Evaluation of the Role of Eosaphageal Manometry in Tailoring of Fundoplication Type in the Management of Hiatal Hernia

Ebrahim Mokhtar Farag, MBBCh; Ashraf Kamal Abdallah, MD; Ahmed Magdy Farrag, MD
Department of General Surgery, Faculty of Medicine, Ain shams University, Egypt

Introduction: An established surgical treatment for patients with hiatus hernia with gastroesophageal reflux disease (GERD) is laparoscopic fundoplication. In order to enhance reflux control while reducing negative postoperative troublesome side effects mainly dysphagia, high resolution esophageal manometry (HRM) is considered an essential step in preoperative evaluation.

Aim of work: To examine the impact of preoperative high-resolution manometry (HRM) on determining the appropriate type and degree of fundoplication in patients with hiatus hernia, aiming to anticipate surgical outcomes, focusing particularly on the probability of postoperative dysphagia. The evaluation includes both a short-term (3-month) and a long-term (6-month) postoperative follow-up period.

Patients and methods: 24 eligible patients with an established diagnosis of hiatal hernia were the total number of patients in our prospective clinical trial study at the General Surgery outpatient's clinic, Ain-Shams University Hospitals, in the period from April 2022 until the end of October 2022. They were divided intentionally according to their preoperative high-resolution oesaphageal manometry results into two equal groups; the first 12 patients with oesophageal hypomotility underwent partial fundoplication. The other 12 having normal oesophageal motility underwent complete fundoplication. All the patients met the inclusion criteria. Exclusion criteria included: (a) pregnant and lactating females. (b) patients with a history of previous esophagogastric surgery. (c) Patients with achalasia. (d) patients who will refuse to participate in the study. (e) surgically unfit patients.

Results: Regarding the difference between follow-up visits after 3 and 6 months among group 1 "partial fundoplication," there was no statistically significant difference between them, i.e., no worsening of symptoms, where the following GERD, bloating, and dysphagia were reported in 0 (0%), 2 (16.7%), and 1 (8.3%), respectively, of patients at 3 months and in 0 (0%), 1 (8.3%), and 0 (0%) of patients at 6 months. difference between follow-up visits after 3 and 6 months among group 2 "complete fundoplication," the following GERD, bloating, and dysphagia were reported in 0 (0%), 3 (25%), and 3 (25%), respectively, of patients at 3 months and in 0 (0%), 0 (0%), and 2 (16.7%), respectively, of patients at 6 months.No significant association was demonstrated between other preoperative HRM parameters and surgical outcomes.

Conclusions: Preoperative esophageal manometry is a crucial step before deciding the type of fundic wrap fashioned as an antireflux procedure in patients with hiatus hernia. Inadequacy of lower esophageal sphincter (LES) relaxation with swallowing, indicated by high integrated relaxation pressure (IRP), or weak esophageal motility as shown by a low distal contractile integral (DCI), are key predictors of adverse long-term postoperative outcomes most importantly dysphagia.

Key words: Dysphagia, Fundoplication, GERD, High resolution manometry, Nissen, Toupet.

Introduction

An established treatment for symptomatic hiatal hernia is laparoscopic fundoplication. Although it successfully reduces heartburn and regurgitation, it may have troublesome side effects, the most common of which are postoperative dysphagia, postprandial fullness, gas bloating, and increased flatus.[1] The effectiveness and safety of different surgical techniques for managing reflux continue to be debated. While a full fundal wrap is common, some experts recommend a partial fundal wrap to reduce adverse effects.[2] This approach is particularly advised for patients with oesophageal dysmotility, as it potentially lowers the risk of postoperative dysphagia, a complication influenced by preoperative oesophageal body motility status.[3-5] Therefore, a lot of comparative studies between laparoscopic total and partial fundoplication have been conducted.

Surgical modifications, such as using larger bougies for wrap sizing, shorter wrap lengths, and mobilizing the short gastric arteries, have shown proved benefit in avoiding adverse postoperative outcomes.[6,7] However, esophageal manometry, especially high-resolution manometry (HRM), is emerging as a potential tool for predicting long-term dysphagia following anti-reflux surgery for hiatus hernia. Although routine preoperative manometry doesn't always correlate with surgical outcomes, HRM's advanced technology offers more detailed insights.[6,8] HRM, equipped with 36 circumferential sensors spaced at 1-cm intervals, provides a thorough evaluation of the entire esophageal length and functional motility, a significant advancement over conventional manometry that typically uses only 4–8 sensors.[9]

According to the majority of existing literature, no clinically significant changes have been found in predicting surgical outcome and complications when

DOI: 10.21608/ASJS.2024.351417

manometry is routinely used in pre- and postoperative settings. The primary goal of esophageal manometry prior to antireflux surgery for hiatus hernia is to rule out other possible causes of GERD symptoms, including achalasia, hypercontractile oesophagus, and distal oesophageal spasm.[10] However, traditional manometry is still used in most of these published studies. Dysphagia that persists after antireflux surgery may be better understood with the use of modern, high-resolution manometry.

The aim of the present study was to find out whether preoperative high resolution manometry (HRM) has an effective role in selecting between the two most common fundoplication types, either complete or partial posterior wrap, as an essential step in antireflux surgery for hiatus hernia patients and if specific HRM metrics can be used to predict postoperative outcome.

Patients and methods

24 eligible patients with an established diagnosis of hiatal hernia were the total number of patients in our prospective clinical trial study at the General Surgery outpatient's clinic, Ain-Shams University Hospitals, in the period from April 2022 until the end of October 2022. They were divided intentionally according to their preoperative high-resolution oesaphageal manometry results into two equal groups; the first 12 patients with oesophageal hypomotility underwent partial fundoplication. The other 12 having normal oesophageal motility underwent complete fundoplication. All the patients met the inclusion criteria. Exclusion criteria included: (a) pregnant and lactating females. (b) patients with a history of previous esophagogastric surgery. (c) patients with achalasia. (d) patients who will refuse to participate in the study. (e) surgically unfit patients.

High resolution manometry

HRM was achieved by passing narrow-spaced 36 solid-state, round sensors at 1-cm intervals trans-nasally. In the supine posture, ten swallows of 5 cc liquid were employed. Data on esophageal motility and EGJ pressure patterns were analyzed using the chicago classification method, which was the most recently updated version 4.0.

HRM measured LES length, intraabdominal LES length, resting pressure of LES, LES integrated relaxation pressure (IRP), mean distal contractile integral (DCI), upper esophageal sphincter (UES) pressure, and percentage of peristalsis types (simultaneous, hypotensive, or failed).

The average of the four highest seconds of LES relaxation within a ten-second time frame following the relaxation of the upper esophageal dphincter (UES) induced by swallowing was used to determine LES IRP. The mean IRP was calculated for each patient over ten swallows. An IRP result was considered normal if it was less than 15-20 mmHg. The strength of esophageal contraction was represented by DCI. The mean DCI was calculated for each patient's 10 swallows. As shown in **(Table 1),** it was considered normal if it was between 450 and 5000 mmHg/sec/cm and weak if it lied between 100 and 450 mmHg/sec/cm. When 70% of swallows were inefficient, either failed (DCI less than 100 mmHg/sec/cm) or weak (DCI greater than 100 but less than 450 mmHg/sec/cm), ineffective esophageal motility (IEM) was the diagnosis according to the most recent Chicago classification.

Clinical follow-up

Immediate Post-operative examination and treatment included oral fluids on the first postoperative day, soup on the second, a soft diet on the third, and a normal meal on the fourth. Following that, all patients were evaluated clinically for postoperative symptoms on two occasions, three and six months following surgery. Postoperative dysphagia was scored using the following system: no dysphagia = 0; mild = 1 (tolerable); moderate = 2 (annoying to the patient); and severe = 3 (with loss of weight). Furthermore, postoperative clinical follow-up of symptoms included evaluation of bloating, difficult belching, and epigastric pain. The later symptoms were graded as follows: no symptoms = 0; mild = 1 (tolerable); moderate = 2 (Requires medical attention); and severe = 3 (Daily and affecting lifestyle).

Operative technique

Nearly all operations were performed laparoscopically. Two cases were performed with an open abdominal laparotomy approach due to previous major abdominal surgery. Five trocars were used, and mobilizing the oesophagus was performed. reduction of the herniated part of the stomach through the hiatus was done. Both crura were sutured by two to five stitches with a 36 F-bougie in the oesophagus **(Fig. 1).** During Nissen fundoplication procedures, the short gastric vessels are typically divided. Fashioning a fundal wrap in this procedure involved the use of a U-shaped stitch. Crucially, this U-stitch always encompassed the esophagus. Additionally, two simple sutures were placed: one above and one below the U-stitch.

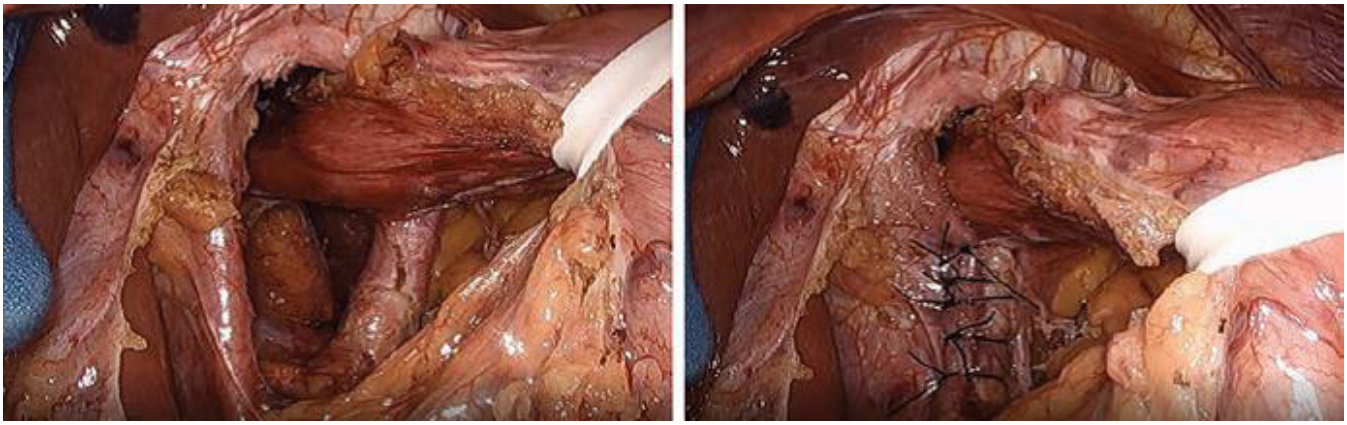

Fig 1: Closure of esophageal hiatus.

Notably, these simple sutures did not involve the esophageal wall.

In the procedure of partial posterior fundoplication, a specific technique was employed to construct the fundal wrap. Initially, the right part of the wrap was anchored to the right crus of the diaphragm using three stitches. Following this, the wrap's free end was attached to the right anterior section of the lower esophagus with three additional sutures. On the left side, a similar approach was taken, securing the wrap to the left anterior side of the lower esophagus using three stitches **(Fig. 2).** This method ensured that approximately 1 cm of the anterior lower esophagus remained uncovered by the wrap. By applying the above steps only, we can achieve a manometrically normal lower esophageal sphincter (LES), as seen in Nissen fundoplication. For both

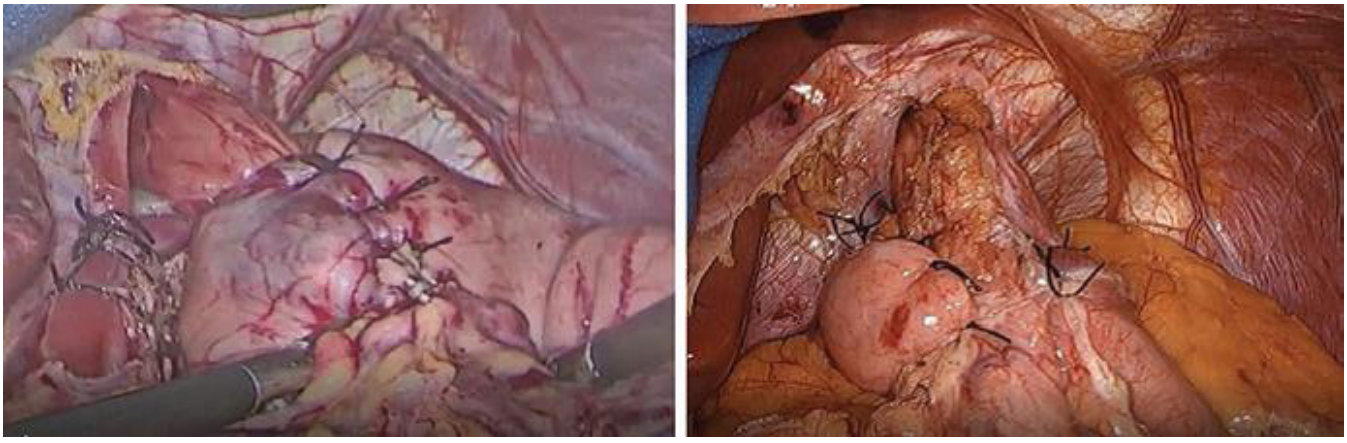

Fig 2: Nissen complete fundoplication (left) and spartial posterior ''Toupet'' (Right).

procedures, the team employed non-absorbable sutures, and all operations were consistently carried out by the same team of surgeons.

Statistical analysis

Data for this research was methodically collected, arranged, and subjected to statistical analysis on an IBM-compatible personal computer equipped with the statistical package for the social sciences (SPSS), version 26. The approach to statistics in this study encompassed both descriptive and analytic methods. In the descriptive analysis, quantitative data was detailed in terms of mean, standard deviation, median, and range, while qualitative data will be represented through counts and percentages. For the analytic portion, significant tests such as the Chi-square test or Fisher's Exact test was employed to explore associations between two qualitative variables. Additionally, the Student's t-test was utilized to compare quantitative variables between two normally distributed groups. The significance of the results was determined based on a P-value threshold of less than 0.05.

Ethical Consideration

According to approved standards by the ethical commitee of Ain Shams University.

Results

Regarding the demographic data of our study, it included a total of 24 patients, 12 in each group, of whom 6 (50%) were males and 6 (50%) were females in Group 1 (Partial fundoplication), 5 (41.7%) were males, and 7 (58.3%) were females in Group 2 (Complete fundoplication), with no statistical difference between them. Both groups

were age- and sex-matched (p = 0.072 and 0.682, respectively). In **(Table 2)** these findings are evident

(Table 4) demonstrates that diabetes mellitus and hypertension were the most prevalent comorbidities among both study groups (Both were 16.7%); also, mean BMI was reported as 21.78±1.67 and 24.25±4.37 among groups 1 and 2, respectively, with no statistical difference between them (p = 0.088). The vast majority of patients had their medical treatment for GERD, 83.3% and 75% among groups 1 and 2, respectively, with no statistical difference between them (p = 1.00).

Preoperative parameters taken by esophageal manometry were illustrated in **(Table 3),** where there was no significant difference in resting pressures between groups 1 and 2 (19.57±5.9 and 18.48±5.9, respectively). Also, the median LES IRP showed no significant difference between groups 1 and 2 (10.38±5.9 and 18.48±5.9, respectively).

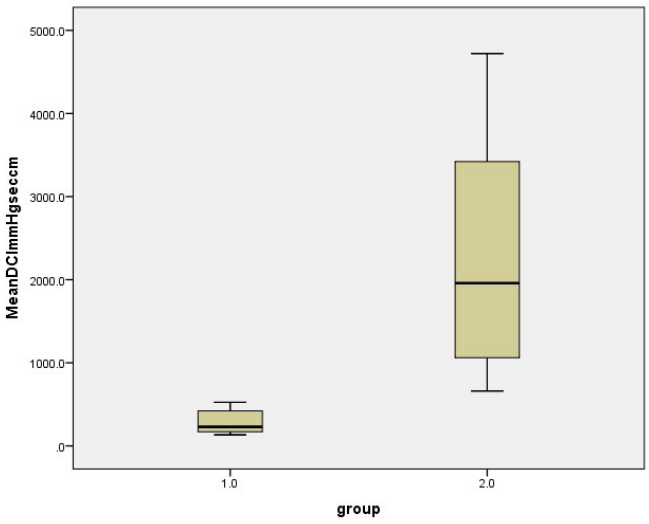

Fig 3: Boxplot of the mean DCI among both study groups 1 and 2.

However, there was a statistically significant difference between groups 1 and 2 regarding mean DCI (293.39±144.62 and 2205.22±1380.77, respectively), as shown in **(Fig. 3).**

Patients had been followed up at 3 months postoperatively to investigate their symptoms; as shown in **(Fig. 4),** there was no difference regarding GERD as 12 (100%) of patients didn't develop its symptoms among both groups 1 and 2. Dysphagia was present in 8.3% of group 1 patients, while both bloating and dysphagia were documented in 25% of patients in group 2.

Follow-up was continued until 6 months postoperatively. As shown in **(Fig. 5)** symptoms were still stable and didn't get worse, whereas 12 (100% of patients) didn't have GERD symptoms in both groups 1 and 2. Also, dysphagia shows a noticeable difference between both groups (P = 1.00 and 0.478, respectively), with persistent dysphagia in 16.7% of group 2 and total absence of dysphagia in group 1.

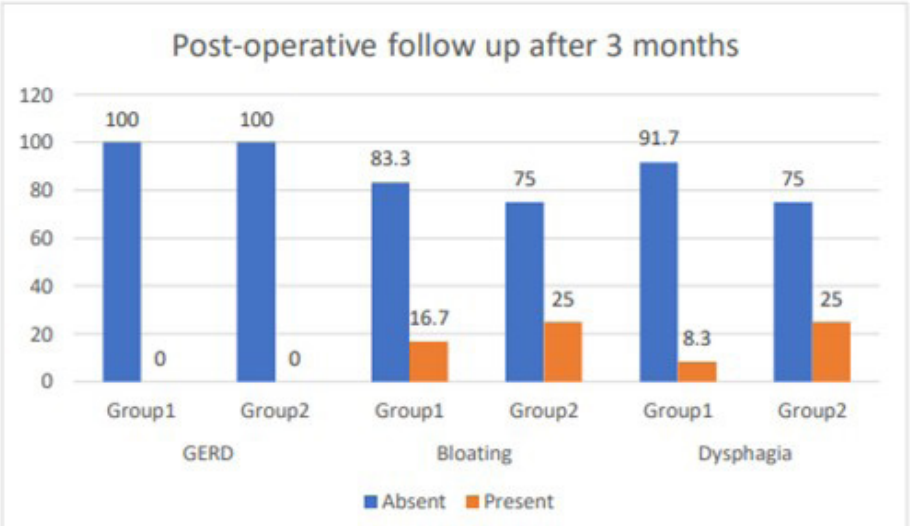

Fig 4: Postoperative follow-up after 3 months between both groups.

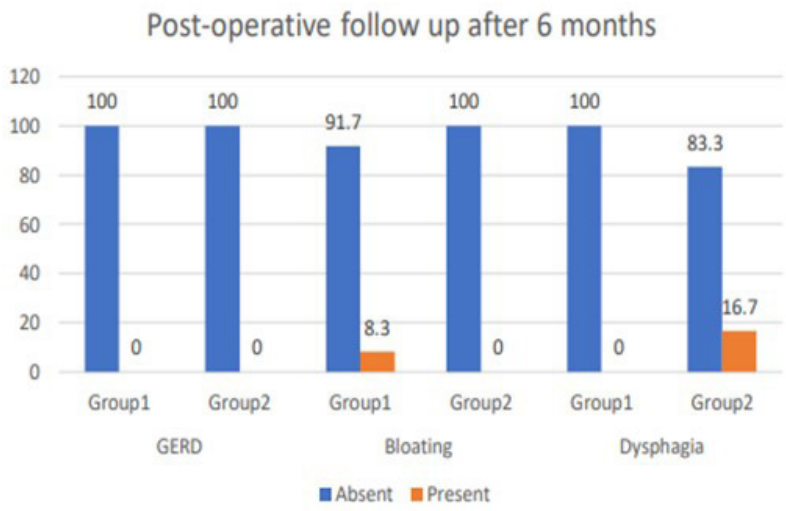

Fig 5: Postoperative follow-up after 6 months between both groups.

Table 1: Normal parameters of HRM

Characteristic	Normal value
Relaxation of LES	IRP <15 mmHg
Peristaltic propagation	CVF <9 cm/sec DL > 4.5 sec
Contractile force	DCI 450-5000 mmHg/sec/cm

Integrated relaxation pressure (IRP), distal latency (DL), contractile velocity front(CVF), distal contractility integral (DCI).

Table 2: Socio-demographic characteristics of study participants. (n=24)

	Group 1 partial fundoplication (n = 12)	Group 2 complete fundoplication(n =12)	p-value
Sex			
Male	6 (50%)	5 (41.7%)	0.682 *
Female	6 (50%)	7 (58.3%)	
Age in years			
(mean±SD)	53.33±8.9	45.16±12.02	0.072 **

*: Chi-square test. **: Independent samples T-test.

Table 3: Pre-operative esophageal manometry among study participants (n = 24).

	Group 1 partial fundoplication (n = 12)	Group 2 complete fundoplication (n=12)	p-value
Resting Pressure(mmHg)			
(mean±SD)	19.57±5.9	18.48±5.9	0.657 *
Median LES IRP (mmHg)			
(mean±SD)	10.38±2.69	10.41±5.9	0.986 *
Mean DCI (mmHg.sec.cm)			
(mean±SD)	293.39±144.62	2205.22±1380.77	0.001 *

*: Independent samples T-test.

Table 4: Medical and surgical history of study participants (n = 24)

	Group 1 partial fundoplication (n = 12)	Group 2 complete fundoplication (n = 12)	p-value
Comorbidities:			
DM	2 (16.7%)	2 (16.7%)	
HTN	2 (16.7%)	2 (16.7%)	
HCV	1 (8.2%)	0 (0%)	0.317 *
IHD	2 (16.7%)	1 (8.3%)	
Fibromyalgia	0 (0%)	1 (8.3%)	
None	5 (41.7%)	6 (50%)	
Surgical history:			
Cataract	1 (8.3%)	0 (0%)	
Cesarean Section	2 (16.7%)	2 (16.7%)	
Tonsillectomy	1 (8.3%)	0 (0%)	0.514 *
Umbilical hernia	1(8.3%)	0 (0%)	
Mastectomy	0 (0%)	1 (8.3%)	
Free	7 (58.3%)	9 (75%)	
BMI: (mean±SD)	21.78±1.67	24.25±4.37	0.088 **
Medical Treatment for GERD:			
Taken	10 (83.3%)	9 (75%)	1.00 ***
Taken; not compliant	2 (16.7%)	3 (25%)	

*: Chi-square test. **: Independent samples T-test. ***: Fisher's exact test.

Discussion

The advent of multiple surgical techniques has empowered foregut surgeons to customize anti-reflux surgery for hiatus hernia patients, taking into account individual patient factors.A key factor in this individualized approach is the assessment of esophageal contractility, evaluated through esophageal manometry. Consequently, high-resolution manometry has become an essential component of the preoperative evaluation for patients undergoing anti-reflux surgery for hiatus hernia, giving rise to the concept of tailored fundoplication.One might anticipate that such technical advancements would lead to a wealth of research, enhancing clinical understanding and improving anti-reflux surgery outcomes. However, with the exception of a few specialized institutions, esophageal physiology has not been a key emphasis at most surgical foregut facilities.In fact, some surgeons are increasingly in doubt about the need for esophageal manometry prior to anti-reflux surgery. They contend that manometry has no effective impact on the decision or result of surgery, putting the necessity of preoperative manometry into question.[11]

Some studies have shown that an insufficient preoperative evaluation is a major contributor to unsatisfactory results after antireflux surgery for hiatus hernia.[12] An important preoperative examination that Chan et al.[13] from Gyawali's group conducted on a large cohort of patients referred for manometric evaluation before antireflux surgery demonstrated the value of esophageal manometry. Out of 1,103 motility tests conducted before surgery, 1% had undetected achalasia and 1.5% had severe impairment in LES relaxation. Endoscopic or surgical myotomy is necessary for the management of these motor problems, as fundoplication is completely contraindicated for them. Another 3.2 percent suffered aperistalsis, while 1.3 percent had more than 80% of their contractions fail. In all, 7% of patients reported abnormalities that were either absolute or relative contraindications to Nissen fundoplication, indicating the importance of preoperative esophageal manometry.

Our analysis demonstrates that patients with long-term dysphagia, particularly after Nissen fundoplication, exhibit lower DCI and/or greater IRP at the lower esophageal sphincter than those without dysphagia. A possible explanation for this phenomenon could be that fundoplication, which increases resistance at the esophagogastric junction (EGJ), exacerbates pre-existing high basal IRP. This increased resistance is further augmented when combined with weak or borderline esophageal contractility, potentially leading to more pronounced postoperative dysphagia. Moreover, in the preoperative context, a normal IRP has been shown to be a reliable indicator for predicting the absence of long-term postoperative dysphagia. This indicates the high sensitivity of the preoperative IRP metric in anticipating the risk of dysphagia following fundoplication.

This study aligns with several researches that support a tailored approach to fundoplication based on preoperative manometric evaluation. This strategy involves deciding between a full or partial fundoplication depending on the presence

or absence of impaired esophageal peristalsis on preoperative manometry. Supporting this approach, Waston et al. identified that patients with esophageal hypomotility preoperatively were at a higher risk of experiencing postoperative dysphagia.[14] Likewise, Kauer et al. demonstrated that individuals with suboptimal preoperative esophageal motor function are more likely to encounter unsatisfactory results post-surgery.[15] This highlights the importance of tailored surgical strategies based on preoperative individual patient assessment.

Several non-randomized trials have failed to validate the concept of the tailoring approach in anti-reflux surgery.[16-18] Notably, none of these randomized studies on laparoscopic fundoplication procedures included preoperative esophageal motility as a component in the study. As a result, these studies do not give solid evidence of the usefulness of the tailoring approach.[19] Furthermore, the authors of these studies advocate for a "one size fits all" approach in anti-reflux surgery. They suggest that Nissen fundoplication is suitable for all patients, irrespective of their preoperative manometry results. This stance overlooks potential issues such as the development of dysphagia due to increased outflow resistance, raising questions about the routine preoperative use of manometry. However, it is important to consider the limitations of these studies before applying their conclusions in clinical settings. A notable issue is that many of these researches utilized conventional manometry, which may not provide as comprehensive a picture as newer techniques like high-resolution manometry. Furthermore, there's an inconsistency in how esophageal dysfunction is defined across these studies, with many deviating from the classifications currently accepted in the surgical field. This variability in methodology and definitions can impact the reliability and applicability of their findings in clinical practice.

In a study that involved 200 patients, Fibbe et al.[20] observed that Nissen fundoplication increased swallowing difficulties in patients with normal preoperative motility and was less effective in lowering postoperative dysphagia for those with esophageal dysmotility than Toupet fundoplication. However, this study's follow-up period was only four months. A more recent trial with 163 patients showed that partial fundoplication resulted in lower postoperative dysphagia rates after 24 months, despite the higher recurrence of reflux.[21]

Despite the importance of some metrics in high-resolution manometry, many of the novel HRM parameters do not show a significant impact on the outcomes of anti-reflux surgery in our study, except for mean DCI and LES IRP. Moreover, esophageal dysfunction that is subclinical and identified only during preoperative manometry (Usually low normal range mean DCI) can become apparent as prolonged dysphagia after surgery, which can be attributed to the changes in the hiatal anatomy induced by a fundoplication.

Numerous studies have identified the significance of elevated IRP and impaired LES relaxation as predictors of dysphagia following fundoplication. According to Marjoux et al., the only manometric measure that was substantially linked with postoperative dysphagia was increased postoperative IRP at 2–3 months after laparoscopic Nissen fundoplication. In a study of 21 patients, those with dysphagia showed a higher IRP (10.2 mmHg) compared to those without dysphagia (5.1 mmHg, $p < 0.02$).[19] Additionally, elevated IRP values in the LES are recognized as typical post-fundoplication manometric changes.[22,23] Postoperative IRP ranges tend to be higher following Nissen fundoplication (5.1–24.4 mmHg) than after Toupet fundoplication (3.1–15.0 mmHg).[23] This impaired LES relaxation, especially when combined with limited peristaltic contraction strength (As indicated by reduced DCI and mean wave amplitude), contributes to postoperative dysphagia. This is likely due to the inability of the esophageal contractions to overcome the increased LES pressure created by a complete wrap, leading to swallowing difficulties.

This is parallel to our study findings, while two patients (16.7%) in the Nissen group with persistent dysphagia at 6 months had a preoperative basal high IRP (or upper normal range), and one of them also had a low normal value of mean DCI (the surgical team converted him to Toupet later with relief of dysphagia soon postoperatively). So, an upper normal or high IRP preoperatively will be augmented after a complete wrap, and according to this result, we can explain why postoperative dysphagia has been documented in both of these two Nissen patients with elevated IRP preoperatively. Unlike conventional manometry, the IRP provides a more clear understanding of the dynamics at the esophagogastric junction (EGJ). It can also effectively distinguish between intraluminal pressure influences and the crural diaphragm's impact on EGJ pressure. This distinction allows for a more detailed analysis of EGJ function.

Supporting the utility of IRP in HRM, Yamamoto et al. conducted a retrospective study of 43 patients, which corroborates our findings. Their research revealed a significant association between higher preoperative IRP values measured via HRM and the likelihood of dysphagia following Nissen fundoplication, with a p-value of 0.049.[24] Similarly, Wilshire et al. found that patients experiencing dysphagia post-Nissen fundoplication had notably higher basal IRP values (16.2 mmHg) compared to those without symptoms (11.1 mmHg, $p = 0.05$).[25] These studies highlight the importance of IRP as

a predictive factor for postoperative dysphagia in patients undergoing Nissen fundoplication.

In our analysis, around 83.3% of the Nissen group with optimal basal esophageal contractility were free from dysphagia beyond the first 6 months of follow-up. All of them had normal values for the preoperative mean DCI. It is also worth mentioning that total relief of dysphagia occurred in one Nissen patient at 6-month follow-up. The mean DCI of this patient was in the low normal range (735.8 mmHg/sec/cm) despite an average IRP. This can be explained by the fact that a compensatory circular muscle adaptation to overcome elevated EGJ pressure after a complete wrap has occurred.[26] This adaptive mechanism appeared to fail when the borderline low mean DCI was combined with a high IRP. This may explain the persistence of dysphagia beyond 6 months in 16.7% of patients with Nissen wrap whose IRP was elevated preoperatively.

In the prospective randomized study by Wykypiel et al., it was determined that there was a considerable improvement in esophageal hypomotility following Toupet fundoplication but not after Nissen in patients with normal preoperative LES IRP.[27] Accordingly, partial posterior fundoplication has been noted to enhance weak esophageal peristalsis. This improvement is attributed to the maintenance of normal postoperative LES relaxation, which in turn allows the tubular esophagus to regain muscle tone. This impact does not appear following the Nissen fundoplication, as stated by Stein et al.[28] This is concordant with our study results, while there was no persistent dysphagia documented beyond 6 months in the Toupet group, although all of these patients have ineffective esophageal motility. This is why some studies recommend a tailored strategy: applying partial posterior fundoplication in situations with poor oesophageal contractility and reserving the Nissen fundoplication for patients with normal esophageal peristalsis and patent LES function.

Although some studies on primary Nissen fundoplication have shown that ineffective esophageal motility or low-amplitude contractions in the distal esophagus do not necessarily lead to increased rates of postoperative dysphagia, the outcomes of revisional anti-reflux surgery present a different picture.[29,30] Furnée et al. highlight that sufficient preoperative esophageal contraction amplitude is a crucial factor in resolving dysphagia for patients undergoing revisional anti-reflux surgery.[31] Their findings suggest that patients with borderline esophageal motility reserve may be more prone to dysphagia if they receive a complete wrap or a tightly closed crura. Consequently, in patients with pre-existing borderline contractility or hypomotility, a reoperation might not effectively relieve their dysphagia. Therefore, ensuring adequate preoperative esophageal motility is essential for the successful alleviation of dysphagia in patients undergoing revisional anti-reflux surgery.

Therefore, to prevent persistent postoperative dysphagia, it is crucial to consider the power of esophageal peristalsis during patient selection for fundoplication surgery. This consideration ensures that the peristaltic force is adequate to overcome the anticipated increased resistance of LES after a complete wrap is performed. In a recent study by Ayazi et al., it was demonstrated that certain metrics on preoperative manometry are significant risk factors for postoperative dysphagia, particularly following complete fundoplication. These metrics include a DCI of less than 750 mmHg/sec/cm, a distal wave amplitude of less than 43 mmHg, and less than 80% effective peristaltic contractions. These findings highlight the importance of thorough preoperative esophageal motility testing.[32]

Regarding efficacy in GERD control, both Nissen and partial posterior fundoplication demonstrated equal efficacy in our patient series. The primary reason for this outcome is that both surgical techniques succeeded in similarly increasing the resting pressure and the intra-abdominal length of the lower esophageal sphincter. This increase in LES parameters is a key factor in the effective management of GERD symptoms.These observations align with the findings of Zornig et al. in their study.[33]

Ultimately fundoplication stems from the need to strike a balance between the unfavorable consequences of dysphagia and the possibility of recurrent reflux, both of which have substantial implications for quality of life. Although our analysis is consistent with many aspects of the current literature, its power is necessarily constrained by the relatively small sample size.

Conclusion

According to the results of our research, preoperative esophageal manometry is a crucial step before deciding the type of fundic wrap fashioned as an antireflux procedure in patients with hiatus hernia. Also, inadequacy of lower esophageal sphincter (LES) relaxation with swallowing indicated by high integrated relaxation pressure (IRP) or weak esophageal motility as shown by a low distal contractile integral (DCI) are key predictors of adverse long-term postoperative outcomes, most importantly dysphagia. A tailoring approach can be implemented during patient selection for partial or complete fundoplication to avoid worse postoperative outcomes.

References

1. Low DE, Mercer CD, James EC, Hill LD: Post Nissen syndrome. ***Surg Gynecol Obstet.*** 1988; 167: 1–5.

2. Watson A, Jenkinson LR, Ball CS, Barlow AP, Norris TL: A more physiological alternative to total fundoplication for the surgical correction of resistant gastro-esophageal reflux. ***Br J Surg.*** 1991; 78: 1088–109.

3. Kauer WK, Peters JH, DeMeester TR, Heimbucher J,Ireland AP: Bremner CGA tailored approach to antireflux surgery. ***J Thorac Cardiovasc Surg.*** 1995; 110: 141–146.

4. Patti MG, ArceritoM, Pellegrini CA, Mulvihill SJ, Tong J, Way LW: Minimally invasive surgery for gastroesophageal reflux disease. ***Am J Surg.*** 1995; 170: 614 –617.

5. Waring JP, Hunter JG, Oddsdottir M, Wo J, Katz E: The preoperative evaluation of patients considered for laparoscopic antireflux surgery. ***Am J Gastroenterol.*** 1999; 90: 35–38.

6. Stefanidis D, Hope WW, Kohn GP, Reardon PR, Richardson WS, Fanelli RD: Guidelines for surgical treatment of gastroesophageal reflux. ***Surg Endosc.*** 2010; 24: 2647–2669.

7. DeMeester TR, Bonavina L, Albertucci M: Nissen fundoplication for gastroesophageal refux disease. Evaluation of primary repair in 100 consecutive patients. ***Ann Surg.*** 1986; 204: 9–20.

8. Marjoux S, Roman S, Juget-Pietu F, Robert M, Poncet G, Boulez J, Mion F: Impaired postoperative EGJ relaxation as a determinant of post-laparoscopic fundoplication dysphagia: A study with high-resolution manometry before and after surgery. ***Surg Endosc.*** 2012; 26: 3642–3649

9. Pandolfino JE, Ghosh SK, Rice J, Clarke JO, Kwiatek MA, Kahrilas PJ: Classifying esophageal motility by pressure topography characteristics: A study of 400 patients and 75 controls. ***Am J Gastroenterol.*** 2008; 103: 27–37.

10. Weijenborg PW, Savarino E, Kessing BF, Roman S, Costantini M, Oors JM, et al: Normal values of esophageal motility after antireflux surgery; A study using high-resolution manometry. ***Neurogastroenterol Motil.*** 2015;27:929-35.

11. Ayazi S: Esophageal manometry testing and anti-reflux surgery: The preoperative necessity and prognostic utility. ***Foregut.*** 2021; 1(3): 216-226.

12. Patti MG, Allaix ME, Fisichella PM: Analysis of the causes of failed antireflux surgery and the principles of treatment: A review. ***JAMA Surg.*** 2015; 150(6): 585-590.

13. Chan WW, Haroian LR, Gyawali CP: Value of preoperative esophageal function studies before laparoscopic antireflux surgery. ***Surg Endosc.*** 2011; 25(9): 2943-2949.

14. Watson A, Jenkinson LR, Ball CS, et al: A more physiological alternative to total fundoplication for the surgical correction of resistant gastro-oesophageal reflux. ***Br J Surg.*** 1991; 78: 1088–1094.

15. Kauer WK, Peters JH, DeMeester TR, et al: A tailored approach to antireflux surgery. ***J Thorac Cardiovasc Surg.*** 1995; 110: 141–146.

16. Coster DD, Bower WH, Wilson VT, et al: Laparoscopic partial fundoplication versus laparoscopic Nissen–Rosetti fundoplication. Short-term results of 231 cases. ***Surg Endosc***. 1997; 11: 625–631.

17. Bell RC, Hanna P, Mills MR, et al: Patterns of success and failure with laparoscopic Toupet fundoplication. ***Surg Endosc.*** 1999; 13: 1189–1194.

18. Pessaux P, Arnaud JP, Ghavami B, et al: Laparoscopic antireflux surgery: comparative study of Nissen, Nissen-Rossetti, and Toupet fundoplication. Societe Francaise de Chirurgie Laparoscopique. ***Surg Endosc.*** 2000; 14: 1024–1027.

19. Marjoux S, Roman S, Juget-Pietu F, Robert M, Poncet G, Boulez J, et al: Impaired postoperative EGJ relaxation as a determinant of post laparoscopic fundoplication dysphagia: A study with high-resolution manometry before and after surgery. ***Surg Endosc.*** 2012; 26: 3642-9.

20. Fibbe C,Layer P, Keller J, Strate U, Emmermann A: Zornig C Esophageal motility in reflux disease before and after fundoplication: a prospective, randomized, clinical, and manometric study. ***Gastroenterology***. 2001; 121: 5–14.

21. Baigrie RJ, Cullis SNR, Ndhluni AJ, Cariem A: Randomized double-blind trial of laparoscopic Nissen fundoplication versus anterior partial fundoplication. ***Br J Surg.*** 2005; 92: 819 – 823.

22. Yang H, Watson DI, Kelly J, Lally CJ, Myers JC, Jamieson GG: Esophageal manometry and clinical outcome after laparoscopic Nissen fundoplication. ***J Gastrointest Surg.*** 2007; 11: 1126–1133.

23. Weijenborg PW, Savarino E, Kessing BF, Roman S, Costantini M, Oors JM, Smout AJPM, Bredenoord AJ: Normal values of esophageal motility after antireflux surgery; a study using highresolution manometry. ***Neurogastroenterol Motil.*** 2015; 27: 929–935.

24. Yamamoto SR, Akimoto S, Hoshino M, Mittal SK: Highresolution manometry findings in symptomatic post-Nissen fundoplication patients with normal endoscopic configuration. ***Dis of Esophagus.*** 2015.

25. Wilshire CL, Niebisch S, Watson TJ, Litle VR, Peyre CG, Jones CE, Peters JH: Dysphagia postofundoplication: More commonly hiatal outflow resistance than poor esophageal body motility. ***Surgery.*** 2012; 152: 584–594.

26. Scheffer RC, Samsom M, Haverkamp A, Oors J, Hebbard GS, Gooszen HG: Impaired bolus transit across the esophagogastric junction in postfundoplication dysphagia. ***Am J Gastroenterol.*** 2005; 100: 1677-84.

27. Wykypiel H, Gadenstaetter M, Klaus A, Klingler P, Wetscher GJ: Nissen or partial posterior fundoplication: which antireflux procedure has a lower rate of side effects? ***Langenbecks Arch Surg.*** 2005; 390: 141–147.

28. Stein HJ, Bremner RM, Jamieson J, DeMeester TR: Effect of Nissen fundoplication on esophageal motor function. ***Arch Surg.*** 1992; 127: 788-91.

29. Beckingham IJ, Cariem AK, Bornman PC, Callanan MD, Louw JA: Oesophageal dysmotility is not associated with poor outcome after laparoscopic Nissen fundoplication. ***Br J Surg.*** 1998; 85(9): 1290-1293.

30. Munitiz V, Ortiz A, Martinez de Haro LF, Molina J, Parrilla P: Ineffective oesophageal motility does not affect the clinical outcome of open Nissen fundoplication. ***Br J Surg.*** 2004; 91(8): 1010-1014.

31. Furnée EJ, Draaisma WA, Broeders IA, Smout AJ, Vlek AL, Gooszen HG: Predictors of symptomatic and objective outcomes after surgical reintervention for failed antireflux surgery. ***Br J Surg.*** 2008; 95(11): 1369-1374.

32. Ayazi S, Schwameis K, Zheng P, et al: Establishing preoperative risk factors and development of a predictive nomogram for dysphagia after magnetic sphincter augmentation. ***Journal of the American College of Surgeons.*** 2020; 231(4): e1-e2.

33. Zornig C, Strate U, Fibbe C, Emmermann A, Layer P: Nissen vs Toupet laparoscopic fundoplication. ***Surg Endosc.*** 2002; 16: 758-66.