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Abstract

Introduction. A percutaneous transhepatic approach has been used to place tunneled catheters in the inferior vena cava for hemodialysis. This route through the suprahepatic vein could be used to place a tunneled catheter for permanent haemodialysis without complications and with an excellent permeability rate.

Single centre experience. From 2011 to 2020 in a Military Medical Academy we treated 4 patients with transhepatic central venous catheter for hemodialysis. All of them had exhausted approaches during period of hemodialysis. Arterio-venous fistulas had been thrombosed on the arms, thrombosis subclavian vein billateraly or superior cava vein and complications by femoral catheters was present. Peritoneal dialysis was not possible.

Discussion. Limited number of papers described outcome of placement transhepatic catheters for hemodialysis. In our experience one patient needed scroll catheter due hemodialysis had not well outcome, and one patient needed thrombolysis catheter. Two of them are on hemodialysis without complications for 300 and 1650 days.

Conclusion. The transhepatic venous access under ultrasound and radioscopic guidance is a simple and safe method. It is an acceptable alternative for permanent haemodialysis catheters when other venous accesses are exhausted, and when it is performed by a well-trained team.

Key words: hemodialysis, permanent catheter, hickmann, transhepatic, approach.

Apstrakt

Apstrakt

Uvod. Perkutani transhepatični pristup je korišćen za postavljanje tuneliziranih katetera u donju šuplju venu za hemodijalizu. Ovaj pristup za suprahepatici deo donje šuplj ve ne bi mogao biti korišćen za postavljanje tuneliziranog katetera za trajnu hemodijalizu sa minimalnim rizikom za pojavu komplikacija i sa odličnom funkcionalnošću. Iskustvo jednog centra. U periodu od 2011. do 2020. godine na Vojnomedicinskoj akademiji lečili smo 4 pacijenta transhepatičnim centralnim
venskim kateterom radi hemodijalize. Svi pacijenti su imali iscrpljene vaskularne pristupe tokom dugogodišnjeg perioda hemodijalize. Trombozirane arterio-venске fistule na gornjim ekstremitetima, bilateralnu trombozu subklavijske vene, trombozu gornje šuplje i donje šuplje vene infrahepatično vene, kao i ilijačnim i femoralnim venama kao posledica dugotrajnih hemodijaliza preko femoralnih katetera. Peritoneumska dijaliza nije bila moguća. Diskusija. Ograničeni broj radova opisuje ishod postavljanja transhepatičnih katetera za hemodijalizu. Sumirajući naše iskustvo konstatovali smo da je kod jednog pacijenta bilo potrebno uraditi repoziciju kateteta, a kod jednog katetera smo uradili trombolizu zbog malfunkcije. Druga dva su imala uspešne hemodijalize bez pojave komplikacija u trajanju od 300 odnosno 1650 dijaliznih dana. Zaključak. Perkutani transhepatični venski pristup vođen ultrazvukom i radioskopskim kontrolom je sigurna metoda. Prihvatljiva je alternativa za plasiranje tuneliziranih hemodijaliznih katetera kada su iscrpljeni drugi dijalizi pristupi i kada ih izvodi dobro obučen tim.

Ključne reči: hemodijaliza, dijalizi kateter, hikman, transhepatični.

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 use only when all other options have been exhausted.

Complications of vascular access are the most common cause of hospitalization for patients with end-stage renal disease.

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 rose from 435 to 699 pmp, while mortality rate fell from 20.7% to 16.7%. In the United States by 2011 and beyond, the drive to improve quality of care for hemodialysis patients has identified vascular access issues as a key contributor to outcomes.
Transhepatic venous access was first described in 1994 by Po et al.\textsuperscript{6}. A percutaneous transhepatic approach has been used to place tunneled catheters in the inferior vena cava for hemodialysis. The outcome of this procedure has been reported in two series\textsuperscript{7,8} constituting a total of 57 catheters in 23 patients. When all vascular approaches were used, transhepatic and translumbal vascular access were recommended as a vascular approach\textsuperscript{7,8}. The transhepatic route through the right hepatic vein could be used to place a tunneled catheter for permanent haemodialysis with an excellent permeability rate\textsuperscript{9}.

**Single centre experience**

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

In a period before placement transhepatic catheter they had dialysed on transfemoral, subclavian or jugular permanent catethers. All of patients had repeated infection of femoral catheters. Central catheters were placed in femoral vein bilateraly but due thrombosis or infection they had to be removed. Before made a desicion for placement transhepatic catether we had diagnosed in all patients: thrombosis subclavian veins bilateraly, superior vena cava thrombosis, inferior vena cava thrombosis, and bilateral iliac vein thrombosis. Figure 1, 2. In the meantime, an attempt was made with peritoneal dialysis, but perivisceral adhesion were prevented good outcome. After consultation between vascular surgeons, nephrologists, radiologists we decided to place transhepatic catheter in inferior vena cava for hemodyalysis.

**Technique:**

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

**Discussion**

The transhepatic pathway is a life-saving alternative in patients with the worn-out features of classic vascular access, and it is certainly a kidney transplant that 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 current issues\(^9\)-\(^{13}\). Only four series described outcome of placement transhepatic catheters for hemodialysis\(^7,8,14,15\). In a Smith series\(^8\) of 16 patients and 21 catheter placement, 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 300-1650 dialysis days in our series. Complications of this access could be acute: wire embolism, subcutaneous hematoma, catheter misplacement, and long-term: air embolism, catheter embolism, catheter occlusion, central venous thrombosis and stenosis, catheter-related infection and specific for transhepatic route: massive intraperitoneal hemorrhage, perihepatic hematoma, hepatic arterial injury\(^8,14\). We had one catheter malposition that was resolved by repositioning in angio room. The repositioning was done under scopy control where the catheter tip was moved more distally, having previously been in contact with the atrial wall. One catheter thrombosis that was successfully resolved using thrombolitics. Alteplase thrombolysis was performed in a patient whose catheter 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 are 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 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, so far dialyzing 300 and 1650 days without complications. There was no infection, but the number of hospital days in patients with a transhepatic Hikman catheter was increased.

The Hemodialysis Reliable Outflow (HeRO) Graft is a permanent fully subcutaneous vascular access system for catheter-dependent patients and patients dialyzing with failing arteriovenous fistulas or arteriovenous grafts due to outflow stenosis. The HeRO system is another option and possibility in patients where there are 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. Performed an arterioarterial prosthetic loop (AAPL) on the upper or lower extremity, is another option, well described but is associated with significant complications. The femoral vein transposition and saphenous vein loop grafts was not possible due to iliac vein thrombosis that all patients have had as a result of long-term presence of femoral dialysis catheters, frequent punctures and infections.

**Conclusion**

Arterio-venous fistularemains the gold standard to vascular approach for hemodialysis. Asa last resort transhepatic catheter could be used to extend the time on hemodialysis. The 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 haemodialysis catheters when other venous accesses are exhausted, and when it is performed by a well-trained team.

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| Number | Gender | Age | Duration on hemodyalysis before transhepatic access (years) | Duration of transhepatic access use (days) | Complications / Intervention |
|--------|--------|-----|-----------------------------------------------------------|-------------------------------------------|-----------------------------|
| 1.     | Female | 65  | 8                                                         | 1650                                      | Hemathoma, malpositio       |
| 2.     | Female | 69  | 6                                                         | 959                                       | Malpostitio/repositio       |
| 3.     | Female | 71  | 15                                                        | 465                                       | Catheter thrombosis/Thrombolysis |
| 4.     | Female | 76  | 11                                                        | 300                                       | Malposition                 |

Table 1. gender, age, duration of access use, complications, etc.

Figure 1. Thrombosed left (a), and right (b) iliac and femoral vein.

Source: Authors
Figure 2. Thrombosed right jugular (a) and left subclavian vein (b) with thrombosis inferior cava vein
Source: Authors.

Figure 3. Merit Mak Medical system for liver puncture; 6Fr, 20cm and Arrow 15Fr Tip to Cuff 27cm catheter for hemodialysis
Source: Authors
Figure 4. Ultrasound mapping right hepatic vein, guide wire in right atrium

Source: Authors

Figure 5. Dilatation, introducer sheet, catheter

Source: Authors

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