VASCULAR ACCES IN THE PATIENTS TREATED WITH CHRONIC HEMODIALYSIS FOR 30 YEARS OR MORE: SINGLE CENTER EXPERIENCE

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ABSTRACT

Objectives. The aim of our report is to present vascular access in patients treated by chronic hemodialysis for ≥30 years at our dialysis center. **Materials and methods.** In April 2007 seven patients were alive, treated at our center by chronic hemodialysis for ≥30 years (mean 32±1.7 years, maximum 34 years and 2 months). There were 3 men and 4 women, median age 65 years (range 45-83). Primary renal disease: chronic glomerulonephritis in 4, analgesic nephropathy in one, reflux nephropathy in one and lupus nephritis in one. None had dibetes. In two of them kidney transplantation was performed, in one graft never functioned, in the other graft functioned for 16 months. 2/7 are dialyzed 4 times a week (five of them 3 times a week), two by acetate-free biofiltration, one by hemodiafitration, and four by bicarbonate hemodialysis with ultrapure dialysis fluid. Reuse was never used in our center or in Slovenia. Body weight of the patients is 53.4±10.8 kg, average weekly time on dialysis is 14.7±2.5 hours (range 12-19 hours), dialyzers are high-flux synthetic with steam sterilization. **Results.** Vascular access in 5/7 patients is native forearm arteriovenous fistula, in three on left side and in two on right side. One patient has her primary AV fistula still in function for 34 years (without salvage procedure). The other started HD with AV shunt on the left leg (for 1 year), after that forearm AV fistula was constructed, still in function after 29 years. In 3 patients (one of them also started HD with shunt)

salvage procedures were performed (thrombectomy and reanastomosis), in two of them new AV fistula was constructed on the other forearm, in the third reconstructed primary AV fistula is still in use. In the last 2/7 patients the present vascular access is temporary single lumen precurved jugular hemodialysis catheter, precurved (for the last 4,5 and 3,5 years, respectively), locked with citrate in interdialysis period (4% or 30%). Mupirocin is applied at exit site. The catheters are exchanged by guide-wire if mechanical damage occurs (approximately once per year). None of these two patients had catheter-related sepsis or exit site infection. One is dialyzed in single-needle dialysis mode (19 hours per week, 4 HD sessions), in the other the catheter is used as the »artery« and the blood is returned on the peripheral vein on the leg. Before catheters one patient had native AV fistula for 15 years, and 4 PTFE grafts (3 on thigh), functioning for 1.5, 3 and 5 years. The other patient had two native AV fistulas, functioning for 3 and 15 years, and one arm PTFE graft, functioning 7 years. **Conclusion.** The majority of the long-term survivors on chronic hemodialysis have native AV fistula. However, more than 30 years of survival is possible with the combined use of native AV fistula, PTFE graft and nonccuffed precurved jugular single lumen catheter, locked with citrate, with mupirocin applied at exit site, and used as permanent vascular access.

INTRODUCTION

Long-term hemodialysis survivors are the living evidence of the goals, limits and achievements of hemodialysis therapy. Data from Japanese dialysis registry on 31 December 2004 report on 4012 patients treated by chronic hemodialysis for more than 25 years and another 4999 patients treated for 20-25 years (1). Two patients treated by chronic hemodialysis for 35 years were recently reported by Kurkus et al (2). A serie of 188 renal replacement therapy (RRT) patients treated for 20 or more years, was reported from the Piemonte region in Northern Italy. They found the prevalence of the patients treated by RRT for 20 years or more was approximately 3% of all RRT patients (3).

Vascular access is of crucial importance for performing chronic hemodialysis. There is a wide consensus that native arteriovenous fistula is the best vascular access, although there are wide varioations in prevalence of AV fistula usage in different countries (4).

The aim of our report is to present the actual vascular access and vascular access history in patients treated by chronic hemodialysis for 30 years or more at our dialysis center.

PATIENTS AND METHODS

In April 2007 seven patients were alive, treated at our center by chronic hemodialysis for 30 years or more (mean 32±1,7 years, maximum 34 years and 3 months). There were 3 men and 4 women, median age 65 years (range 45-83). Primary renal disease: chronic glomerulonephritis in 4, analgesic nephropathy in one, reflux nephropathy in one and lupus nephritis in one. None had dibetes. In two of them kidney transplantation was performed, in one graft never functioned, in the other graft functioned for 16 months. 2/7 are dialyzed 4 times a week (five of them 3 times a week), two by acetate-free biofiltration, one by hemodiafiltration and four by bicarbonate hemodialysis with ultrapure dialysis fluid. Reuse was never practised in the center or in Slovenia. Body weight of the patients is 53.4±10.8 kg, average weekly time on dialysis is 14.7±2.5 hours (range 12-19 hours), dialyzers are high-flux synthetic with steam sterilization.

RESULTS

Vascular access in 5/7 patients is native forearm arteriovenous fistula, in three on left side and in two on the right side. One patient has her primary AV fistula still in function for 34 years and 3 months (without

salvage procedure). The other started HD with AV shunt on the left leg (for 1 year), after that forearm AV fistula was constructed, still in function after 29 years. In 3 patients (one of them also started HD with shunt) salvage procedures were performed (thrombectomy and reanastomosis), in two of them new AV fistula was constructed on the other forearm, in the third reconstructed primary AV fistula is still in use. In the last 2/7 patients the present vascular access is temporary single lumen precurved jugular hemodialysis catheter, precurved (for the last 4.5 and 3.5 years, respectively), locked with citrate in interdialysis period (4% or 30%). Mupirocin is applied at exit site. The catheters are exchanged by guide-wire if mechanical damage occurs (approximately once per year). None of these two patients had catheter-related sepsis or exit site infection. One is dialyzed in single-needle dialysis mode (19 hours per week, 4 HD sessions), in the other the catheter is used as the »artery« and the blood is returned on the peripheral vein on the leg. Before catheters one patient had native AV fistula for 15 years, and 4 polytetrafluoroethylene (PTFE) grafts (3 on thigh), functioning for 1.5, 3 and 5 years. The other patient had two native AV fistulas, functioning for 3 and 15 years, and one arm PTFE graft, functioning 7 years.

Detailed data on individual patients are presented bellow.

Patient No 1. 45-year old male, BW 66 kg, chronic hemodialysis was started because of chronic sclerosant mesangioproliferative glomerulonepritis, at the age of 15 years. This same year binephrectomy was performed because of malignant hypertension. Present vascular access in right forearm AV fistula. He has started hemodialysis with AV shunt on the left leg for 6 months, after that he had native forearm left AV fistula, that functioned for 15 years. In 1991 cadaveric kidney transplantation was performed, graft never functioned because of thrombosis and was explanted after 2 weeks from transplantation. He refused transplantation thereafter. In 1993 right forearm AV fistula was constructed (after failure of left forearm AV fistula), that thrombosed in 1997. Simple thrombectomy was performed,

resulting in immediate rethrombosis. Thrombectomy with reanastomosis was performed after that sucessfully, and this AV fistula is still in excellent function.

Hemodialysis prescription in April 2007: acetate-free biofiltration, 3 x 5.5 hours a week, postdilutional infusion of Biosol 145 (Hospal-Gambro, Lund, Sweden) of 2.8 l/hour, dialyzer FX100 (Fresenius, BadHomburg, Germany), blood flow 300 ml/min, anticoagulation Fraxiparine 0.4+0.3 ml, Eprex 3x2000 u/week i.v.

Patient No 2. 56-ear old male, BW 56 kg, chronic hemodialysis was started because of reflux nephropathy at the age of 23. He is hepatitis B and hepatitis C virus positive. Present vascular access is single-lumen precurved right jugular catheter, he is dialyzed in single-needle mode. His first vascular access was native left forearm AV fistula functioning for 15 years, after that he had left forearm PTFE graft in function for 5 years. It was extracted because of the infection. He had PTFE graft on both arms that never functioned. After that he had PTFE graft on right thigh in function for 5 years, than on left thigh in function of 3 years, than another graft on right thigh in function for 1.5 years. For the last 3.5 years he has single-lumen precurved right jugular non-cuffed hemodialysis catheter (Medcomp, Harleysville, PA, USA) that was replaced over guidewire once in this 3.5 years, because of the mechanical damage. The catheter is locked with 4% citrate in interdialysis period, mupirocin is applied on exit site.

Hemodialysis prescription in April 2007: bicarbonate hemodialysis (ultrapure dialysate), four times a week (3x4 hours and once 5 hours), dialyzer FX80 (Fresenius, BadHomburg, Germany), single-needle dialysis mode with blood flow 300 ml/min, heparin 1500/1000 iu/hour, Eprex 3x1000 u/week i.v.

Patient No 3. 57-year old female, BW 51.5 kg, chronic dialysis (she started with peritoenal dialysis and was transferred to hemodialysis after 4 months) at the age of 25 years, because of lupus nephritis. Present vascular access is right forearm AV fistula. She started hemodialysis with left forearm AV fistula that functioned for 21 years when aneurysm had to be extirpated because of rupture possibility. Right forearm AV fistula was created and is functioning today.

Hemodialysis prescription in April 2007: postdilutional hemodiafiltration 3x4 hours/week, dialyzer FX80 (Fresenius, BadHomburg, Germany), blood flow 250 ml/min, heparin 750/750 iu/hour, Eprex 3x2000 u i.v./week.

Patient No 4. 65-years old female, BW 59 kg, chronic hemodialysis was started on 24 January 1973 at the age of 31, because of chronic glomerulonephritis. Left forearm AV fistula was the first and is the present vascular access, without salvage procedures.

Hemodialysis precription in April 2007: bicarbonate hemodialysis (ultrapure dialysate), 3x5 hours/week, dialyzer FX80 (Fresenius, BadHomburg, Germany), blood flow 280 ml/min, heparin 1500/1250 iu/hour, Eprex 2x2000 u/week i.v.

Patient No 5. 72-year old male, BW 58 kg, chronic hemodialysis was started at the age of 41 years, because of chronic glomerulonephritis. He is Hepatitis B virus (HBsAg) positive. His present vascular access (for the last 4.5 years) is single lumen precurved right jugular noncuffed catheter (as the artery), the blood is returned in peripheral vein on leg (right and left, interchangebly). His first vascular access was left forearm AV fistula, that functioned for 3 years and thrombosed after cadaveric kidney transplantation. Kidney graft functioned for 16 months and he was returned to hemodialysis. Right forearm AV fistula was created that functioned for 15 years. After that he had arm PTFE graft that functioned for 7 years. Thigh PTFE graft was never created because of peripheral artery disease. His jugular noncuffed catheter, that is in use for 4.5 years, was changed over the guidewire 4 times, twice because of mechanical damage, once because of possibility of sepsis (that was not proved) and once for undefined reason.

Hemodialysis prescription in April 2007: bicarbonate hemodialysis (ultrapure dialysate), 3x4.5 hours/week, dialyzer PF210H (Gambro, Lund, Sweden), blood flow 230 ml/min, heparin 750/750 iu/hour, Aranesp 30 mcg/10 days i.v.

Patient No 6.78-year old female, BW 52 kg, hemodialysis was started at the age of 48 years, because of analgesic nephropathy. Her present vascular access is the left forearm AV fistula, that functions for

29 years. Her first vascular access was AV shunt on the left leg, that functioned for one year. After being on chronic hemodialysis for 4.5 years, she stopped hemodialysis for 5 years because of partial improvement in renal function and then started hemodialysis again until today.

Hemodialysis prescription in April 2007: bicarbonate hemodialysis (ultrapure dialysate), 3x4 hours/week, dialyzer FX80 (Fresenius, BadHomburg, Germany), blood flow 300 ml/min, Fraxiparine 0.6 ml, Eprex 1000 u/week i.v.

Patient No 7. 83-year old female, BW 31.5 kg, hemodialysis was started at the age of 50, because of chronic glomerulonephritis. She had left forearm AV fistula created one year before the start of hemodialysis. It functioned for 29 years until thrombosis occurred. Surgical thrombectomy was performed twice, on two consecutive days, fistula functioned for 3 weeks and thromosed again. Than thirt thrombectomy was performed, with reanastomosis, and this fistula is still in function today.

Hemodialysis prescription in April 2007: acetate free bifiltration, 4 times a week, 3x4 hours and 1x 3.5 hours, infusate Biosol 145 postdilutionally 2.0 l/h, dialyzer FX60 (Fresenius, BadHomburg, Germany), blood flow 250 ml/min, heparin 250/250 iu/hour, no epoetin therapy.

In Dialysis Center Zaloška there are two additional patients, being treated by chronic hemodialysis for 29 years, 66-year old female and 60-year old male, both started hemodialysis because of chronic glomerulonephritis. Both are currently dialyzed through thigh PTFE graft, after multiple native AV fistula and PTFE grafts on forearms and arms.

The diabetic patients with the longest duration on chronic hemodialysis in Dialysis Center Zaloška is 52-year old female, being treated by chronic hemodialysis for 22 years. After failure of multiple AV fistula and PTFE grafts on arms and forearms and thigh PTFE graft her present vascular access (for the almost last 10 years) is single-lumen precurved right jugular noncuffed catheter, locked with citrate, with

mupirocin applied at exit site, used as the artery (blood flow 250 ml/min), with the blood being returned on left basilic forearm vein for years.

DISCUSSION

The majority of long-term (≥30 years) hemodialysis survivors have native AV fistula as vascular access, some of them reconstructed after thrombosis to prolong their use (5). However, native AV fistula is not a necessary condition for long-term survival on hemodialysis. PTFE grafts and non-cuffed catheters precurved jugular catheters, locked with citrate, and used as long-term vascular access, can significantly contribute to prolongation of hemodialysis therapy into decades, after failure of AV fistula.

Nephrologists at our center have taken care of vascular access: construction and reconstruction of AV fistula and graft and insertion of hemodialysis catheters. From mid-ninetees ultrasonography examination of vascular access was introduced at our center (preoperative mapping, ultrasonography of dysfunctional and failed AV fistula and graft).

Citrate locking for all hemodialysis catheters in our center was introduced in 1994 (6). In addition to avoid systemic anticoagulation citrate has antimicrobial effect and we believe that is the important factor contributing to the opportunity of long-term use of non-cuffed precurved jugular catheter (7). Mupirocin at exit site can have beneficial antimicrobial as well as lubricating effect (8). Catheter nursing care is, of course, of critical importance.

Long functioning time for PTFE grafts was achieved in selected patients. In our 65-year old female patient treated by chronic hemodialysis for 29 years, straight arm PTFE graft was in function for 15 years, without intervention.On ultrasonography examination the disappearance of complete upper part

(wall) of the graft was observed after 10 years in function, without obvious psevdoanevrysms (9). Her present thigh PTFE grafts is in excellent function for 5 years without intervention. In other long-term functioning PTFE grafts we have observed (by ultrasonography) small to moderate graft defects, usually on the puncturing sites, frequently causing psevdoanevrysms, that are used as puncture sites for years (9).

In conclusion, the majority of our long-term (≥30 years) survivors on chronic hemodialysis have native AV fistula. However, more than 30 years of survival on hemodialysis is possible with the combined (subsequent) use of native AV fistula, PTFE graft and non-cuffed precurved jugular single lumen catheter, locked with citrate (with mupirocin applied at exit site) and used as permanent vascular access. Salvage of thrombosed AV fistula significantly prolonged its use in some patients.

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