Impact of surgical repair in type IV paraesophageal hernias (PEHs)

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INTRODUCTION

Paraesophageal hernias (PEHs; types II-III-IV) account for about 5% of hiatal hernias (HHs). The peculiarity of PEHs is the presence of a herniated sac which contains a more or less important part of the stomach, along with other abdominal organs in type IV PEHs. Surgical treatment is more complex since it requires a reduction not only of the herniated content but also of the "container", namely the sac adherent to mediastinal structures. Since type III and IV PEHs are mostly grouped together as large PEHs, there is a lack of articles in the literature with regards to clear surgical outcomes.

AIM

This study aims to compare the outcomes in type IV *vs.* type III PEHs after laparoscopic surgical repair.

METHODS

A retrospective cohort study was conducted from a prospective collected database of patients who underwent laparoscopic paraesophageal hernia repair (LPEHR) at the Department of Digestive Surgery of the Nouvel Hôpital Civil (NHC) in Strasbourg, France between January 2006 and January 2020.Type III and IV PEHs patients were included. Demographic characteristics and medical data including age, gender, BMI, comorbidities (graded according to the Charlson Comorbidity Index (CCI)), and preoperative symptomatology were considered.

Postoperative outcomes included the following: operative time, length of hospital stay (LOS), adverse events (AEs graded according to Clavien-Dindo classification) and overall mortality.

Data were analyzed using Stata 16 software (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC). Data were reported using mean and standard deviation (SD) for continuous variables and number (n) and percentage (%) for categorical variables unless stated otherwise. Groups were compared using the Student's t test when a normal distribution of the variables was documented with a normality test or the non-parametric Mann-Whitney test for variables without a normal distribution. Paired comparison of qualitative variables was performed with a Fisher's exact test or chi-square tests. The significance level was defined as p <0.05.

RESULTS

Between January 2006 and January 2020, a total of 103 patients were included for analysis. Baseline patient characteristics are reported in *Table 1*.

Data comparing type III *vs.* type IV PEHs are shown in *Table 2*. Briefly, patients with type IV PEHs were older as compared to patients with type III PEHs. Mean age was 75.25±7.15 *vs.* 66.91±13.58 years respectively (p=0.039). Additionally, mean CCI score was statistically significantly higher in type IV PEHs (4.25±1.48) when compared to type III (2.96±1.72) (p=0.016) (Figure 1). Operative time was also higher in type IV PEHs as compared to type III PEHs (243 *vs.* 133 minutes, p =0.003).

Postoperative complications were statistically significantly higher in patients with type IV PEHs (50% *vs.* 8.79%, p=0.000 for type IV and III respectively). In type IV PEHs minor complications (Clavien-Dindo ≤IIIA) occurred in 2/12 patients, i.e. mediastinal collections which were solved conservatively. Major complications occurred in 4/12 patients. Three patients had Clavien-Dindo IIIB, one patient developed a mucosal herniation through a breach of the esophageal muscular layer which was treated with an endoscopic stent. One patient developed atrial fibrillation, which required pacemaker placement, and another patient presented with an early (24 hours) hernia recurrence requiring reoperation. Overall mortality account for only in one patient with type IV PEHs (0.86%) due to pneumonia.

Sixty-nine percent of patients were followed up for at least 12 months clinically and if needed radiologically. The mean follow-up time was 23.88 months. Sixteen patients (15.53%) had a recurrence of hiatal hernia, and the mean time of recurrence was 33.61± 36.17 months. Recurrence was observed in 2/12 patients with type IV PEHs (16.67%) as compared to 14/91 patients with type III PEHs (15.38%) and only 3 patients (2.91%) were reoperated on.

There was no statistically significant difference between simple crural repair and mesh reinforcement (p =0.553) in term of recurrence.

We used multiple logistic analysis to examine the relation between major postoperative complications (Clavien-Dindo ≥IIIB) and PEHs type (Table 3). When adjusting for age, smoking, dyspnea, mesh use, the odds of major postoperative complications in LPEHR is 3.82 times higher in patients with type IV PEHs (95% CI: 1.16 – 6.48, p=0.01).

TABLE 1

	N=103
Male/Female (N°)	70/ 33 (67.96%/32.04%)
Age (years)	67.68 ± 10.25
BMI (kg/m²) median (IQR)	26(21a 30)
ASA	
I	10 (9.80%)
II	63 (61.76%)
III	29 (28.43%)
IV	0 (0%)
Regurgitation	25 (24.27%)
Dysphagia	38 (36.89%)
Chest pain	18 (17.48%)
Pulmonary symptoms	33 (31.92%)
Dyspnea	27 (26.21%)
Cough	6 (5.83%)
Comorbidities	69 (66.99%)
Pulmonary disease	33 (32.04%)
Cardiac history	42 (40.78%)
Obesity	19 (18.62%)
Diabetes mellitus type 2	9 (8.74%)
Hypertension	47 (45.63%)
Chronic renal failure	7 (6.80%)
Dyspnea	26 (27.18%)
Charlson Comorbidity Index (CCI)	3.10 ± 1.74
Symptoms	
Chronic cough/vomiting	59 (57.28%)
Reflux	49 (47.57%)
Dysphagia	54 (52.43%)
Barrett's esophagus	5 (4.85%)
Esophageal manometry	15 (14.56%)
CT-scan	51 (49.51%)
Surgery	
Primary repair	92 (89.32%)
Redo	11 (10.68%)
Mesh	
Bridging	89 (86.41%)
Semi-elective	8 (7.96%)
Emergency	6 (5.83%)
Other	0 (0.00%)

TABLE 2

	Type III (n=91)	Type IV (n=12)	P value
Age	66.91± 13.58	75.25± 7.15	0.039
Gender (F/M)	64/27	6/6	0.159
Primary	81 (89.01%)	11 (91.67%)	0.779
Redo	10 (10.99%)	1 (8.33%)	
Elective	83 (91.21%)	9 (75.0%)	0.113
Semi-elective	3 (3.30%)	2 (16.67%)	
Emergency	5 (5.49%)	1 (8.34%)	0.602
Gastric volvulus	13 (14.29%)	4 (33%)	0.330
BMI	27.3± 4.5	25.2± 3.2	0.056
Operative time	133.38±41.76	243.25±105.73	0.002
Morbidity	8 (8.25%)	6 (50%)	0.000
Clavien-Dindo I	2 (2.20%)	1 (8.33%)	
Clavien-Dindo II	3 (3.30%)	1 (8.33%)	
Clavien-Dindo IIIa	0 (0.00%)	0	
Clavien-Dindo IIIb	2 (2.20%)	3 (25%)	
Clavien-Dindo IVa	0	0	
Clavien-Dindo IVb	0	0	
Clavien-Dindo V	0	1 (8.33%)	
Major complications	2 (2.20%)	4 (33.33%)	0.000
Clavien-Dindo ≥IIIB			
Length of hospital stay	6.64±7.17	7.67±11.23	0.669
ICU days	1	2.5±6.65	0.037
Mesh reinforcement	69 (81.54%)	8 (72.73%)	0.553
Recurrence	14 (15.38%)	2 (16.67%)	0.908
30-day readmission rate	4 (4.40%)	2 (16.67%)	0.098
90-day readmission rate	1 (1.10%)	1 (8.33%)	0.095
Reoperation	2 (2.20%)	1 (8.33%)	0.233

TABLE 3

	crude			adjusted		
	OR	95% CI	P value	OR	95% CI	P value
Age	0.05	(-0.03 – 0.12)	0.22	0.09	(-0.04 – 0.24)	0.16
Smoking	1.47	(-.34 –3.29)	0.11	2.92	(0.09 – 5.74)	0.04
Dyspnea	1.05	(-0.61 – 2.72)	0.21	0.78	(-1.45 – 3.02)	0.49
CCI	0.25	(-0.23 – 0.73)	0.30	-0.66	(-1.70 – 0.39)	0.22
Mesh use	1.16	(-1.02 – 3.35)	0.29	1.04	(-1.48 – 3.56)	0.42
Type IV PEH	3.10	(1.26 – 4.95)	0.00	3.82	(1.16 – 6.48)	0.01

Table 1. Patient baseline characteristics
Table 2. Analysis of patients with type III *vs.* IV PEHs
Table 3. Multivariate analysis of major complications (Clavien-Dindo ≥ IIIB) for all cohorts of patients

IMAGE 1

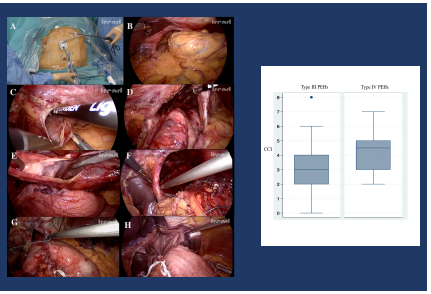


FIGURE 1

Image 1. LPEHR surgical technique. A. The patient was placed in a prone lithotomy position, the surgeon standing between the patient's legs. Ports were placed in a proper triangulation configuration. A 12mm camera port was placed above the umbilicus. Four 5mm ports were placed above the camera port; one port in the right axillary line for liver retraction (Nathanson liver retractor), two 5mm working trocars, one in the left midclavicular line, and one below the xiphoid process. Finally, one 5mm port was placed in the anterior axillary line (assistant trocar). B. Exposure and identification of type IV PEH, and the transverse colon is the additional herniated organ. C. Dissection at the level of the pars flaccida (inferior part of the lesser omentum) and identification of the right crus, extrasaccular dissection with the LigaSure™ vessel-sealing device (Medtronic) finding the cleavage plane between the hernia sac and the phrenoesophageal ligament. D. Mediastinal dissection and esophageal mobilization up to the inferior pulmonary veins respecting the mediastinal pleura. E. Hernia sac resection. F. Closure of the esophageal hiatus. G. Fundoplication. H. Mesh reinforcement, if need be.
Figure 1. Boxplot of Charlson Comorbidity Index (CCI) according to PEH type.

CONCLUSIONS

The higher incidence of morbidity outcomes in fragile patients with type IV PEHs should be handled with appropriate concerns, advocating for surgical treatment in experienced hands. Further prospective clinical studies should evaluate clinical outcomes according to hernia types.

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