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Application of Amplatzer vascular occluder in hepatic artery closure as a method of treatment of high-flow arterioportal fistula before liver transplantation

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Summary

Background:

Arterioportal fistula (APF) is an abnormal, direct connection between hepatic artery or its branch and the portal vein. Fistula can be acquired or, rarely, congenital. One of the acquired causes of fistula is a liver biopsy. Patients with liver cirrhosis are particularly vulnerable to its development due to the large number of performed biopsies. APF increases mortality and morbidity of liver transplantation procedure and may be a contraindication to it. The authors present a patient with liver cirrhosis, in whom percutaneous APF closure facilitated liver transplantation.

Case Report:

We describe a case of a 50-year-old patient with liver cirrhosis and APF, probably formed as a result of liver biopsy. Due to the presence of a high-flow fistula, which elevated portal hypertension, patient did not qualify for the liver transplantation. Patient was transferred to the interventional radiology department, where the fistula's vascular supply was endovascularly closed using the Amplatzer occluder. This subsequently enabled the execution of transplantation.

Conclusions:

Percutaneous closure of APF should be considered a relatively simple and fast-acting tool to facilitate or even enable liver transplant surgery. Currently, there are more and more products available such as e.g. Amplatzer occluder to simplify the procedure and shorten the duration of exposure to ionizing radiation.

Key words:

arterioportal fistula • endovascular • liver transplantation • Amplatzer occluder

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Background

Liver transplantation is the only life-saving treatment for patients with chronic, end-stage liver failure and in some cases of acute failure. Surgical procedure is complicated and long. Proper reconstruction of organ's vascular supply is the greatest challenge for the operator. Success of the procedure depends largely on preoperative assessment and patient qualification.

Anatomical difficulties complicating surgical technique are relative contraindications to transplantation.

Arterioportal fistula (APF) is one of such difficulties.

Arterioportal fistula is an improper, direct communication between hepatic artery or one of its branches and portal vein, which may lead to high-grade portal hypertension [1].

Arterioportal fistulas may be divided to intra- and extra-hepatic depending on morphology or to congenital and acquired depending on etiology.

Congenital fistulas are rare and are usually associated with disorders such as Osler-Weber-Rendu, Ehlers-Danlos syndrome or biliary atresia.

The most common causes of acquired arterioportal fistulas include blunt or penetrating trauma, iatrogenic (liver biopsy, surgical procedures), cirrhosis, liver tumors or vasculitis (e.g. Behcet's disease) [2].

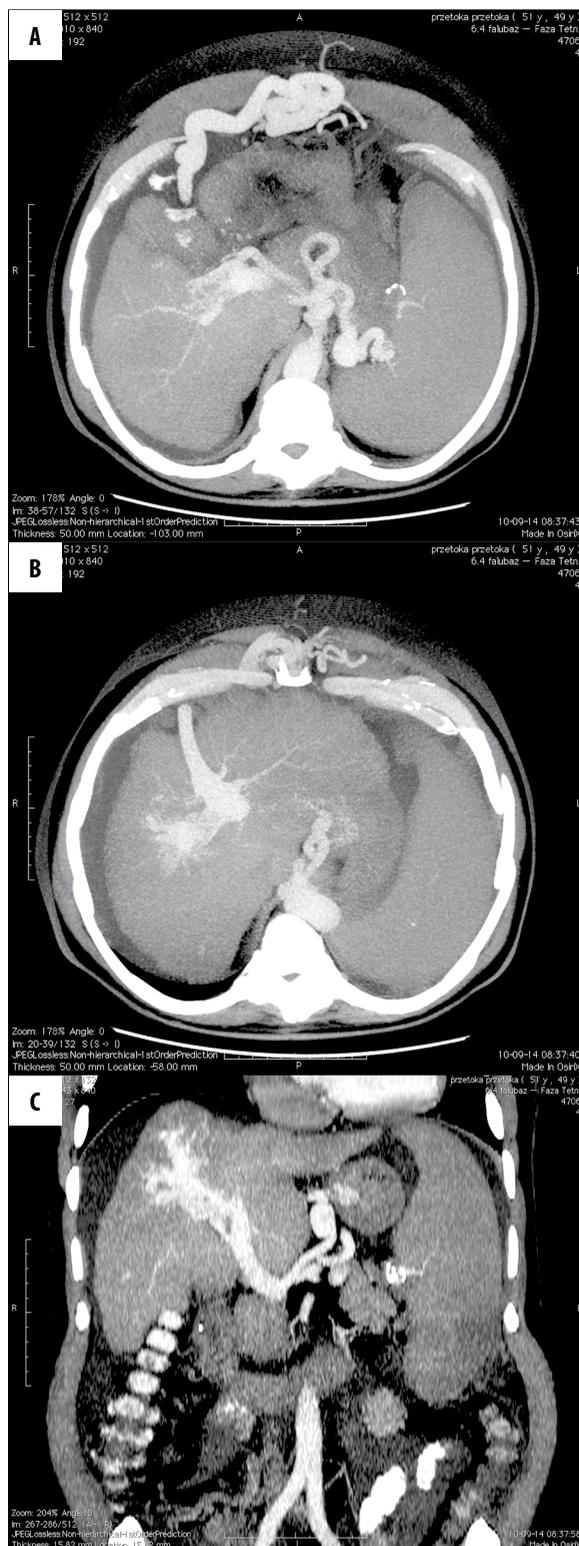


Figure 1A–C. Axial and coronal cross-sections obtained during the aortic phase of CT study. Arterioportal fistula and well-developed collateral venous circulation.

In case of the described patient fistula was a iatrogenic complication as a result of previous liver biopsies. Patients with liver cirrhosis are particularly vulnerable to APF development due to a large number of performed biopsies [3–6].



Figure 2. Intrahepatic arterioportal fistula in superselective DSA examination.

Cooperation between surgical transplantology and interventional radiology teams made liver transplantation possible in case of a patient previously disqualified from this procedure due to the presence of high-flow APF.

Application of interventional radiology procedures allows for non-surgical management of arterioportal fistula, making liver transplantation possible and decreasing the risk of perioperative complications.

Case Report

A 50-year-old patient with diagnosed liver cirrhosis in the course of HBV and HCV infection, with persistently elevated markers of liver failure, ascites resistant to treatment as well as grade IV esophageal and gastric varicose veins.

Performed CT and MR imaging of the abdominal cavity demonstrated well-developed collateral circulation associated with portal hypertension in the course of liver cirrhosis, additionally supplied by an arterioportal fistula (Figure 1A–C).

For that reason patient was disqualified from liver transplantation.

We decided to broaden the diagnostics of a fistula in the interventional radiology suite before a potential embolization attempt.

Endovascular procedure began with digital subtraction angiography (DSA) examination of visceral vessels performed under local anesthesia using femoral access according to Seldinger method. A 6F Destination (Terumo) leader was positioned at the origin of the celiac trunk. Hepatic artery was superselectively catheterized using a 4F Glidcatch catheter and an angled 0.035" Glidewire (Terumo) leader.

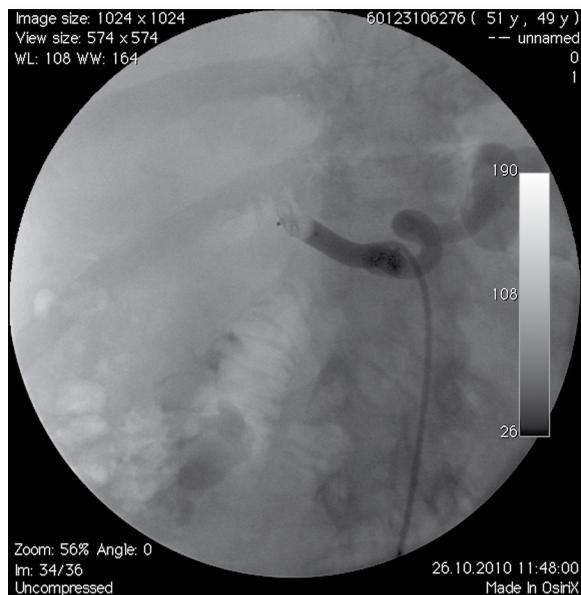


Figure 3. Follow-up angiography after occluder implantation revealed exclusion of the fistula from circulation.

Subsequently, contrast medium was administered for visualization of arterioportal fistula (Figure 2). In light of potential liver transplantation, taking into consideration the width and high-flow character of the fistula, an Amplatzer VP 4 occluder system was used to close the hepatic artery before the origin of the fistula. Follow-up DSA visualized complete exclusion of fistula from circulation (Figure 3). Patient was then transferred to the Department of Hepatic Surgery.

Follow-up abdominal CT examination demonstrated preserved flow only in the initial part of common hepatic artery. Right and left branches of hepatic artery received blood from collateral circulation (Figure 4A, B). We noted only traces of flow through the fistula, mainly in the venous phase of the study. Moreover, A hypodense area, about 6 cm in diameter, corresponding to an infarct was visible in the 5/6 liver segments (Figure 5).

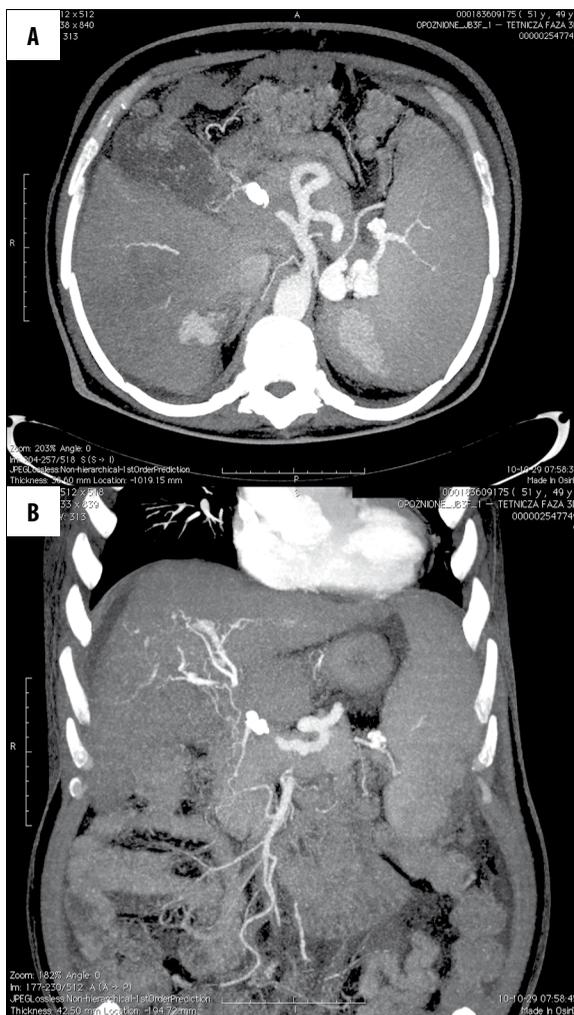
Following another surgical consultation, patient was referred for liver transplantation. Due to constantly raising liver function tests and an episode of encephalopathy with hepatic coma, an urgent procedure was indicated and patient was successfully transplanted 3 weeks later.

Discussion

The past three decades resulted in a dynamic development of interventional radiology methods. In the past, most patients with PAF were treated surgically. Nowadays however, interventional radiology procedures are preferred, leaving cases unsuitable for endovascular treatment to classical surgery.

Percutaneous procedures are associated with shorter hospitalization time, reduction of pain, number of complications and perioperative mortality compared to classical surgery.

Literature reports numerous cases of successful endovascular closure of arterioportal fistulas, both congenital and acquired [7–10].



Figures 4A, B. Axial and coronal cross-sections obtained during the arterial phase of CT study. Blood flow is preserved only in the initial section of the hepatic artery. Hepatic artery branches fill via collateral circulation.

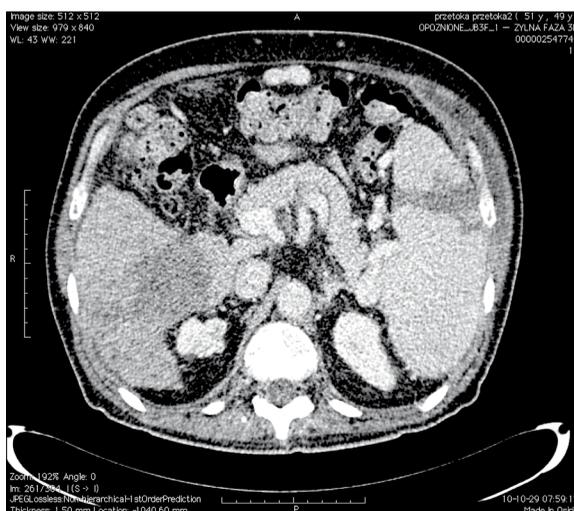


Figure 5. Axial cross-section obtained during venous phase of CT study. A hypodense focus corresponding to an infarcted liver area. In addition, a postinfarct area is visible in the spleen, present in CT examination prior to endovascular procedure.

Procedure presented in this publication enabled patient qualification to liver transplantation.

It is worth noting that there are differences between APF embolization procedure in a patient requiring liver transplantation and one with a healthy organ.

Arteriovenous fistulas are often supplied by more than one vessel, which increases the level of difficulty in achieving full APF closure, often requires re-intervention and closure of additional branches supplying the fistula [7].

In case of patients referred for heart transplantation, the procedure is not aimed at full closure, but at reducing blood flow through the fistula, so that it is no longer a risk factor for perioperative complications. Interventional radiologist may focus on closing the main supplying vessel and there is no need to obliterate other small-caliber vessels. Fast closure of hepatic artery may be achieved using the Amplatzer® Vascular Plug (AVP) 4 system, designed for peripheral vessel closure via a diagnostic catheter [11,12].

The procedure is performed quickly, which little exposure to ionizing radiation for the patient and the radiology team. Positioning of the occluder, which is clearly visible in fluoroscopy, seems safe, although it is associated with stretching of the diagnostic catheter used for implantation.

Additional advantage of endovascular fistula closure in a potential liver transplant recipient is related to the fact that his/her own liver will be later resected. It allows for greater leeway in choosing a vessel for embolization. Possible closure of a vessel supplying even a large area of liver parenchyma does not carry the same consequences as for a patient with healthy liver who will need proper native organ function for the rest of his/her life.

Exposure to ionizing radiation is a drawback of percutaneous procedures. Nowadays, there are more and more products on the market such as Amplatzer occluder device, which simplify the procedure and shorten the time of exposure to radiation.

Due to these advantages, endovascular treatment is a relatively simple and quick method of arterioportal fistula occlusion.

Describing this case, we recommend cooperation between transplantology and interventional radiology teams, as it may facilitate liver transplantation.

Literature reports numerous cases of similar cooperation, such as in treatment of transplantological complications using interventional radiology methods [13–15].

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