

Predictive factors for short gastric vessels division during laparoscopic total fundoplication

Fatores preditivos da necessidade de secção dos vasos gástricos curtos nas funduplicaturas totais videolaparoscópicas

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A B S T R A C T

Objective: to determine clinical variables that can predict the need for division of the short gastric vessels (SGV), based on the gastric fundus tension, assessing postoperative outcomes in patients submitted or not to section of these vessels. **Methods:** we analyzed data from 399 consecutive patients undergoing laparoscopic fundoplication for gastroesophageal reflux disease (GERD). The section of the SGV was performed according to the surgeon evaluation, based on the fundus tension. Patients were divided into two groups: not requiring SGV section (group A) or requiring SGV section (group B). **Results:** the section was not necessary in 364 (91%) patients (Group A) and required in 35 (9%) patients (Group B). Group B had proportionally more male patients and higher average height. The endoscopic parameters were worse for Group B, with larger hiatal hernias, greater hernias proportion with more than four centimeters, more intense esophagitis, higher proportion of Barrett's esophagus and long Barrett's esophagus. Male gender and grade IV-V esophagitis were considered independent predictors in the multivariate analysis. Transient dysphagia and GERD symptoms were more common in Group B. **Conclusion:** the division of the short gastric vessels is not required routinely, but male gender and grade IV-V esophagitis are independent predictors of the need for section of these vessels.

Key words: Fundoplication. Video-Assisted Surgery. Gastroesophageal Reflux. Gastric Fundus.

INTRODUCTION

Laparoscopic total fundoplication is an effective procedure for the treatment of gastroesophageal reflux disease (GERD)¹. However, some technical points are still controversial, especially the need for short gastric vessels (SGV) division². While most authors believe this step brings better results³⁻⁵, others showed similar outcomes whether SGV are divided or not or even complications attributed to SGV division^{2,6-9}.

This study aims to determine: (a) clinical variables that may predict the need of SGV division based on gastric fundus tension and (b) the outcomes in patients with or without SGV division.

METHODS

We retrospectively studied 399 consecutive patients (50% male, mean age 49 years) recorded in a prospectively kept database that underwent laparoscopic total fundoplication for the surgical treatment of GERD. This

study was approved by the local institutional review board. (CEP 0742/11).

Patients were questioned before the operation regarding the presence of symptoms. These were grouped into esophageal symptoms (heartburn and regurgitation), extra-esophageal symptoms (thoracic pain, respiratory symptoms, such as cough and asthma or ear, nose and throat symptoms) or dysphagia. Anthropometric variables were also recorded. Individuals with partial fundoplication, paraesophageal hernia, previous foregut operation or conversion to conventional laparotomy were excluded from the analysis.

All patients were submitted to an upper endoscopy to evaluate the presence of hiatal hernia (HH), esophagitis and Barrett's esophagus. HH was classified according to size in <4cm or ≥4cm. Modified Savary-Miller endoscopic classification¹⁰ was used for grading esophagitis. Barrett esophagus was defined by the presence of intestinal metaplasia and classified as short-segment (<3cm) or long-segment (≥3cm). Esophageal manometry was available to review in 283 (71%) patients. Ambulatory 24-hour esophageal pH monitoring was only performed in

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patients without esophagitis or with atypical symptoms. pH monitoring results were available for review in 62 (15%).

Surgical technique has been previously described². In summary, an extensive mobilization of the posterior wall of the gastric fundus followed the dissection of the distal esophagus and diaphragmatic crus in all patients. SGV division was done at the discretion of the surgeon based on tension of the gastric fundus after performing a specific maneuver ("drop-test" - Figure 1). A short-floppy total fundoplication was performed without the aid of a bougie. All procedures were performed by or under the supervision of a single experienced surgeon. Patients were grouped according to the necessity for SGV division (Group A – no division; Group B – SGV division).

Follow-up visits were scheduled for 15, 30, 90, 180 and 360 days after the surgery and then annually, irrespective of the presence of symptoms. Upper endoscopy was performed annually or earlier if the patient had any complaints related to the postoperative period. All selected patients had at least a 6-month postoperative follow-up period.

Chi-square, Student's t test and logistic regression were used when necessary. A value of *p* was considered significant at the 0.05 level. Variables are expressed as mean ± standard deviation.

RESULTS

SGV division was deemed not necessary in 364 (91%) patients (Group A) but required in 35 (9%) patients (Group B). Demographic data, symptoms distribution, endoscopic and manometric data are depicted in table 1. Group B had more males and a higher height. Endoscopic parameters were worse for group B, with larger hiatal hernias, higher proportion of hiatal hernias >4cm, more severe esophagitis (Grade IV-V), higher proportion of Barrett esophagus, and higher rate of long-segment Barrett esophagus. Manometric parameters also disfavored group B with decreased lower esophageal sphincter basal pressure. Only male gender and grade IV-V esophagitis stood as independent predictive factors for the need of SGV division at the multivariate analysis (Table 2).

Average follow-up was 13.8 months. Outcomes at last follow-up are depicted in table 3. Transient dysphagia and GERD symptoms were more common in Group B.

If patients at higher risk for gastric fundus tension (namely males with severe esophagitis) that did not undergo SGV division are compared to the remaining patients no difference in symptoms were noticed.

DISCUSSION

Our results show that: (a) male gender and severe esophagitis are independent predictors for the need to SGV

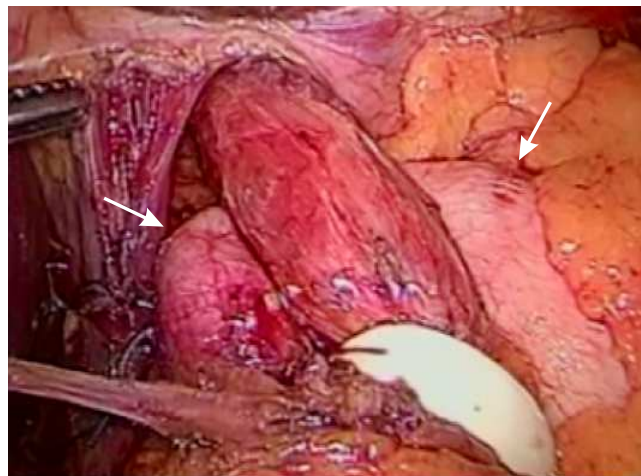


Figure 1 - Gastric fundus in place without the need of traction - drop-test- (Arrows).

division and (b) SGV division may lead to more transitory dysphagia and GERD symptoms.

The effect of SGV division on the outcomes of laparoscopic fundoplication have been evaluated in five prospective randomized studies^{2,6-9} and their meta-analysis¹¹⁻¹⁴. These studies showed a longer operative time and intraoperative bleeding^{2,6,8,9,11-14}, higher incidence of transient dysphagia² and gas-bloating syndrome⁷ when SGV are divided. Our results also showed more postoperative GERD symptoms. No benefit has been attributed to SGV division¹⁵. Very interestingly, however, authors that do not routinely divide SGV find this step necessary at the time of the fundoplication due to tension on the gastric fundus in up to 33% of patients¹⁶ even after extensive gastric fundus mobilization by lysis of adhesions between the stomach and diaphragm^{2,6}.

In this study, 8.8% (35/399) of the patients needed SGVD for the completion of a short floppy fundoplication. The likely cause of this low need of SGVD is the extensive gastric fundus mobilization employed in all patients, as advocated by Farah *et al*⁶ and Chrysos *et al*⁶. We believe that when this surgical step is used, one makes a larger length of the gastric fundus available for the construction of a floppy fundoplication around the esophagus. So, even in those cases in which there is an enlarged cardia, this maneuver lessens the likelihood of the need of SGVD.

Some previous studies attempted to identify anatomic parameters to predict gastric fundus tension and consequent need to SGV division. Szor *et al*.¹⁶ found some sort of tension in half of the cases during funduplications in cadavers, but no anatomic parameter predicted this tension. Huntington *et al*.¹⁷ deemed necessary to divided SGV in some patients based on the gastric fundus length and the esophageal circumference. Severe esophagitis as a predictor for fundus tension in our study may be linked to esophageal circumference as progressive dilatation of the esophageal

Table 1 - Demographic data, symptoms distribution, endoscopic and manometric data.

Variable	No SGVD(n = 364)	SGVD(n = 35)	P Value
Male	47.3%	80%	<0.001 ^{X2}
Male-female ratio	0.89:1	4:1	
Mean age (sd). years	49.77 ± 13.05	51.15 ± 13.46	0.564 ^{t-S}
Mean weight (sd). Kg	74.56 ± 12.85	79.76 ± 16.86	0.084 ^{t-S}
Mean height (sd). m	1.67 ± 0.10	1.72 ± 0.08	<0.001 ^{t-S}
Mean BMI (sd). Kg/m ²	26.9 ± 4.39	26.86 ± 5.02	0.969 ^{t-S}
% Typical symptoms	96.7%	100%	0.275 ^{X2}
% Atypical symptoms	29.7%	14.3%	0.054 ^{X2}
% Dysphagia	2.7%	8.6%	0.064 ^{X2}
Mean duration of symptoms (sd). months	66 ± 51.17	65 ± 41.63	0.921 ^{t-S}
% Hiatal Hernia	79.4%	71.4%	0.137 ^{X2}
Mean hiatal hernia length (range). cm	3 ± 2-9	3 ± 2-10	0.004^{t-S}
% 2-4 cm	68.7%	48.6%	0.016^{X2}
% > 4 cm	10.7%	22.9%	0.033^{X2}
% Esophagitis	85%	94%	0.129 ^{X2}
I-II-III (Savary-Miller)	58	37	0.019^{X2}
IV-V (Savary-Miller)	27	57	<0.001 ^{X2}
% Barrett esophagus	23.9%	42.9%	0.014^{X2}
Mean size of Barrett (sd). cm	2.17 ± 1.68	3.13 ± 2.29	0.056 ^{t-S}
% Short-segment Barrett	18.1%	22.9%	0.492 ^{X2}
% Long-segment Barrett	5.8%	20%	0.002^{X2}
Mean LES pressure (sd). mmHg	8.74 ± 4.98	6.01 ± 3.50	0.012^{t-S}

SGVD: short gastric vessels division; n: number; sd: standard deviation; y: years; m: meters; mo: months; cm: centimeters; LES: lower esophageal sphincter; X2: chi-square; t-S: Student's t test.

diameter is observed as esophagitis severity increases^{18,19}. Male gender may bring a higher chance of fundus tension probably due to more exuberant visceral fat compared to females. To the best of our knowledge, no other series studied clinical parameters to predict gastric fundus tension.

The current study studied a large number of patients; however, it has the limitations of a retrospective case series. As such, some parameters that could help understand the results of the study were not evaluated, such as the amount of visceral fat. Also, the time of follow-up is short for a stronger conclusion that SGV division does

not affect long-term outcomes. More importantly, even though a single surgeon operated all cases, gastric fundus tension was based on subjective parameters.

We conclude that SGV division is not necessary routinely but male sex and grade IV-V esophagitis are independent predictors of the need of SGV division. However, not all patients in these conditions need SGV division as a subanalysis of these population that did not underwent this step did not show worse outcomes compared to other patients. Gastric fundus tension must still be evaluated based on subjective parameters by experienced surgeons.

Table 2 - Multivariate analysis for the need to short gastric vessels division.

Variable	Odds Ratio(95% CI)	P Value
Male gender	28.3 (2.25-355.22)	0.010
Weight	1.03 (0.98-1.09)	0.216
Hiatal hernia length	1.64 (0.75-3.59)	0.213
Esophagitis grade IV-V	19.5 (2.08-182.26)	0.009
Barrett esophagus and extension	0.11 (0.01-1.06)	0.056
LES pressure	0.79 (0.62-1.01)	0.063

LES, lower esophageal sphincter; CI, confidence interval.

Table 3 - Clinical follow-up.

Variable	No SGV division n=364	SGV division n=35	P
Transient dysphagia	6 (1.6%)	4 (11.4%)	0.007
Persistent dysphagia	12 (3.3%)	1 (2.8%)	1
Reflux symptoms	6 (1.6%)	3 (8.5%)	0.04
Subgroup analysis			
Variable	Male sex. esophagitis IV-V, no SGV division n=58	Other patients n=341	P
Transient dysphagia	4 (6.9%)	8 (2.3%)	0.08
Persistent dysphagia	1 (1.7%)	11 (3.2%)	1
Reflux symptoms	1 (1.7%)	8 (2.3%)	1

SGV: short gastric vessels.

R E S U M O

Objetivo: determinar variáveis clínicas que possam prever a necessidade de secção dos vasos gástricos curtos (VGC), baseado na tensão do fundo gástrico, avaliando os resultados pós-operatórios em pacientes submetidos ou não à secção destes vasos.

Métodos: foram analisados os dados de 399 pacientes consecutivos submetidos à funduplicatura total laparoscópica para a doença do refluxo gastroesofágico (DRGE). A secção dos VGC foi realizada de acordo com a avaliação do cirurgião, baseado na tensão do fundo gástrico. Os pacientes foram distribuídos em dois grupos: sem necessidade de secção dos VGC (grupo A) ou com necessidade de secção dos VGC (grupo B). **Resultados:** A secção não foi necessária em 364 (91%) pacientes (Grupo A) e necessária em 35 (9%) pacientes (Grupo B). O Grupo B tinha proporcionalmente mais pacientes do sexo masculino e maior estatura média. Os parâmetros endoscópicos foram piores para o Grupo B, com maiores hérnias hiatais, maior proporção de hérnias com mais de quatro centímetros, esofagite mais intensa, maior proporção de esôfago de Barrett e esôfago de Barrett longo. O sexo masculino e as esofagites graus IV-V foram considerados fatores preditivos independentes na análise multivariada. A disfagia transitória e os sintomas de DRGE foram mais comuns no Grupo B. **Conclusão:** A secção dos vasos gástricos curtos não é necessária rotineiramente, porém o sexo masculino e as esofagites graus IV-V são fatores preditivos independentes da necessidade da secção destes vasos.

Descritores: Funduplicatura. Cirurgia Vídeoassistida. Refluxo Gastroesofágico. Fundo Gástrico.

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