

# Influence of the inversion of the portal/splenic vein diameter in the results of the surgical treatment of schistosomotic portal hypertension

## *Influência da inversão do diâmetro veia porta/veia esplênica nos resultados do tratamento cirúrgico da hipertensão portal esquistossomótica*

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### A B S T R A C T

**Objective:** To evaluate the morbidity and mortality in surgical treatment of schistosomal portal hypertension in patients with inversion of the Portal/Splenic Vein diameter ratio. **Methods:** We conducted a retrospective cross-sectional study of patients undergoing surgical treatment of portal hypertension in the period between September 1993 and January 2004. The study population was divided into two groups: a) Inversion – splenic vein diameter greater than or equal to portal vein's – and b) control group (portal vein diameter greater than the splenic vein's). Statistical comparisons used the Student t test for averages difference, chi-square test for proportions difference and Fisher's exact test for small samples. **Results:** 169 patients were analyzed, with follow-up averaging 23.6 months. Twenty-one patients (12.4%) had splenic vein caliber greater of equal than the portal vein's (Inversion – study group). The mean preoperative diameter of the portal and splenic veins were respectively 1.49 and 1.14 cm in the control group, and 0.98 versus 1.07 cm in the inversion group. The portal vein diameter was significantly higher in the control group when compared to the inversion group ( $p < 0.05$ ). Varices in the gastric fundus were found in 33.3% of the inversion group and in 38.5% of patients in the control group. Postoperative rebleeding occurred in 23.1% of patients in the inversion group and in 13.4% of the control group ones ( $p > 0.05$ ). In the postoperative evaluation with Doppler ultrasonography of portal vessels, no cases of portal vein thrombosis were observed in the inversion group, whilst in the control group portal thrombosis was identified in 16.9% of the patients ( $p < 0.05$ ). Death occurred in one (4.8%) individual from the inversion group; mortality was 4.1% in the control group ( $p > 0.05$ ). The mean serum level of platelets was significantly lower (65,950/mm<sup>3</sup>) in the inversion group than in the controls (106,647/mm<sup>3</sup>) ( $p < 0.05$ ). **Conclusion:** The results suggest that the reversal of portal/splenic vein caliber ratio does not represent a contraindication to surgical treatment of schistosomal portal hypertension.

**Key words:** Schistosomiasis. Splenectomy. Risk factors. Portal vein. Hypertension, portal.

### INTRODUCTION

Schistosomiasis is a helminth enemy in certain regions of Brazil, with the highest prevalence in the northeast and north of the state of Minas Gerais, and affects approximately eight million individuals. The hepatosplenic form of schistosomiasis is the more severe and occurs in about 7% of those infected. It characteristically presents with splenomegaly and periportal hepatic fibrosis, leading to the serious consequences of portal hypertension.

Surgical treatment of schistosomal portal hypertension by splenectomy with ligation of left gastric vein, followed by postoperative endoscopic sclerosis is indicated in cases associated with prior upper gastrointestinal

bleeding due to rupture of esophageal varices and/or gastric ulcers, or in cases of hypersplenism with important clinical consequences for the patient<sup>1</sup>.

Historically, surgery for esophagogastric devascularization with splenectomy has indisputably helped to reduce variceal hemorrhage, especially when associated with interventions in varicose veins such as endoscopic (banding, sclerotherapy) and surgical (ligation of left gastric vein and Gastric fundus varices) methods<sup>1</sup>.

Schistosomiasis patients may have important immunological deficiencies, which, added to an impaired nutritional status and the magnitude of the surgical procedure, confer a high risk for postoperative complications, particularly infectious<sup>2</sup>.

Work conducted in the Department of General Surgery, Hospital das Clínicas, Federal University of Pernambuco (HC-UFPE SCG), Recife, Pernambuco, Brazil.

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In an attempt to identify risk factors that may compromise the postoperative outcome of patients undergoing surgery for disconnection and splenectomy, several authors have tried to preoperatively identify parameters that can improve late results in this group of patients, mainly with respect to rebleeding<sup>3-22</sup>.

We have noticed that in some patients the study with Doppler ultrasound made preoperatively showed an inversion of the portal/splenic caliber ratio (portal vein diameter smaller or equal to splenic vein diameter). This finding could be related to a sharp decrease in portal pressure after splenectomy and thereby increase the incidence of portal vein thrombosis. It might as well be related to a higher incidence of hypersplenism, varices of the gastric fundus, and increased hepatic resistance due to the degree of fibrosis. Thus, we conducted this study in order to characterize this group of patients and analyze the influence of the portal/splenic ratio inversion in the results of surgical treatment of schistosomal portal hypertension.

## METHODS

We conducted a retrospective cross-sectional study, with chart review of patients who underwent surgical treatment of schistosomal portal hypertension from September 1993 to January 2004.

A total of 169 patients operated between September 1993 and January 2004 were included in the study. Clinical, laboratory and ultrasound results were recorded and classified as continuous or categorical variables. The study population was divided into two groups according to the caliber of the splenic and portal veins at Doppler ultrasound: study group (reversal - splenic vein diameter equal to or greater than the portal vein's) and control group (portal vein diameter greater than the splenic vein). We identified 21 patients who had reversal of the portal/splenic caliber ratio (splenic vein diameter greater than or equal to the size of the portal vein).

Surgical treatment of schistosomal portal hypertension followed the standard operations of general surgery at the Hospital das Clínicas, UFPE: stomach greater curvature devascularization, splenectomy, left gastric vein ligation, liver biopsy and postoperative endoscopic sclerosis of esophageal varices,<sup>3,17,18,20</sup>. When there were varices in the gastric fundus (64/169) we associated a routine opening of the stomach and suturing of the gastric fundus varices.

Splenectomy follows a pattern that includes the opening of the abdominal cavity, approach and ligation of splenic artery near the splenic hilum, release of the lower pole of the spleen and ligation of vessels in the gastrosplenic ligament, release of the remaining of the spleen and splenic ligament division, and approach to the pedicle with double ligation and section of the splenic vein and new ligation and section of the splenic artery.

All patients were evaluated postoperatively at the outpatient clinic of the Hospital Liver and Portal Hypertension Sector for follow-up, with record of clinical, laboratory, endoscopic and ultrasound exams, plus routine Doppler ultrasound of portal vessels to record the characteristics of postoperative portal flow.

Mean follow-up was 28.5 months in the control group and 23.6 months in the study group.

All patients had positive epidemiology for schistosomiasis, characterized by contact with stagnant water in endemic areas, as well as a history of gastrointestinal bleeding manifested by hematemesis and/or melena.

Inclusion criteria were: history of upper gastrointestinal bleeding; esophageal varices by endoscopy; enzymatic activity not lower than 50%; negative viral serology for hepatitis B and C; and confirmation, by liver biopsy, of pure schistosomiasis.

Exclusion criteria were: mixed liver disease, non-variceal upper gastrointestinal bleeding.

The patients' ages ranged from 22 to 56 years, with an average of 40.9. They all underwent elective procedures, out of acute gastrointestinal bleeding.

The classification of schistosomal fibrosis followed the criteria described by Coelho<sup>23</sup>. According to intensity, fibrosis was classified as: Grade I: portal spaces displaying richness of connective cells, slight collagen production and a varying presence of inflammatory infiltrate, normal periportal sheet and reticule; Grade II: expansion of periportal connective tissue, with the emission of radial collagen septa, giving it a starry aspect; Grade III: conjunctive septa forming bridges with other portal spaces or hepatic veins, with evident angiomatoid neof ormation.

The diagnostic criteria of hypersplenism secondary to schistosomiasis portal hypertension were: 1) anemia (hemoglobin less than 13 g/dl in men and less than 12 g/dl in women), leukopenia (less than 4000 leukocytes/mm<sup>3</sup>), thrombocytopenia (platelets less than 150,000/mm<sup>3</sup>) or a combination thereof, 2) splenomegaly, 3) improvement or regression after splenectomy<sup>15</sup>.

## RESULTS

The control group and study group (inversion) consisted of 148 and 21 patients, respectively. The mean follow-up was 28.5 months for patients in the control group and 23.6 months for patients of the study (inversion) group. The hospital stay was 6.1 and 7.7 days for the patients in control and inversion groups, respectively. The occurrence of gastric fundus varices in patients of the control group was 38.5% (57/48) and 33.3% (7/21) in the inversion group.

The average preoperative portal vein caliber in the control and inversion groups were 1.49 cm and 0.98 cm ( $p < 0.05$ ), respectively, while the average preoperative

sizes of the splenic vein in the control and inversion groups were 1.14 and 1.07 ( $p > 0.05$ ).

The degree of fibrosis was so distributed in the control group: grade I = 17.6% (26/148); grade II = 41.9% (62/148); and grade III = 40.5% (60/148). In the inversion group: grade I = 28.6% (6/21); grade II = 33.3% (7/21); and grade III = 38.1% (8 / 21). There was no statistical difference between them ( $p > 0.05$ ). The need for blood transfusion was 35.2% and 33.3% with an average of 2.45 and 1.57 blood packs in the control and inversion groups, respectively ( $p > 0.05$ ). The average spleen weight was 1043.6 g (347 - 6000g) in the control group and 859.4 g (500 - 1300g) in the inversion one ( $p > 0.05$ ).

As for the size of esophageal varices, there was the following distribution in the control group: Large (37% - 17/46), Medium (17.4% - 8/46) Thin (10.9% - 5/46); Medium-thin (4.3% - 2/46), Medium-large (30.4% - 14/46). In the inversion group: Large (45.4% - 5/11) Medium-thin (36.4% - 4/11); Medium-large (18.2-2/11). There was no statistical difference between them ( $p > 0.05$ ). (Table 1)

Regarding laboratory data, no statistical difference was found between the levels of hemoglobin,

leukocytes, kidney and liver functions. However, we observed statistical significance ( $p < 0.05$ ) for the difference in the mean serum levels of platelets between the control (106 647/mm<sup>3</sup>) and the inversion group (65,950/mm<sup>3</sup>).

With regard to postoperative complications, in the control group there were: portal vein thrombosis in 16.9% (11/65), rebleeding in 13.4% (13/97), with a mortality of 4.1%. In the inversion group we identified rebleeding in 23.1% (3/13) ( $p > 0.05$ ) and absence of portal vein thrombosis ( $p < 0.05$ ), with a mortality of 4.8% ( $p > 0.05$ ).

## DISCUSSION

The great controversy related to the surgical treatment of schistosomotic portal hypertension is the fact that there are different ways of approaching the problem. In an attempt to minimize variceal bleeding, procedures are performed that may impair liver function and cause long-term deterioration of the patient's general condition. Moreover, there are procedures that have little influence on liver function, but display elevated rebleeding rates<sup>24</sup>.

According to Abrantes<sup>25</sup>, the ideal operation for treating portal hypertension secondary to schistosomiasis

**Table 1-** Relation between inversion of the portal/splenic caliber ratio and surgical outcomes of patients with hepatosplenic schistosomiasis.

	Inversion Group (21 patients)	Control Group (148 patients)	p
Mean follow-up	23,6 months	28,5 months	$p > 0,05$
Hospital stay	6,1 days	7,7 days	$p > 0,05$
Varices			
Gastric fundus	7/21 (33,3%)	57/148 (38,5%)	$p > 0,05$
Large caliber	5/11 (45,4%)	17/46 (37,0%)	$p > 0,05$
large-medium caliber	2/11 (18,2%)	14/46 (30,4%)	$p > 0,05$
medium caliber		8/46 (17,4%)	$p > 0,05$
medium-small caliber	4/11 (36,4%)	2/46 (4,3%)	$p > 0,05$
small caliber		5/46 (10,9%)	$p > 0,05$
Preoperative hypersplenism	90,5% (19/21)	92,6% (137/148)	$p > 0,05$
Preoperative			
Portal vein caliber	0,98 cm	1,49 cm	<b><math>p &lt; 0,05</math></b>
Splenic vein caliber	1,07 cm	1,14 cm	$p > 0,05$
Rebleeding	23,1% (3/13)	13,4% (13/97)	$p > 0,05$
Portal vein thrombosis	0%	16,9% (11/65)	<b><math>p &lt; 0,05^*</math></b>
Peri-portal fibrosis			
Grade I	28,6% (6/21)	17,6% (26/148)	$p > 0,05$
Grade II	33,3% (7/21)	41,9% (62/148)	$p > 0,05$
Grade III	38,1% (8/21)	40,5% (60/148)	$p > 0,05$
Spleen weight (mean)	859,4 g	1043,6 g	$p > 0,05$
Preoperative PO <sub>2</sub> (mean)	100,25	99,1	$p > 0,05$
Overall mortality	4,8% **	4,1%	

\* - Fisher's exact Test.

\*\* - One patient died due to progression of non-Hodgkin lymphoma.

**Table 2 -** Relation between inversion of the portal/splenic caliber ratio and laboratory results of preoperative patients with hepatosplenic schistosomiasis.

	<b>Inversion Group (21 patients)</b>	<b>Control Group (148 patients)</b>	<b>p</b>
Hemoglobin	11,5g%	10,34g%	p>0,05
Leucocytes	4330\ mm3	4000\ mm3	p>0,05
Platelets	65.950\ mm3	106.647\ mm3	<b>p&lt;0,05</b>
Prothrombin time	15s	15s	p>0,05
Glucose	112,8g\dl	103,5 g\dl	p>0,05
Urea	29,9g\dl	29,11g\dl	p>0,05
Creatinin	0,7	0,8g\dl	p>0,05
Albumin	3,34g\dl	3,51g\dl	p>0,05
AST	46,7g\dl	39,5g\dl	p>0,05
ALT	49 g\dl	40,0g\dl	p>0,05
Total bilirubin	1,11g\dl	0,96g\dl	p>0,05

should prevent rebleeding, not cause encephalopathy, not aggravate liver function and cure hypersplenism.

We follow a doctrine established and disseminated by Prof. Solomon Kelner, from the beginning of the decade of 1960<sup>26</sup>. This doctrine was based on a surgical treatment that provides reduced pressure to the portal compartment associated with the minimum of physiological changes and is capable of reversing the changes caused by hypersplenism. Over four decades we continue following and defending these principles, evidently matching the pillars of thought with the available new technologies and newly acquired pathophysiological knowledge. Thus, since 1992 we perform splenectomy with ligation of left gastric vein associated with partial devascularization of the greater curvature of the stomach and subsequent endoscopic treatment of esophageal varices<sup>1-3,17,18,20</sup>.

Splenectomy in hepatosplenic schistosomiasis with previous gastrointestinal bleeding requires a correction in the values of hematological alterations (anemia, leukocytes, lymphocytes, and platelets), and an average reduction of portal pressure of about 28%<sup>15,27-29</sup>.

In an attempt to preoperatively identify the patients who benefit little from surgical treatment with splenectomy and ligation of left gastric vein associated with partial devascularization of the stomach greater curvature, we analyzed clinical, laboratory and ultrasound findings in 169 patients, from which 21 had inversion of the portal/splenic caliber ratio. Of these, none had portal vein thrombosis in the postoperative Doppler. In this group, recurrence of upper gastrointestinal bleeding occurred in 23.1%.

However, we noted that: the hospital stay was similar in patients in whom the portal vein caliber was smaller or larger than the diameter of splenic vein; hypersplenism had no direct relation with the portal/splenic ratio, present in 90.5% of patients in the study

group (inversion) and in 92.6% of patients in the control group (p>0.05); the caliber of the portal vein also correlated with the spleen weight and increased progressively as the spleen weight increased, this figure having been identified in previous work of our institution – the data found in this study displayed a statistical difference between control and inversion groups in the mean caliber of the portal vein preoperatively (p<0.05); and there was no statistical difference regarding recurrence of bleeding between the patients with portal/splenic ratio inversion (23.1%) and the one of the control group (13.4% - p>0.05).

We did not observe the presence of portal vein thrombosis in the inversion group, while in the control group the incidence was 16.9% (p <0.05). Although faced with limited number of patients in the inversion group, we might already infer that portal vein thrombosis is not an important complication in this group of patients.

The mortality in the postoperative period did not differ between control and inversion groups, with rates of 4.8% and 4.1% (p> 0.05), respectively.

We did not identify any change in the preoperative blood counts, blood glucose, urea, creatinine, albumin, bilirubin and transaminases, however, there was statistical difference between the mean serum levels of platelets between the control group and the inversion one (65,950/mm<sup>3</sup> x 106,647/mm<sup>3</sup>, respectively – p<0.05).

Regarding the comparison of our data with the literature, we did not identify approaches that discuss the inversion of the caliber of the splenic vein and the surgical outcomes of patients with hepatosplenic schistosomiasis.

The results obtained in this study allow us to infer that patients with splenic vein diameter greater than or equal to the portal vein diameter did not represent a group of patients at high risk for complications in the surgical treatment of schistosomal portal hypertension.

## R E S U M O

**Objetivo:** Avaliar a morbidade e a mortalidade no tratamento cirúrgico da hipertensão portal esquistossomótica em pacientes portadores de inversão do diâmetro entre a veia porta e veia esplênica. **Métodos:** Estudo transversal retrospectivo, de pacientes submetidos ao tratamento cirúrgico da hipertensão no período entre setembro de 1993 e Janeiro de 2004. A população do estudo foi distribuída em dois grupos: a) Inversão - calibre da veia esplênica maior ou igual ao da veia porta e b) grupo controle (calibre da veia porta maior que o da veia esplênica). Na análise estatística foram utilizados o teste t de student para diferença de médias, qui-quadrado para diferença de proporções e o exato de Fisher para amostras reduzidas. **Resultados:** 169 pacientes foram analisados com seguimento pós-operatório médio de 23,6 meses. 21 pacientes (12,4%) apresentavam a veia esplênica de igual ou maior calibre que a veia porta (Inversão - grupo de estudo). A média dos diâmetros pré-operatórios das veias porta e esplênica foram, respectivamente, 1,49/1,14cm no grupo controle, e 0,98/1,07cm no grupo de inversão. O diâmetro da veia porta foi significativamente maior no grupo controle quando comparado ao grupo de inversão ( $p < 0,05$ ). A presença de varizes de fundo gástrico foi identificada em 33,3% do grupo de inversão e em 38,5% dos pacientes do grupo controle. Recidiva hemorrágica pós-operatória ocorreu em 23,1% dos pacientes do grupo de inversão e em 13,4% no grupo controle ( $p > 0,05$ ). Na avaliação pós-operatória com ultrassonografia Doppler de vasos portais, não houve casos de trombose portal no grupo de inversão, e no grupo controle a trombose portal foi identificada em 16,9% dos pacientes ( $p < 0,05$ ). O óbito ocorreu em um (4,8%) paciente do grupo inversão, e a mortalidade foi de 4,1% no grupo controle ( $p > 0,05$ ). A média do nível sérico de plaquetas foi significativamente menor ( $65.950 \text{mm}^3$ ) no grupo de inversão do que no grupo controle ( $106.647 \text{mm}^3$ ) ( $p < 0,05$ ). **Conclusão:** Os resultados sugerem que a inversão do calibre veia portalesplênica não representa uma contraindicação ao tratamento cirúrgico da hipertensão portal esquistossomótica..

**Descritores :** Esquistossomose. Esplenectomia. Fatores de risco. Veia porta. Hipertensão portal.

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