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The Relation between Bougie Size and Postoperative Complications in Cases of Fundoplication Surgery

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Abstract

Background: Fundoplication is a surgical procedure used to treat stomach acid reflux. An effective length of fundoplication and bougie size has never been established in literature and it was mainly determined based on body weight or BMI.

Aim of Study: Comparison between post-operative complications mainly dysphagia based on the size of bougie used during Nissen fundoplication for patients diagnosed with GERD.

Material and Methods: Twenty patients were enrolled and randomized into two equal groups; group A "bougie size 40 French" and group B "bougie size 52 French". Any perioperative related complications were documented and correlated to the size of bougie. Patients were seen in clinic 3 to 4 weeks after their operation for their postoperative check. All patient charts were reviewed for an upper endoscopy specifically for dysphagia and/or dilation within 6 months after surgery.

Results: Patients in group (B) had nausea and heart burn recurrence more than group (A), patients in group (A) had gas bloating more than group (B) and each study group had the same number of patients who had vomiting without any significant difference between two study groups at any symptom. According to Eckardt score assessment pre- and postoperatively within two study groupsit was less post than preoperatively with statistically significant difference.

Conclusion: A performance of Nissen fundoplication with a bougie offers a safe and effective therapy for gastroesophageal reflux disease although there were no differences between different sizes of esophageal bougie regarding postoperative complications. It may provide low rates of long-term postoperative dysphagia and reflux recurrence.

Key Words: *Bougie size – Fundoplication – Dysphagia – Reflux.*

Introduction

THE prevalence of the prevalent condition gastroesophageal reflux disease (GERD) is rising. Antisecretory drugs and surgery to treat reflux are among the treatment options (ARS). The preoperative workup includes esophageal manometry, upper endoscopy, and pH testing **[1]**.

The fear of both immediate side effects like reherniation and the need for another operation as well as long-term side effects like dysphagia and gas-bloat syndrome is one explanation for the decline in anti-reflux surgeries that has been observed over the last few decades, though there are likely other factors at play as well **[2]**.

After a Nissen fundoplication, studies have revealed very high patient satisfaction. Although early postoperative dysphagia is very common, the majority of patients see a resolution by 8 to 12 weeks after surgery **[3]**.

However, up to 25% of patients in certain series needed endoscopic dilation or reoperation **[4]**.

The laparoscopic Nissen fundoplication is the gold standard in anti-reflux surgery, yet there is ongoing controversy over several technical aspects: Mesh versus no mesh, whole versus partial fundoplication, bougie versus no bougie **[5]**.

Use of an esophageal bougie decreased the long-term incidence of dysphagia after fundoplication, which has encouraged the majority of surgeons to do the wrap over abougie. The purpose of each modification is to enhance reflux management while concurrently decreasing undesirable outcomes such as dysphagia. But the reported risk of bougie complications ranges from 0.5% to 1.00% and can cause significant morbidity **[6]**.

The current literature lacks any evidence on the most appropriate size of bougie that can decrease the incidence of postoperative complication in patients who are undergoing Nissen fundoplication for GERD **[7]**.

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Material and Methods

Twenty patients who were diagnosed with GERD and sought medical advice were enrolled.

Study type:

It was a prospective randomized comparative study.

Study place:

The study was conducted at General Surgery Department of Ain Shams Specialized Hospital El-Demerdash Hospital from Dec. 2021 – May 2022.

Study period:

The study was conducted from December 2021 until May 2022.

Inclusion criteria:

Both genders aged more than 18 years old, with BMI between 18 and 28kg/m^2 diagnosed with GERD with or without hiatal hernia resistant for medical treatment >6 months.

Exclusion criteria:

Patients with underlying neurological diseases, chronic abuse of NSAIDs, endocrinopathies as gastrinoma or previous esophageal pathology as stricture or traumatic injury were excluded.

Patient and Methods:

After recruitment of patients, they were randomized into two groups: Group A with bougie size 40 French and Group B with 52 bougie size French. Patients' preferred closed envelope randomization method was used.

All included patients were subjected to the following:

Detailed medical history including demographics as age, gender, BMI, occupation, and special habits of medical importance as (smoking, alcohol consumption, and substance addiction).

Previous medical conditions that were persistent (diabetes, hypertension, cardiac diseases, morbid obesity, peptic ulcers, immunological and pulmonary diseases).

Through clinical examination was conducted to all patients.

Investigations included complete blood picture, kidney and liver function tests, serum electrolytes (sodium, potassium and chloride) and coagulation profile. Forthose who were older than 40 years or cardiac patients an ECG was performed.

All recruited patients had undergone:

Upper GI endoscopy to examine any possible gastrointestinal disorders that may be present (e.g., esophageal varices).

Esophageal manometery was used to measure dysmotility, which was defined as more than 40% failure of primary peristalsis or an average amplitude of less than 30mm Hg in the distal esophagus.

Barium swallow and PH testing was conducted to confirm reflux.

Surgical Methods:

Equipment:

Insufflation using CO_2, drapes, monitors, laparoscopic instruments, and electrocautery were among the essential pieces of laparoscopic equipment used for the procedure. The following additional tools are specific to the procedure:

- Four trocars ranging from 5mm to 10mm.
- A liver retractor.
- 30-degree angled laparoscope.
- Group A: Size 40 French bougie.
- Group B: Size 52 French bougie.
- Endoscope.
- Laparoscopic ultrasonic energy device dissector.

Preparation:

Thirty minutes before the incision, the patient received preoperative antibiotics and venous thromboembolism prevention. In the preoperative ward, clippers were used to trim the hair on the patient's abdomen. After that, the patient was correctly fastened on the operating table and placed there.

A stomach-based oro-gastric tube was placed following anaesthetic induction. The patient's arms were extended while they were in the lithotomy position. From the nipples to the pubic symphysis, the skin was routinely prepped. A time-out was taken.

Surgical technique:

The Veress needle method and direct entry to the peritoneal cavity were used to achieve insufflation. The umbilicus was put next to a camera port. Following these measurements: 5mm right subcostal anterior axillary line, 10mm left subcostal anterior axillary line, and 5mm left subcostal mid axillary line were used to position the remaining ports for direct visibility. In the subxiphoid region, a liver retractor was positioned. After that, the patient was put into a reverse Trendelenburg position.

Traction of the gastroesophageal junction fat pad made the phrenogastric ligament more visible. Next, the phrenogastric ligament was cut. The short gastric vessels were seen by the surgeon. The helper applied left lateral traction while holding onto the lateral gastrosplenic ligament. The short gastric vessels, which are located around 1cm laterally to the stomach wall, were sequentially divided using an ultrasonic dissector.

Starting with the pars flaccida, the gastrohepatic ligament was stretched open. It was divided superiorly, and the phrenoesophageal membrane below was subsequently cut away to reveal the right crural fibres. It was created a retroesophageal window. To encourage caudal retraction, a Penrose drain was positioned around the oesophagus at the level of the hiatus.

Prior to being mobilised anteriorly/posteriorly in the intra-abdominal cavity, the distal oesophagus was first moved in the posterior mediastinum. This was carried out up until at least 3cm of the oesophagus lay in the abdominal cavity unrestrained. Using two heavy (0) permanent sutures, the right and left crura were re-aproximated posteriorly.

Creation of the wrap:

A 40 or 52 French bougie was used in place of the orogastric tube. The gastroesophageal junction was located 3cm away from the gastroesophageal junction, and the bougie was crossed with the suture 2cm away. The posterior fundus was brought in front of the oesophagus and joined with the posterior fundus at the 10 o'clock position on thefront part of the oesophagus after being passed behind the oesophagus from left to right. From left to right, three sutures were inserted via three different structures.

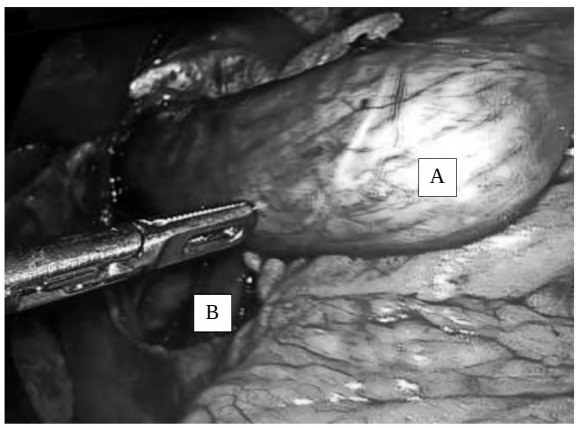

Fig. (1): Introduction of the bougie in the esophagus to create the wrap.

A: Bougi 52f inside the lower part of the esophagus.
B: The hiatal hernia opening after dissection.

The first suture passed through the fundus anteriorly then the seromuscular layer of the esophagus then the posterior fundus. The other 2 sutures passed only through the anterior fundus and the posterior fundus of the stomach. The bougie was removed and re-introduced several times to ensure floppiness of the wrap. Ryle tube insertion into the stomach was performed to secure the wrap from postoperative acute gastric dilatation. A fascial closure was done at the 10-mm port sites. Skin closure was done at all sites.

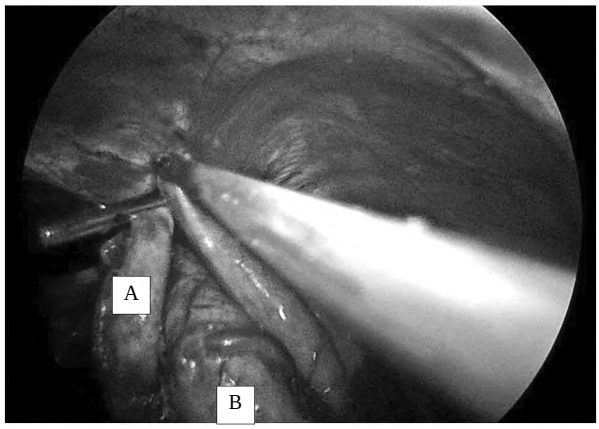

Fig. (2): Creation of wrap of Nissan fundoplication.

A: Fundas of the stomac.
B: The lower part of the esophagus containing a bougie 40f inside.

Intraoperative complications:

Any major bleeding, organ or vessel injuries were reported in the corresponding group.

Postoperative assessment:

Postoperative assessment included dysphagia score after 24, 48, 72 hours, light juices and water was initiated after regaining peristalsis, then solid food was started in the second day postoperatively. Hospital stay, need for analgesia, dysphagia score, surgical site infection, esophageal tear or injury and need for reoperation were documented.

Symptom	Score			
	0	1	2	3
Dysphagia	None	Occasional	Daily	With every meal
Regurgitation	None	Occasional	Daily	With every meal
Chest pain	None	Occasional	Daily	Several times a day
Weight loss (kg)	0	<5	5-10	>10

- The final score is the sum of the four component scoes, ranging from 0 to 12.

Fig. (3): Eckardt dysphagia score.

Postoperative complications:

Early postoperative complications such as severe post-operative nausea and vomiting, GERD, dysphagia, gas bloat, esophageal perforation and late complications as wrap-migration or ischemia, recurrent regurgitation or heartburn were documented in the corresponding group.

Follow-up:

All patients conducted their follow-up visits after 3-4 weeks form the operative day; all late complications were documented in the corresponding group. After 6 months of surgery, upper GI endoscope was requested to assess dysphagia and/or dilation within 6 months after surgery.

Statistical analysis:

Statistical package for Social Science was used to review, code, tabulate, and introduce the acquired data to a computer (SPSS 23). Data were presented, and the type of data obtained for each parameter was appropriately analysed. With regards to descriptive statistics, median and interquartile range (IQR) were employed for non-parametric numerical data whereas mean, standard deviation (SD), and range were used for parametric numerical data.Non-numerical data were expressed in frequency and percentage. Analytical statistics were utilised to determine the statistical significance of the difference between the means of the two study groups using the student *t*-test. The statistical significance of the difference between two means assessed twice for the same research group was evaluated using a paired *t*-test. To investigate the connection between two qualitative variables, the Chi-Square test was performed. When the predicted count is less than 5 in more than 20% of the cells, Fisher's exact test was employed to investigate the association between two qualitative variables.

Results

This study was conducted on 20 patients underwent Nissen fundoplication surgery using different sizes of bougi (F), 10 (50%) with size 40 and 10 (50%) with size 52. Mean age of study group was 35.20±9.29 ranged from 21 to 48 years old, 10% of patients had DM as well as HTN (Table 1).

The manometry test was done to all patient, 50% of patients had LES and 50% had LES with mean 4.86± 1.26 ranged from 2.7 to 6.8mm Hg. Upper GIT endoscope (Hiatal hernia) mean was 4± 1.03 ranged from 3 to 6 Cm. Regarding intra-operative data, 30% of patients lost 20- & 30-ml blood, 20% lost 40ml and 10% lost 100 & 150ml, with mean surgery time 44.0 ± 5.53 ranged from 35 to 55 minutes. All patients stayed at hospital for 24 hours post-operative (Table 2).

Regarding post-operative complication the most frequent complications were nausea and gas bloating by 18 (90%), the second one was heart burn recurrence by 6 (30%) and the least complication was vomiting by 4 (20%), while no one complaint of oesophageal perforation (Table 3).

Regarding eckardt score was assessed, pre-operative mean was 6.0±0.79 and it was less in post-operative follow up as it was 4.80±0.62, 3.40±0.5, 2.6±0.5 and 2.4±0.5 in 2 weeks, 1 month, 2 months and 4 months respectively, it was decreased by time post-operatively and it was the least after 4 months of follow-up (Table 4).

Regarding the relation between the different sizes of bougi (F) used in the study groups and scocio-demographic data there was no significant difference between two groups in neither age nor co-morbidities as *p*-value was (>0.05) (Table 5).

In the relation between two study groups and manometry all patients in bougi (F) 40 group had LES with mean 5.08± 1.09mm Hg and all patients in bougi (F) 52 group had LES with mean 4.64± 1.43mm Hg without significant difference between two groups in the manometry (mm Hg) measurement. There was no significant difference between Upper GI endoscopy (Hiatal hernia) nor intra operative blood loss between two study groups as *p*-values were (>0.05). There was significantdifference between two groups in surgery time as in was more in bougi (F) 40 group, *p*-value was (<0.05) (Table 6).

Regarding post-operative complications between two study groups, patients in Group B had nausea and heart burn recurrence more than Group A, patients in Group A had gas bloating more than Group Band each study group had the same number of patients who had vomiting without any significant difference between two study groups at any symptom as *p*-values were (>0.05) (Table 7).

According to eckardt score assessment pre- and post-operatively between two study groups, it was more pre-operative and in 4 months follow-up in Group B, it was more and in 2 weeks and 2 months follow-up in Group A and was the same in 1 month follow-up without significant difference betweentwo groups at any time point of follow-up as *p*-values were (>0.05) (Table 8).

According to eckardt score assessment pre- and post-operatively within two study groups, it was

less post-operative than pre-operative with significant difference pre and post-operatively within each group as p-value was (<0.05) (Table 9).

Table (1): Demographic data for the study groups.

	N (%) Mean ± SD	Range
Grouping Size of bougi:		
Group A	10 (50%)	
Group B	10 (50%)	
Age	35.20±9.29	(21-48)
Comorbidity:		
No	16 (80%)	
DM	2 (10%)	
HTN	2 (10%)	

Table (2): Manometry, Upper GI endoscopy, intra operative blood loss, time of surgery and hospital stayamong study groups.

	N (%) Mean ± SD	Range
Manometry:		
LES	10 (50%)	
LES	10 (50%)	
Manometry (mm Hg)	4.86±1.26	(2.7-6.8)
Upper GI endo (Hiatal hernia) Cm	4.00±1.03	(3-6)
Intra operative blood loss (ml):		
20	6 (30%)	
30	6 (30%)	
40	4 (20%)	
100	2 (10%)	
150	2 (10%)	
Time of surgery (Mins)	44.0±5.53	(35-55)
Hospital stay (Hours)	24.0	

Table (3): Post-operative complications among study groups.

	N	%
Nausea:		
No	2	10.0
Yes	18	90.0
Vomiting:		
No	16	80.0
Yes	4	20.0
Gas bloating:		
No	2	10.0
Yes	18	90.0
Heart burn recurrence:		
No	14	70.0
Yes	6	30.0
Esophageal perforation:		
No	20	100.0
Yes	0	0.0

Table (4): Eckardt score among study groups.

	Mean ± SD	Range
Eckardt score in pre-operative	6.0±0.79	(5-7)
Eckardt score in 2 weeks	4.80±0.62	(4-6)
Eckardt score in 1 month	3.40±0.5	(3-4)
Eckardt score in 2 months	2.6±0.5	(2-3)
Eckardt score in 4 months	2.4±0.5	(2-3)

Table (5): Relation between the different sizes of bougi (F) and scocio-demographic data among study groups.

	Grouping Size of bougi		Test of significance	
	Group A	Group B		
	Mean ± SD N (%)	Mean ± SD N (%)	p-value	Sig.
Age	39±8.77	31.4±8.55	0.065 **(T)**	NS
Comorbidity:				
No	6 (60%)	10 (100%)	0.087 **(F)**	NS
DM	2 (20%)	0 (0%)		
HTN	2 (20%)	0 (0%)		

Table (6): Manometry, Upper GI endoscopy, intra operative blood loss, time of surgery and hospital stay among study groups.

	Grouping Size of bougi		Test of significance	
	Group A	Group B		
	Mean ± SD N (%)	Mean ± SD N (%)	p-value	Sig.
Manometry:				
LES	0 (0%)	10 (100%)	<0.001 **(C)**	S
LES	10 (100%)	0 (0%)		
Manometry (mm Hg)	5.08±1.09	4.64±1.43	0.448 **(T)**	NS
Upper GI endo (Hiatal hernia) Cm	4.4±1.07	3.6±0.84	0.081 **(T)**	NS
Intra operative blood loss (ml):				
20	4 (40%)	2 (20%)	0.3 86 **(F)**	NS
30	2 (20%)	4 (40%)		
40	2 (20%)	2 (20%)		
100	0 (0%)	2 (20%)		
150	2 (20%)	0 (0%)		
Time of surgery (Mins)	47±5.37	41±3.94	0.011 **(T)**	S
Hospital stay (Hours)	24	24		

Table (7): Post-operative complications among study groups.

	Grouping Size of bougi		Fisher's Exact test	
	Group A	Group B		
	N (%)	N (%)	p-value	Sig.
Nausea:				
No	2 (20%)	0 (0%)	0.474	NS
Yes	8 (80%)	10 (100%)		
Vomiting:				
No	8 (80%)	8 (80%)	1.00	NS
Yes	2 (20%)	2 (20%)		
Gas bloating:				
No	0 (0%)	2 (20%)	0.474	NS
Yes	10 (100%)	8 (80%)		
Heart burn recurrence:				
No	8 (80%)	6 (60%)	0.628	NS
Yes	2 (20%)	4 (40%)		
Oesophageal perforation:				
No	10 (100%)	10 (100%)		
Yes	0 (0%)	0 (0%)		

Table (8): Eckardt score assessment pre- and post-operatively.

	Grouping Size of bougi		Student t-test	
	Group A	Group B		
	Mean ± SD	Mean ± SD	p-value	Sig.
Eckardt score in pre-operative	5.8±0.79	6.2±0.79	0.272	NS
Eckardt score in 2 weeks	5±0.67	4.6±0.52	0.151	NS
Eckardt score in 1 month	3.4±0.52	3.4±0.52	1.00	NS
Eckardt score in 2 months	2.8±0.42	2.4±0.52	0.074	NS
Eckardt score in 4 months	2.2±0.42	2.6±0.52	0.074	NS

Table (9): Eckardt score assessment pre- and post-operatively.

	Grouping Size of bougi	
	Group A	Group B
	Mean ± SD	Mean ± SD
Eckardt score in pre-operative	5.8±0.79	6.2±0.79
Eckardt score in post-operative	2.2±0.42	2.6±0.52
Paired t-test:		
p-value	<0.001	<0.001
Sig.	S	S

Discussion

In contrast to the current study, 82 patients who underwent laparoscopic Nissen fundoplication were retrospectively examined by Somasekar and colleagues. The treatment was performed on each patient in turn, using bougies on the first 40 patients and not using them on the remaining 42. The severity of the dysphagia in each group was equivalent at discharge, six weeks, twelve weeks, twenty-four weeks, and one year. Consecutive operations could have produced a learning curve effect, and non-blinded individuals assessed dysphagia. In the discussion section, the authors brought up issues crucial to doctors thinking about potential studies in the future. The timing of the assessment and the scoring system employed in assessing post-operative dysphagia must both be rigorously analysed in order to assess outcomes, as post-operative dysphagia may occasionally be connected to dysmotility that was missed during preoperative evaluation **[8]**.

28 patients undergoing laparoscopic para-oesophageal hernia repair and fundoplication were prospectively examined by Ng and colleagues. The first 14 underwent the surgery with a bougie, while the following 14 underwent it without one. Quality-of-life and dysphagia were evaluated prior to surgery and for six months following it, but no significant differences between the groups were discovered, contradicting the currentstudy. The tiny sample size and absence of power estimations in this study are major limitations **[9]**.

Additionally, Zacharoulis and associates looked back on the laparoscopic Nissen fundoplication experience at a single hospital. There were 128 procedures without a bougie and a total of 405 with one. In both groups, the prevalence of post-operative dysphagia was comparable. Given that surgeries were performed over a 12-year span by several surgeons, bias is likely to have been introduced and the severity and timeframe of the dysphagia reported are unclear **[10]**.

German surgeons who undertake anti-reflux treatments were the subject of an anonymous national study conducted by Huttl and colleagues. A total of 546 questionnaires were distributed, and 2540 anti-reflux procedures were covered by them. The response rate was 72%. Respondents indicated that 46 percent always used a bougie for calibrating the hiatus, while 15 percent occasionally did so, 24 percent never did, and 15 percent did not specify **[11]**.

Walsh and associates examined 268 consecutive laparoscopic fundoplications performed at a single facility between 1994 and 2000 in retrospect. 179 individuals underwent the surgery without a bougie, whereas 89 had one. At a mean follow-up period of 26.8 months, the incidence of severe post-operative dysphagia and moderate/severe heartburn in both groups was comparable **[12]**.

Laparoscopic Nissen fundoplication (LNF) without a bougie is a safe and efficient treatment for gastroesophageal reflux disease, according to Novitsky and colleagues. Low rates of long-term postoperative dysphagia and reflux recurrence may be provided while minimising potential concerns for stomach and esophageal injuries **[13]**.

According to Ostlie and colleagues, LNF in young children has demonstrated that most patients can have their GERD symptoms resolved with an average fundoplication length of about 2cm and a graduated bougie size in relation to the patient's weight. 100 patients were under 15kg in weight (mean, 7.23kg). 95 minutes was the average running time (range, 31 minutes to 159 minutes). 32 patients received gastrectomies. For elective LNF, postoperative hospitalisation lasted, on average, 1.8 days. Each patient's fundoplication length was measured; the average value was 2.06cm.The size of the bougie, which ranged from 22F to 42F, depended on the patient's weight. There were no cases of dysphagia or the necessity for postoperative esophageal dilatation. Recurrent symptoms have required the attention of two patients. While the other patient's upper gastrointestinal study and pH study were both normal, one patient needed a second LNF **[14]**.

Patterson and colleagues conducted a blinded prospective randomised clinical trial on 171 patients undergoing laparoscopic fundoplication, and the-current study supported their findings. 81 patients underwent the surgery with a 56 Fr bougie in place, while 90 patients had the bougie removed. Overall problems and dysphagia at one month were comparable. Overall long-term dysphagia (mean follow-up of 11 months) and the onset of severe or frequent dysphagia were both noticeably more common in the no-bougie group **[15]**.

During 1620 cases of laparoscopic foregut surgery at five large institutions in the USA, Lowham and colleagues retrospectively analysed the processes of oesophageal perforation resulting from the installation of bougie or nasogastric tubes. The largest published series that makes an effort to quantify the reported incidence of oesophageal perforation, which is 0.8 percent, is this one. The anterior gastro-oesophageal junction was the site of perforations most frequently due to incorrect retraction during bougie insertion, the authors highlighted that this incidence was higher than expected **[16]**.

100 patients who underwent open Nissen fundoplication between 1972 and 1984 with a mean follow-up duration of 45 months were retrospectively reviewed by DeMeester and colleagues. Several staged changes in technique were undertaken during this time. One change involved increasing the bougie from 36 to 60 French Francs. The incidence of transitory (up to 3 month) swallowing discomfort was much lower as a result of the bougie size increase, but it had no impact on the incidence of caused chronic dysphagia. Given that this retrospective study is 25 years old, there is a chance that a learning curve will have an impact on the findings **[17]**.

Strengths:

The strengths of current study were due to it was the first clinical trial assessed the post-operative complications based on the size of bougie used during Nissen fundoplication for patients diagnosed with GERD. The same team performed all clinical assessments, surgical procedures, and evaluations of research results. All follow-up data were documented with great care, and only complete information was used in the data analysis.

Limitations:

The limitations of current study were due to blinding of the observer wasn't performed, relatively small sample size regarding accuracy of study outcomes and COVID 19 pandemic.

Conclusion:

Although there were no differences between different sizes of esophageal bougie regarding postoperative complications, a performance of Nissen fundoplication with a bougie offers a safe and effective therapy for gastroesophageal reflux disease. It may provide low rates of long-term postoperative dysphagia and reflux recurrence. So, more clinical trials with larger sample size and more data are needed for further evaluation of study outcomes.

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Conflict of interest: None declared.

Ethical approval: The study was approved by the Research Ethics Committee (REC), General Surgery Department, Ain Shams University (IRB 00006379).

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العلاقة بين حجم قسطرة البوجى ومضاعفات ما بعد عمليات تثنية القاع للمعدة فى حالات ارتجاع المرئ

المقدمة : يعد مرض الارتجاع المعدى المريئى مرضاً شائعاً يتزايد معدل حدوثه. يشمل العلاج الأدوية المضادة للإفراز والجراحة المضادة للارتجاع. أظهرت الدراسات رضا المريض الممتاز بعد عملية تثنية القاع. على الرغم من أن عسر البلع المبكر بعد الجراحة شائع نسبياً. إلا أنه يتم حله فى معظم المرضى خلال ٨-١٢ أسبوعاً بعد الجراحة. ومع ذلك، فى بعض الدراسات العلمية، احتاج ما يصل إلى ٢٥٪ من المرضى إلى توسيع بالمنظار أو إعادة الجراحة . تفتقر الأبحاث الحالية إلى أى دليل على الحجم الأنسب للبوجى الذى يمكن أن يقلل من حدوث مضاعفات ما بعد الجراحة فى المرضى الذين يخضعون لعملية تثنية القاع لنيسن لعلاج مرض ارتجاع المرئ غير المستجيب للعلاج الدوائى.

الإستنتاج : على الرغم من عدم وجود فروق بين الأحجام المختلفة لبوجى المرئ، فيما يتعلق بمضاعفات ما بعد الجراحة، فإن أداء تثنية القاع لنيسن مع بوجى يوفر علاجاً آمناً وفعلاً لمرض الارتجاع المعدى المريئى. قد يوفر معدلات منخفضة لعسر البلغ بعد العملية الجراحية وتكرار الارتجاع على المدى الطويل. لذلك، هناك حاجة إلى مزيد من التجارب السريرية ذات حجم أكبر للعينة والمزيد من البيانات لمزيد من التقييم لنتائج الدراسة.