CASE REPORT

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Transhepatic venous access for hemodialysis – a single-center experience

Transhepatički venski pristup za hemodijalizu – iskustvo jednog centra

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Abstract

Introduction. A percutaneous transhepatic approach has been used to place tunneled catheters for hemodialysis in the *inferior vena cava*. This route through the suprahepatic vein could be used to place a tunnelled catheter for permanent hemodialysis without complications and with an excellent permeability rate. **Case report.** From 2011 to 2020 at the Military Medical Academy, we treated 4 patients with the transhepatic central venous catheter for hemodialysis. All of them had exhausted approaches during the period of hemodialysis. Arterio-venous fistulas thrombosed on the arms, subclavian vein thrombosis bilaterally or *superior* and *inferior vena cava* thrombosis, as well as bilateral iliac and femoral vein thrombosis were present as complications of longterm hemodialysis through femoral catheters. Peritoneal dialysis was not possible. One patient needed a scroll catheter since the hemodialysis did not have a good outcome, and one patient needed a thrombolysis of catheter due to its malfunction. The other two patients have been on hemodialysis without complications for 300 and 1,650 days, respectively. **Conclusion.** Transhepatic venous access under ultrasound and radioscopic guidance is a simple and safe method. It is an acceptable alternative for permanent hemodialysis catheters when other venous accesses are exhausted and when it is performed by a well-trained team.

Key words:
catheters, indwelling; catheterization, central venous; dialysis, renal; liver circulation; radiology, interventional.

Apstrakt

Uvod. Za postavljanje tuneliziranih katetera za hemodijalizu u donju šuplju venu koristi se perkutani transhepatični pristup. Ovaj pristup preko suprahepatičnog dela donje šuplje vene mogao bi da se koristi za postavljanje tuneliziranog katetera za trajnu hemodijalizu, sa minimalnim rizikom od pojave komplikacija i sa odličnom funkcionalnošću. **Prikaz bolesnika.** U periodu od 2011. do 2020. godine, u Vojnomedicinskoj akademiji u Beogradu kod 4 bolesnika bio je postavljen transhepatični kateter za hemodijalizu. Svi bolesnici su imali iscrpljene vaskularne pristupe tokom dugogodišnjeg perioda hemodijalize. Kao posledica dugotrajnih hemodijaliza preko femoralnih katetera kod njih su bile prisutne trombozirane arteriovenske fistule na gornjim ekstremitetima, bilteralna tromboza supklavijske vene, tromboza gornje i donje šuplje vene, kao i bilateralna tromboza ilijačne i femoralne vene. Peritoneumska dijaliza nije bila moguća. Kod jednog bolesnika je bilo potrebno uraditi repoziciju katetera, a kod drugog smo uradili trombolizu katetera zbog malfunkcije. Druga dva bolesnika imala su uspešne hemodijalize bez pojave komplikacija u trajanju od 300, odnosno 1 650 dijaliznih dana. **Zaključak.** Perkutani transhepatični venski pristup vođen ultrazvukom i radioskopskom kontrolom je sigurna metoda i prihvatljiva je alternativa za plasiranje tuneliziranih hemodijaliznih katetera ukoliko su iscrpljeni drugi dijalizni pristupi i kada ih izvodi dobro obučen tim.

Ključne reči:
kateteri, trajni; kateterizacija, centralna, venska; hemodijaliza; jetra, cirkulacija; radiologija, interventna.

Introduction

Problems related to hemodialysis access are a significant cause of morbidity and mortality in patients with end-stage renal disease. Primary arterio-venous (AV) fistulas are recommended with venous transposition if necessary. AV grafts are used when autogenous access is not feasible, and tunneled dialysis catheters are recommended for long-term

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use only when all other options have been exhausted [1]. Complications of vascular access are the most common cause of hospitalization for patients with end-stage renal disease [2, 3].

Within the period 1997–2009 in Serbia, the incidence of patients on renal replacement therapy increased from 108 to 179 per million population (pmp), prevalence from 435 to 699 pmp, while the mortality rate fell from 20.7% to 16.7% [4]. In the United States, by 2011 and beyond, the drive to improve the quality of care for hemodialysis patients has identified vascular access issues as a key contributor to outcomes [5].

Transhepatic venous access was first described in 1994 by Po et al. [6]. A percutaneous transhepatic approach has been used to place tunneled catheters for hemodialysis in the inferior *vena cava*. The outcome of this procedure has been reported in two series [7, 8], constituting a total of 57 catheters in 23 patients. When all vascular approaches were used, transhepatic and translumbar vascular access was recommended as a vascular approach [7, 8]. The transhepatic route through the right hepatic vein could be used to place a tunnelled catheter for permanent hemodialysis with an excellent permeability rate [9].

Case report

In a period from 2011 to 2020 at the Military Medical Academy in Belgrade, we treated 4 patients with the transhepatic central venous catheter for hemodialysis. Our patients were women aged 65–76 years. On the chronic program of hemodialysis before placing the transhepatic catheter, they were 6–15 years. All of them had exhausted approaches during the period of hemodialysis. Arterio-venous fistulas had been thrombosed on the arms, with a worn-out ability to create new AV fistulas at the extremities after multiple interventions and reinterventions.

In the period before placing the transhepatic catheter, they had been dialyzed on transfemoral, subclavian, or jugular permanent catheters. All patients had repeated infections of femoral catheters. Central catheters were placed in the femoral vein bilaterally, but they had to be removed due to thrombosis or infection. Before making a decision to place a transhepatic catheter, we had diagnosed the following in all patients: subclavian vein thrombosis bilaterally, *vena cava superior* (VCS) thrombosis, *vena cava inferior* (VCI) thrombosis, and bilateral iliac vein thrombosis (Figures 1 and 2). In the meantime, an attempt was made with peritoneal

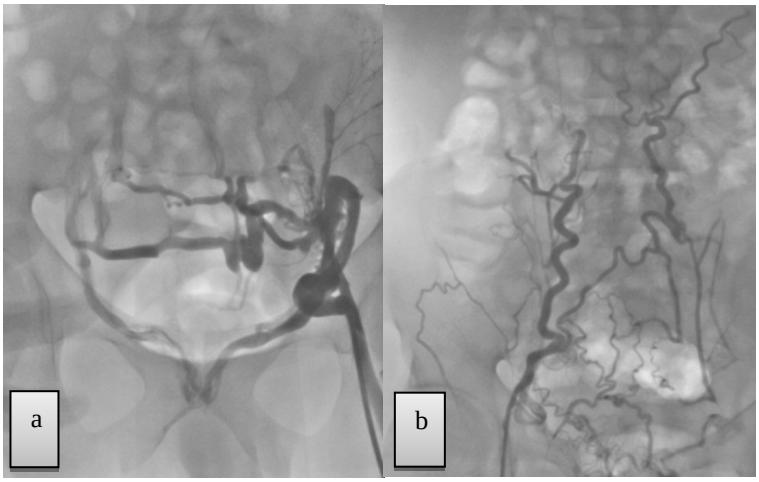

Fig. 1 – Thrombosed (a) left, and (b) right iliac and femoral vein, with thrombosis of *vena cava inferior*.

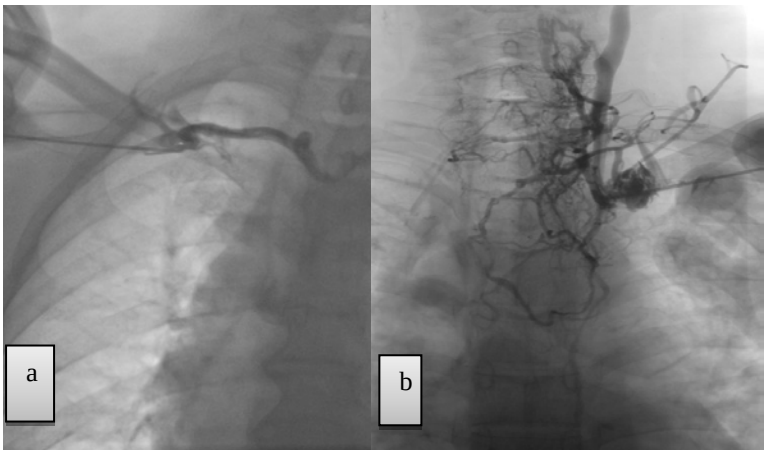

Fig. 2 – Thrombosed (a) right jugular and (b) left subclavian vein with thrombosis of *vena cava superior*.

dialysis, but perivisceral adhesion prevented a good outcome. After consultation among vascular surgeons, nephrologists, and radiologists, we decided to place the transhepatic catheter in the *inferior vena cava* for hemodialysis.

Technique

For the planned procedure, a liver punction kit and a tunneled catheter were provided (Figure 3). In the first step, by using ultrasound, we detected the right hepatic vein between the eighth or ninth intercostal space in the right midaxillary line. After mapping, the right hepatic vein was punctured with a needle from the system. The entire procedure has been followed by X-ray monitoring, also. The guide wire was placed through the right hepatic vein into the *inferior vena cava* (Figure 4). After punction and introduction wire, we approached implementation of the central tunneled catheter step-by-step using standard technique (dilatation, introducer sheet, catheter, making a subcutaneous tunnel, final check function, and position). All procedures were done under X-ray control step-by-step: wire transducer, dilatators, sheet (Figure 5). The catheter was placed with the top in the right atrium. At the end of the procedure, the catheter was tunneled and performed on the front abdominal wall and fixed with skin sutures.

Fig. 3 – Merit Mak Medical system for liver punction (6 Fr, 20 cm) and Arrow 15 Fr Tip to Cuff 27 cm catheter for hemodialysis.

Fig. 4 – Ultrasound maping right hepatic vein; guide wire in right atrium.

Fig. 5 – Dilatation (left), introducer sheet (center), catheter (right).

Discussion

The transhepatic pathway is a life-saving alternative in patients with the worn-out features of classic vascular access, and a kidney transplant certainly has no alternative. Creating and establishing a reliable route for hemodialysis is still a challenge. In the literature, we can find a small number of papers with case reports and case series addressing the current issues [9–13]. Only four series described the outcome of placing transhepatic catheters for hemodialysis [7, 8, 14, 15]. In the Smith et al. [8] series of 16 patients and 21 catheter placements, the complication rate was 29%, including one death from massive intraperitoneal hemorrhage. In our study, we did not have massive bleeding or death due to immediate complications. Although the average duration of dialysis via this route in the two series was 24 and 138 days, respectively, one patient was dialyzed for 599 days. We had 300–1,650 dialysis days in our series. Complications of this access could be acute: wire embolism, subcutaneous hematoma, catheter misplacement; long-term: air embolism, catheter embolism, catheter occlusion, central venous thrombosis, and stenosis; catheter-related infection and specific for the transhepatic route: massive intraperitoneal hemorrhage, perihepatic hematoma, hepatic arterial injury [8, 14]. We had one catheter malposition that was resolved by repositioning in the angio room. The repositioning was done under scope control, where the catheter tip was moved more distally, having been previously in contact with the atrial wall. One catheter thrombosis was successfully resolved using thrombolytics. Alteplase thrombolysis was performed in a patient whose catheter was thrombosed after two months (Table 1). Transhepatic dialysis catheter placement has a high rate of procedural success but also a higher rate of complications compared with traditional access sites. Immediate catheter failures occur most often due to migration, which can be minimized by placing the catheter tip in the mid or even upper right atrium to avoid caudal migration into the hepatic veins from respiratory motion [16], which we also used.

In our experience, one patient needed repositioning because hemodialysis did not have a good outcome, and one patient underwent catheter thrombolysis after two months. The other two patients have been on hemodialysis without complications for 300 and 1,650 days, respectively. There was no infection, but the number of hospital days in patients with a transhepatic Hickman catheter was increased.

The Hemodialysis Reliable Outflow (HeRO) Graft is a permanent, fully subcutaneous vascular access system for catheter-dependent patients and patients dialysing with failing arteriovenous fistulas or arteriovenous grafts due to outflow stenosis [17]. The HeRO system is another option and a possibility for patients with no contraindications for its placement, where there is no significant local obstruction and limitation of a technical nature, as well as where the price is not a limiting factor. At that time, it was not possible to implant a HeRo graft in our institution due to technical problems. Performing an arterio-arterial prosthetic loop (AAPL) on the upper or lower extremity is another option; it is well described but associated with significant complications [18]. The femoral vein transposition and saphenous vein loop grafts were not possible due to iliac vein thrombosis, which all patients had as a result of the long-term presence of femoral dialysis catheters, frequent punctures, and infections.

Conclusion

Arterio-venous fistula remains the gold standard for the vascular approach for hemodialysis. As a last resort, a transhepatic catheter could be used to extend the time on hemodialysis. Transhepatic venous access under ultrasound and radioscopic guidance is a safe method if you are adequately staffed and technically equipped. It is an acceptable alternative for permanent hemodialysis catheters when other venous accesses are exhausted and when it is performed by a well-trained team.

Table 1

Characteristics of patients undergoing transhepatic venous access

Patient	Gender	Age (years)	Duration on hemodialysis before transhepatic access (years)	Duration of transhepatic access use (days)	Complications/ intervention
1	Female	65	8	1,650	Hemathoma, malposition
2	Female	69	6	959	Malposition/ reposition
3	Female	71	15	465	Catheter thrombosis/ thrombolysis
4	Female	76	11	300	Malposition

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