Possibilities for Recovery of Blood Outflow During Thrombosis of the Liver's Own Hepatic Veins in the Early Periods after Transplantation

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Abstract

Orthotopic liver transplantation with preservation of the retrohepatic inferior vena cava (IVC) using the so-called piggyback technique (MBT) has a number of priorities over the classical technique.

Since 2006, our Belghiti modified piggyback technique (MPBT) has been used in our center as a normal procedure for a liver transplantation program and has been performed 490 times by December 2018. Among them, in 6 recipients in the immediate postoperative period (12- 48 hours), occlusion of the own veins of the liver graft was noted. In all 6 observations, whole liver was used, obtained from the donor after ascertaining brain death. The age of these recipients was 32 ± 12 years, the age of donors was 48 ± 10 years. Percutaneous stenting was not used to correct the venous outflow. Re-transplantation due to the absence of a donor organ was not performed.

The best way to treat occlusion of blood outflow from the veins of a liver transplant is to prevent the very cause of its occurrence. The length of the upper vena cava of the graft must be short enough to prevent its fracture and redundancy, and the length of the anastomosis must provide a good venous outflow and be at least 6 cm. segments of the transplanted liver.

The results of our study led to the conclusion that early diagnosis of occlusion of the own veins of a liver transplant, based on clinical signs and ultrasound diagnostics, allows detecting pathology in time, reducing ischemic damage to the transplanted organ increases the possibilities of its recovery.

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Introduction

Orthotopic liver transplantation with preservation of the retrohepatic inferior vena cava (IVC) using the so-called piggyback technique (MBT) has a number of priorities over the classical technique. Its indisputable advantages are noted, including reducing the duration of thermal ischemia, ischemia, improving intraoperative hemodynamics and oxygen delivery to tissues, maintaining a stable perfusion pressure in the kidneys and renal postoperative function, and hence reducing the material costs of treatment[1]. This largely contributed to a wider distribution of the technique in the world, it is used more often than the classical one, and now 90% of liver transplantation centers actively use it[2].

But due to the unnatural location of the graft, the recipient's vena cava is frontal and the cava-caval anastomosis is not sufficient, which is often caused by a mismatch between the diameters of the anastomosing sites of the donor and the recipient and their anatomic features. Compression of the anastomosis,

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especially with an increased size of the liver transplant or compression I segment of the donor liver increases the risk of bending of the vessels after implantation and complications associated with venous anastomosis. Strictures or “kinking syndrome” can lead to early acute Budd-Chiari syndrome, or contribute to chronic limitation of outflow with various clinical manifestations[3].

Complications of liver transplantation using MPBT are well described in the literature, although some differences exist and are associated with the type of modification used by the surgical technique itself, so the venous outflow obstruction should be considered as a separate variant of vascular complications. This condition is relatively rare, but at the same time, quite difficult and often associated with transplantation of liver fragments obtained from a living or deceased donor. Therefore, the optimal use of vascular reconstructive intervention techniques is of paramount importance for improving early and long-term results after liver transplantation.

To date, there is no consensus about the optimal method used to perform a kava-caval anastomosis, as well as the restoration of blood flow through the own veins of a liver graft[4]. In 1992, Belghiti et al. modified their own methodology, in which the difficulty of outflow was minimized[5]. However, according to the updated piggyback method, the frequency of occlusion of the outflow of one's own veins of the liver graft remains up to 2.2% and in some studies even more[6]. With whole-liver transplantation, the frequency of venous outflow disorders varies from 0.5% -3%, but considering the chronic and acute overloads associated with blood outflow through the graft, they are much higher[7,8]. The clinical picture of violations of the venous outflow from the graft, as a rule, corresponds to Budd-Chiari syndrome. And the frequency of postoperative stenosis and thrombosis of the hepatic veins is more characteristic of the technique, performed with the preservation of the IVC and varies in the range of 0.8 - 10% depending on the modification[9].

Occlusion of the venous outflow requires emergency intervention, but studies have shown that complete clamping of the IVC necessary for revision of the kava-caval anastomosis and removal of thrombotic masses showed its low efficiency due to a sharp deterioration of the transplanted transplant caused by thermal ischemia[10]. leads to irreversible ischemic damage to the transplanted organ, and massive necrosis of the hepatocytes and biliary epithelium serves as a trigger for multiple organ failure and sepsis.

The only hope for saving the life of the patient in such a situation remains an urgent retransplantation, which is limited both by the acute shortage of donor organs and by the extremely grave condition of the recipient himself[11].

Materials and methods. Since 2006, our Belghiti modified piggyback technique (MPBT) has been used in our center as a normal procedure for a liver transplantation program and has been performed 490 times by December 2018. Among them, in 6 recipients in the immediate postoperative period (12- 48 hours), occlusion of the own veins of the liver graft was noted. In all 6 observations, whole liver was used, obtained from the donor after ascertaining brain death. The age of these recipients was 32 ± 12 years, the age of donors was 48 ± 10 years. Percutaneous stenting was not used to correct the venous outflow. Re-transplantation due to the absence of a donor organ was not performed. All complications were noted after the primary transplantation. Occlusion of venous outflow from the liver graft's own veins was diagnosed, according to the clinical signs of Budd-Chiari syndrome, and a stable monophasic waveform was detected during Doppler sonography (ultrasound), in one case slow blood flow ≤ 10 cm / second.

Materials and methods

Accurate and timely diagnosis is the most important factor that affects the immediate and long-term result. As an alternative to the existing methods for occlusion of the outflow through the hepatic veins after liver transplantation, they used (Fig. 1) caudal cavaplasty proposed in 1996 by Herrera et al[12]. But during revision of the cava-caval anastomosis, it is necessary to turn off both the blood flow to the liver transplant and completely block the blood flow through the recipient's inferior vena cava, which is impossible for a number of reasons.

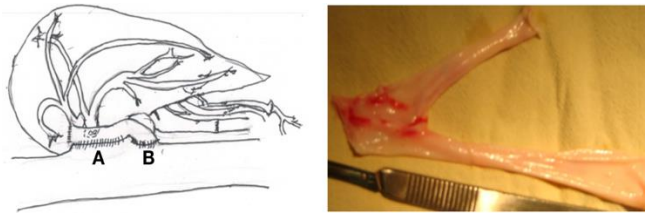

Figure 1 The caudal cavaplasty proposed by Herrera et al in 1996 (a) the initially performed cavaval anastomosis; (b) caudal plastic repair of the kava-caval anastomosis according to Herrera. At the photo we observe venous graft prepared from the IVC of the donor.

This significantly lengthens the time of thermal ischemia of an already compromised organ and increases necrosis of the hepatocytes, cells of the biliary system of the graft, and destabilizes the hemodynamics of the recipient. For this reason, the technique is not so widespread. In our observations, it was not necessary to use the end-to-side portal vein bypass (IVC) with the IVC due to the short phase of the agepathic period (about 40 minutes) while maintaining good hemodynamic stability with the existing IVC blood flow. Temporary bypass was used only in 1 patient after fulminant hepatic failure due to acute liver necrosis and waiting for the graft, which was transplanted after 3 hours.

The average duration of the operations was 260 minutes, it took 10 minutes to complete the cavaval anastomosis, and the total time to complete all three vascular anastomoses took 80 minutes on average. In 6 (1.2%) recipients of 490 cases of OLT, occlusion of blood outflow from a liver transplant was noted. In one case, marked necrosis of the transplanted transplant, ascites, graft dysfunction, oliguria was observed, and a second liver transplant was required. There was no organ, and the patient died on the 4th day after the operation due to non-correcting graft dysfunction and sepsis. Another recipient was transplanted a large liver from a donor, who noted the altered position of the internal organs “situs visceral inverses” and abnormal branching of the liver arteries.

After implantation, a transplant edema was immediately noted, which increased as the position of the organ changed. The fixation of the ligaments of the liver somewhat improved the picture, the puffiness decreased significantly, however, it grew again in the immediate postoperative period. When Doppler revealed a persistent monophasic waveform. Up to 5 liters of ascitic fluid, oliguria were obtained from the drains, an additional 12 hours later, liver transplant artery thrombosis was diagnosed and signs of transplant necrosis increased. Attempts to repeat laparotomy and revision of the anastomosis did not improve the condition and the recipient died 3 days after OLT.

In 4 cases, we used the method developed by us to restore the venous outflow after its occlusion. (Fig. 2 a, b, c, d). After laparotomy, the sutured end of the cranial section of the inferior vena cava of the liver transplant was maximally separated, the clamp was clamped with a clamp increased in this way along the length of the stump and all seams were removed.

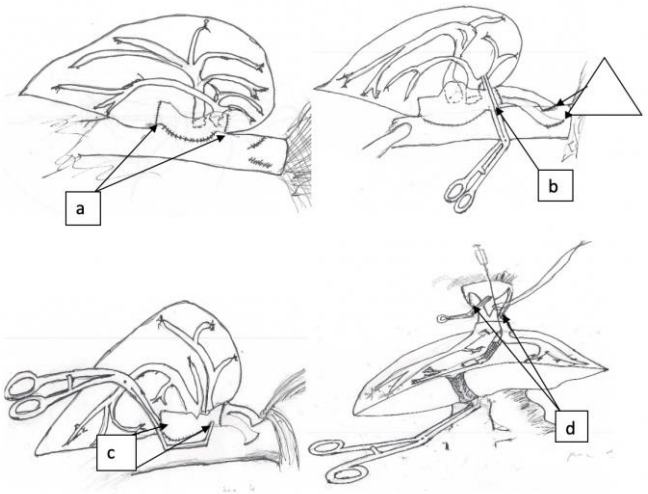

Figure 2. (Scheme)

a) Cava Cavalry anastomosis “BIB Technique by Belghiti”,

b) clamping a dedicated area of the cranial section of the liver IVC of the donor and stitching the conduit at the level of the selected bifurcation of the right and left iliac vein (1 and 2 mouths of the right, left and median veins of the recipient’s liver).

c) clamping the kava-caval anastomosis,

d) thrombectomy from the own veins of the liver transplant.

The open stump of the cranial section of the liver transplant antivomozirovali “end to end” with a fragment of the bifurcation of the IVC together with the iliac veins of the donor, obtained by removing the liver fig. 1 (photo). The right branch of the conduit was sewn into the mouth of the recipient's own right hepatic vein, and the left branch into the combined mouth of

the left and middle hepatic veins (Fig. 2b.). The Cavino-caval anastomosis was clamped with a Satinsky clamp, and De Becky's clamps clamped the right or left branch of the vascular conduit, and, depending on the location of the thrombus, a prosthesis performed. Through the openings thus obtained, blood clots were removed from the veins of the liver transplant using a Fogerti catheter (Fig. 2g).

After clamping the kava-caval anastomosis (Fig. 2c), the outflow from the liver transplant was redirected through the cranial section of the vena cava and the bifurcated hempered conduit into the recipient vena cava. Depending on the location of the thrombus, one of the branches was prosthetically performed and then blood clots were removed from the liver transplant own veins using a Vogerti catheter. (Fig. 2d).

After receiving a good blood flow, the holes in the conduits were sutured and the clips were removed from the mouths of the right, united left and middle hepatic veins, and then the kava-caval anastomosis was opened, removing the Satinsky clip. The recovered outflow of blood, both through the kava-caval anastomosis, and by the newly obtained reconstruction of the cranial department of the inferior vena cava provided a good outflow and was less susceptible both to different bends and changes in the position of the liver transplant or IVC of the recipient in the abdominal cavity after the operation, and deformities liver transplant own veins.

In one of the 4 cases with thrombosis of the middle vein of a liver transplant, we used only one short insert, obtained from the iliac donor vein, which was sutured only to the partially open left half of the cranial section of the IVR donor. Using the same techniques, with the help of a Fogarty catheter, blood clots were removed from the liver's graft clogged with a blood clot, the hole was sutured and clamps were removed from both the newly formed reconstruction and the Satinsky clamp from the IVC recipient.

Occlusion of the outflow of the own veins of the liver transplant was diagnosed on the first day after surgery. All four recipients were reoperated using the above-described cranial plasty of donor IVC. The postoperative period was uneventful, the average hospital stay was 20 days. Observation throughout the year showed a satisfactory condition of the recipients and good graft function.

Thus, additional reconstruction of the cranial section of the IVC liver transplant and an open kava-caval anastomosis provided a more reliable outflow even with the inflection and compression of the primary anastomosis and additional possibilities for increasing the functional reserves for the restored liver transplant.

Discussion

The best way to treat occlusion of blood outflow from the veins of a liver transplant is to prevent the very cause of its occurrence. The length of the upper vena cava of the graft must be short enough to prevent its fracture and redundancy, and the length of the anastomosis must provide a good venous outflow and be at least 6 cm. transplanted liver segments.

The acute manifestations of Budd-Chiari syndrome in the very first hours or days are more suitable for open surgery. However, depending on the signs of the appearance of the syndrome, therapeutic procedures will be different. The treatment of the acute form of Budd-Chiari syndrome varies, from a simple change in the position of the graft during reimplantation to open surgery on the vessels. Special care should be taken because of the risk of air embolism and transplant ischemia during vascular clamping, which can lead to serious consequences[13]. It may even be necessary to reanastomy with thrombectomy, (www.intechopen.com), the need to change the standard liver transplant technique, or urgent reimplantation if the graft is seriously damaged. Also sometimes perform anastomosis - “bridge”, end to side of the stump of the portal vein into the hollow for subsequent retransplantation[14]. In our second observation, this did not help.

Less aggressive non-surgical measures may also be effective, even in the first postoperative days, with fresh anastomoses[15]. Thrombolysis by streptokinase is successfully used for caval thrombosis, as well as diuretics for marked ascites[15]. But the most commonly used endovascular stenting and endoluminal dilatation anastomosis (venoplasty). When stenting scar tissue anastomosis or fibrous stenosis, the procedure is less invasive and less risky, but does not give 100% success[16]. Migration of the stent and re-twisting reduce the effectiveness of the technique. Sometimes repeated dilatation

eliminates stenosis.

The main advantage of the method presented by us is that it allows you to perform direct thrombectomy from the own veins of a liver transplant, which cannot be done with another technique, for example, proposed by Herrera et al., (Fig. 1 a,) or other researchers[12]. The method presented schematically in fig. 2 (a, b, c, g), allows to reduce blood loss, maintain blood flow through the IVC, avoid both blood clot migration, and airborne pulmonary embolism and pulmonary arteries, and significantly reduce the mortality of recipients and loss of grafts after such complications, which currently up to 18-27%[17].

Four recipients performed a fairly successful reconstructive intervention using the above original technique. With minimal blood loss (up to 200 ml), thrombotic masses were removed and outflow was restored in full. An important role was played by early diagnosis, assessment of the condition of the recipient and ultrasound diagnostics. The implementation of the proposed technique takes a relatively short period of time, approximately 30 minutes, does not destabilize hemodynamics, does not contribute to an increase in thermal ischemia, since there is no active intervention: the blood flow to the inferior vena cava does not overlap, thus avoiding repeated transplantation the liver. The observed 4 recipients for 1 year showed good graft function, with no signs of dysfunction and reduced outflow from the transplanted organ.

Due to a shortage of organs, as was the case in two of our observations, the TNA ended in the death of recipients. To save the life of the recipient and the graft in any way with a large shortage of donor organs is very important. The technique increases the ability to use grafts even with abnormal anatomy, for example, with the donor's “situs visceral inverses”. True, the only observation in our case ended in the death of the recipient; but at that time the presented technique was not used yet.

We did not use the interventional stenting of the hepatic veins of a liver graft, but we believe that the method we proposed allows us to quickly and efficiently remove blood clots from the liver graft and reliably ensures adequate outflow of blood from the transplanted organ. Retransplantation was not performed due to the absence of an organ for that period.

Thus, the presented modification of Belbiti BMPT ensures the safety of blood flow through the IVC, reduces hemodynamic instability, reduces the need for blood transfusion and reduces the time of thermal and cold ischemia. During the agepathic period, the RV technique provides an adequate venous inflow to the heart, supporting the hemodynamics of the patient and the renal venous outflow. Partial clamping of the IVC at the level of the hepatic veins usually does not cause significant changes in both the mean arterial and venous pressure in the inferior vena cava and in the systemic vascular resistance index and cardiac index. Urine excretion before, during and after revascularization does not change significantly. But the MBT technique is not without the risk of outflow barriers and this modification cannot be the method of choice for all recipients[17].

Our modification the specifics of performing the hepatectomy itself in the recipient, as well as our manipulations during the performance of the kava-caval anastomosis improve the angle of operative action, which largely levels the possible dangers and drawbacks[18]. And the proposed plasty of the cranial end of the liver transplant NIP allows you to quickly resolve the outflow occlusion without the risk of air embolism and overlapping of the IVC - with a positive effect on hemodynamics in all cases, which further enhances the possibility of using a PB modification according to Belghiti.

Conclusions

Thus, the results of our study led to the conclusion that early diagnosis of occlusion of the own veins of a liver transplant, based on clinical signs and ultrasound diagnostics, can detect abnormalities in time, reduce ischemic damage to a transplanted organ, increases the possibilities of its recovery. The proposed method of cranial cavaplasty of liver graft NPS allows us to extract thrombotic masses from our own veins without the risk of an air embolism and restore the outflow in full. When performing the presented technique, the arterial and venous blood supply of the graft and blood flow through the NIP of the recipient is maintained, which is very important for reducing the damaging effects of thermal ischemia and preserving hemodynamics during the operation itself.

Declaration of Interest

The authors report no conflict of interest.

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