www.jmscr.igmpublication.org

Impact Factor 3.79
ISSN (e)-2347-176x

IGM Publication

Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Placement of Temporary Double Lumen Haemodialysis Catheters: A Rural Institutional Experience

Authors

Amit Singh[1], Vijay K. Verma[2], Khwaja S. Zafar[3], Shekhar Tandon[4]

[1]Assistant Professor, Dept of Cardiovascular & Thoracic Surgery, UP RIMS&R, Saifai, Etawah, India
[2]Assistant Professor, Dept of Medicine, UP RIMS&R, Saifai, Etawah, India
[3]Associate Professor, Dept of Medicine, UP RIMS&R, Saifai, Etawah, India
[4]Professor, Dept of Cardiovascular & Thoracic Surgery, UP RIMS&R, Saifai, Etawah, India

Corresponding Author

Amit Singh

Assistant Professor, Department of Cardiovascular and Thoracic Surgery, Uttar Pradesh Rural Institute of Medical Science and Research, Saifai, Etawah, Uttar Pradesh, India-206301
Mob: 09917550631 Email: *softmedbiz@yahoo.com*

Abstract

Background: *The correct placement of large-bore venous catheters plays an important role in the management of patients on haemodialysis. The aim of this study is to review the complications of temporary double lumen haemodialysis catheters inserted using landmark-guided technique at the cardiovascular and thoracic surgery department of a rural Institute.*

Methods: *Temporary non-tunnelled double lumen haemodialysis catheters were placed in 116 patients using landmark-guided technique over an 11 month period from May 2014 to March 2015. Data collected included age, sex, indication for haemodialysis, type of vein cannulated, number of kits used, number of attempts for successful cannulation, duration of haemodialysis through the catheters, cause of removal and complications.*

Results: *Internal jugular vein cannulation using landmark-guided technique was successful in 99% of patients. The vein was cannulated in the first attempt in 70.7% of patients. The most common complication was exit site infection seen in 12% of patients. The arterial puncture rate was 1.7%. No case of haemothorax or pneumothorax was reported. Mean duration time of haemodialysis through the catheter was 29 days.*

Conclusions: *The placement of temporary haemodialysis catheter by an experienced operator using landmark-guided approach is a safe and reliable technique of obtaining venous access in the initial management of patients with chronic renal failure requiring haemodialysis. The complications related to catheter placement were similar to or lower than those reported in literature by various authors.*

Key words: *haemodialysis, double lumen catheter, internal jugular vein*

INTRODUCTION

The placement of reliable and safe venous access plays an important role in the management of patients with chronic renal failure requiring haemodialysis until a functioning vascular access, most commonly a radio-cephalic arteriovenous fistula, can be created. The internal jugular, subclavian and femoral veins are the usual sites for cannulation. The right internal jugular vein is most commonly used for temporary haemodialysis [(1)]. Even though the femoral vein is easy to cannulate, interference with ambulation, high prevalence of infection and deep vein thrombosis limits its regular use [(2)]. Despite being routine procedures in most hospitals, significant morbidity and mortality can occur due to the procedure. Complications include arterial puncture, hematoma, haemothorax, pneumothorax, insufficient blood flow rate, exit site infection and occlusion [(3)].

Real-time ultrasound-guided cannulation is reported to cause fewer complications compared to the conventional landmark-guided technique. Though the procedure for landmark-based placement of these catheters is well known and practiced worldwide, the complications reported by various authors differ significantly and are operator dependent [(4)]. Our study demonstrates that landmark-based placement of these catheters by an experienced operator is a safe and reliable technique of obtaining venous access with complication rates similar to or lower than those reported in literature by various authors.

MATERIALS AND METHODS

This study was carried out by the department of cardiovascular and thoracic surgery in collaboration with the haemodialysis unit of the medicine department of the Institute. 116 patients with stable hemodynamics needing haemodialysis for chronic renal failure over an 11 month period from May 2014 to March 2015 were included in this study.

All catheters were placed by the same cardiovascular and thoracic surgeon in the cath lab of the department. The same 11.5F, 13.5cm polyurethane double lumen catheter sets were used in all patients. Right internal jugular vein (RIJV) was chosen as the first preference for catheter insertion. Left internal jugular vein (LIJV) and right subclavian vein (RSV) were respectively preferred when the RIJV was unsuitable for catheter insertion. Catheters were followed by trained technicians in the haemodialysis unit. An average of two haemodialysis per week was performed. After each haemodialysis session, catheter lumens were flushed with 10ml sterile saline solution and then were locked using pure heparin.

After informed consent, patient was made to lie supine with the head tilted slightly to the contralateral side. Part was painted with betadine and draped with sterile sheets. With strict aseptic precautions, the skin at the top of the triangle between the sternal and clavicular heads of the sternocleidomastoid muscle was anaesthetised with 1% lignocaine. A 21-gauge finder needle connected to a 2 ml syringe was advanced through the skin at 60 degrees angle and in the direction of

the ipsilateral nipple. After aspiration of venous blood, the finder needle was used to guide an 18 gauge introducer needle connected to a 5ml syringe. After recannulation of the vein, a guidewire was advanced into the vein. The needle was removed and a dilator was used over the guidewire to dilate the subcutaneous track. After removing the dilator, a double lumen haemodialysis catheter was advanced over the wire into the internal jugular vein. Both the lumens were checked for free flow of venous blood and flushed with heparinised saline. Fluoroscopy was performed to rule out pneumothorax and confirm the position of the catheter. Catheter was fixed with suture and sterile dressing applied. Patient was sent for haemodialysis straightaway.

Data collected included age, sex, indication for haemodialysis, type of vein cannulated, number of kits used, number of attempts for successful cannulation, duration of haemodialysis through the catheters, cause of catheter removal and complications. Complications include arterial puncture, hematoma, haemothorax, pneumothorax, insufficient blood flow rate (<200 ml/min), inadvertent withdrawal, infection and occlusion. Cause of catheter removal were recorded as creating new arteriovenous fistula (AVF), occlusion or low blood flow rate, patient transfer to other treatment modalities (such as peritoneal dialysis and transplantation), exit site infections and patient death.

RESULTS

This study included 116 patients, 64 men (55.2%) and 52 women (44.8%), age range from 25yrs to 88 yrs with mean age of 52yrs. The main indication for haemodialysis was end stage renal disease (ESRD) due to diabetic nephropathy (37.9%), hypertension (27.6%), chronic glomerulonephritis (13.8%), chronic pyelonephritis (6.9%), obstructive nephropathy (4.3%) polycystic kidney disease (1.7%) and other diseases (7.8%). (Table-1)

Table-1: Causes of ESRD

Cause	N	%
Diabetes Mellitus	44	37.9
Hypertension	32	27.6
Chr. Glomerulonephritis	16	13.8
Chr. Pyelonephritis	8	6.9
Obstructive Nephropathy	5	4.3
Polycystic Kidney	2	1.7
Others	9	7.8

The site of catheter placement was RIJV in 112 (96.5%), LIJV in 3 (2.6%) and RSV in 1 (0.9%). Only one kit was used per patient.

Successful cannulation in first attempt was done in 82 (70.7%), in second attempt in 20 (17.2%), in third attempt in 8 (6.9%). In 6 (5.2%) patients, many attempts were made to cannulate the vein. (Table-2)

Table-2: No. of attempts for cannulation

No. of attempts	N	%
First	82	70.7
Second	20	17.2
Third	8	6.9
Fourth & more	6	5.2

The mean duration time of haemodialysis through the catheter was 29 days (range 12-40 days). The

most frequent indications of catheter removal were creation of new AVF in 76 patients (65.5%), infection in 14 (12.1%), insufficient flow rate in 8 (6.9%), conversion to tunnelled haemodialysis catheter (THC) in 6 (5.2%), inadvertent withdrawal in 4 (3.4%), switching over to peritoneal dialysis (PD) in 4 (3.4%), occlusion in 2 (1.7%) and patient's death in 2 (1.7%). (Table-3) The deaths were due to the complications of chronic renal failure.

Table-3: Causes of catheter removal

Cause	N	%
Conversion to AVF	76	65.5
Exit site infection	14	12.1
Insufficient flow rate	8	6.9
Switching over to THC	6	5.2
Inadvertent withdrawal	4	3.4
Switching over to PD	4	3.4
Occlusion	2	1.7
Patient death	2	1.7

The most common complication was exit site infection in 14 (12.1%) followed by insufficient flow rate in 8 (6.9%), inadvertent withdrawal in 4 (3.4%), occlusion in 2 (1.7%), arterial puncture in 2 (1.7%) and hematoma in 1 (0.9%). There was no incidence of pneumothorax or haemothorax in our study. No mortality was associated with the procedure or its complication. (Table-4)

Table-4: Early and late complication

Complications	N	%
Exit site infection	14	12.1
Insufficient flow rate	8	6.9
Inadvertent withdrawal	4	3.4
Occlusion	2	1.7
Arterial puncture	2	1.7
Hematoma	1	0.9
Pneumothorax	0	0
Hemothorax	0	0

DISCUSSION

The correct placement of large-bore venous catheters plays an important role in the management of patients on haemodialysis. Although a radio-cephalic arteriovenous fistula appears to be the most satisfactory permanent vascular access, it takes a few weeks before the fistula is available [5]. Planning and preparation of vein, creation and maturation of AVF can take a long time. Patients with acute renal failure requiring prompt haemodialysis and those with failure of previous AVF need a temporary vascular access too. A double lumen internal jugular vein haemodialysis catheter is now widely used for this purpose because of both reliability and safety [1,3]. However, the technique of placement of a double lumen catheter is not without complications.

Initially the subclavian vein emerged as the most commonly used site. Internal jugular vein cannulation has become the preferred approach for temporary haemodialysis catheter placement following the reports of an increased incidence of subclavian vein stenosis due to subclavian vein catheterization [6].

The skill of the operator plays an important role in the success rate in both the techniques of vein cannulation [4,7]. Using the landmark technique, we found that the success rate of IJV catheterization was 99.1%, which is consistent with previous reports (ranging from 85% to 99%) [8,9].

Success rates and incidences of traumatic complications associated with IJV cannulation have been reported elsewhere. In a series of 302 patients, Denys et al. reported a success rate of

88.1% and an arterial puncture rate of 8.3% [10]. Vanholder et al. reported an incidence of 3.7% for traumatic complications and Campistol et al. reported an arterial puncture rate of 4% [3,11]. The average number of needle passes and the success rate of the first attempt are of concern because an increasing number of needle passes relates to a higher incidence of traumatic complications [10].

Troianos at al. compared ultrasound to anatomical localisation in 160 cardiothoracic surgical patients requiring internal jugular cannulation [12]. They found that they had a 100% success rate with ultrasound versus 96% with landmark localization, and were successful on their first attempt in 73% of patients with ultrasound versus 54% in the controlled landmark group. Carotid artery puncture occurred in 1.7% of ultrasound-guided patients versus 8.3% of landmark guided patients.

In our study, successful IJV cannulation was achieved in 99.1% of the patients out of which 70.7% of the patients were cannulated in the first attempt using the landmark technique and the carotid puncture rate was 1.7%. Local hematoma with neck swelling occurred in one patient which responded to catheter removal with local compression and resolved within four days. Anatomical variations of the internal jugular veins might explain why high rates of traumatic complications occur in patients who undergo landmark-based internal jugular venous cannulation, even though performed by an experienced operator [13, 14].

The study done by Kamanran et al reported that 21.9% of catheters had to be removed due to complications like infection, thrombosis or catheter kinking [15]. The most common late complication in our study was exit site infection (12.1%) necessitating catheter removal, followed by insufficient flow rate (6.9%) and inadvertent withdrawal (3.4%). A course of broad spectrum intravenous antibiotics was given for 7 to 14 days in patients with infection, depending on the symptoms. There was no incidence of pneumothorax or haemothorax in our study. No mortality was associated with the procedure or its complication.

CONCLUSIONS

The placement of temporary haemodialysis catheter by an experienced operator using landmark-guided approach is a safe and reliable technique of obtaining venous access in the initial management of patients with chronic renal failure requiring haemodialysis. The complications related to catheter placement were similar to or lower than those reported in literature by various authors.

REFERENCES

1. Cimochowski GE, Worley E, Rutherford WE, Sartain J, Blondin J, Garter H. Superiority of the internal jugular over the subclavian access for temporary hemodialysis. Nephron 1990; 54:154-161
2. Oliver MJ, Callery SM, Thorpe KE, Schwab SJ et al. Risk of bacteraemia from temporary haemodialysis catheters by rate of insertion and duration of use: a prospective study. Kidney Int 2000; 58(6):2543-5

3. Vanholder R, Hoenich N, Ringoir S. Morbidity and mortality of central venous catheter haemodialysis: A review of 10 years experience. Nephron 1987; 47:274-279
4. Sznajder JI, Zveibil FR, Bitterman H, Weiner P, Busztein S. Central vein catheterization: failure and complication rates by three percutaneous approaches. Arch Intern Med 1986; 146:259-261
5. Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic haemodialysis using venipuncture and a surgically created arteriovenous fistula. N Engl J Med 1966; 275:1089
6. Clark DD, Albina JE, Chazan JA. Subclavian vein stenosis and thrombosis: A potentially serious complication in chronic haemodialysis patients. Am J Kidney Dis 1990; 15:265-268
7. Hind D, Calvert N, Mcwillams R, Davidson A, Paisley S, Beverly C et al. Ultrasonic locating devices for central venous cannulation: metaanalysis. Br Med J 2003; 327:361-8
8. Daily PO, Griep RB, Shumway NE. Percutaneous internal jugular vein cannulation. Arch Surg 1970; 101:534-6
9. Gordon AC, Saliken JC, Johns D, Owen R, Gray RR. US-guided puncture of the internal jugular vein: complications and anatomical considerations. J Vasc Interv Radiol 1998; 9:333-338
10. Denys BG, Uretsky BF, Reddy PS. Ultrasound-assisted cannulation of the internal jugular vein: A prospective comparision to the external landmark-guided technique. Circulation 1993; 87:1557-1562
11. Campistol JM, Almirall J, rello J, Revert L. Jugular vein cannulation for haemodialysis access. Nephron 1988; 50:391-392
12. Troianos CA, Jobes DR, Ellison N. Ultrasound-guided cannulation of the internal jugular vein: A prospective randomized study. Anesth Analg 1991; 72:823-826
13. Lin BS, Kong CW, Tarng DC, Tang JG, Huang TP. Anatomical variation of the internal jugular vein and its impact on temporary haemodialysis vascular access: An ultrasonographic survey in uremic patients. Nephrol Dial Transplant 1998; 13:134-138
14. Scott WE. Complications associated with central venous catheters. Chest 1988; 1221-24
15. Kamanran T, Zaheer K, Khan AA, Khalid M, Akhtar MS. Applications and complications of subclavian vein catheterization for haemodialysis. J Coll Physicians Surg Pak 2003; 13:40-6