



and Other Interventional Techniques

## 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  $52 \pm 31$  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

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  $61 \pm 12$  years (range, 32–88) years, and the mean body mass index (BMI) was  $28 \pm 4$  kg/m<sup>2</sup> (range, 21–37 kg/m<sup>2</sup>). 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).

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



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

	Without mesh reinforcement $n$ (range)	With mesh reinforcement $n$ (range)	$p$ value
Age (years)	59 ± 11(32–75)	66 ± 12 (36–88)	0.056
BMI (kg/m <sup>2</sup> )	28 ± 3	29 ± 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 × 9 cm (± 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

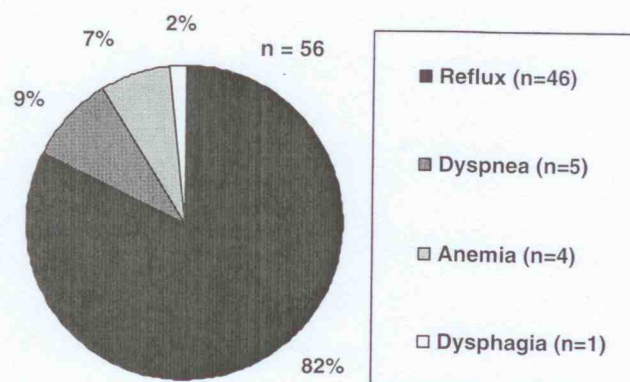
Perioperative data were collected retrospectively. Long-term follow-up assessment was prospectively performed for 53 patients (95%) using a standardized questionnaire. The hiatal hernia recurrence rate was investigated via a barium contrast swallow for 52 patients (93%). The mean follow-up period was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

