Temporary Access Catheter for Hemodialysis Complications and Follow up

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Objective: To determine the acute and chronic complications of temporary access catheter insertion for hemodialysis.

Design; Cross-sectional study.

Place and duration of the study: This was a hospital based study carried out in the hemodialysis unit of Shalamar Hospital, Lahore. This study was conducted from June 2003 to December 2005.

Subjects and Methods: All patients who presented for hemodialysis were included in the study and who were not fit were excluded from the study. Location of the catheters was subclavian vein, internal jugular and femoral vein. Acute complications were noted at the time of insertion of catheter. Patients were followed up for three months for long term complications. A blood sample was drawn for routine hematological and biochemical work up on presentation.

Results: A total of 177 patients were enrolled in the study who presented for hemodialysis. 227 temporary double lumen dialysis catheters were passed in these patients. Most common cause of catheter insertion was diabetic nephropathy followed by chronic glomerulonephritis. Acute complications were at the rate of arterial puncture 9 (4%), hematoma 1 (0.4%) and pneumothorax 1 (0.4%). Complications during hemodialysis were, fever at the rate of 19 (8.4%), hypotension 7 (3.1%), blood flow problem6 (2.6%) and miscellaneous 3 (1.2%). Mean duration of catheter insertion was 5 weeks and dialysis sessions were 9.5. Among late complications infection were at the rate of 27 (11.9 %), vascular stenosis 5 (2.2%) and thrombosis 3 (1.3%).

Conclusion: Complications at the time of catheter insertion are minimal even it is done blindly. Infections are most common late complication and complication during dialysis. Temporary access catheter insertion is very simple and free of life threatening complications .It is readily used on emergency basis when there is no permanent access for dialysis.

Key Words: Temporary access catheter, hemodialysis, complications.

After developing renal failure, there is accumulation of uremic toxin in the patient body. These uremic toxins effect in different ways on the body. For the removal of these toxins dialysis is required. There are two types of dialysis i.e hemodialysis and peritoneal dialysis. For hemodialysis, central venous catheters are used as a secure access to central circulation. Central venous catheters are of temporary and permanent type. Temporary central catheters are used in acute renal failure and in chronic renal failure when there is no arteriovenous fistula and arteriovenous graft. Temporary access is established by percutaneous insertion of a catheter in to a large vein[1] like subclavian vein (SCV), internal jugular vein (IJV) and femoral vein (FV) .Among these veins, SCV was used as central access for first time in 1969[2]. According to DOQI guidelines, SCV is not recommended for routine use as catheter insertion because of long term complications like venous thrombosis and stenosis.[3,4] Femoral vein is the safest method of vascular access[5] and in some centers it is used as preferred site[6].

These catheters can be inserted blindly and under ultrasound guidance.[7,8] These catheters increase the catheter related complications including bacterimia and sepsis.[9-11] Sepsis is associated with very high mortality rate and hospitalization.[12-13]

Infection is also the second leading cause of death of persons receiving hemodialysis on long term basis[14]. Catheter use has also been associated with death from cardiac causes, suggesting it is a marker of co morbidity[15]. In our country there is very limited data on this subject, so this study was to determine the complications of temporary access catheter.

Material and Methods

This study was conducted at hemodialysis unit of Shalamar Hospital from June 2003 to December 2005. All patients who presented for hemodialysis whether suffering from acute or chronic renal failure were included in this study. Patients who were not fit for hemodialysis were excluded from the study.

Temporary access catheter was passed in right subclavian vein followed by right internal jugular vein and femoral vein priority wise after discussing and taking consent from patient. All the catheters were passed by consultant blindly by anatomic land mark technique. The position of catheter was confirmed by a chest radiograph. Each port of catheter was filled with heparin following insertion and after each dialysis session. Prophylactic antibiotic were not used for catheter infection prevention. Femoral catheter was passed in those patients who were unable to lie flat due to volume overload. The catheters used were Arrow Two-Lumen hemodialysis catheter. Blood sample was drawn at the same time for routine hematological and biochemical evaluation. Patients were followed for acute (at the time of insertion) and chronic complications of access catheter up to three

months. Patients who died before completing three months and lost to follow up were excluded from the study for long term complication.

Simple frequencies were calculated as shown in the table and results.

Results

In this study, one hundred and seventy seven patients were enrolled. Two hundred and twenty eight catheters were passed in these patients in two and half year. Among these patients, 186 (81.57%) were having one time catheter insertion and in 42 (18.41%) > two time catheter insertion was done. Most common cause of renal failure for catheter insertion was diabetic nephropathy as shown in Table 1.

Table 1: *Cause of renal failure n = 227.*

	Cause	n (%)
1	Diabetic Nephropathy	122 (53.7)
2	Chronic glomerulonephritis	39 (17.2)
3	Acute or Acute on Chronic renal failure	26 (11.4)
4	Obstructive Nephropathy	15 (6.6)
5	Hypertensive Nephropathy	14 (6.2)
6	Miscellaneous	11 (4.8)

Table 2: *Hematological, biochemical and viral markers of dialysis patients n = 227.*

	Parameter	n (%)
1	Haemoglobin (Hb) (bm/dl)	8.33 + 1.91
2	TotalLeukocyteCount (per c mm)	11088+4710
3	Blood urea (mg/dl)	246.86 + 96.67
4	Serum creatinine (mg/dl)	10 + 4.31
5	Serum potassium (meq/l)	4.96 + 0.9
6	Serum Albumin (gm/dl)	3.17 + 0.49
7	Serum Calcium (mg/dl)	7.74 + 0.87
8	Serum Phosphorus (mg/dl)	6.44 + 2.1
9	Hepatitis B surface Ag	
	Negative	225 (99.1%)
	Positive	1 (0.4%)
10	Anti HcV	
	Negative	174 (76.7%)
	Positive	53 (23.3%)

Gender distribution was almost equal in female 116 (51.1%) and male 111 (48.9%). Majority of patients were anemic Hb <10 gm/L 197 (86.78%) and hypoalbuminemic. Hepatitis C and B was negative in majority of patients as shown in Table 2. Temporary access catheter was passed in subclavian, internal jugular and femoral vein at rate of 126 (55.5%), 84 (37%) and 17 (7.51%) respectively. Acute complications were none in majority 216 (95.51%) of patients as shown in Table 3. Fever 19 (8.4%), blood flow problem 6 (2.6%) and hypotension 7 (3.1%) were major complications during dialysis. Major reason for removal of catheter was availability of parent access and death in 106 (45%) patients as shown in Table 4. Duration of dialysis catheter was 37.14 days with range of 1-160 days. Mean hemodialysis sessions were 9.56 + 9.26. 95 (41.9%) patients were followed up for three months for long term complication .Among chronic complication infection was at the rate of 27 (11.9%), vascular stenosis 5 (2.2%) and thrombosis 3 (1.3%) as shown in Table 3.

Table 3: *Acute and chronic complications of dialysis catheter.*

	Acute Complications n = 227 (100%)	n (%)
1	None	216(95.15%)
2	Arterial puncture	9 (4%)
3	Hematoma	1 (0.4%)
4	Pneumothorax	1 (0.4%)
	Chronic Complications = 95 (41.5%)	**n (%)**
1	None	60 (26.4)
2	Infection	27 (11.9)
3	Vascular Stenosis	5 (2.2)
4	Thrombosis	3 (1.3)

Table 4: *Reasons for removal of the catheter n = 175 (77.1%).*

1	Availability of parent access	58 (25)
2	Death	48 (21.1)
3	Recovery of renal function	33 (14.5)
4	Catheter related infection	19 (8.4)
5	Occlusion/dysfunction	9 (4)
6	Miscellaneous	8 (3.5)

Discussion

Hemodialysis catheters play an important role in the delivery of hemodialysis. The role of these catheters is as a bridge to the permanent access for hemodialysis patients. Recent advances in catheter technology, access techniques and choice of access site has improved outcomes associated with hemodioalysis catheters. According to Dialysis Outcome Quality Initiative (DOQI) guidelines,[16] internal jagular vein should be the preferred site for hemodialysis access. In this study the subclavian vein is used in majority of patients 125 (55.5%) like an other study in Pakistan by Kamran et al[17] in which subclavian vein was used in all patients. Major reason for this is non availability of precurved J-shaped catheters and when straight catheters are passed in IJ vein it stands about 10cm above the neck (as shown in figure 1).

This causes inconvenience in sleeping and neck movement in these patients. Along with that patients also feel uncomfortable while keeping that catheter out and bandage around the head and neck. Femoral vein was used only in 17 (7.5%) patients, who were unable to lie flat due to pulmonary oedema. This catheter was removed within one week after insertion according to DOQI guidelines[16]. Because according to a study by Oliver et al, bacteremia incidence was 1.9% one day after femoral vein catheter insertion, but increased to 13.4% by the second day if catheter was not removed[17].

Fig. 1:

Complications during insertion of catheter were none in most (95.5%) of the patients which were statistically significant (P Value = 0.0001). Acute complications were at the rate of 11 (4.8%), same to a study in Turkey[18] but much less then other study by Kamran et al.[19] There are a lot of reasons for such a low rate of complication in our center. One reason is that this procedure is done by the senior person of unit who is very much expert in this regard. The second reason is that amongst all patients who presented for hemodialysis, none of them have permanent vascular access so catheter insertion is done in all patients which increase our experience. Third reason is that in our dialysis center hemodialysis is preferred treatment modality as compared to peritoneal dialysis that is why this procedure of catheter insertion is done more frequently in our center. In acute complication arterial puncture was a major problem in 9 (4.0%) patients. Amongst these nine arterial punctures, five were in SCV and the rest were in IJ vein. The patients who developed arterial puncture were managed conservatively with local pressure bandage and no catastrophic complication had taken place. Other complication like hematoma and pneumothorax were also being managed conservatively. Therefore we conclude that central venous catheterization is a safe procedure even without the use of ultrasound guidance or cardiac monitoring.

Complications during dialysis were none in majority of patients which were statistically significant (P Value = 0.0001). Amongst complications during dialysis, fever was the most common followed by blood flow problem and hypotension. The fever was most probably due to line induced sepsis. This rate of infection is less than a study by Ponikwar et al.[20] The reason for this low rate of infection is that in our center technician usually perform dressing with pyodine on every dialysis session. The patients are not asked to do dressing themselves at home. Other complications during dialysis were blood flow problem and hypotension. Blood flow problem were due to either kinking of catheter or thrombosis. This may be due to quality of the catheter or superimposed infection.

Major reason for catheter removal was elective (availability of parent accent) which is also present by an other study (48%) by Adrian et al[21]. The other reasons of catheter removal were death 48 (21.1%) and recovery of renal functions 33 (14.55). Such a high rate of death in patients with renal failure is because of delayed initiation of dialysis. This delayed initiation is due to late referral to nephrologists and wrong concepts about treatment modality. According to a lot of studies delayed referral to nephrologists increases morbidity and mortality of dialysis patients.[22,23] Other reason for such a high rate of death may be because double lumen catheter is used as primary access for hemodialysis which increases mortality according to Van Waeleghen[24]. Catheter related infection can be life threatening and in different studies two thirds of the catheter will need to be removed.[25-6] But in this study only 19 (8.4%) catheters were removed due to infection.

Among the late complications, there were no complications in 60 (26.4%) which were statistically significant (P Value = 0.0001). Infections are the most common 27 (11.9%). This rate was in agreement with the results (20%) of Minshaway et al[27] but much less (39%) than the other studies done in Pakistan by Kamran et al[17] and R.A sheikh et al[28] in which it was 30%.According to DOQI guidelines[16] these uncuffed catheters are recommended for short term use i.e less than three weeks. In this study mean duration of

Fig. 2:

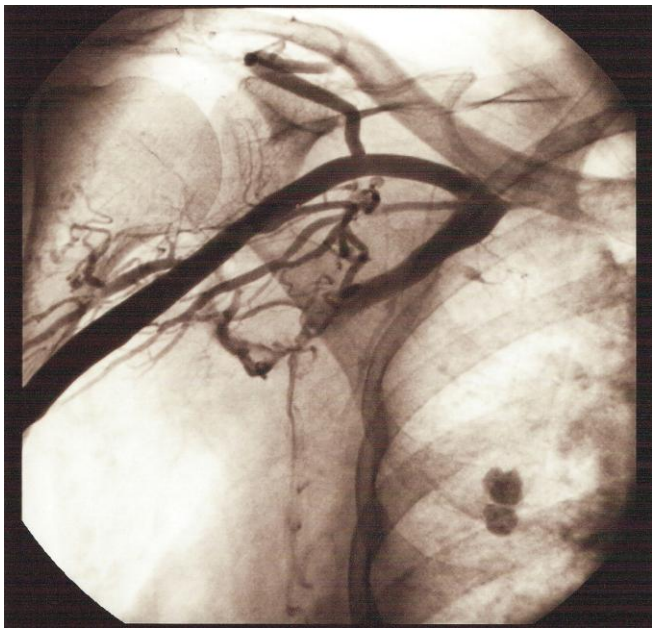

Fig. 3:

Fig. 4:

catheter use was five week with range of 1-23 weeks. The long term complications like infections and vascular stenosis has statistically significant ($p < 0.05$) relationship with longer duration & increased dialysis sessions. These things lead to increased manipulation of the catheter which increases the chances of getting infection. This long duration of catheter was due to delayed creation and maturation of permanent access. Except long duration and increased dialysis sessions no other clinical and biochemical parameters was responsible for long term complications. Waclaw et al observed same thing that longer duration of dialysis was associated with more vascular stenosis.[29] Temporary access catheter was used in all of the patients i.e 100% as primary access for the dialysis as compared to the findings of DOPPS study[30] (48%in USA and 75% in Europe).Vascular stenosis was devasting complication and it was only present in 5 (2.2%) patients in subclavian vein. This rate of complication is much less than other study by Cimochowski et al.[31] in which it was 40-50%. It led to generalized swelling of the whole limb. It was very painful and almost gaining the width of the thigh (as shown in Figure 2). The vascular stenotic lesions were lengthy on venography (as shown in Figure 3). So angioplasty was not possible. Two patients were under gone subclavian grafting for bypass surgery and their symptoms improved (Fig. 4.)

Conclusion

Temporary access catheter insertion is very simple and without life threatening complication if it is done by experienced hands even it is done without ultrasound guidance. Acute complication can be managed conservatively. Universal precautions of infection control decrease the incidence of infection in dialysis center. Temporary access catheters should be used for limited time to prevent term long term complications.

Suggestions

Patients of chronic kidney disease should be referred to nephrologists at an early stage for management and counseling for renal replacement therapy.

Arteriovenous fistula/graft should be made when GFR is < 15ml/min to avoid short and long term complications of temporary access catheter.

Temporary access catheter should be used for limited time i.e less than three weeks.

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