative acid reflux.

*Key words:* Hiatal hernia – Mesh – Antireflux surgery

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Since the 1990s, laparoscopic approach has been suggested as the definitive treatment for patients with hiatal hernia. Two topics are still under discussion: the need to perform antireflux surgery and the need for mesh use in a hiatoplasty in order to avoid gastroesophageal reflux and to prevent recurrence of the hernia after surgery.<sup>1-6</sup> In this prospective study, we present our postoperative results in patients with large hiatal hernias, defined as those more than 5 cm in size. These results were focused on hernia recurrence, its association with mesh reinforcement, and the manometric and 24-hour intraesophageal pH monitoring.

### Patients and Methods

In this prospective study, 81 patients were included; there were 26 men and 55 women with a mean age of 45.8 years (range, 37 to 75 years). Before and after surgery, all of them underwent a complete evaluation through a clinical questionnaire, barium sulfate radiologic evaluation, and endoscopy. Manometry and 24-hour intraesophageal pH monitoring were carried out on 69 patients before surgery, and 39 of them accepted evaluation after the operation.

Clinical questionnaire was used in order to verify the presence of reflux symptoms, dysphagia, or other extraesophageal manifestations, such as retrosternal pain, cardiac symptoms, or respiratory symptoms.

Endoscopy was used in order to confirm the presence of esophagitis and hiatal hernia. Hiatal hernia was suggested if the presence of an axial or lateral sacular formation with gastric folds emerging from a distal ring was observed during the examination. The intragastric U turn of the instrument confirmed the vision of gastric folds invagination to the proximal esophagus through a dilated hiatus, demonstrating the presence of a true hiatal hernia.<sup>7</sup>

Radiology examination, using a barium sulfate bolus, was performed to confirm the type of hiatal hernia, measure its size, and evaluate its anatomical characteristics.<sup>8</sup>

### Definition of the type of hernia

#### Type I

Sliding axial hiatal hernia is one in which gastroesophageal junction migrates through the hiatus to the mediastinum.

#### Type II

True paraesophageal hernia is one in which the fundus herniates through the hiatus laterally to the esophagus, but the esophagogastric junction remains in the abdominal cavity.

#### Type III

Is a combination of Types I and II in which the esophagogastric junction herniate into the mediastinum without other complications or involvement of other abdominal organs.

#### Type IV

Type IV is a very large Type III hiatal hernias in which the stomach or other organs (*e.g.*, colon, spleen, omentum) herniates into the thorax. These hernias are often associated with volvulus or complex distortion of the gastric anatomy.

Manometry was performed in order to pinpoint the location and resting pressure of the lower esophageal sphincter (LES) and esophageal body motility. The 24-hour intraesophageal pH monitoring was performed in order to establish the presence of abnormal acid reflux. The details of both methods have been previously published.<sup>9</sup>

### Follow-up

Follow-up was carried out 3 to 5 years afterward, using the same protocol. Thirty asymptomatic patients with normal endoscopy and radiology rejected a new manometry and acid reflux test.

Recurrence of hernia was defined if radiologic and endoscopic evaluation after surgery demonstrated an intrathoracic portion of the stomach, regardless of its size or type.

### Surgical procedure

We used five trocars for the surgical procedure, similar to our technique for antireflux surgery.<sup>10</sup> After the recognition of the anatomy of the hiatal hernia, a babcock forcep was used for retracting the anterior surface of the hernia sac, which was divided at 1 cm above the hiatus and which softly tractioned to the abdomen. All the fibrotic and fat tissues were also divided. When the sac was completely positioned in the abdomen, we proceeded to identify the anterior face of the esophagus, anterior vagus nerve, complete esophageal and esophagogastric junction, and the hiatal crura, which were closed with three or four stitches by using unabsorbable sutures (Ethibond 00 or Silk 00, Ethicon, Inc, New Jersey, USA).

Table 1 Intraoperative and postoperative complications and treatment

Complications	Patients (N = 81)		Treatment
	n (%)		
Intraoperative	9 (11.1)		
Bleeding	5 (6.2)		
Mediastinic	2		Conversion (2.4%)
Splenic tear	1		Coagulation + Surgicell application
Short gastric vessels	2		Clippage and coagulation
Massive emphysema	4 (4.9)		Observation
Postoperative	11 (13.6%)		
Pleural effusion	3		Kinesic treatment
Dysphagia	4		Endoscopic dilatation
Transitory gastric atony	2		Prokinetics + erythromycin
Bleeding (gastric ulcer)	1		Omeprazole
Subphrenic abscess	1		Reoperation/drainage
Mortality	0		

In 23 patients who had a dilated hiatus greater than 5 cm in diameter, we preferred to perform hiato-plasty plus mesh reinforcement in order to prevent eventual recurrent hiatal hernia appearance using Vycril mesh, n = 8, Ultrapro mesh, n = 13 (Ethicon, Inc, New Jersey, USA) or Surgisis mesh, n = 2 (Cook Medical Bloomington, IN, USA). When the closure of the hiatus was completed, we proceeded to perform a fundoplication and posterior gastropexy for antireflux procedure in all patients.<sup>10</sup>

## Results

Type I hernia was found in 35 patients, Type II was in 5 patients, Type III was in 26 patients, and Type IV was in 15 patients. The mean operative time was 115 minutes (range, 90 to 145 minutes). Intraoperative complications occurred in 9 patients (11.1%). Bleeding was seen in 5 patients during the initial

period of our experience (*i.e.*, learning curve). Three were successfully treated immediately with clippage, coagulation, and application of hemostatic tissue (Surgicell, Ethicon, Inc, New Jersey, USA) over the splenic surface, but 2 patients were converted to open surgery (2.4%). Postoperative complications occurred in 11 patients without postoperative mortality. In Table 1, intraoperative and postoperative complications are shown.

Preoperative and postoperative symptoms according to the type of hernia are shown in Table 2. Heartburn and regurgitation were present especially in patients with Type I hernia. Chest pain, respiratory symptoms, or cardiac symptoms were present in patients with large, Type IV hiatal hernias. Vomiting was observed in 8 patients who had large hiatal hernias associated with partial gastric volvulus. After surgery, reflux symptoms decreased significantly. Heartburn was observed in 10 patients

Table 2 Symptoms associated with type of hiatal hernia before and after surgery

Symptoms	Preoperative				Postoperative					
	Patients n (%)	Type of hernia				Patients n (%)	Type of hernia			
		I	II	III	IV		I	II	III	IV
Heartburn	61 (75.3%)	35	2	26		10 (12.3)	10			
Regurgitation	59	35		24						
Chest pain	28		1	16	13					
Dysnea	15		1		14					
Cardiac <sup>a</sup>	15		1		14					
Anemia	14				14					
Vomiting	8				8	2 (2.4)	2			
Dysphagia	6			5	1	5 (6.1)	5			

<sup>a</sup>Tachycardia, arrhythmias.

## Before surgery



## Before surgery



## After surgery



## After surgery



**Fig. 1** Hiatal hernia before and after hiatoplasty, fundoplication, and mesh reinforcement.

(12.3%), and pain, cardiac symptoms, or respiratory symptoms disappeared. Dysphagia was present in 5 patients who needed endoscopic dilatation with Savary-Guillard bougies (Cook Medical, Bloomington, IN, USA) and who improved after the procedure. Two patients with vomiting, most likely

**Fig. 2** Endoscopic visualization of a giant hiatal hernia before and after surgery.

secondary to transitory gastric atony, responded well to nasogastric tube placement and prokinetics treatment.

Figure 1 shows the radiologic evaluation before and after the operation, and Fig. 2 shows the

Table 3 Recurrence rate according to the type of hernia and the use or not of a mesh reinforcement for closure of the diaphragmatic crura

Mesh	Type				Total	Recurrence n (%)
	I (Rec)	II (Rec)	III (Rec)	IV (Rec)		
Yes		1 (0)	14 (0)	8 (0)	23	0
No	35 (3)	4 (0)	12 (3)	7 (4)	58	10 (17.9) <sup>a</sup>
Total	35 (3)	5 (0)	26 (3)	15 (4)	81	10 (12.3)

Rec, recurrence number.

<sup>a</sup>Significantly different,  $P = 0.03$ .

endoscopic images before and after the operation. The recurrence rate of hiatal hernia according to the type of hernia and the use or not of a mesh for reinforcement of the crura closure is shown in Table 3. After surgery, 3 (8.6%) of 35 patients with Type I hernias presented with small, recurrent, hiatal hernias. No recurrent hernia was found in patients with paraesophageal hiatal hernia, regardless if mesh reinforcement was used or not. Of 26 patients with Type III hernia, 12 had no mesh reinforcement, and 3 of them presented with recurrent, Type I hiatal hernia (25%). In 14 patients with mesh reinforcement, no postoperative hiatal hernia was found. Of 15 patients with Type IV, 7 did not have mesh reinforcement, and 7 of them (57.1%) had a recurrent, Type I hiatal hernia. In 8 patients with mesh placement, no postoperative recurrence of hiatal hernia was observed. Of 58 patients without mesh reinforcement, 10 (17.2%) presented with a Type I recurrent hernia, whereas 23 patients with mesh reinforcement showed no hiatal hernia recurrence ( $P = 0.03$ ). The global recurrence was 10 (12.3%) of 81 patients.

Table 4 shows the characteristics of the hiatal hernia with regard to its type and size and postoperative recurrence, objectively demonstrated with barium sulfate swallow. Before surgery, 22 patients with hiatal hernias less than 9.9 cm in size corresponded to Type I hernias, whereas larger size (>10 cm) corresponded to Type III or IV hernias. After surgery, we observed 10 patients (12.3%) with recurrent, Type I small hernias.

Before surgery, LES was hypotensive in 58 (84.1%) of 69 patients. After surgery, only 5 (12.8%) of 39 patients presented with hypotensive LES, and the mean ( $\pm$  standard deviation) LES pressure (LESP) was  $8.78 \pm 2.51$  mmHg (Fig. 3). An abnormal reflux test was observed in 61 (88.4%) of 69 patients, whereas 5 (12.8%) of 39 patients after surgery presented positive on 24-hour pH monitoring (Fig. 4). These results demonstrated that resting

Table 4 Type, size, and recurrence of hiatal hernia

Type	Recurrence (n) by size			Total
	5–9.9 cm	10–14.9 cm	>15 cm	
I				
Preop	22	11	2	35
Postop	10			10
II				
Preop		1	4	5
Postop				0
III				
Preop		18	8	26
Postop				0
IV				
Preop			15	15
Postop				0

Postop, postoperative. Preop, preoperative.

lower esophageal sphincter pressure increased significantly after surgery ( $P < 0.05$ ).

## Discussion

From 2000 to now, several papers have reported the results of different hiatal hernia surgery topics.<sup>11–13</sup> Early results after laparoscopic surgery compared with open surgery demonstrated that conversion to open surgery was very low, less than 3%, and postoperative complications ranged from 5% to 38%, most of them corresponding to minor complications. Respiratory (3.4%), cardiac (2.9%), or leaks (1.2%) have been the most common postoperative complications observed, almost exclusively in elder patients. The mortality associated with these complications has been less than 1%.<sup>12–17</sup> According to the published data, a high recurrence rate of up to 40% has been observed after the laparoscopic technique without the use of mesh.<sup>2,5,14–17</sup> In a recent review of 20 selected papers published by Mehta *et al*,<sup>13</sup> 9 authors did not use a mesh placement, but 11 other authors were enthusiastic about using mesh in order to diminish the recurrence after surgery. In this study, only 10% of patients were candidates for mesh reinforcement. Johnson *et al*,<sup>18</sup> in another review that included 19 papers on 1368 patients describing the use or not of different prosthetic materials to repair the crura, reported a recurrence rate of 10.7% in patients without mesh reinforcement compared with 1.8% in the group with mesh use. Furthermore, partial migration of the antireflux wrap has been observed.<sup>19–21</sup> Frantzides *et al*<sup>17</sup>

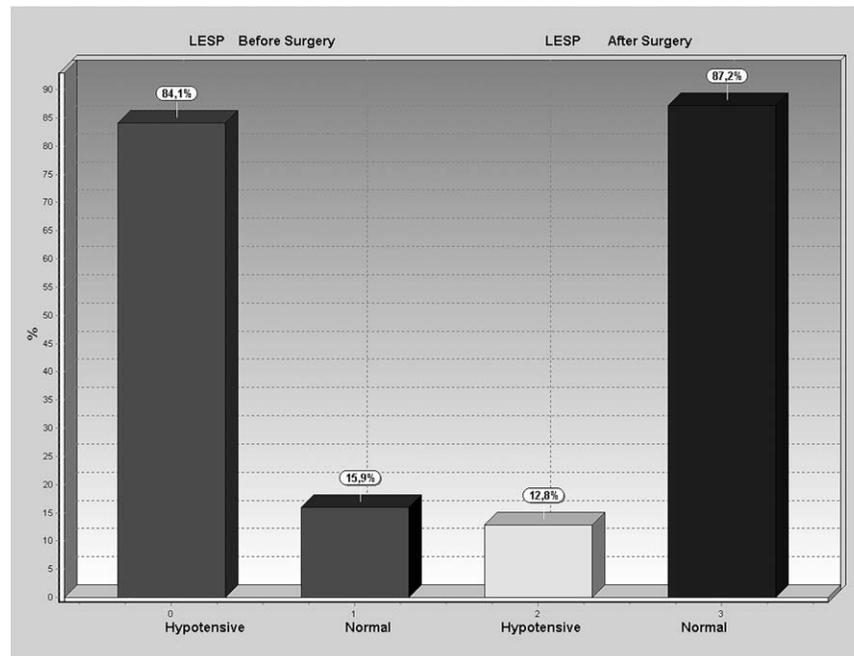


Fig. 3 Percentage of patients with normal or incompetent lower esophageal sphincter (LES) before and after the operation.

published a decrease in recurrence from 22.2% for primary repair to 0% with reinforcement of the hiatus with a prosthetic material.

The results comparing the use or not of different types of mesh have been discussed in the literature.<sup>18–35</sup> Erosions, strictures, and migration have been reported when prolene mesh was used. However, these complications are not commonly reported in large series, and only a few isolated cases have been published.<sup>22–24</sup> New prosthetic materials have been proposed, and the last tendency is to use biologic absorbable mesh in order to avoid complications later on.<sup>33–35</sup> A very important point is the follow-up and how patients are evaluated after surgery. According to the reports by Metha *et al*<sup>13</sup> and Andujar *et al*,<sup>21</sup> recurrence reached nearly 30%, which increased with a broader follow-up using radiologic assessment. Regardless of the high recurrence rate after hiatal hernia repair, it is necessary to emphasize that the majority of recurrences are small-size, Type I hernias, as defined in the preoperative period, even after repairing large Type IV hernias,<sup>36–39</sup> as we also observed in our patients.

In our experience, the recurrence was observed exclusively in patients without mesh reinforcement, but we think that the indication for mesh use depends on the diameter of the defect. Therefore, it is clear that, in order to avoid recurrence of mesh

placement, onlay or keyhole closure may offer better results.

Is it necessary to add antireflux surgery? This is another point of discussion. Why not? Some surgeons oppose the addition of fundoplication because of the appearance of dysphagia and complications after surgery.<sup>37</sup> This phenomenon is observed in the same proportion after fundoplication for patients without hiatal hernia, and it is considered a transitory effect after surgery. According to the experience reported by Rakic *et al*,<sup>40</sup> Myers *et al*,<sup>41</sup> and Geha *et al*,<sup>42</sup> the addition of fundoplication is based on the presence of preoperative esophagitis or LES incompetence. Patients with esophagitis improved after the addition of fundoplication.<sup>39–42</sup> Ideally, all patients must be evaluated before surgery with manometry and a reflux test, and selection of patients requiring fundoplication must be based on these preoperative findings. A high percentage of patients with axial hiatal hernias also had abnormal acid reflux because a high percentage of patients had abnormal acid reflux. Few papers have demonstrated results concerning the manometric or acid reflux evaluation in patients who underwent surgery for hiatal hernias. Currently, most surgeons agree to perform an additional antireflux procedure, because a great proportion of patients have an abnormal reflux test.<sup>13</sup> In this study, there was not a control group without antireflux procedure,

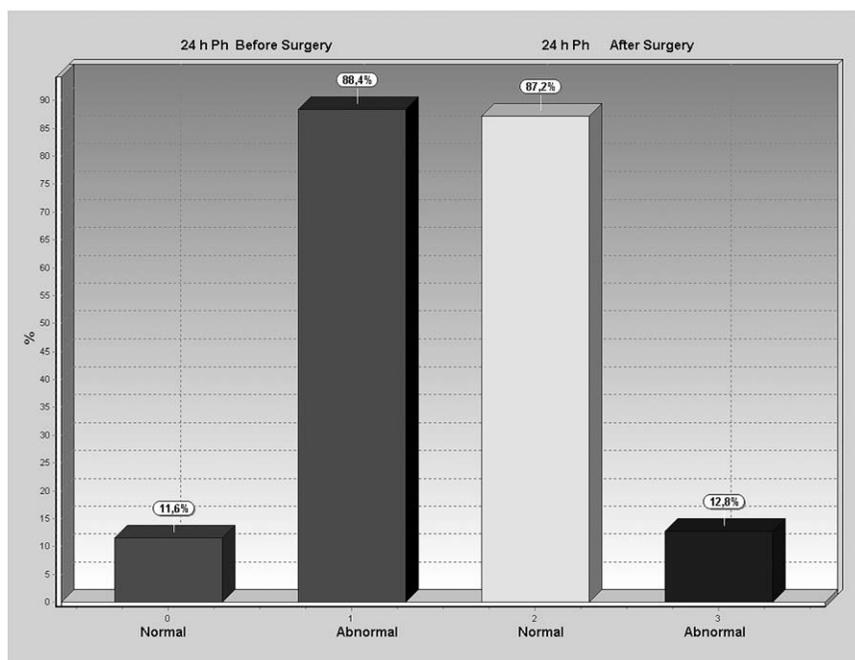


Fig. 4 Percentage of patients with normal or abnormal intraesophageal 24-hour pH monitoring before and after the operation.

because, according to the available data on the literature,<sup>2,13,39–42</sup> extended mobilization of the distal esophagus and esophagogastric junction promote reflux after surgery, and the addition of an antireflux procedure can avoid postoperative reflux symptoms or esophagitis. We have confirmed the value of antireflux surgery in order to increase LESP and avoid the recurrence of acid reflux after surgery.

## Conclusion

Hiatoplasty plus mesh reinforcement reduces the risk of hernia recurrence in patients with large hiatal hernia (*i.e.*, >5 cm in diameter). We recommend addition of an antireflux procedure during the hiatal hernia repair.

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