PORTAL VEIN THROMBOSIS IN LIVER TRANSPLANTATION – OUR OUTCOMES AND SURGICAL TECHNIQUES

Trombose venosa portal em transplantação hepática – nossos resultados e técnica cirúrgica

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ABSTRACT

Introduction: Liver transplant is still a surgical challenge mainly in cases of portal venous thrombosis. While some patients listed for liver transplant are preoperatively diagnosed with such condition, others are detected during the transplant surgery. Depending on the extent of thrombosis, there are several portal revascularization techniques. However,results are far from desirable. **Purpose:** The aim of this article is to report our experience in managing portal vein thrombosis in liver transplant surgery, and to describe alternative surgical techniques for grade III thrombosis. **Material and Methods**: We assessed 70 liver transplant recipients with portal vein thrombosis who underwent surgery between December 2009 and August 2018. During this period, 847 liver transplants were performed. The surgical technique, postoperative period, recurrence of portal thrombosis and survival were considered for evaluation. **Results**: The incidence of portal vein thrombosis in transplanted patients during this period of time was 8%. Half of patients were diagnosed along surgery, even though 89% had a doppler or angiogram in the 3 preceding months of the transplant. The majority (40%) had grade I and 21% had grade III thrombosis, according to the Yerdel classification. 87% underwent thrombectomy and direct portal anastomosis. The remaining patients required the use of other surgical techniques that included reconstruction with venous graft, namely the "Y cavo-iliac vein" graft. **Conclusions**: Portal venous thrombosis is under-diagnosed; nevertheless, it is no longer considered a contraindication for transplantation. There are alternative techniques to solve more extensive portal vein thrombosis with good outcomes.

Keywords: Venous thrombosis, Liver Transplant, Portal Vein.

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INTRODUCTION

Portal venous thrombosis refers to the presence of partial or complete obstruction of blood flow in the portal vein due to the presence of a thrombus. The currently accepted classification is based on the description by Yerdel et al. in 4 grades, depending on the extent of the portal venous thrombosis.[1]

Several risk factors have been linked to portal venous thrombosis, such as: male gender, previous treatment for portal hypertension, class C Child-Pugh, and alcoholic liver cirrhosis.[1]

Portal venous thrombosis is present in approximately 2 to 26% of liver patients on active list for liver transplant.[2-3]

Several techniques have been described, according to the degree of thrombosis, such as: thrombectomy, use of homologous or artificial vascular grafts, portal vein arterialization, and techniques requiring anastomosis to the renal or left gastric veins.[4]

Postoperative complications differ among studies. However, it is expected to be higher in those patients, since they are generally more fragile. The survival is lower in patients with more severe forms of portal venous thrombosis.[5-7]

This article has as main purpose to report our experience in cases of portal vein thrombosis in liver transplant and some surgical alternative techniques for grade III thrombosis.

MATERIAL AND METHODS

This study is a retrospectively review of transplanted patients at the Liver Transplant Unit of Hospital Curry Cabral, Lisbon, Portugal. From December 2009 to August 2018, 847 liver transplants were performed, and 70 patients with portal vein thrombosis intraoperatively diagnosed were included in the study (8%).

The following potential risk factors for portal vein thrombosis were studied: age, sex, primary disease, previous treatment for portal hypertension and previous upper abdominal surgery. Presence of ascites despite the use of diuretics was also assessed.

The surgical techniques employed were analyzed according to the grade of the portal vein thrombosis. Warm ischemia time and patient survival were analyzed.

Lifetable analysis was performed by using the Kaplan-Meier method on IBM SPSS 23®.

RESULTS

Between December 2009 and August 2018, 847 adult patients with chronic liver disease underwent liver transplant. Seventy patients (8%) had operatively confirmed portal vein thrombosis, being 40% grade 1, 39% grade 2 and 21% grade 3.

In a multivariable analysis, only MELD showed some tendency towards statistical significance (p=0.08), other demographic and clinic variables showed no relationship with thrombosis. (Table 1)

***Table 1** - Characteristics of transplant with portal vein thrombosis. *angioCT (angiography computed tomography), MELD score (model for end-stage liver disease), TIPS (transjugular intrahepatic portosystemic shunt), ♀ female gender, ♂ male gender.*

Characteristics of transplants with portal vein thrombosis	Values
Age	[24-71] years, medium 55
Gender	14♀58♂
MELD score	[8-40]
Average MELD score	17
Previous treatments for portal hypertension (TIPS)	25%
Previous abdominal surgery	21%
Ascites	58.3%
Doppler ultrasonography or angioCT 3 months before surgery	89%

Eighty-nine percent of patients had Doppler ultrasonography or angiogram 3 months prior to the transplant. Nevertheless, only half of these were diagnosed with portal vein thrombosis prior to the surgery. It is interesting to notice that 60% of patients with intraoperative diagnosis had grade 1 portal vein thrombosis.

Alcoholic cirrhosis and hepatocellular carcinoma were the two major causes for liver transplant even in cases of portal vein thrombosis.

Cadaveric donor was the primary source of liver graft in 82.5% of cases, and the remain is attributed to domino liver donation.

The median time of surgery and warm ischemia did not differ significantly between patients with and without portal thrombosis. (Table 2)

***Table 2 -** Surgical Time with and without portal vein thrombosis.*

With or without portal vein thrombosis	Surgical Time	Cold ischemia time	Warm Ischemia time
With portal vein thrombosis	334 min [210-510]	386 min [150-510]	49 min [30-90]
Without portal vein thrombosis	309 min [120-510]	388 min [30-510]	46 min [20-90]

Thrombectomy and primary anastomosis was performed in 88% of patients with grade I and II portal thrombosis. The remaining liver transplants with grade III thrombosis required portal vein anastomosis with "Y vein cavo-iliac graft" interposition, namely a portal-mesenteric-left renal graft and a portal-mesenteric-left gastric vein graft. This type of reconstruction was performed in 5 patients with spontaneous spleno-renal shunt. (Table 3) There was no recurrence of portal thrombosis in patients requiring a venous graft.

***Table 3** - Characteristics of 5 patient transplanted with Y grafts venous reconstruction. *angioCT (angiography computed tomography), MELD score (model for end-stage liver disease), TIPS (transjugular intrahepatic portosystemic shunt), ♀ female gender, ♂ male gender.*

Characteristics of transplants with Y graft venous reconstruction	Values
Age	[36-64] years, medium 56
Gender	1♂:4♀
MELD score	[10-25]
Average MELD score	16.5
Cause for liver transplant	1 Auto-imune Cirrhosis 2 Alcoholic Cirrhosis 2 Hepatocelular carcinoma
Previous treatments for portal hypertension (TIPS)	None
Previous abdominal surgery	2 patients
Ascites	60%
Doppler ultrasonography or angioCT 3 months before surgery	100%
Liver donor	85% cadaveric 15% domino

The two main complications after liver transplant in patients with portal vein thrombosis were: bleeding with need for re-intervention (15.7%) and early biliary complications (11.4%). (Table 4)

***Table 4 -** Complications after liver transplant*

Complications after transplant	Values
Bleeding	15,7%
Arterial thrombosis	2.85%
Early venous thrombosis (<30days)	7.14%
Late venous thrombosis (>30days)	4.28%
Early biliary complications (<30days)	11.4%
Late biliary complications (>30days)	5.7%

Venous complications – whether early or late – are related to "fresh" vein thrombosis. In this series, only half of patients with early vein thrombosis required thrombectomy due to the extension of the thrombus or clinical deterioration. Arterial complications were very rare, as only two patients presented it with arterial thrombosis. One required a re-transplant and the other one was successfully managed with arterial thrombectomy.

Early biliary complications presented as to leaks, and half of them required surgery. Late complications required re-anastomosis, and only one patient was re-transplanted due to ischemic cholangiopathy.

Other complications presented were found in 20% of patients, namely acute kidney injury with need for dialysis. Other causes for intensive care unit re-admission are less frequent. Need for re-transplant was 11.4%.(Table 5)

***Table 5** - Causes of re-admission in intensive care unit*

Causes of re-admission in intensive care unit	Incidence rate (%)
Venous and arterial thrombectomy	4.3
Nosocomial Pneumonia	4.3
Biliary peritonites/ Dehiscence of hepaticojejunostomy	2.9
Aspergillus Pneumonia	1.4
Infected hematoma	1.4

The median time of admission after liver transplant was 23 days, including approximately 10 days in the intensive care unit. During this period, every patient started on prophylactic low molecular weight heparin, depending on the platelet count and prothrombin time.

The patient survival rate at ninety days was 85% in patients with portal vein thrombosis and 87% in those without. Despite this early difference, survival rates become similar over time.

DISCUSSION

Surgical expertise is necessary to overcome the operative challenges related to portal vein thrombosis. The ratio of patients with this condition who had liver transplant in our series is 8%, which is similar to what was previously reported in other studies. Preoperative Doppler ultrasonography or angiogram are the preferred methods of assessing the patency of portal veins

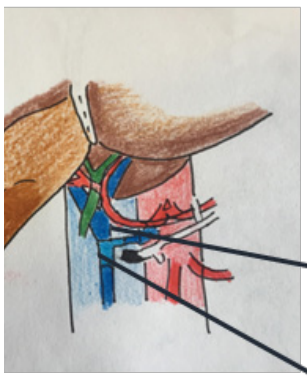
and deciding on the best surgical strategy. Collateral circulation should also be considered.

The initial strategy for portal vein thrombosis grades I and II is the removal of the thrombus and primary anastomosis, with or without resection of the affected segment.[6] For thrombi that extend beyond the splenomesenteric junction (grade III), the use of grafts for superior mesenteric or others venous shunts (left gastric, left renal veins) is the primary alternative.[8]

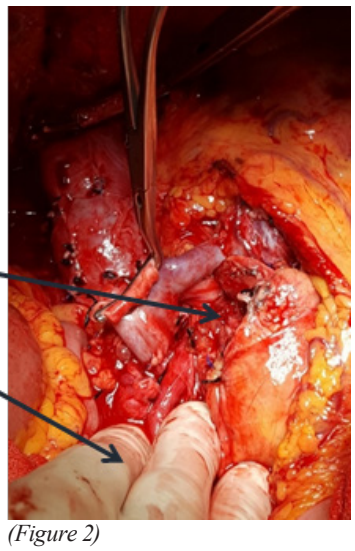
The use of venous graft was initially described by Shaw for adult patients and children with sclerosis or hypoplasia of the portal vein.[9] The most important step is to assure there is no compression of the shunt. The renoportal anastomosis was first described by Sheil and modified by Kato with interposition of a vein graft. This procedure can be used when there are spontaneous splenorenal shunts or surgical revascularization allowing portal decompression.[10-11]

We present 5 cases with grade III venous thrombosis with need for reconstruction with a venous graft. All cases were addressed using a cavo-iliac vein from the donor with anastomosis of the portal vein from the donor liver to the left renal vein or left gastric vein of the receptor, and the superior mesenteric vein. We believe that this "Y vein graft" reconstruction may increase the venous flow to the portal vein, and thus decompressing both the mesenteric and splenic areas. Although empirical, this is the rationale for the use of this type of reconstruction. (Figure 1 and 2). These patients started anticoagulation as soon as possible in the post-operative period with good outcomes.

Figure 1 - *This is a case of grade III portal vein thrombosis. The portal and mesenteric veins are colored blue; splenic vein is white with a proximal black thrombus. We see a schematic reconstruction of the Y cavo-iliac venous graft in light blue, represented on the right (**Figure 2**), following the arrows. The anastomosis with left gastric vein (upper arrow) and the mesenteric vein (lower arrow). The biliary and arterial anastomosis are not represented.*



(Figure 1)



(Figure 2)

In Yerdel's report, the 5-year survival of patients was lesser in the group with portal vein thrombosis in relation to the group without portal vein thrombosis.1 We found the same trend in our series, although there was not statistically difference (p=0,884). (Figure 3 and 4)

Figure 3 - *Kaplan Meier curve of survival in days for patients with portal venous thrombosis.*

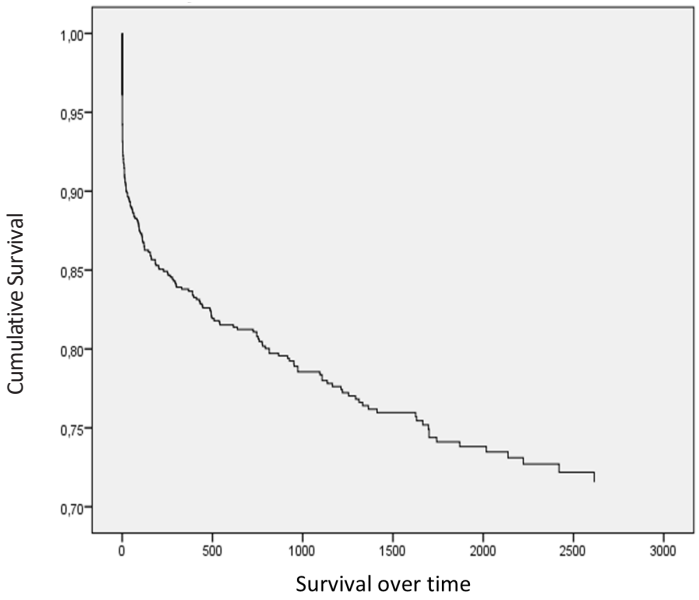
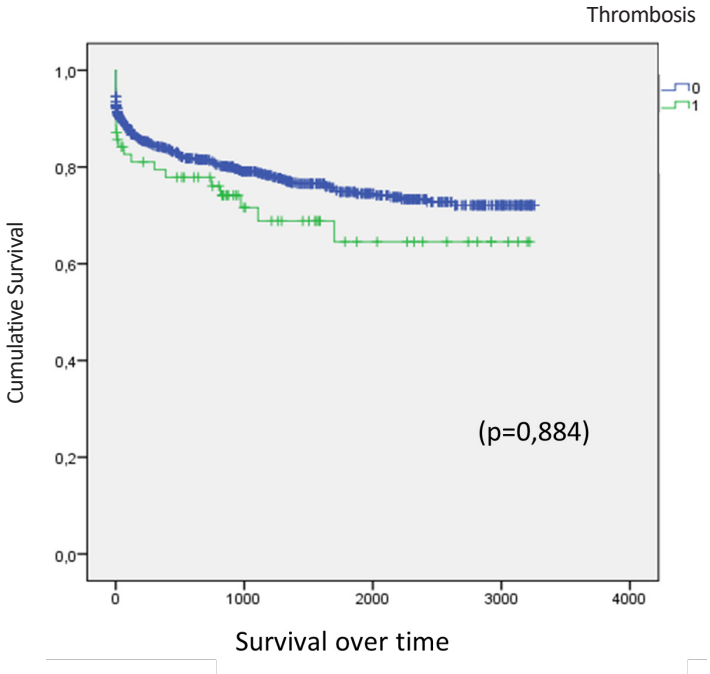


Figure 4 - *Kaplan Meier curve comparing survival in days in two groups with (in green) and without portal vein thrombosis (in blue).*



CONCLUSION

Despite an 8% prevalence of portal vein thrombosis in our series, the survival in this group is similar to the main population of liver transplant patients. A “Y cavo-iliac venous graft” is a promising surgical alternative in cases of grade III portal thrombosis.

Portal vein thrombosis in liver transplant is challenging. With careful preoperative assessment, preparation by the anesthesia team, knowledge of different surgical strategies, and experienced surgical team, liver transplantation can be successful even in the presence of portal vein thrombosis.

RESUMO

Introdução: Transplante de fígado ainda é um desafio cirúrgico, principalmente nos casos de trombose da veia porta. Enquanto alguns doentes em lista para transplante hepático são diagnosticados com essa condição no pré-operatório, outros são detetados durante a cirurgia de transplante. Dependendo da extensão da trombose, existem várias técnicas de revascularização portal. No entanto, os resultados estão longe de serem os desejáveis. Objetivos: O objetivo deste artigo é relatar nossa experiência na abordagem da trombose portal no transplante hepático e descrever técnicas cirúrgicas alternativas para a trombose de grau III. **Material e métodos**: Avaliamos 70 recetores de transplante de fígado com trombose da veia porta submetidos a transplante entre dezembro de 2009 e agosto de 2018. Nesse período, 847 transplantes de fígado foram realizados. Avaliamos a técnica cirúrgica, o pós-operatório, recorrência da trombose portal e a sobrevida. **Resultados**: A incidência de trombose da veia porta em pacientes transplantados nesse período foi de 8%. Metade dos doentes foi diagnosticada durante a cirurgia, embora 89% tenham realizado doppler ou tomografia computadorizada com contraste endovenoso nos 3 meses anteriores ao transplante. A maioria, 40%, apresentava trombose de grau I e 21% apresentava trombose de grau III, de acordo com a classificação de Yerdel. 87% foram submetidos a trombectomia e anastomose portal direta. Os restantes exigiram o uso de outras técnicas cirúrgicas que incluíam reconstrução com enxerto venoso, nomeadamente, o enxerto "em Y cavo-ilíaco". **Conclusão**: A trombose venosa portal é subdiagnosticada; no entanto, não é mais considerada uma contraindicação para transplante. Existem técnicas alternativas para responder a casos com trombose mais extensa da veia porta.

Descritores: Trombose venosa; Transplante de Fígado; Veia Porta.

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