

Complications of Insertion of Double Lumen Catheter in Subclavian Vein in Patients of Renal Failure

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ABSTRACT

Introduction: The demand of long term central venous access devices has risen over the last few decades. These devices are increasingly being used for administration of antibiotics and chemotherapeutic drugs, for total parenteral nutrition and providing high flow access for hemodialysis and plasmapheresis. Inadvertent arterial puncture, arteriovenous fistula, thoracic duct injury, brachial plexus injury, laceration of the subclavian vein, and air embolism are the well described complications of the central line insertion. **Objective:** This study was designed to find out the frequency of complications during Central venous line insertion via sub clavian route. **Methodology:** This cross-sectional descriptive study was conducted at DHQ Hospital Sargodha from April 2014 to April 2015. Two hundred patients both male and female requiring hemodialysis were included in the study. All patient underwent double lumen catheterization of subclavian vein after informed consent. **Results:** Mean Age of the patients was 54.55 ± 10.45 . 71% of the patients were female and 29% of the patients were male. Out of 200 patients subjected to double lumen catheterizations; 28 (14.0%) developed various complications related to insertion. Out of 28 patients who developed complications, in 08 (28.57%) cases complication was failure to cannulate, in 08 (28.57%) cases there was arterial puncture, in 04 (14.28%) cases catheters were mal-positioned/kincking. Hemothorax and subclavian arterio-venous fistula developed in 02 (7.14%) each. 02 (7.14%) cases had arrhythmias and death occurred in 02 (7.14%) cases.

Conclusions & Recommendations: Subclavian double lumen catheters proved to be reasonably safe, easy and a reliable way of obtaining vascular access for hemodialysis. The procedure is a short term alternative to AV fistula formation for patients requiring long term hemodialysis. It is recommended that double lumen subclavian vein catheterization should be part of post graduate training in large units where hemodialysis is available.

Keywords: Subclavian vein, Double lumen catheter, Renal failure

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INTRODUCTION

The history of central venous cannulation started in 1929, when Forssmann described the advance of a plastic tube to the heart by puncturing his own arm vein.¹ At the beginning of 1950s Aubaniac reported about the puncture of the subclavian vein.² The demand of long term central venous access devices has risen over the last few decades.³ These devices are increasingly being used for administration of antibiotics and chemotherapeutic drugs, for total parenteral nutrition and providing high flow access for hemodialysis and plasmapheresis.⁴

Hemodialysis was first introduced in 1944 by Kolff,⁵ using rubber and, later, plastic catheters. An emergency central vascular access is needed whenever an emergency hemodialysis is required,⁶

for example, in acute renal failure, hyperkalemia, end-stage renal disease requiring immediate dialysis, thrombosis of arteriovenous fistula, acute intoxication, continuous arterio-venous hemofiltration, temporary shift from peritoneal dialysis and transplant patients undergoing temporary hemodialysis. The double lumen catheter, developed in 1980s, is now a days the most popular central venous catheter used for hemodialysis.⁷ Venous access under ultrasonographic and fluoroscopic guidance has the added advantage of significantly reducing the rate of immediate complications.⁸ Inadvertent arterial puncture, arteriovenous fistula, thoracic duct injury, brachial plexus injury, laceration of the subclavian

vein, and air embolism are the well described complication of the central line insertion.⁹ The frequency of these complications is related to the experience of the physician inserting the catheter.¹⁰ The major risks are the complication associated with insertion.¹¹ With expert techniques these complications are extremely uncommon. Chronic complications include catheter related sepsis, thrombosis of the catheter which will cause neck swelling and venous hypertension in the extremity.⁷

OBJECTIVE

To determine the frequency of complications of insertion of double lumen catheter in subclavian vein in patients of renal failure requiring hemodialysis in DHQ Teaching Hospital, Sargodha.

Design: A Cross Sectional Descriptive study.

Duration & place of study: From April 2014 to April 2015 for a period of one year, DHQ Teaching Hospital, Sargodha.

METHODOLOGY

Sample Size: Two hundred patients both male and female requiring hemodialysis via subclavian vein double lumen catheter were included in this study.

Setting: The study was carried out in Department of Medicine DHQ Teaching Hospital Sargodha. Following patients were included in the study:

- Patients of renal failure, acute or chronic, older than 15 years irrespective of sex.
- Patients of ESRD requiring hemodialysis having no other vascular access
- Patients of acute renal failure requiring hemodialysis
- Cases of renal failure suffering from diabetes mellitus and hypertension.

Following patients were excluded from the study:

- Patients with established vascular access like A-V fistulas or grafts
- Patients having bleeding diathesis and thrombocytopenia
- Patients with history of previous subclavian vein catheterization for hemodialysis
- Patients suffering from Chronic hepatitis B and Hepatitis C infection.
- Patients suffering from severe respiratory infections and chest trauma.

After taking approval from Ethical Review Committee PMC, Faisalabad and detailed informed consent from the patients or their relatives. All

patients included in this study underwent the following routine investigations.

- Blood complete picture
- Prothrombin time
- Serum urea and creatinine
- Serum electrolytes
- Electrocardiogram
- X-ray chest (PA)
- Hep BsAG and Anti HCV by ELISA

Double lumen catheter was placed in the subclavian vein after taking informed consent. The data was collected on structured performa designed specifically for this study. The patients suffering from renal failure were assessed for the initiation of emergency hemodialysis. Those who met the inclusion criteria were enrolled for the study on first come first serve basis.

Data analysis: Data was analyzed on computer software SPSS version 10. Mean \pm Standard Deviation was calculated for the age of patients. Frequency and percentages were calculated for gender of patients, type of renal failure, site of double lumen cannulation and complications of insertion of subclavian catheters.

RESULTS:

Out of 200 patients enrolled in the study, 58 (29.0%) were male and 142 (71.0%) were female. Mean age of the patients was 54.55 ± 10.45 years.

Table 1: Gender distribution

Gender	Frequency	Percentage
Male	58	29%
Female	142	71%

Among them 18 (9.0%) were in under 20 age group, 56 (28.0%) were 20-39 age group, 84 (42.0%) were in 40-59 age group, 36 (18.0%) in 60-79 age group and 6 (3.0%) were 80 and above.

Table 2: Distribution of sample population in different age groups

Age group (year)	Frequency	Percentage
<20	18	9%
20-39	56	28%
40-59	84	42%
60-79	36	18%
>80	6	3%

Out of 200 patients enrolled 190 (95.0%) were suffering from chronic renal failure and 10 (5.0%) were suffering from acute renal failure.

In 192 (96.0%) of the patients catheter was inserted in right subclavian vein while in 6 (4.0%) was inserted in left subclavian vein.

Out of 200 patients subjected to double lumen catheterizations; 28 (14.0%) developed various complications related to insertion. Out of 28 patients who developed complications, in 08 (28.57%) cases complication was failure to cannulate, in 08 (28.57%) cases there was arterial puncture, in 04 (14.28%) cases catheters were malpositioned/kinking. Hemothorax and subclavian arterio-venous fistula developed in 02 (7.14%) each. 02 (7.14%) cases had arrhythmias and death occurred in 02 (7.14%) cases.

Table 3: Complication of cannulation (n=28)

Complication	Frequency	Percentage
Canulation failure	08	28.57%
Arterial puncture	08	28.57%
Catheter malpositioning	04	14.28
Hemothorax	02	7.14%
Arteriovenous fistula	02	7.14%
Arythmias	02	7.14%
Death	02	7.14%

DISCUSSION

This study was carried out in DHQ Teaching Hospital Sargodha to evaluate the complications of double lumen subclavian catheter insertion in patients with renal failure requiring emergency hemodialysis. Central vein catheterization is an established procedure to obtain vascular access for acute and chronic hemodialysis. The major advantages of these percutaneous venous catheters are their relative ease of insertion and immediate availability for dialysis.¹²

The severity and likelihood of complication of insertion varies with the site of insertion. All these insertions were done without image guidance using Seldinger guide wire technique, in the diaysis unit of DHQ Teaching Hospital Sargodha. It is the method of choice as it yields a very low complications rate. The most common complication were failure to cannulate (4%) and inadvertent arterial puncture (4%). Both of these occurred in

obese patients (BMI>30). In advertent arterial puncture in our study was similar to a study by Zeki Aydin et al¹³ in which it was found that Arterial puncture occurred in 9.7% among on which 13 had resultant subcutaneous hematoma. This might be due to less prominent anatomical landmarks for subcutaneous insertion and deeply located veins requiring steeper angle for catheterization. Age related osteoarthritic changes involving first rib and clavicle, restlessness due to uremic encephalopathy and inadequate local anesthesia causing pain induced restlessness might be other contributory factors.

The second commonest complication was malpositioning/kinking in 2% cases. One catheter tip was found in right internal jugular vein in post-insertion chest X-ray and the other kinked below the clavicle. Both the complications were picked up on routine post insertion chest X-ray prior to the start of hemodialysis. This highlights the importance of mandatory chest X-ray recommended in KDOQI guidelines. Other complications included haemothorax, transient arrhythmias, subclavian vein thrombosis and atrio-venous fistula in one case each out of 200 patients.

Some of the insertion related complications can be reduced with the aid of image guidance during catheter placement. However the use of ultrasound guidance during subclavian venous catheterization had mixed results in clinical trials, probably for anatomical reasons.

Some of the above mentioned complications are comparatively low in number probably because of the small size and majority of the insertions were carried out by the well-trained personnel.

CONCLUSIONS & RECOMMENDATIONS

Subclavian double lumen catheters proved to be reasonably safe, easy and a reliable way of obtaining vascular access for hemodialysis. Complications were infrequent and relatively minor. The rate of complication in our study was similar to that reported in other studies carried out on this subject. There was no undue increase in the incidence of complications with subclavian vein insertion technique and this could be further reduced by image guidance. The procedure is a short term alternative to AV fistula formation for patients requiring long term hemodialysis.

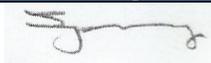
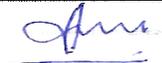
It is recommended that double lumen subclavian vein catheterization should be part of post graduate

training in large units where hemodialysis is available.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Name of Author	Contribution to the paper	Author's Signatures
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Prof. Dr. Mirza Akmal Sharif	Main idea of writing paper	
Dr. Umair Ahmed	Manuscript writing, Statistics & References	
Dr. Faran Maqbool	Proof Reading	
Dr. Tahir Habib Rizvi	Manuscript writing	