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Journal of Clinical Nephrology

Research Article

Complications of Internal jugular catheters in haemodialysis patients at a kidney care center in Nigeria

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Abstract

Internal jugular vein catheters (IJC) is recommended as the central venous access of choice in haemodialysis patients. However it is associated with complications of variable severity.

Objectives: To study the complications associated with internal jugular vein catheters in haemodialysis patients in southern part of Nigeria.

Methodology: The clinical details of patients who had IJC insertion at the kidney house, Hilton clinics Port Harcourt from 1st October 2011 to 30th September 2016 were documented. Complications from the IJC developed by the patients during the study period were also documented. The data obtained was analyzed using SPSS version 22. P value less than 0.05 was considered significant.

Result: A total of 129 patients had 150 internal jugular catheter insertions. The mean age was 51.4±15.2 years with male to female ratio of 1.5:1. All the patients had chronic kidney disease; about 80% had tunneled IJC and 96.9% of the catheters were inserted in the right internal jugular vein. Immediate complications were recorded in 10% and late complications in 34.9% of the procedures. The immediate complications were kinking of guide wire (2%), arterial puncture (1.3%) and difficulty in locating the internal jugular vein (1.3%) or tunneling (1.3%). The late complications were infection (12.8%), poor blood flow (9.2%), bleeding (5.5%) and spontaneous removal of the catheter (5.5%). There was no statistical significant difference in both immediate and late complication with age and sex.

Conclusion: Internal jugular catheter is froth with immediate and late complications in haemodialysis patients.

More Information

Submitted: 27 June 2019
Approved: 10 July 2019
Published: 11 July 2019

How to cite this article: Hughes OU, Stella A, Samuel E. Complications of Internal jugular catheters in haemodialysis patients at a kidney care center in Nigeria. J Clini Nephrol. 2019; 3: 121-125.

DOI:10.29328/journal.jcn.1001037

ISSN: 2576-9529

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Introduction

Internal jugular vein catheter (IJC) plays a key role in the management of kidney failure patients requiring haemodialysis. The kidney disease outcome quality initiative (K - DOQI) recommends that internal jugular vein catheter is the preferred central venous catheter for patients requiring haemodialysis [1]. In Nigeria, central venous catheters (CVCs) are the most common and readily available vascular access for haemodialysis. It can be used in acute/salvage/emergency haemodialysis and also in patients requiring maintenance haemodialysis in whom AVF/AVG is contraindicated, not feasible or not functional. Internal jugular catheters especially the right internal jugular vein are usually preferred because of their straight course, less interference with movement and less likelihood of vascular and pulmonary injuries etc. Tunneled catheters are preferred CVC in patients for long term maintenance haemodialysis [2].

Varying complications has been associated with the use of IJC in haemodialysis patients. Use of IJC has been reported to increase risk of death 2- to 3-fold and serious infection 5- to 10-fold compared with use of AVF in HD patients [3]. CVC including IJC has been reported as a major risk factor for bacteremia in HD patients and this can lead to life-threatening complications in over 10% of cases including septic shock, endocarditis, septic arthritis, osteomyelitis and abscesses [4,5]. Catheter-related complications vary widely depending on the terminology and definition of complications, patient population, units of measurement, duration of catheterization, follow-up, catheter location, placement and care, and also diagnostic methods 6. These complications can be immediate

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or delayed in nature. Immediate complications occur at the time of catheter insertion and include vascular, cardiac, pulmonary, and placement complications. Delayed complications which include catheter dysfunction and infection usually occur during catheter dwell period or during removal. Prevention of catheter-related complications using maximal sterile precautions during insertion and maintenance of the catheter is critical to improving patient care [6,7]. Furthermore prompt identification and subsequent management of complications associated with IJC reduces morbidity and mortality and improves outcomes in these haemodialysis patients. The aim of this study is to determine the complications associated with IJC used for haemodialysis in a kidney care center in southern Nigeria.

Materials and Method

All patients who had internal jugular catheter inserted for haemodialysis at Hilton clinics Port Harcourt Nigeria from 1st October 2011 to 30th September 2016 were retrospectively studied. The study was approved by the ethical committee of the hospital. The clinical and haemodialysis records of the patients were retrieved from the renal unit of the hospital. The bio data of the patients, cause of kidney disease, details of dialysis, and details of the procedure for the IJC insertion including the immediate complications, the late complications and the outcome of the patients were also documented. The data obtained was entered into a spread sheet and analyzed using IBM (New York) statistical package for social sciences version 22. The results were presented in text, tables and charts as mean, standard deviation and frequencies. The P value of less than 0.05 was considered significant.

Results

One hundred and twenty nine patients had 150 IJC insertions (procedures) during the period studied. The age range was 12 to 84 years with a mean of 51.4±15.2 and median of 53 years. Seventy seven (59.7%) were males with a male: female ratio of 1.5:1. Majority of the patients were married (85.3%), Christians (96.1%), public servants (38.8%), and had at least secondary education (72.5%). All the patients had chronic kidney disease presenting either as end stage kidney disease or acute on chronic kidney disease. All the patients used femoral vein access when commencing haemodialysis with duration ranging from 1 to 52 weeks (mean of 10.1±8.7 weeks and median of 8 weeks) before internal jugular catheter was inserted. Four (3.1%) patients had left IJC while others (96.9%) had right IJC. One hundred and seven (82.9%) patients had 121(80.7%) tunneled IJC (tIJC) and 25(19.4%) patients had 29(19.3%) non tunneled IJC (ntIJC). One hundred and twelve (86.8%) patients had only a single IJC insertion; 13(10.1%) had IJC inserted 2 times, 4(3.1%) patients had IJC inserted 3 times. The duration of the procedure ranged from 20 to 210 minutes with a mean of 58.4±26.5 minutes (median of 55 minutes). One hundred and fifty catheters were inserted, 102 (68%) had a single puncture, 25(16.7%) were punctured twice, 19 (12.7%) thrice, and 4(2.7%) had more than 3 punctures. The duration patient used the tunneled and non-tunneled IJC were 1-88 and 1-8 weeks respectively, with a median of 10 and 4 weeks respectively.

Complications

Complications were either immediate (occurring during the procedure) or late (occurring after the procedure). Immediate complications occurred in 15(10%) and late complications in 38(34.9%) procedures.

Immediate complications

Immediate complications were occurred 15(10%) procedures. And they include kinking of the guide wire (2%), difficulty locating the vein (2.7%) and arterial puncture (2%). The details of immediate complications are as documented in table 1.

The age distribution of immediate complications:

Majority of those with immediate complications were 45 years and above, however this is not statistically significant (P=0.56). The details of the age distributions is as shown in table 2.

Sex distribution of immediate complications

Males had more immediate complications (6.7%) than the females (3.3%). The difference is statistically significant (P=0.047). Details of sex distribution of immediate complications is shown in table 3.

Table 1: Distribution of immediate complications.

Complications (150)	Frequency	Percent
Kinking guide wire	3	2
Difficult location of IJV	2	1.3
Difficult tunneling	2	1.3
Arterial puncture	2	1.3
Difficult location of IJV /Failed insertion	1	0.7
Stuck guide wire	1	0.7
Pulling guide wire	1	0.7
Difficult dilatation	1	0.7
Difficult location of IJV/tunneling	1	0.7
Arterial puncture/failed insertion	1	0.7
Total	15	10

Table 2: Age distributions of immediate complications.

Complications	< 45 years (%)	≥45 years (%)	Total (%)
Kinking guide wire	1(0.7)	2(1.3)	3(2)
Difficult location of IJV	1(0.7)	1(0.7)	2(1.3)
Difficult tunneling	1(0.7)	1(0.7)	2(1.3)
Arterial puncture	1(0.7)	1(0.7)	2(1.3)
Difficult location of IJV/Failed insertion	1(0.7)	0	1(1.3)
Stuck guide wire	0	1(0.7)	1(0.7)
Pulling guide wire	1(0.7)	0	1(0.7)
Difficult dilatation	1(0.7)	0	1(0.7)
Difficult location of IJV/tunneling	0	1(0.7)	1(0.7)
Arterial puncture/failed insertion	0	1(0.7)	1(0.7)
Total	7(4.7)	8(5.3%)	15(10)

Late complications

Thirty nine patients who had 41 procedures were lost to follow up. There were 38(34.9%) late complications. Infection, poor blood flow, dislodging of the catheter and bleeding were the common complications occurring in 15.6%, 9.2%, 6.4% and 5.5% respectively. Three patients (3.2%) presented with 2 different late complications. The details of the late complications were as shown in table 4.

The age distribution of late complications

Late complications were commoner in patients aged 45 years and above occurring in 21.1% of them, and 13.8% of the younger age group(<45 years). P=0.053. The details is shown in table 5.

Sex distribution of late complications

Late complications occurred in 21.2% males and 13.8% females with a ratio of 15:1. This is statistically significant. (P=0.031). The details of sex distribution of late complications is as shown in table 6.

Table 3: Sex distribution of immediate complications.

Complications	Males	Females	Total
Kinking guide wire	3(2)	0	3(2)
Difficult location of IJV	2(1.7)	0	2(1.3)
Difficult tunneling	1(0.7)	1(0.7)	2(1.3)
Arterial puncture	1(0.7)	1(0.7)	2(1.3)
Difficult location of IJV/Failed insertion	0	1(0.7)	2(1.3)
Stuck guide wire	0	1(0.7)	1(0.8)
Pulling guide wire	1(0.7)	0	1(0.8)
Difficult dilatation	1(0.7)	0	1(0.8)
Difficult location of IJV/tunneling	1(0.7)	0	1(0.7)
Arterial puncture/failed insertion	0	1(0.7)	1(0.7)
Total	10(6.7)	5(3.3)	15(10)

Table 4: Distribution of late Complications of IJC in HD patients.

Complications (38)	Frequency	Percent
Infection	14	12.8
Poor flow	9	8.3
Dislodging	6	5.5
Bleeding	3	2.8
Infection/bleeding	2	1.8
Bleeding/dislodging	1	0.9
Fibrosis	1	0.9
Kinking	1	0.9
Neck swelling/poor flow	1	0.9
Total	38	34.9

Table 5: Age distribution of late complications.

Complications	< 45 years (%)	≥45 years (%)	Total (%)
Infection	2(1.8%)	12(11)	14(12.8)
Poor flow	7(6.4)	2(1.8)	9(8.3)
Bleeding	1(0.9)	2(1.8)	3(2.8)
Spontaneous removal	1(0.9)	5(4.6)	6(5.5)
Infection / bleeding	1(0.9)	1(0.9)	2(1.8)
Removal / bleeding	1(0.9)	0	1(0.9)
Fibrosis	1(0.9)	0	1(0.9)
Kinking	1(0.9)	0	1(0.9)
Poor flow / neck swelling	0	1(0.9)	1(0.9)
Total	15(13.8)	23(21.1)	38(34.9)

Table 6: Sex distribution of late complications.

Complications	Males (%)	Females (%)	Total (%)
Infection	8(7.4)	6(5.5)	14(12.8)
Poor flow	5(4.6)	4(3.6)	9(8.3)
Dislodging	5(4.6)	1(0.9)	6(5.5)
Bleeding	3(2.8)	0	3(2.8)
Infection / bleeding	0	2(1.8)	2(1.8)
Dislodging /bleeding	0	1(0.9)	1(0.9)
Fibrosis	0	1(0.9)	1(0.9)
Kinking	1(0.9)	0	1(0.9)
Poor flow/neck swelling	1(0.9)	0	1(0.9)
Total	23(21.1)	15(13.8)	38(34.9)

Discussion

The spectrum, severity and frequency of complications associated with IJC in haemodialysis patients are variable. Fatalities though very rare has been reported during insertion of internal jugular catheters and usually result from cardiovascular or pulmonary complications. There was none recorded in this study. The incidence of immediate complication of IJC in haemodialysis patients is variable and depends on the skill/experience of the surgeon/physician and technique used – landmark/imaging. Ultrasound and fluoroscopic guided insertion has remarkably reduced the incidence of immediate complications associated with IJC [8,9]. The incidence rate of complications of 10% in this study is comparable to other studies especially were landmark technique was used to locate the vein [9-11]. However in a study of 132 patients on haemodialysis using IJC Chung et al reported a higher (21.3%) rate of immediate complication. Challenges in insertion of the catheter and injuries to the vessels, heart, lungs and/or lymphatics has been reported as the immediate complications encountered in patients with IJC. In this study, about 85% of patients presenting with immediate complications, the causes were mainly from placement of the catheter and these included difficulties in locating the vein, inserting the guide wires and tunneling the catheter. Carotid arterial puncture occurred in only 2% of the procedures; there was no injuries to other vital organs including the heart, lungs or lymphatics. The procedure was discontinued in 2 occasions after 3 unsuccessful attempts but there was no life threatening complications. Natalie et al. [12], in a similar study reported incidence rate of immediate complications of 10%, arterial puncture 5%, haematoma 1.25% and failure of canulation in 3.75%. Also other studies reported arterial puncture in 4.2 -9% [12,13] which is higher than our study. The lower rate in our study could be attributed to the skill and experience of the operator, extra precaution and limiting unsuccessful attempts to a maximum of three. Arterial injuries resulting from punctures were uncommon, pulsatile and thus easy to identify except in hypotensive and critically ill patients [14]. Other vascular injuries/complications reported in internal jugular catheter insertion includes laceration of the superior vena cava, brachiocephalic vein, right atrium and ventricle, cardiac arrhythmias and cardiac arrest [8,9,15]. None of these was found in this study. The incidence of vascular injuries

has been significantly reduced by use of imaging technique and strict precaution taken by the operator. Immediate complication occurred more in males but had no relationship with age, reason is not known.

Late complications associated with IJC are draw backs in management of haemodialysis patients and may be catheter related or unrelated, infective or non-infective, and mild or severe. There were 34.9% of late complications in this study, and they include infection, poor blood flow, bleeding and dislodging of the catheter. They were commoner in males and older age group which may be related to better personal hygiene in the younger age groups and females. Chung et al. [16], reported a lower rate of late complications in 11.3% and this includes infection, poor flow, dislodging and rhabdomyolysis. Central venous stenosis, fractured catheters, intracranial haemorhage, thromboembolism has also been reported as late complications [6,12,17]. Infection has been variously reported as a major late complication seen in haemodialysis patients using central catheters as vascular access [16,18,19]. It is the commonest late complication in this study and occurred in 12.8% of the procedures. It varies in severity ranging from asymptomatic bacteraemia to life threatening septicaemia. A mortality was recorded in our study in a patient who had infective endocarditis. Infection also contributed significantly to catheter failure and reason for catheter replacement. Sources of infection in these patients include the patient's skin flora, contaminants from dialysis staff, dialysis apparatus, caregivers or substance infused through the catheter including anticoagulant/antibiotics [20]. Poor blood flow rate of 9.2% found in this study is higher than a report of 3.3 – 5% in a similar study [12,16]. This reduces the adequacy and effectiveness of haemodialysis as it produces poor solute clearance. Poor blood flow has been attributed to catheter malpositioning/misplacement/twisting/kinking and formation of fibrin sheath. Repositioning and declotting of the catheter has been used to correct poor blood flow, failure of which usually leads to catheter removal and replacement [16,17,21].

Spontaneous removal of the catheter and bleeding were other late complications observed in this study, occurring in 6.4% and 4.6% respectively. The catheter is usually anchored at the exit point using sutures during the procedure and later fibrous tissue formation around the catheter cuff also ensures the catheter does not dislodge. However improper placement and undue traction on the catheter at the exit point can lead to spontaneous removal/dislodgement. Care in handling the catheter during dialysis, patients and caregivers education on care of the catheter will reduce the spontaneous dislodgement. Bleeding of variable severity resulting from spontaneous removal, puncture of the catheter, dislodging of the ligated vessel and opening of one of the lumen has been reported. The bleeding in this study were mild and didn't necessitate blood transfusion. The limitations of this study were that its retrospective nature, small sample size and incomplete data in some patients. Thus it may be difficult to generalize the findings in this study.

In conclusion IJC plays a very crucial role in patients on maintenance haemodialysis in our center where use of atrio-venous fistula and/or graft is not readily available. Guidewire related complications and infections were the commonest immediate and late complications respectively. Use of ultra-sound/fluoroscopy guided insertion will significantly reduce immediate complications; and careful handling of the IJC during intra and interdialysis period will reduce late complication. A multi-center study with larger sample size is recommended.

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