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**Splenic artery ligature associated to endoscopic banding for schistosomal portal hypertension**

Colaneri RP *et al*. New treatment for presinusoidal portal hypertension

Renata Potonyacz Colaneri, Fabrício Ferreira Coelho, Roberto de Cleva, Marcos Vinícius Perini, Paulo Herman

**Renata P Colaneri, Fabrício F Coelho, Roberto de Cleva, Marcos V Perini, Paulo Herman,** Department of Gastroenterology, University of São Paulo Medical School, São Paulo, SP CEP 05403-000, Brazil

**Authors contributions:** Colaneri RP collected datas from surgical procedures and follow-up, also wrote the manuscript; Coelho FF, Perini MV and Herman P performed the surgical procedures and the patients evaluation on follow-up and reviwed the manuscript;De Cleva R and P Herman designed the study and were envolved in editing of the manuscript.

**Correspondence to: Dr. Renata P Colaneri,** Department of Gastroenterology, University of São Paulo Medical School, Av. Dr. Enéas de Carvalho Aguiar, number 255, Cerqueira César, São Paulo, SP CEP 05403-000, Brazil. pcol\_renata@yahoo.com.br

**Telephone**: +55-11-981266852 **Fax:** +55-11-26617560

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**Abstract**

**AIM**: To propose a less invasive surgical treatment for schistosomal portal hypertension.

**METHODS**: Schistosomiasis represents one of the main causes of portal hypertension and is frequently associated to digestive hemorrhage, due to the gastro-esophageal varices rupture; surgical treatment is considered the best therapeutic option. In a recent study from our group, systemic and portal hemodynamic changes were assessed on schistosomal patients ongoing esophagogastric devascularization and splenectomy and it has been shown that the splenic artery ligature alone promotes the correction of the systemic hiper dynamic state. Ten patients were submitted to a small supraumbilical laparotomy with the ligature of the splenic artery and left gastric vein. During the procedure a direct portal vein pressure measurement before and after the ligatures was assessed. Upper gastrointestinal endoscopy was performed at the 30th postoperative day, when esophageal varices diameter were measured and band ligature performed; during follow-up other endoscopic procedures were made according to endoscopy findings.

**RESULTS**: There was no intra operative mortality and all patients had confirmed histological diagnosis of schistosomal portal hypertension. During immediate post operative period, two patients (20%) had complications, one characterized by splenic infarction, and the other by an incision hematoma. Mean hospitalization time was 4.1 d (ranging from 2 to 7 d). Pre and post operative liver function tests did not show any significant changes. Thirty days after surgery, during endoscopy, we observed a decrease on varices diameter in 7 patients. During the follow up (57-72 mo), endoscopic therapy was perfomed and seven patients had their varices eradicated. Considering the late post operative evaluation, nine patients had a decrease on varices diameter. A mean of 3.9 endoscopic banding sessions were performed per patient. Two patients presented bleeding recurrence on the late post operative period; however, in only one patient due to variceal rupture that was controlled with endoscopic banding. The other patient bleeding presented secondary to congestive gastropathy. Both bleeding episodes were of minor degree with no hemodynamic consequences or need for blood transfusion.

**CONCLUSION**: This study showed that this new surgical technique is a promising method in the treatment of presinusoidal schistosomotic portal hypertension due to its less invasive characteristic.

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**Key words:** Portal hypertension; Variceal bleeding; Esophageal varices; Schistosomiasis; Endoscopic banding

**Core tip:** In a recent study from our group, systemic and portal hemodynamic changes were assessed on schistosomal patients ongoing esophagogastric devascularization and splenectomy showing that the splenic artery ligature alone promotes the correction of the systemic hiper dynamic state and a significant decrease in portal pressure. The objective of the present study was to propose a less invasive surgical treatment for portal hypertension in schistosomiasis, which consists in splenic artery ligature, followed by endoscopic varices treatment. This study showed that this new technique is a promising method in the treatment of presinusoidal portal hypertension due to its less invasive characteristic.

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**INTRODUCTION**

Portal hypertension is the pathological pressure increase on the portal venous system leading to porto-systemic collateral circulation, frequently associated to digestive hemorrhage due to the rupture of gastro-esophageal varicous veins, independently of the hepatocellular function. Portal vein pressure is directly related to the intra-hepatic vascular resistance and the portal blood flow and, in most patients portal hypertension is a result of both: increased intra-hepatic resistance due to the architectural distortion of liver parenchyma secondary to fibrosis and to the splanchnic hyperflow[1,2].

Schistosomiasis is an endemic disease in many countries and represents one of the main causes of portal hypertension worldwide. In the hepato-splenic subtype, the most severe form of the disease, liver fibrosis, hepatomegaly mostly of the left lobe, pre-sinusoidal portal hypertension, preserved hepatic function and substantial splenomegaly are observed[2-7]. Esophageal varices rupture and bleeding is the most fearsome complication of the disease being observed in up to 52% of the patients, with a mortality rate of 11.7% on the first episode[8-10].

Since upper gastrointestinal hemorrhage is the main cause of death in patients with portal hypertension and preserved liver function, surgical treatment is considered the best therapeutic alternative, mainly for those with hepatosplenic schistosomiasis[6,10-12]. However, there is no agreement which surgical technique is the most appropriate: esophagogastric devascularization and splenectomy or distal splenorenal shunt? Distal splenorenal shunt had been employed for the treatment of pre sinusoidal portal hypertension however, due to high rates of late postoperative porto-systemic encephalopathy and longterm worsening of the liver function, this procedure is increasingly less used[13]. Esophagogastric devascularization and splenectomy (EGDS), a relatively simple technique, with good results and absence of post operative encephalopathy, is the treatment of choice for the majority of groups that lead with the disease[11,14-16]. The disadvantage of EGDS is bleeding recurrence, observed in 6%-29% of the patients, therefore a complementary post operative endoscopic therapy is necessary[16,17].

In a recent study from our group[18], systemic and portal hemodynamic changes were assessed on schistosomal patients during EGDS and measurements were done after every single surgical step: ligature of splenic artery, splenectomy and after esophagogastric devascularization. The hyper dynamic state, characterized by cardiac output increase and peripheral vascular resistance observed preoperatively in all patients, returned to normal values after EGDS. The intraoperative hemodynamic monitoring showed that within all sugery steps, the splenic artery ligature alone promotes the correction of the hiper dynamic state therefore leading to the conclusion that the systemic hemodynamic changes were related to a splenic hyper flow.

The objective of the present study was, supported by the knowledge of the physiopathology of the disease based on hemodynamic behavior, to propose a new less invasive surgical treatment for presinusoidal portal hypertension in patients with schistosomiasis. The technique consists in the ligature of the splenic artery followed by postoperative endoscopic treatment (variceal band ligature).

The initial series of 10 patients is a pilot study and all patients were submitted to conventional surgery with intra operative measurement of portal pressure and evaluation of long term results before starting a minimally invasive laparoscopic approach, as a continuance of this inicial series.

**MATERIALS AND METHODS**

The study was approved by the University Hospital Ethics Committee and all patients signed an informed consent before the operation.

Ten consecutive patients with hepato-splenic schistosomiasis and portal hypertension with history of upper gastrointestinal hemorrhage from esophageal varices rupture were evaluated.

Exclusion criteria were other liver diseases, as hepatitis caused by alcohol or virus, and patients with portal or mesenteric venous system thrombosis.

After admission, patients underwent laboratory and liver function tests evaluation; chest X-Ray (anterior-posterior and lateral view);   abdominal ultrasound with portal system Doppler evaluation; upper gastrointestinal endoscopy with esophageal varices diameter measurement.

All cases were discussed on a multidisciplinary meeting before surgery and were operated electively at least 30 d after the bleeding episode. At operation patients were submitted to a small (10 cm) supraumbilical and midline incision, ligation of gastroepiploic vessels leading to the exposure of the retroperitoneum, followed by ligature of the splenic artery (as closest as possible from celiac trunk) and of the left gastric vein. At the beginning of the procedure, a small (6 Fr) catheter was inserted through a jejunal venous branch, locating it’s extremity inside the portal vein, allowing a direct portal vein pressure measurement before and after the ligature of the splenic artery. At the end of the procedure, the jejunal vein catheter was removed and the vein ligated. Liver biopsy to confirm the ethiology of liver disease was performed with a Tru-Cut needle in all patients.

An upper gastrointestinal endoscopy was performed at the 30th postoperative day where esophageal varices diameter were measured and band ligature performed.

Patients were followed at the Liver Surgery unit and at the Endoscopy clinics, where other endoscopic procedures were made according to endoscopy findings.

**RESULTS**

From 10 patients included in our study, 7 were male and 3 female with a mean age of 41.9 years (ranging from 26 to 66 years).

All patients had normal liver function and diagnosis of hypersplenism, characterized by low white blood cell and platelet count, under 140000 and 4000 respectively.

There was no intra operative mortality and all patients had confirmed histological diagnosis of schistosomal portal hypertension. During immediate post operative period, two patients (20%) had complications, one characterized by splenic infarction, which was conservatively treated with painkillers and no need for re-operation, with fast improvement; the other one had an incision hematoma, which was reoperated and drained on the second post operative day. Both immediate post operative complications were easy to solve and patients' evolution was uneventful. No complications related to the jejunal vein catheterization were observed.

Mean hospitalization time was 4.1 d (ranging from 2 to 7 d). During hospitalization, none of the patients presented any change on liver function. On the other hand, during the immediate post operative period, in 9 patients a platelet and white blood cell count increase was observed and in 6 patients an improvement of the red blood cell count was also observed.

Pre and post operative liver function tests did not show any significant changes. Concerning the hypersplenism, 9 patients presented a transient increase on leukocyte and platelets levels, around 14.5%. However, on late post operative period, low platelet and white blood cell count persisted.

Thirty days after surgery, during endoscopy, we observed a decrease on varices diameter in 7 patients.

Mean follow up was 67.2 mo (57-72 mo). During follow-up, endoscopic therapy was perfomed and seven patients had their varices eradicated; in four of them varices recurrence was observed and submitted to endoscopic re-treatment. Considering the late post operative evaluation, nine patients had a decrease on varices diameter. A mean of 3.9 endoscopic banding sessions were performed per patient.

Two patients presented bleeding recurrence on the late post operative period; however, in only one patient due to variceal rupture that was controlled with endoscopic banding. The other patient bleeding presented secondary to congestive gastropathy. Both bleeding episodes were of minor degree with no hemodynamic consequences or need for blood transfusion.

**DISCUSSION**

It has been already shown that surgical treatment is the best therapy for schistosomal patients with previous digestive hemorrhage due to esophageal varices rupture however, there is still no agreement on which is the best technique[6,11]. The most common operations performed during the last 20 years were distal splenorenal shunt (DSRS) and esophagogastric devascularization and splenectomy (EGDS). Both techniques have favorable arguments and significant postoperative complications[6,11]. DSRS have excellent results considering hemorrhage relapse with less than 5% of bleeding recurrence[15,19-21], however, it can lead to postoperative portosystemic encephalopathy in 3.3 to 14.8% of the patients[15,34] and, taking into account portal hypertension of schistosomal origin, where liver function is preserved and encephalopathy is not part of the disease clinical presentation, this procedure is not considered ideal. Having this in mind, EGDS, a relatively simple technique that has relatively good results and does not lead to post operative encephalopathy is the first choice in most of groups that lead with the disease[11,14,15]. This technique's disadvantage is bleeding recurrence, that can occur in 6%-29% of the patients, making the association with postoperative endoscopic therapy necessary[22].

A previous study from our group[18] on systemic and portal hemodynamics in schistosomal patients submitted to EGDS, showed on preoperative systemic hemodynamic evaluation that these patients present a hyper dynamic circulation characterized by cardiac output increase, low peripheral resistance and an increase on portal flow. Hemodynamic measurements (portal and systemic) were taken after each step of the operation, *i.e.,* after splenic artery ligature, splenectomy, esophagogastric devascularization and it was shown that immediately after splenic artery ligature, normalization of the hyper dynamic circulation occurred in all patients; moreover a 28% decrease on portal flow and a 30% decrease on portal pressure were also observed. No other surgical step changed the hemodynamic parameters, which remained stable after splenic artery ligation through the end of the procedure[18]. Therefore, it became clear that splenomegaly and splenic overflow are important factors on the generation of the hyper dynamic circulation in the hepato-splenic form of schistosomiasis.

In addition, Sakai *et al*[22] showed that endoscopic sclerotherapy on schistosomal patients that had been previously submitted to EDDS is more effective that for patients without previous surgery, once varices have a smaller diameter, making the endoscopist action easier and leading to significant better results. The decrease on varices diameter may be related to portal pressure decrease after EGDS with consequent pressure decrease on esophageal vessels, once changes on portal pressure have a direct impact on esophageal varices[23]. Lacerda *et al*[24] measured the pressure on esophageal varices during splenectomy and left gastric vein ligature in schistosomal patients and found a 28.5% decrease on varices pressure after the procedure.

Based on the demonstration that splenic artery ligature alone leads to the normalization of cardiac output and peripheral vascular resistance and to a significant decrease of portal flow and pressure, associated with the knowledge that splenectomy leads to esophageal varices diameter decrease, we proposed a new and less invasive treatment for patients with presinusoidal portal hypertension due to hepatosplenic schistosomiasis, with the simple splenic artery ligature associated to post operative endoscopic treatment (esophageal variceal band ligature).

Intraoperative mortality was not observed and the hospitalization period was short due to the low rate of complications. Spleen infarction observed in one patient, possibly happened because the splenic artery ligation was done in a distal portion of the artery due to technical issues.

In our study, 30 d after surgery we observed a decrease on varices diameter in 70% of the patients. During follow-up seven patients had their varices eradicated, but four of them had varices recurrence. Ferraz *et al*[11] obtained esophageal varices eradication in 18.2% patients with the EGDS operation alone and in 52.7% when postoperative endoscopic sclerotherapy was associated. We have previously shown that endoscopic exams perfomed after EGDS associated to postoperative varices banding program, leaded to varices eradication in 85.7% of patients however, variceal recurrence was observed in 56.6% of the cases[17]. In the last endoscopic evaluation, 90% of our patients had a decrease on varices diameter when compared with the preoperative period, what can be considered as an excellent result. Finally, two of our patients evolved with bleeding recurrence but only one due to variceal rupture. In our experience, after long term follow-up, bleeding recurrence occurred in 24.7% of patients submitted to EGDS, being in half of them (14.6%) due to varices rupture[17].

In conclusion,this pilot study showed that this new surgical technique is a promising treatment for presinusoidal schistosomotic portal hypertension due to its less invasive characteristic and low complication rate. In continuance to this study a minimally invasive laparoscopic approach will be employed.

**COMMENTS**

***Background***

In a recent study from our group, systemic and portal hemodynamic changes were assessed on schistosomal patients during esophagogastric devascularization and splenectomy, measurements were done after every single surgical step. The intraoperative hemodynamic monitoring showed the splenic artery ligature alone promotes the correction of the hiper dynamic state therefore leading to the conclusion that the systemic hemodynamic changes were related to a splenic hyper flow.

***Research frontiers***

To propose a new less invasive surgical treatment for portal hypertension in patients with schistosomiasis, supported by the knowledge of the physiopathology of the disease based on hemodynamic behavior.

***Innovations and breakthroughs***

All patients were submitted to conventional surgery with intra operative measurement of portal pressure with the ligature of the splenic artery and left gastric vein.

***Applications***

The new surgical technique proposed is a promising treatment for presinusoidal schistosomotic portal hypertension due to its less invasive characteristic and low complication rate.This initial series is a pilot study and the surgical procedures were made through a small laparotomy, before starting a minimally invasive laparoscopic approach, as a continuance of this inicial series.

***Terminology***

Portal hypertension is the pathological pressure increase on the portal system leading to porto-systemic collateral circulation, frequently associated to digestive hemorrhage due to the rupture of gastro-esophageal varicous veins, independently of the hepatocellular function. Schistosomiasis is an endemic disease in many countries and represents one of the main causes of portal hypertension worldwide. Esophageal varices rupture and bleeding is the most fearsome complication of the disease.

***Peer review***

This article “Splenic artery ligature associated to endoscopic banding for schistosomal portal hypertension” is very interesting.

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