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The management of the hepatic artery thrombosis after liver transplantation[1]

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Abstract

The clinical case of liver revascularization in a recipient using the technique of selective thrombolysis of the hepatic artery and its stenting at the arterial anastomosis site has been reported. The applied technique allowed a quick elimination of thrombosis and stenosis of the arterial anastomosis, providing a long-term effect, preventing more severe consequences for the recipient, and saving the liver graft. The presented case showed that the combined technique of endovascular intervention might be a good alternative to the reconstruction of arterial anastomosis by re-exploration and by liver re-transplantation.

Keywords: liver transplantation, vascular complications, hepatic artery

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HA, hepatic artery

LBFV, linear blood flow velocity

LT, liver transplantation

MELD, Model for End Stage Liver Disease

Ri, Resistivity Index

TLT, thrombolytic therapy

UNOS, United Network for Organ Sharing

US, ultrasonography

V_{max}, maximum volume

Introduction

Despite the improvement in the surgical technique of liver transplantation (LT), the incidence of vascular complications has no tendency to decrease and reaches 7% in cadaveric liver transplantation and about 13% in living donor LT [1]. Any vascular complication can seriously threaten the recipient's life, since a graft circulation impairment, if any, significantly increases the risk of the donor liver loss [2].

The problem of early diagnosis and treatment of vascular complications after LT, in particular the hepatic artery (HA) thrombosis, which incidence reaches 64-82% among all post-transplant complications, remains one of the most pressing in transplantation [3-5]. This explains the present day approach consisting in the need for close dynamic monitoring of all vascular anastomoses after transplantation.

This tactic justifies itself due to the fact that it is often possible to promptly take measures to restore the blood supply to the graft before the changes in the liver become irreversible [6–7]. Therefore, any emerging vascular catastrophe requires an immediate handling.

Currently, the drugs widely used in clinical practice for the treatment of arterial thrombosis, have a recombinant tissue plasminogen activator alteplase as an active ingredient. Thrombolytic therapy (TLT) with alteplase has successfully been used in the treatment of acute myocardial infarction, massive pulmonary embolism, ischemic stroke in the acute period [8–9].

To restore the blood supply to the transplanted liver in HA thrombosis, TLT can also be used [10], but in 20% of cases, its consequences involve hemorrhagic complications, turning fatal in some cases. This can be explained that achieving a therapeutic effect requires the high doses of the drug administered, as a rule, via the intravenous route, which affects systemic coagulation [2].

Revascularization of the graft can be supplemented with endovascular methods, specifically, intra-arterial TLT, particularly in cases where the patency of the intrahepatic arterial bed is in serious doubt. However, one should remember that endovascular interventions, as a rule, are ineffective for the thrombosis caused by technical factors. If the vascular stenosis occurs, the only way to cope with it is either open or minimally invasive angioplasty. If thrombectomy and angioplasty are ineffective, it is only liver re-transplantation that can save the patient's life [11].

We present a case from our own experience in the treatment of thrombosis and stenosis of the arterial anastomosis after LT, in which we managed to cope with these complications in a minimally invasive way using the endovascular technique, without exposing the patient to the

risks associated with thrombectomy and an open reconstruction of arterial anastomosis.

Clinical Case Report

Patient S., 30 years old, was admitted to the Center for Surgery and Organ Donation Coordination of the Rostov Regional Clinical Hospital on 01.05.2017 with diagnosis: liver cirrhosis viral etiology (chronic mixed infection B and D hepatitis virus), Model for End Stage Liver Disease (MELD) score 28 points, decompensation, portal hypertension, hepatosplenomegaly, esophageal varices grade 2, resistant ascites, superior mesenteric vein thrombosis, hepatic encephalopathy grade 2, United Network for Organ Sharing (UNOS) class – 2A.

On the same day, after an anthropometrically compatible donor with an identical blood group had been found, orthotopic LT was performed. The surgery duration was 7 hours.

At dynamic ultrasound (US) examinations of the graft vessels in the first 2 days after surgery, all vascular anastomoses were patent. The blood flow velocity characteristics were within acceptable range of values. Two days after surgery at ultrasound examination of the hepatic artery visualization was difficult, maximum volume (V_{max}) distal blood flow was 30/0 cm/s, Resistivity Index (Ri) was 1.0. There was an increase in the linear blood flow velocity (LBFV) in the splenic artery, V_{max} was 149/67 cm/s, (Ri) 0.54. Vascular anastomoses were patent. From May 4, 2017, to May 6, 2017, visualization of the hepatic artery anastomosis was difficult; the Vmax of distal blood flow was 30/0 cm/s, Ri was 1.0. The splenic artery maintained an increased blood flow V_{max} 145 cm/s. Vascular anastomoses were patent. On the seventh day after surgery, the hepatic artery ultrasound examination was failed to reliably visualize the

blood flow. The patient was transferred to the X-ray Operating Room for angiography.

Under local anesthesia, a hydrophilic introducer of 6 Fr internal diameter and 25 cm length was inserted into the right radial artery. Under X-ray guidance, a diagnostic angiographic catheter of AMPLATZ RIGHT 2 modification was inserted into the descending aorta along a 260 cm long guidewire. At the level of the XII thoracic vertebra, a celiac trunk catheterization, a selective catheterization of the common HA and its selective angiography were performed, which revealed thrombosis at 1.5 cm from the orifice (Fig. 1).

A controlled Asahi Sion coronary guidewire of 0.014 inches in diameter and 190 cm length was passed through the thrombosis zone into the distal parts of the common HA. A 135 cm Corsair microcatheter was inserted along the coronary guidewire. The arteriography performed via the microcatheter revealed that its distal tip was located in thrombotic masses. A decision was made to perform selective thrombolysis. Through a microcatheter, 15 mg of Actilyse® was injected at a rate of 1 mg/min into the thrombotic zone, using an infusion pump.

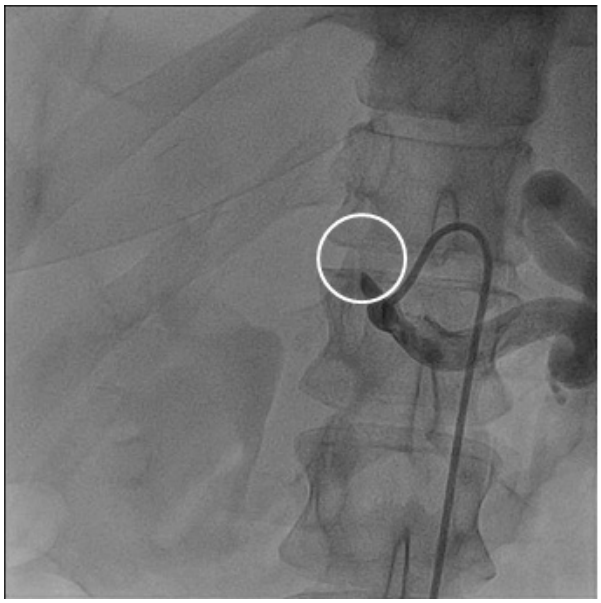

Fig. 1. Selective angiography of the common hepatic artery after liver transplantation: the thrombotic pre-stenotic occlusion in the proximal area visualized as a contrast "break"; stenosis of arterial anastomosis

The thrombolytic effect was achieved within 20 minutes. After the lapse of time, the control angiography performed to confirm the lysis of thrombotic masses revealed a 90% stenotic anastomosis between the common HA an the artery of the donor liver, the blood flow distal to the anastomosis area was slow and turbulent. A XIENCE Xpedition 4.0x18 mm everolimus-eluting coronary stent was implanted in the artery. Control angiography showed no hemodynamically significant stenosis at the anastomotic site, no contrast extravasation; the blood flow velocity along the common hepatic artery was satisfactory (Fig. 2).

Fig. 2. Selective angiography of the common hepatic artery after liver transplantation: a, the liver revascularization after selective thrombolysis; b, the hepatic artery stenting at the arterial anastomosis site

The intervention was completed by removing the instruments and applying a pressure bandage over the puncture site in the radial artery.

Results

A day later, on May 8, 2017, the ultrasonography of the HA and its anastomosis showed the patency had restored; distal to the anastomosis, the blood flow V_{max} was 80/11 cm/s, Ri was 0.61. LBFV in the splenic artery V_{max} was approaching 78 cm/s. On May 27, 2017, the patient was discharged from the hospital in a satisfactory condition for further outpatient treatment with recommendations on the timing of follow-up at hepatologist's and on monitoring the immunosuppressive therapy course. In addition to the immunosuppression protocol, the patient was prescribed a long-term course of antiplatelet agents (Coplavix® 175 mg twice a day).

At the control follow-up examination 3 years after surgery, the patient's condition was satisfactory, there were no signs of liver failure. The patient was adapted and able to work.

Discussion

With a sufficiently large global experience of LT, there are still no clear criteria that would allow predicting the outcome of this surgery, especially in case of vascular complications. The shortage of donor organs dictates that the transplantation team should be focused on preserving each transplanted liver, improving the quality of recipient's life in the postoperative period. In such a situation, impaired blood flow in the HA appears to be one of the main problems of transplant hepatology. Early postoperative graft dysfunction caused by HA thrombosis can result in the graft loss, and, moreover, in a fatal outcome.

Thanks to the dynamic instrumental monitoring of all the blood vessels supplying the transplanted liver, it is possible to reliably assess their condition, to identify the vascular complications and take timely measures to cope with them. Endovascular technologies assist both in identifying a vascular problem, and also in urgently restoring the blood flow impaired in the graft.

For biliary complications and persistent biliary sepsis in the outcome of hepatic arterial thrombosis, liver re-transplantation was and still is the only treatment. In order to restore the blood supply to the transplanted liver, we performed selective thrombolysis and simultaneous HA stenting in conditions of constantly monitoring the systemic coagulation. This tactical approach allowed us to quickly stop the threatening complication without resorting to open reconstruction of the arterial anastomosis and, moreover, avoiding re-transplantation, but obtaining a long-term effect.

Conclusion

The presented clinical case clearly demonstrates a success in solving the complex problem of the hepatic artery thrombosis and stenosis after liver transplantation by using a combined endovascular technique and with achieving a positive result and avoiding any harmful consequences for the recipient. With a high degree of probability, this complication could have led to more serious consequences, however, timely diagnosis and immediately taken measures in the form of selective thrombolysis and hepatic artery stenting prevented further deterioration of the patient's condition and a graft loss.

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