ORIGINAL ARTICLE

Splenectomy and ligation of the left gastric vein in *schistosomiasis mansoni*: the effect on esophageal variceal pressure measured by a non-invasive technique

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Abstract. The treatment of choice, in the Northeast of Brazil, of patients with a history of upper GI bleeding from ruptured esophageal varices (EV) and with hepatosplenomegaly secondary to schistosomiasis (HSS), is splenectomy and left gastric vein ligation (SLGL). However, the effect of this procedure on the EV pressure, the parameter that best correlates to re-bleeding risk, has not yet been evaluated. With the introduction of a minimally invasive technique to measure the EV pressure, it has become possible to assess the effect of this surgery without an increased risk to the patient. SLGL was performed in twenty two patients with a history of HSS and upper GI Bleeding secondary to esophageal varices. The non-invasive endoscopic pneumatic balloon was used to measure the EV pressure before surgery and the results were then compared with measurements made between five and eight days post-operatively. The pre-operative EV pressure ranged from 20.0 mmHg to 28.7 mmHg (mean 24.35 +/– 2.36 mmHg), with no correlation between the pressure and the calibre of the varices. In the post-operative period, a significant decrease in EV pressure was observed, ranging from 14.6 mmHg to 21.5 mmHg (mean 17.29 +/– 1.75 mmHg, $p < 0.001$). These results support the use of SLGL in patients with HSS and a history of variceal bleeding. The operation results in, at least for the short term and in the majority of cases, a reduction in the EV pressure, and therefore a reduced risk of repeating upper GI Bleeding. (Keio J Med 51 (2): 89–92, June 2002)

Key words: splenectomy, left gastric vein, *schistosomiasis mansoni*

Introduction

Since 1992, both of the University Hospitals of Recife, Brazil, have used splenectomy with left gastric vein ligation (SLGL) as the treatment of choice in patients with *schistosomiasis mansoni* and a history of esophageal variceal bleeding. This simple technique, which has a low morbidity and mortality, has a pathophysiological basis to its use.[1] The use of portosystemic shunts in patients with HSS was affected by the results of the prospective randomised trial conducted in 1989 by Raia *et al.*[2] This study demonstrated that distal renal-splenic anastamosis resulted in re-bleeding rates similar to those observed in some patients that had undergone splenectomy with azygo-portal disconnection (SAPD), but with greater rates of encephalopathy and late mortality.[3] These results confirmed the belief that shunts are contra-indicated in schistosomiasis patients.[4,5]

In 1991, we performed an angiographic and pressure study of the effect of the splenectomy with esophageal variceal ligation (SEVL) on the portal hemodynamics of these patients.[6,7] It was found that the intervention caused a significant reduction in the diameter of the

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This article is based on a study first reported in Cláudio Moura Lacerda, Wilson Freire, Paulo Sérgio Vieira de Melo, Heloisa Ramos Lacerda, Gustavo Carvalho: Esplenectomia e ligadura da veia gástrica esquerda na esquistossomose mansônica: efeito sobre a pressão das varizes de esôfago aferida por técnica não-invasiva. [The role of splenectomy and ligature of the left gastric vein on the esophageal variceal pressure measured by a non-invasive technique in mansonic shistosomotic patients.] Rev Col Bras Cir 1999; 26: 15–19 (in Portuguese)

portal vein, an increase in the diameter of the hepatic artery and a slight increase in mean sinusoidal pressure. In addition, in some cases, post-operatively, a large part of the portal blood flow was deviated via the left gastric vein into the azygos system. As a result, the liver became arterialised and the sinusoidal pressure increased markedly, a process similar to a porto-caval anastamosis with poor long-term prognosis. The same process was observed in patients undergoing SAPD, where the disconnection is performed tangentially to the stomach, because the branches of the left gastric vein that drain into the azygos system were left intact. To avoid these effects, after removal of the spleen the origin of the left gastric vein was ligated, without ligating the esophageal varices. This procedure was replaced with endoscopic sclerotherapy when deemed necessary.

However, a proper evaluation of the effect of splenectomy and ligation of the left gastric vein on EV pressure, the parameter that correlates best to re-bleeding risk, was necessary. The introduction of the non-invasive endoscopic balloon by Gertsch in 1993 has made this possible.[8] The objective of this study is to evaluate the effect of SLGL on EV pressure in patients with schistosomiasis and a history of upper GI bleeding secondary to esophageal varices.

Patients and Methods

In a prospective study, 22 patients between the ages of 29 and 79 with a mean age of 51.45 years were evaluated. Thirteen patients were female and nine were male. All patients had HSS and a history of ruptured esophageal varices, without associated hepatic disease. All patients were classified as A-class according to Child-Pugh's score.

The endoscopic and manometric technique described by Gertsch in 1993 was used.[9] The inflatable transparent balloon was fixed to the endoscope and lubricated. Upon introduction into the stomach the balloon was gently inflated and deflated several times. It was then pulled back up into the distal esophagus, at which point the variceal calibre was measured using the transverse lines on the balloon, that were 5 mm apart, as reference points. Then the balloon was progressively inflated until the varix began to collapse. The manoeuvre was repeated several times until the exact moment when the varix began to collapse could be clearly detected, at which point the pressure from the interior of the balloon was transmitted to the manometer and registered on the polygraph. The procedure was repeated 4 times, obtaining 4 pressure curves, and an arithmetic mean of these values was then calculated for each case.

The 22 pre-operative endoscopic evaluations were obtained in the week before the surgical intervention, and the post-operative evaluations were performed between the 5th and the 8th day post-op. Two patients did not undergo to post-operative endoscopy. The first refused, and the second had died on the 4th day due to hemorrhagic complications. The same endoscopist carried out all the evaluations. In the statistical analysis comparing the pressure values before and after surgery, the paired student t-test was used.

A standard splenectomy was performed on all the patients, followed by ligation of the left gastric vein at its origin, close to the portal vein. Hepatic biopsy was taken confirming that only Symmers periportal fibrosis was present, in all cases.

Results

The 42 pre- and post-operative endoscopic and manometric examinations were performed, as described above, without any complications. Other than the usual discomfort that accompanies a regular endoscopy, the patients had no additional complaints.

SLGL was carried out in accordance with the technique standardized in our Department. The spleen was voluminous, in the majority of cases, with an *in vitro* weight ranging from 380 g to 1,750 g, with a mean of $877.64 +/- 374.17$ g. The left gastric vein was easily identified in all cases, with its calibre ranging from 6 to 18 mm, with a mean of 9.0 mm. The oldest patient in the group, 71 years old, was found to have chronic cholecystitis at operation. After performing SLGL, a cholecystectomy was carried out. The surgery proved to be very difficult, with significant blood loss as result of adhesions, portal hypertension and coagulopathy. The patient developed a hemoperitoneum and despite re-operation, succumbed on the 4th post-operative day. The remaining cases all responded well to the surgery and were discharged from hospital between the 6th and 10th post-operative days.

Table 1 shows a summary of the variceal diameter measured in the pre- and post-operative period. In four patients there was a reduction in variceal diameter compared with the pre-operative measurement. In the remaining patients there was no change in the size of the varices. Table 2 compares variceal pressures measured in the pre- and post-operative period. In the post-operative period, a significant reduction in EV pressures was found ($p < 0.001$, $t = 13.9$). There was no correlation between the diameter of the varices and their pressures.

Discussion

Two problems limit the classical techniques in the evaluation of portal system pressure. First, there is no consistent correlation between mesurements obtained at mesenteric, splenic, portal or sinusoidal levels and

Table 1 Comparison of Esophageal Variceal Diameter Evaluated before and after Splenectomy and Left Gastric Vein Ligation – According to Palmer's Classification

Case	Pre-Op	Pos-Op
01	L	L
02	L	L
03	M	M
04	M	S
05	L	L
06	L	L
07	L	L
08	M	*
09	L	M
10	L	L
11	M	S
12	L	L
13	L	L
14	L	L
15	L	L
16	M	*
17	L	L
18	L	L
19	L	L
20	M	M
21	L	L
22	M	S
S-small (d < 4 mm)	*S-0*	*S-3*
M-medium (4 mm–6 mm)	*M-7*	*M-3*
L-large (d > 6 mm)	*L-15*	*L-14*
**-Not available*		*Diameter Reduction-4 (20%)*

Table 2 Comparison of Esophageal Variceal Pressures Measured before and after Splenectomy and Left Gastric Vein Ligation (mmHg)

Case	EV pressure		Reduction	
	Pre-Op	Pos-Op	Absolute (mmHg)	Relative (%)
01	25.0	18.5	6.5	26.0
02	23.5	16.2	7.3	31.0
03	20.0	16.5	3.5	17.5
04	25.5	18.3	7.2	28.2
05	25.7	18.2	7.5	29.1
06	28.7	19.5	9.2	32.0
07	28.5	21.5	7.0	24.6
09	24.6	17.8	6.8	27.6
10	25.5	17.7	7.8	30.6
11	24.5	14.4	1.1	41.2
12	21.5	16.1	5.4	25.1
13	23.3	19.5	3.8	16.3
14	24.3	17.3	7.0	28.8
15	24.0	17.2	6.8	28.3
17	20.3	17.0	3.3	16.2
18	27.3	14.6	12.7	46.5
19	24.5	15.3	9.2	37.5
20	21.5	17.0	4.5	20.9
21	23.5	15.6	7.9	33.6
22	25.5	17.7	7.8	30.5
n	*20*	*20*	*20*	*20*
Min	*20.0*	*14.4*	*3.3*	*16.2*
Max	*28.7*	*21.5*	*12.7*	*46.5*
X	*24.36*	*17.29*	*7.06*	*28.57*
SD	*2.36*	*1.73*	*2.29*	*7.72*
		$t = 13.9$ $p < 0.001$		

the risk of variceal rupture. Second, the invasive character of these techniques conveys a significant morbidity.

The concept that the absence of valves throughout the portal system results in a uniform pressure in all of its tributaries does not apply to esophageal varices, where resistance that is exerted by the gastroesophageal wall affects variceal pressure. As this resistance increases so does the pressure gradient between the portal system and the varices, conveying a degree of protection from upper GI bleeding. It is the pressure gradient, which varies according to individual anatomical and functional characteristics, that explains the lack of correlation between the portal pressure and risk of upper GI bleeding. It also explains how certain drugs, by constricting the distal esophageal sphincter, can reduce variceal pressure and limit upper GI bleeding in cirrhotic patients.[10–12]

Studies that have evaluated EV pressure by different methods have shown that it is a sensitive and reliable parameter in predicting upper GI bleeding.[9,13,14] Of the different methods that have been evaluated, the inflatable balloon was superior in terms of cost, simplicity and precision. As an additional advantage, the technique allows a more precise evaluation of the size of the varices, using the transverse markings on the surface of the bolloon.

Table 3 Comparison of Mean Pressures Obtained from Different Authors, in Patients with Hepatic Cirrhosis, Compared with the Mean Pressure Obtained from this Study in Carriers of *Schistosomiasis Mansoni*

Author	Disease	N	X	SD
Kleber *et al.* (13)	cirrhosis	40	17.6	–
Rigau *et al.* (9)	cirrhosis	47	15.70	2.80
Gertsch *et al.* (8)	cirrhosis	29	20.39	–
Nevens *et al.* (14)	cirrhosis	15	16.50	3.20
Lacerda *et al.*	Shistosomiasis	22	24.35	2.22

Table 3 shows a comparison of average EV pressures measured in cirrhotic patients from several authors, with the EV pressures obtained from this study in schistosomiasis patients. These pressures are relatively low, suggesting that patients with HSS tolerate EV pressures that are high, which can be explained using the Law of Laplace.

With the introduction of a minimally invasive tech-

nique to measure the EV pressure, it has become possible to assess the effect of this surgery without an increased risk to the patient EV wall tension. According to the Law of Laplace, the tension in a vessel can be expressed by the following formula:

$$T = (p1 - p2) \times r/t$$

Where p1 = intra-variceal pressure, p2 = external pressure, r = radius and t = thickness of the vessel wall.

In the case of esophageal varices, p2 corresponds to the pressure exerted by the distal esophageal sphincter. Given that patients with HSS have a better nutritional state and consequently connective tissue state than that of cirrhotic patients, it is fair to assume that the thickness of the esophageal varices would be greater, and that the pressure of the distal sphincter would also be greater in patients with HSS than cirrhotic patients. As a result, despite high intra-variceal pressures, the tension remains relatively low and explains how these patients are able to tolerate the higher pressures.

In this study, four patients had a significantly reduced variceal diameter after SLGL, suggesting that diameter reduction does not occur rapidly after surgery. Variceal diameter is not, therefore, a sensitive indicator in the evaluation of therapeutic modalities that interfere with portal hemodynamics.

On the other hand, EV pressure was reduced in all cases by, on average, 28.57% (from 24.36 mmHg to 17.29 mmHg), a difference that was statistically significant ($p < 0.001$). In addition, it was noticed, that in 19 of the 20 cases studied in both the pre- and postoperative period, the EV pressure dropped to levels lower than the lowest value registered in the preoperative period (20 mmHg), suggesting that the intervention is, in fact, effective in the control of upper GI bleeding.

The EV pressure did not drop in any of the cases to levels lower than 14 mmHg, a favourable result when considering that an excessive drop in portal pressure, which would cause reduced portal blood flow, is not physiological. It can be asserted, with a certain degree of conviction, that the ideal portal pressure in a patient with established schistosomotic hepatosplenomegaly is the highest possible pressure that does not cause upper GI bleeding.

The results of this study support the idea behind the splenectomy and left gastric vein ligation in patients with HSS and a history of upper GI bleeding due to esophageal varices. The intervention resulted in, at least in the short term and in the majority of cases, a reduction in the esophageal variceal pressure to levels compatible with hepatic function preservation and low risk of upper GI bleeding relapse.

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