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Research Article

OUTCOME OF TUNNELED CATHETERS IN HEMODIALYSIS PATIENTS: FIVE YEARS SINGLE CENTER EXPERIENCE

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ABSTRACT

Introduction: The tunneled hemodialysis catheters(THCs) are preferred for the patients who are expected to poor survival and the attempts to arteriovenous fistulas (AVF) are failure. In our study,in hemodialysis patients who are implemented tunneled catheter it is evaluated the mean duration for the catheters , their complications and the factors which affect the period of the catheters.

Methods: At the Antalya Research and Education Center Hemodialysis Unit it is retrospectively evaluated the data of 297 hemodialysis patients who are implemented tunneled catheter during 5 years .

Results: The mean duration time of the tunneled catheters has been 224.9+162.9 days. The duration time of right internal jugular vein(RIJV) is considerably higher than left internal jugular vein(LIJV) and subclavian veins (235.8+96.6 days). In diabetic hemodialysis patients, the duration time of the catheter is rather lower than the other end stage renal disease reasons(184.4±72.1 days).

Conclusions: THCs must be considered as an alternative but not a permanent vascular access in hemodialysis patients. Because of relatively short duration times than AVF, high infection risks and thrombosis , it must be used only in patients who have problems with the creating permanent vascular access or patients with expected low survival time. Moreover, it must be taken into consideration the duration time of the catheter is low in diabetic hemodialysis patients. According to our results, catheter duration time was longer in RIJV than in other insertion sites and RIJV must be preferred as first place to placement of THCs.

INTRODUCTION

Adequate care of hemodialysis patients requires vascular access (VA) that delivers a sufficient blood flow rate, good long term patency, and a low complication rate. Currently, arteriovenous fistula (AVF) is the best approach for a long term care of these patients (1). Due to the increase in the number of elderly patients with end stage renal disease (ESRD), especially diabetics referred for hemodialysis therapy and increased survival on dialysis, VA associated morbidity and mortality problems have become an important issue. (2). Vascular access problems, especially primary AVF failure, insufficient blood flow rates, and fistula thrombosis in elderly and diabetic patients now account for a large proportion of renal unit admissions and increasing cost (3-4). Patients with vessels who are unsuitable for AVF or arteriovenous grafts (AVG) need another vascular access route. Currently, cuffed and tunneled central venous catheters (THCs) are increasingly being used for patients with VA problems. THCs have some advantages for VA such as the ability to insert at multiple sites, venipuncture and maturation time not required, and a long term use is possible(5). But THCs also have many disadvantages like higher incidence of infection, thrombosis, and insufficient blood flow rate than AVF (6). In addition, risk of central vein occlusion and stenosis are important complications of THCs(7). During five years followed up, we performed 424 THCs in patients whom AVF or AVG have not been created due to various factors. The outcomes and complications of the THCs have been recorded before in all patients. We retrospectively analysed these hospital records to assess mean duration period, factors that implicate patency rates and complications of THCs in our hemodialysis patients .

PATIENTS AND METHODS

Patients:

During five year followed up period (from January 2004 to January 2009), 424 THCs placed in 297 patients were retrospectively analyzed at the Antalya Research and Education Center Hemodialysis Unit. Data were obtained from the hospital hemodialysis records. End stage renal disease etiologies, reasons of THCs for vascular access preference, insertion sites, duration time, early and late complications, and the factors which influence these paramethers were analyzed. THCs placed in patients whom other VA modalities were unavailable or failed, and patients with poor survival (advanced congestive heart failure or malignancies). Causes of ESRD in patients were shown in Table 1. Catheter insertion localizations were right internal jugular vein(RIJV), left internal jugular vein(LIJV), right subclavian vein(RSV), and left subclavian vein(LSV). Femoral vein was not preferred site for THC insertion in our clinic. Hemorrhagie, insufficient flow rate, hemothorax, pneumothorax, and hematoma were recorded as early complications; THC occlusion, insufficient blood flow rate(<200 ml/min), and infections were recorded as late complications. Causes of catheter removal were recorded as occlusion or low blood flow rate, creating new AVF or AVG, patient transfer to other treatment modalities (such as peritoneal dialysis and transplantation), infections , and patient death.

Cause	N	%
Diabetes mellitus	166	39.0
Hypertension	105	24.8
Unknown	39	9.2
Chronic Glomerulonepritis	40	9.4
Chronic Pyelonephritis	13	3.1
Obstructive Nephropathy	21	5.0
Secondary Amyloidosis	9	2.1
Multiple myeloma	5	1.2
Polycystic Kidney	22	5.0
Others	4	0.9

Table 1: Causes of ESRD

The catheter:

The same catheter (Medcomp 12.5 Fx28cm hemocath silicone double lumen catheters set with Dacron cuffs) were used in all patients. All catheters were placed by the same two nephrologists with local anesthesia without performing an ultrasound in the hemodialysis unit. Chest X-Ray was performed on all patients after catheter placement. Catheters were followed up by the trained nurses. After each hemodialysis session, THC lumens were flushed with 10 ml sterile saline solution and then were locked using pure heparin 1.3 ml for arterial lumen and 1.4 ml for venous lumen. RIJV was chosen as the first preference for catheter insertion. LIJV, LSV, RSV were respectively preferred when the RIJV was unsuitable for catheter insertion. Anticoagulant or anti-thrombotic agents were not used in patients with THCs for any reason.

Statistical analysis:

All statistical analysis was performed by SPSS for Windows software (SPSS, Chicago, IL). Continuous variables were compared by ANOVA, Wilcoxon rank-sum and the categorical variables were compared by chi-square analysis. Results were expressed as mean ± standard deviation (SD). P values < 0.05 were regarded as statistically significant.

RESULTS

Altogether, 297 patients with end stage renal disease receiving regular hemodialysis therapy with tunneled catheter, included in this retrospective study (161 men, 136 women; mean age 61.6+14.3 years ; range , 15 and 90 years). The causes of ESRD were diabetic nephropathy (39.2%), hypertension (24.8%), chronic glomerulonephritis (9.4%), and other diseases (9.2%) (Table 1). Total 424 THCs were performed because of unsuitable vessels for AVF in 196 (46.2%) , failed AVF or AVG in 118 (27.8%) , and maintaining initial vascular access in 110 (25.9%) catheter insertion. In 297 (70%) of patients catheterization was

performed once, in 75 (17.5%) patients it was performed twice, in 34 patients three times, and in 19 patients four or more times. The site of THC placement was RIJV in 268 (63.2%) , LIJV 99 (23.3%) , RSV in 38 (9%) , and LSV in 19 (4.5%) patients (Table 3).

When complications were assessed, the most frequent both early and late complication was insufficient flow rate (blood flow < 200 ml/min); 2.1% and 13% respectively (Table 2). No patient deaths were observed during the catheter insertion.

Early Complications	**Frequency**
Hemorrhage	6(1.4%)
Insufficient flow rate	9(2.1%)
Hemotorax	2(0.5%)
Pneumothorax	2(0.5%)
Hematoma	1(0.2%)
Late Complications	
Occlusion	25(5.9%)
Insufficient flow rate	55(13%)
Infection	38 (9%)

Table 2: Early and Late Complications

Localization	**N(%)**	**Early Complications**	**Late Complications**
RIJV	268 (63.2%)	8 (2.98%)	56 (20.8%)
LIJV	99 (23.3%)	5 (5.5%)	33 (33.3%)
RSV	38 (9%)	6 (15%)	17 (44.7%)
LSV	19 (4.5%)	1 (5.2%)	12 (63.1%)
Total	424 (100%)	20 (100%)	118 (100%)

Table 3: Complications according to catheter localizations

RIJV; Right internal Jugular vein, LIJV; Left internal jugular vein, RSV; Right subclavian vein, LSV; Left subclavian vein.

Early complications were observed in 20 catheters and complication rates were not statistically significant ($p>0.05$) at different catheter placement sites(Table 3). Late complications were observed in 118 catheters and late complications were more frequent in subclavian vein placements than in jugular vein placements ($p<0.05$), (Table 3).

The mean catheter duration time was 229.9±162.9 days (range 10-1230 days). The shortest catheter duration time was found in diabetic ESRD patients (184.4±72.1 days) compared with the other causes of ESRD ($p<0.05$). THCs duration times were 235.80±90.6 days in hypertensive ESRD patients, 256.76±86.6

days in chronic glomerulonephritis and 240.40±66.6 days in other ESRD causes.

The estimated THCs survival rates were at 6 months 82.2%, at 1 year 76.3%, at 2 years 50% , at 3 years %32, at 4 years 12% (Figure 1). At the end of the study, 71 catheters (16.8%) were still functioning.

The mean catheter duration time was 235.80±96.6 days in RIJV, 226.8±128.8 days in the LIJV, 179.1±30 days in the RSV , and 150±24.15 days in the LSV placement. When catheter duration times were compared according to placement sites, the difference was significant ($p<0.05$). The longest duration period was found to be in the RIJV placement and the shortest survival was in the LSV localization.

Early complication rates were similar in terms of the causes of end-stage renal disease, whereas all late complications were significantly more frequent in diabetic patients ($p<0.05$). Late complications such as occlusion, insufficient flow rate, and infections were observed in 8, 41, and 25 diabetic patients respectively (Table 4).

Cause	N (%)	IFR	Occ.	Infection	Total
Diabetes mellitus	166(39)	8	41	25	74(44.5%)
Hypertension	105 (24.8)	11	11	5	27(25.7%)
Unknown	39 (9.2)	0	1	3	4(12%)
Chronic	40 (9.4)	1	0	1	2(5%)
Glomerulonephritis	13 (3.1)	0	0	0	0
Chronic Pyelonephritis	21 (5)	1	1	1	3(14%)
Obstructive	9 (2.1)	2	1	0	3(33%)
Secondary Amyloidosis	5 (1.2)	0	0	3	3(60%)
Multiple myeloma	22 (5)	2	0	0	2(9.09%)
Polycystic Kidney	4 (0.9)	0	0	0	0
Others					
Total	424	25	55	38	118

Table 4: Late complications associated with causes of ESRD

IFR: Insufficient flow rate, O; Occlusion

Total 38 catheter related to infections were observed ; because of retrospective evaluation of the datas, we only recorded infections that needed catheters removal. 2 exit site infections, 8 tunnel infections, 12 catheter related to bacteriemia and 4 patients died because of septicemia. Staphylococcus epidermitis (22 cases) and Staphylococcus aureus (12 cases) were the bacteria most frequently isolated .

The most frequent indications for THCs removal were patient death in 87 (24.6%), creating new AVF or AVG in 83 (23.5%), occlusion and insufficient flow rate due to thrombosis fibrin sheath formation in 80 (22.6%) patients (Table 5).

Cause	N (%)
Occlusion and insufficient flow rate	80 (22.6%)
Conversion to AVF or AVG	83 (23.5%)
Patient death	87 (24.6%)
Peritoneal dialysis	36 (10.1%)
Transplantation	33 (9.3%)
Infection	38 (9.0%)
Dialysis withdrawal	4 (1.1%)
Total	353 (83.2%)

Table 5: Causes of catheter removal

* At the end of the study 71 catheter (16.8%) were still functioning

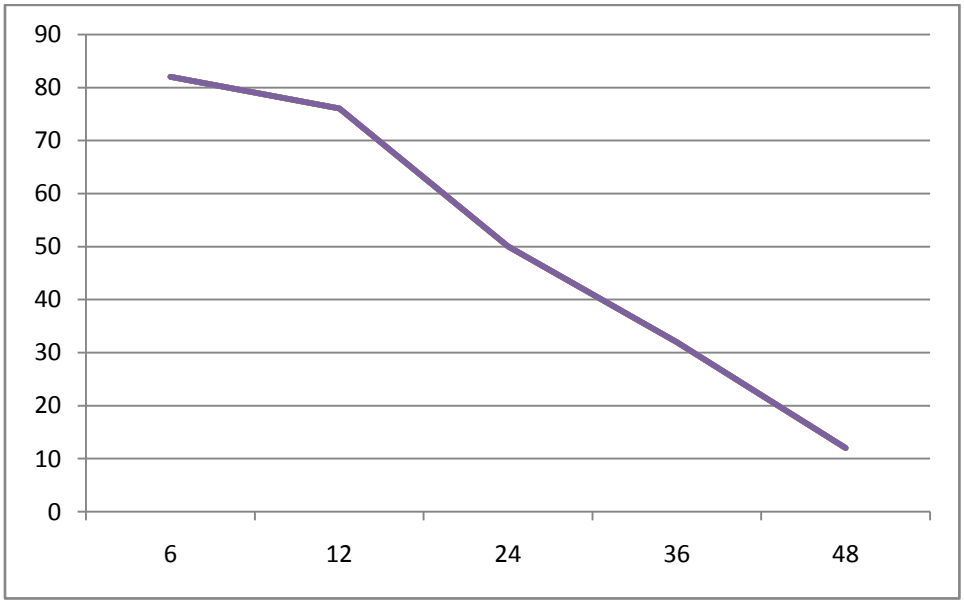

Figure 1: Catheter survival rates(%) in months

DISCUSSION

Although the guidelines strongly recommends the AVF as an access of first choice, it was confirmed that there is an rising trend toward hemodialysis catheter use in patients with ESRD (1, 8, 9). Recent data have indicated that over 70% of the patients with end-stage renal disease initiate dialysis with a catheter. Additionally, up to 27% of the end-stage renal disease patients in the United States are using THCs as their permanent access, with placement rates having doubled since 1996 (21). The type of vascular access at the first dialysis treatment is used as a marker of predialysis care (10). Late referrals of patients to nephrologists

have 3.6-fold increased risk of starting dialysis therapy with catheters , and are probably the most important reason of catheter usage(11). Hemodialysis catheters are preferred in late referrals because of its advantages of being technically simple to insert and permitting immediate access to the vascular system. THCs are superior than non-tunneled catheters comparing them in view of low infection risk and long duration time(12).

In recent studies, THCs duration times were found 345 days(18), 86 days (19), 310 days(20) and 289 days(14). In our study mean duration time was 229 days comparable with other studies. We have found the estimated catheter survival rates were at 6 months 82.2%, at 1 year 76.3%, at 2 years 50% , at 3 years %32, at 4 years 12% (Figure 1). Ervo S et al. also have found similar results for catheter survival rates at 1 year was 82%, at 2 years 56%, at 3 years 42% and at 4 years 20%. (18) . The catheter duration time was found shorter in diabetic ESRD patients (184.4±72.1 days) than other ESRD causes. The presence of diabetes mellitus was significantly related with occlusion and insufficient flow rate as reported previously (7,13). Using THCs in diabetic patients may be limited because short duration times, so that other forms of permanent VA should be sought.

The localization of the catheter into RIJV results in significantly better survival as compared with other insertion sites. The mean catheter duration time was highest in RIJV (235.80±96.6 days) and lowest in the LSV placement(150±24.15 days). When catheter duration times were compared according to placement sites, the difference was significant ($p<0.05$). Similarly Develter W. et al. have showed that RIJV placement has better catheter duration times (mean survival of 650 days in RIJV compared to a mean survival of 519 days in other sites) (20). Maya ID. also have showed that the primary catheter patency (time from placement to exchange) was substantially shorter for femoral catheters than for internal jugular dialysis catheters (22). The possible advantage of placing RIJV catheters over other sites is that doing so may function to preserve better the left-sided vasculature in general, and in particular, when future left-sided access is planned(23).

When complications were assessed, we have found that the most frequent both early and late complications were insufficient flow rate (blood flow < 200 ml/min); 2.1% and 13% respectively (Table 2). Early complications were observed in 20 (4.7%) and late complications were observed in 118 (27.8%) catheters in our study(Table 3). Former studies have shown that early complication rates (hemorrhagia, hematoma, pneumothorax, hemothorax and primary non-function due to wrong catheter tip placement) were between 2% to 11.9% (24-29). An important late complication that affects catheter duration times is occlusion due to thrombosis and fibrin sheath formation. In previous studies, thrombosis and fibrin sheath formation rates were between 7%-12% of THCs(24-29). Our late complication rates seem to be high (%27.8) when compared previous studies. In these studies anti-thrombotic agents were used when catheter occlusion and low blood flow began. We could not use these agents because of insurance payment problems for these indications.

THCs related infection is another important complication that affects catheter duration time and patient's mortality. Previous studies have shown that the total incidence of THC related infections was 0.18-

0.82 episodes per 100 catheters-days and total infection rates were 10.2% to 25% (14, 19, 26,28,30,31,32). In our study these findings were; 0.38 episodes per 100 catheter-days and total infection rate 9.0% . In diabetic hemodialysis patients catheter related infection rates were found significantly high(15%). Since the hospital records were analysed retrospectively, the datas were not sufficient to determine the overall catheter related infections. Only the ones, that caused catheter removal, could be obtained. The strict preventive protocol, we used to follow up the patients with THCs, also may explain the comparable lower rate with the studies reported previously.

The most frequent reason of THCs removal was patient death (24.6%) in our study. Cetinkaya et al. also reported the most frequent reason of THCs removal as patient death (69.4%) (14). Compared to their study, the difference is probably due to the patient population chosen for the THCs placement. In that study, THCs were inserted in patients where other VA modalities were unavailable or had failed on multiple attempts to creating permanent VA and ones with advanced congestive heart failure or malignancies. In addition to these reasons, we placed THCs in patients awaiting living-related kidney donor transplantation or maturation of an AVF . The second reason of THCs removal in our study was conversion from catheter to either fistula or graft (23.5%). In recent studies, it was reported that the conversion of catheters to arteriovenous accesses, preferably fistulas, is associated with improved survival (15-17). In hemodialysis, vascular access type is significantly associated with patient survival. The use of a central venous catheter(CVC) is associated with a substantially greater risk of sepsis, hospitalization, and mortality when compared with the use of an AVF or an AVG (33-35). In other recent study , Pearl J et al. have identified 40,526 incident adult dialysis patients from the Canadian Organ Replacement Register (from 2001 to 2008). Compared with the 7412 peritoneal dialysis patients, 1-year mortality was similar for the 6663 hemodialysis AVF/AVG patients but was 80% higher for the 24,437 hemodialysis CVC patients. During the entire period of follow-up, hemodialysis AVF/AVG patients had a lower risk for death, and hemodialysis CVC patients had a higher risk for death compared with patients on peritoneal dialysis(36).

CONCLUSION

THCs must be considered as an alternative but not a permanent vascular access in hemodialysis patients. Because of relatively short duration times than AVF, high infection risks and thrombosis , it must be used only in patients who have problems with the creating permanent vascular access, patient that needs maturation time for AVF or patients with expected low survival time. Moreover, it must be taken into consideration the duration time of the catheter is low in diabetic hemodialysis patients. According to our results, catheter duration time was longer in RIJV than in other insertion sites and RIJV must be preferred as first place to placement of THCs.

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