



Laparoscopic hiatal hernia repair

Long-term outcome with the focus on the influence of mesh reinforcement

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Abstract

Background: The recurrence rate after laparoscopic repair of hiatal hernias with paraesophageal involvement (LRHP) is reported to be high. Mesh reinforcement has been proposed with the objective of solving this problem. This study aimed to compare the outcome of LRHP before and after the introduction of mesh reinforcement.

Methods: Between 1992 and 2003, 56 consecutive patients received LRHP including posterior crurorrhaphy and additional fundoplication. Of these 56 patients, 17 underwent a mesh-reinforced hiatoplasty. Perioperative outcome was assessed retrospectively, and follow-up assessment was performed according to protocol including a barium contrast swallow.

Results: The follow-up period averaged 52 ± 31 months (range, 9–117 months). The recurrence rate for hiatal hernia without mesh reinforcement was 19% (7/36). No recurrence (0/16) was observed in patients with mesh reinforcement. The intraoperative complication rate was 9%, and the perioperative morbidity rate was 14%. There were neither mesh-related complications nor operation-related deaths.

Conclusions: Although challenging, LRPH is a successful procedure. The high recurrence rate reported in the literature can be reduced by additional mesh reinforcement.

Key words: Gastroesophageal reflux disease — Hiatal hernia — Laparoscopic hiatal hernia repair — Mesh reinforcement — Polypropylene mesh

Laparoscopic repair of hiatal hernias with paraesophageal involvement (LRHP) principally aims at treating hernia-associated symptoms [20]. Treatment also is

mandatory to avoid the potential risk of life-threatening complications such as incarceration, perforation, and bleeding, which occur in up to 30% of patients with paraesophageal hernias (PEH) [7, 18]. As an established, efficient operative procedure, LRPH has reported success rates of 77% to 100% [6, 11]. However, most studies report success rates based on a short follow-up period. Nevertheless, high recurrence rates up to 42% after LRHP have been reported [6], and for this reason, the long-lasting success of LRHP has been doubted. Even if recurrences remain often asymptomatic, many patients require further therapy or reoperation. In addition, the natural history of asymptomatic and nontreated PEH recurrences with the potential risk of severe complications remains unclear. As a consequence and similar to open PEH surgery, a mesh reinforcement of the hiatoplasty has been advocated in LRHP to reduce the recurrence rate. The first laparoscopic procedure with mesh-reinforced hiatoplasty was published by Edelman in 1995 [3]. More recently, the method has been proved effective in a controlled randomized trial [5].

The aim of the present study was to evaluate the influence of mesh reinforcement on LRHP by assessing the outcome, the recurrence rate, and the side effects in the long-term follow-up evaluation.

Materials and methods

Patients

A total of 56 LRPHs with additional fundoplication were performed by the senior surgeon from 1992 to 2003 at Aarberg hospital. The male-to-female ratio was 1:2. The mean age was 61 ± 12 years (range, 32–88) years, and the mean body mass index (BMI) was 28 ± 4 kg/m² (range, 21–37 kg/m²). Perioperative patient risk was assessed using the American Society of Anesthesiology (ASA) Scoring System. Patient demographics did not differ significantly between the group with mesh reinforcement and the group without mesh reinforcement (Table 1).

Table 1. Patient demographics and clinical characteristics; $n = 56$

	Without mesh reinforcement n (range)	With mesh reinforcement n (range)	p value
Age (years)	59 \pm 11 (32–75)	66 \pm 12 (36–88)	0.056
BMI (kg/m ²)	28 \pm 3	29 \pm 4	0.362
ASA I	7	4	
ASA II	28	11	0.400
ASA III	5	1	

BMI, body mass index; ASA, American Society of Anesthesiology classification

Preoperative investigations

Preoperative evaluation included chest x-ray for all patients, upper endoscopy for 52 patients (93%), esophageal 24-h pH measurement for 38 patients (68%), and barium contrast swallow for 16 patients (29%). Final confirmation of a paraesophageal involvement by the hernia was accomplished intraoperatively.

Surgical technique

The operation was performed with the patient under general anesthesia and after intravenous administration of Cefamandole 2 g. The patient was placed in a combined 20°–30° reversed Trendelenburg and French position. Attention was paid to a careful reposition of the stomach, a complete reduction of the hernia sac, and a circular dissection of the esophagogastric junction. Dissection of the short gastric vessels was avoided. Posterior crurorrhaphy was routinely performed with the application of three to four nonabsorbable sutures (2-0 Ethibond™; Ethicon, Spreitenbach, Switzerland) after placement of a 56-Fr esophageal tube. Crurorrhaphy was combined with fundoplication in all the patients. As described previously, the Toupet hemifundoplication was the antireflux procedure of choice [23]. Four of six Nissen fundoplications were performed at the beginning of the study when the concept of generally performing a Toupet hemifundoplication had not yet been established in our institution. One additional Nissen fundoplication was performed as a redo-procedure in a case of recurrent gastroesophageal reflux disease after a Toupet fundoplication, and another was performed in the case of severe gastroesophageal reflux disease with excessive reflux times. Dorr fundoplication was performed in four patients with symptoms other than reflux such as anemia, dyspnea, and recurrent vomiting. In 16 patients, crurorrhaphy was reinforced by a 6 \times 9 cm (\pm 2 cm) butterfly-shaped mesh, which was placed behind the esophagus using onlay technique and fixed with 8 to 10 staples (Endopath EMS™; Ethicon Endo-Surgery, Spreitenbach, Switzerland) to the diaphragm and both crura. Mesh reinforcement was implemented in selected cases with particularly large hernias initially after the first 33 patients, and regularly in the last 11 patients. For the first four patients prolene (Surgipro mesh, Autosuture, Tyco Healthcare, Wollerau, Switzerland) was used as mesh material. As soon as it was available, a combination of prolene and Vicryl (VYPRO I; Ethicon, Spreitenbach, Switzerland) was used, because we believed that lightweight meshes involved a smaller risk of mesh-related morbidity. There was no relationship between the type of fundoplication chosen and mesh reinforcement (Table 2).

Surgical outcome

Perioperative data were collected retrospectively. Long-term follow-up assessment was prospectively performed for 53 patients (95%) using a standardized questionnaire. The hiatal hernia recurrence rate was investigated via a barium contrast swallow for 52 patients (93%). The mean follow-up period was 52 \pm 31 months (range, 9–117 months).

Statistical analysis

Statistical analysis was performed as appropriate using a chi-square test, Fisher's exact test, the Mann-Whitney U test and Student's t -

Table 2. Type of fundoplication in addition to hiataloplasty ($n = 56$)

	Without mesh reinforcement (n)	With mesh reinforcement (n)	p value
Dorr	3	1	
Nissen	5	1	0.852
Toupet	32	14	
Total	40	16	

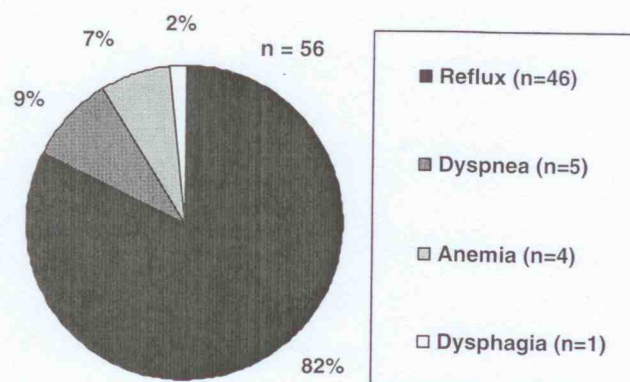


Fig. 1. Cardinal symptoms leading to laparoscopic hiatal hernia repair.

test (SPSS 11.5 software; SPSS Inc., Chicago, IL, USA). A p -value less than 0.05 was considered statistically significant.

Results

An overview of all complaints and the cardinal symptoms leading to LRHP is shown in Fig. 1 and Table 3. All operations were performed from a planned elective list after regular admission. The mean operative time was significantly shorter for the non-mesh group than for the mesh group (Table 4). However, when the non-mesh period 1992–1996, was compared with the period 2000–2003, during which mesh reinforcement was applied in every patient, no significant difference in operative time remained (126 \pm 54 vs 138 \pm 37; $p = 0.082$). None of the patients underwent conversion to open surgery. The intraoperative complication rate was 9% (5/56). We had a total of six complications in five patients: three pleural lesions (5%), two spleen capsule lacerations (4%), and one esophageal injury (2%). The postoperative morbidity rate was 14% (8/56), with morbidity mainly a consequence of pulmonary problems: four atelectasis (7%), one pneumonia (2%), and one pleural effusion after an intraoperative pleural lesion, which had to be drained subsequently. Two patients needed conservative treatment for retrosternal pain caused by gas bloating and esophageal spasm (4%). One patient, the same who needed the pleural effusion to be drained, required laparoscopic reoperation on postoperative day 5 for early hernia recurrence. There was no in-hospital mortality. The mean hospital stay was 8 \pm 2 days (range, 3–17 days).

In the long-term follow-up period, two patients died of an operation-unrelated cause. One further patient

Table 3. Hiatal hernia-related symptoms; *n* = 56

	Without mesh reinforcement % (ratio)	With mesh reinforcement % (ratio)	<i>p</i> -value
Reflux	93 (37/40)	63 (10/16)	0.396
Epigastric pain	28 (11/40)	19 (3/16)	0.744
Cough	20 (8/40)	25 (4/16)	0.737
Fullness	15 (6/40)	19 (3/16)	0.714
Dysphagia	15 (6/40)	19 (3/16)	0.714
Vomiting	15 (6/40)	6 (1/16)	0.663
Anemia	10 (4/40)	19 (3/16)	0.422
Thoracic pain	8 (3/40)	13 (2/16)	0.627
Dyspnea	5 (2/40)	31 (5/16)	0.036
Nausea	3 (1/40)	13 (2/16)	0.218
Postprandial collapses	0 (0/40)	6 (1/16)	0.298

Table 4. Comparison of laparoscopic hiatal hernia repair with and without mesh reinforcement

	Without mesh reinforcement	With mesh reinforcement	<i>p</i> -value
Radiologic follow-up (months)	67 ± 24 (range, 9–117)	20 ± 13 (range, 10–60)	< 0.0001
Operation time (minutes)	125 ± 50 (range, 70–315)	140 ± 37 (range, 75–220)	0.013
Intraoperative complications (<i>n</i> = 56)	5% (2/40)	19% (3/16)	0.135
Postoperative morbidity (<i>n</i> = 56)	15% (6/40)	13% (2/16)	1
Symptom outcome without any symptoms or with only mild gas bloating (<i>n</i> = 53)	54% (20/37)	69% (11/16)	0.318
Patient assessment (good or very good) (<i>n</i> = 53)	97% (36/37)	94% (15/16)	0.517
PPI requirement (<i>n</i> = 53)	11% (4/37)	31% (5/16)	0.109
Would undergo operation again (<i>n</i> = 53)	100% (37/37)	94% (15/16)	0.302
All hernia recurrences (<i>n</i> = 52)	19% (7/36)	0% (0/16)	0.085
Symptoms hernia recurrences (<i>n</i> = 52)	11% (4/36)	0% (0/16)	0.550

PPI, proton pump inhibitor

was lost to follow-up evaluation. One patient refused radiologic follow-up. Symptomatic outcomes are summarized in Fig. 2 and Table 5 whereas 36% (19/53) of the patients were without any complaints, and 23% (12/53) had only mild operation-related side effects such as postprandial fullness, meteorism, flatulence, and diarrhea. The remaining 41% (22/53) had relevant postoperative complaints, at least occasionally, with 17% (9/53) having proton pump inhibitor-dependent gastroesophageal reflux, and 8% (4/53) showing mild dysphagia. Inability to vomit was present in 21% (11/53) of patients, and in 8% (4/53) belching was no longer possible postoperatively. Despite this relatively high proportion of operation-related side effects, 96% (51/53) of the patients assessed their outcome as very good or good, and only 2% (1/53) of the patients were dissatisfied with the operative result. All but one of the patients, (52/53, 98%) would undergo the operation again.

Radiologic follow-up evaluation showed a hiatal hernia recurrence rate of 13% (7/52), with five of the patients again experiencing paraesophageal involvement. In the mesh group, no recurrence could be detected, whereas in the group without mesh reinforcement, there was a recurrence rate of 19% (7/36). However, the mean follow-up period in the mesh group was only 20 ± 13 months (range, 10–60 months) as compared with 67 ± 24 months (range, 9–117 months) in the non-mesh group. Consequently, because they

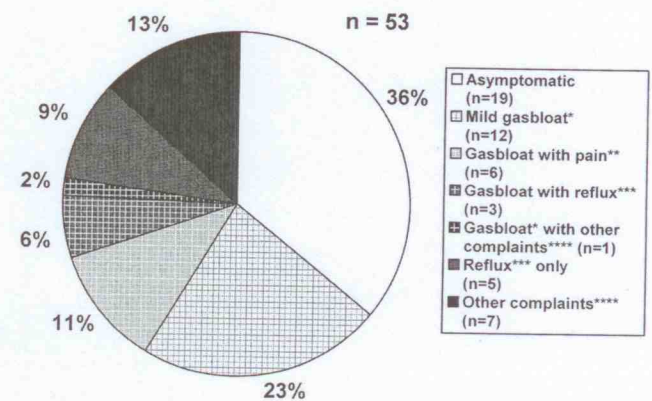


Fig. 2. Symptomatic long-term outcomes (symptoms in groups). *Postprandial fullness, meteorism, flatulence, diarrhea, **Epigastric and retrosternal pain, ***Reflux and heartburn, ****Postprandial dyspnea, dysphagia,...

were exclusively present in the non-mesh group, recurrences were detected only after a mean of 56 months (range, 9–85 months).

Only 57% (4/7) of the patients with hiatal hernia recurrence were symptomatic. Two had gastroesophageal reflux; one had postprandial fullness; and one showed severe dyspnea. The reoperation rate was 4% (2/56). Each patient successfully underwent laparoscopic

Table 5. Symptomatic long-term outcome (all reported symptoms); *n* = 53

	Without mesh reinforcement % (ratio)	With mesh reinforcement % (ratio)	<i>p</i> -value
Fullness	38 (14/37)	25 (4/16)	0.516
Meteorism	27 (10/37)	19 (3/16)	0.742
Reflux	16 (6/37)	25 (4/16)	0.713
Retrosternal pain	14 (5/37)	6 (1/16)	0.662
Epigastric pain	14 (5/37)	0 (0/16)	0.309
Flatulence	11 (4/37)	6 (1/16)	1.000
Dyspnea	5 (2/37)	13 (2/16)	0.584
Diarrhea	3 (1/37)	6 (1/16)	0.527
None	24 (9/37)	63 (10/16)	0.081

surgery for an early and a late symptomatic hiatal hernia recurrence.

Table 5 summarizes the characteristics of the two operative procedures compared in the current study.

Discussion

The perioperative results for our patients are consistent with published data [21]. However, no discrimination between irrelevant minor complications and major complications was undertaken in our series. Consequently, the intraoperative complication rate decreased to 4% if only incidents with an adverse effect on the postoperative course were counted: one esophageal lesion and one pleural injury with consecutive pleural effusion. Similarly, the postoperative morbidity was reduced to 7% if banal atelectasis requiring no further treatment than physiotherapy were excluded. Therefore, LRHP proved to be a demanding but successful procedure in experienced hands, producing even better results than open surgery, at least in the short-term follow-up period [16].

Despite these excellent short-term results, there have been some reports of an increasing failure rate of LRHP in the long-term follow-up period, although long-term follow-up periods exceeding 3 years are rare [4, 9, 10, 12, 13–15]. In the current study with a mean follow-up period longer than 4 years, we found a high radiologic recurrence rate of 19% for LRHP without mesh reinforcement. Corresponding results in the literature range up to 42% [6], and some authors conclude that because of such high recurrence rates, LRHP should not be used anymore as an alternative to open surgery. In our opinion, the obvious weakness of crurorrhaphy alone should be eliminated by mesh reinforcement, as proved to be effective in a randomized controlled trial by Frantzides et al. [5]. Since the introduction of hiatal mesh reinforcement in our series, we have not seen any PEH recurrences. Admittedly, the follow-up period of 20 months for the mesh group was significantly shorter than for the non-mesh group, and we must consider that the recurrence rate in the mesh group may increase with time. In particular, this seems probable with respect to the detection of the recurrences in the non-mesh group after a mean of 56 months. However, these recurrences

could not be detected earlier exactly because of such a late follow-up evaluation. In contrast, other series in the literature with earlier follow-up assessments have suggested that most of the recurrences occurred early after repair [4–6]. Therefore, the follow-up period of 20 months for the mesh group may be long enough for an estimation of the recurrence rate.

Some authors argue against routine mesh reinforcement, referring to the risk of mesh-related complications such as mesh migration, stenosis, adhesions, and fistula formation. However, these reports are based primarily on data from abdominal wall and groin hernia surgery. Reports on mesh-related complications at the esophago-gastric junction are rare [2, 17, 22], and their frequency probably may be overestimated. Finally, we did not observe any mesh-related complications in our series, although the mean follow-up period of nearly 2 years for the mesh group was significantly shorter than for the non-mesh group.

At the beginning, meshes were implanted only in patients with an exceptionally large PEH who needed an extensive dissection of the hernia sac. The longer operative time and the tendency toward a higher intraoperative complication rate in the mesh group may therefore be attributable to a selection bias. This supposition is corroborated by the fact that there is no longer any significant difference in operative times if periods are compared in which a mesh was either never (1992–1996) or always (2000–2003) implanted.

Concerning the symptomatic outcome, it is remarkable that only half of the patients with radiologic PEH recurrence were symptomatic, a fact that had already been shown by others [6, 12, 13, 15, 21]. This demonstrates that recurrence rates are underestimated if they are based only on symptomatic outcome, and that the clinical relevance of asymptomatic PEH recurrences after hiatal hernia repair remains unclear. Natural histories of untreated PEH recurrences are not yet published, and it is conceivable that they differ from that of primary hiatal hernias. At any rate, in terms of only symptom-directed management, a high recurrence rate after LRHP loses its impact if there are no relevant long-term complications.

Our long-term follow-up evaluation shows further that 96% of the patients assessed their operation result as good or very good, and 98% were satisfied with their decision to undergo surgery. In contrast to the excellent

patient assessment, only one-third of the patients were completely free of gastrointestinal symptoms or side effects postoperatively. An additional one-fourth reported mild gas bloating. All other patients admitted further complaints such as severe gas bloating or gastroesophageal reflux symptoms. There was no significant difference in the symptomatic outcome between the mesh group and the non-mesh group. However, there tended to be more patients without any symptoms after mesh reinforcement, which may reflect the fact that still half of the recurrences were symptomatic. In any case, as we reported earlier [8] and in agreement with others [1, 19], high patient satisfaction can be achieved after laparoscopic fundoplication despite persisting gastrointestinal symptoms.

In summary, LRHP is a demanding but successful treatment if performed by an experienced laparoscopic surgeon, leading to a good symptomatic outcome with consecutive high patient satisfaction. However, it is associated with a high radiologic recurrence rate if not combined with hiatal mesh reinforcement, which in our opinion should be performed routinely.

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