Original Article

COMPARISON OF INTERNAL JUGULAR VEIN WITH SUBCLAVIAN VEIN HEMODIALYSIS CATHETER ACCESS

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Abstract

Objectives: To compare internal jugular vs. subclavian venous approach for the placement of central venous line for hemodialysis in term of complication.

Material and methods: All Patients requiring placement of central venous catheter for dialysis, were included in this study, on random basis Patients were divided into two groups. One group of patients underwent internal jugular catheterization; and in 2nd group of patients subclavian catheterization was performed. Complications of catheter's placement were recorded. Data was collected and analyzed by using SPSS 23. We applied chi-square test for qualitative data analysis.

Results: Total 417 patients, were included in the study. In the patients who underwent internal jugular catheterization for central venous catheterization, 26 (12.3%) patients were reported to have arterial puncture as compared to 3 (1.44%) patients who have gone through subclavian approach. Malposition of the catheter tip of the subclavian catheterization 24 (11.59%) was significantly more than the internal jugular 4(1.9%).The incidence for blood stream infections with jugular access 12 (5.71%) was higher than subclavian access 8 (3.86 %).Thrombosis was reported in 23 (10.9%) patients with jugular catheterization in comparison with 5 (2.41 %) patients with subclavian cannulation.The differences in other complications on two approaches were statistically insignificant as occurrence of hemothorax was reported in 5 (2.41%) patients with subclavian catheterization compared to 3 (1.42%) patients with internal jugular approach. Incidence of hematoma was higher in jugular venous line 9 (4.28%) compared to subclavian approach 1 (0.48 %). Failure rate was significantly higher in cases with internal jugular vein catheter 20 (9.5%) compared to cases with subclavian vein catheter 4 (1.93%).

Conclusion: Subclavian catheterization is more appropriate route for central venous catheter placement as it is associated with lower risk and increased chances of fast and safe recovery of the patients. Access time in subclavian catheterization is less as compared to internal jugular approach. This technique can be safely performed in centers where color Doppler ultrasound machine is not available in operation theatre complex.

Key words: Hemodialysis**,** central venous catheterization (CVC)**,** internal jugular vein, subclavian vein.

INTRODUCTION

Central venous catheterization (CVC) is a time tested procedure for rapid access to the central venous system. By the advent of invasive monitoring techniques and intrusive hemodynamic invigoration, many protocols for central venous access have been increased. Therefore, the physicians must be well aware of all the critical skills that may lead to gain introduced rapid and meticulous vascular access[1].

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In order to provide proper patient care, the use of this approach along with other new techniques and number of invasive protocols has been increased in many intensive care settings. Many large central veins including subclavian, jugular and femoral, all have certain relationships to easily identifiable landmarks and can be catheterized in a very less time[2].

In patients undergoing hemodialysis, vascular access of the catheters to the proper insertion site is of prime importance. Current population on dialysis consists of the patients who suffer from various other diseases including diabetes mellitus and peripheral obstructive vascular disease[3]. These patients need vascular access in order to allow adequate blood supply for hemodialysis that is administered three times weekly depending on the condition of patient. Appropriate selection of insertion site is important criteria for the placement of catheters. The selection is based on the ease of placement and the risk factors associated with the procedure. Strict aseptic conditions are required for the placement of central venous catheters due to high risk vascular procedures[4]. Various risk factors are associated with the placement of hemodialysis catheters such as thrombosis and central venous stenosis. Other complications include arterial puncture, pneumothorax and haematoma[5].

Large bore catheters are often used for central venous catheterization in patients with renal failure. These are multipurpose catheters which in addition to hemodynamic monitoring, also perform the function of rapid admixture of fluids and blood products, antibiotic distribution, and vascular access for continuous renal replacement therapy[6].There are different sites for insertion of catheters but the most preferable locations are the internal jugular and femoral veins, and in other instance is the subclavian vein. Ultrasonography efficiently locates the target vein, gives the temporary vascular access and also gives an overview about venous pressure and the occurrence of intravascular thrombi. Right internal jugular vein represents the first line for placement of catheter and the left internal jugular vein serves as the second choice[7].

Ultrasonographic techniques have enabled the medical practitioners to lower the risk of arterial puncture as it is a large superficial vein that is easily visualized. Internal jugular vein serves as the preferred location for insertion because of easier catheterization, high success rate and due to straight path to the superior vena cava[8]. If there are chances of thrombus formation or stenosis before catheterization then left jugular vein serves as best option for catheterization. Femoral vein insertion may be preferred in the circumstances when the need for central venous access in the patients is less than one week and the patients are suffering from pulmonary edema and serious hyperkalemia[9]**.**

The most commonly used technique for the insertion of large bore catheters is the subclavian approach. This procedure is used due to its prominent features such as increased patient comfort, and lower potential for catheter related infections and arterial injury[10].The most commonly performed invasive procedure performed by physicians is the percutaneous subclavian vein catheterization. Subclavian venous cannulation in comparison with other sites promises a low risk of infection and increased patient comfort in terms of long term intravenous therapy. This catheterization is a blind procedure and it needs localization of a deep vein using only superficial anatomical features. Complication rates vary depending upon the experience of the persons performing the procedure site by cvs insertion and nature of the complication[11].

This study was conducted to examine the use of catheters for vascular access and to compare the outcome among patients who have undergone catheterization of the internal jugular vein to the patients with subclavian approach.

MATERIAL AND METHODS

The study was a cross sectional comparative study. Patients of different age groups who underwent central venous catheterization for hemodialysis were included in the study. The study was conducted in Hemodialysis unit, Department of Urology Ghazi Khan Medical College/Teaching Hospital, Dera Ghazi Khan from 1st December 2010 to 30th0october2015.

Study was approved from the ethical committee of hospital. Informed consent from all the patients was taken on specified performa.

Patients were recorded for demographic details including age, gender, area of residence, marital status and body mass index. A brief history of the patients consisting of primary disease acting as major cause of renal failure, acute or chronic cause of renal failure, the catheter implantation sites, different catheterization techniques, the type of the catheter and complications associated with initial insertions were recorded. Prior to the insertion of the catheter, complete blood count, prothrombin time (PT), and activated partial thromboplastin time (APTT) of all the patients was checked.

RESULTS:

Total 417 consecutive patients who were operated for central venous catheterization in Department of Urology Ghazi Khan Medical College/Teaching Hospital were included in the study. Patients were randomly divided into two groups on the basis of insertion of catheters on two different sites. Out of 417 patients 210 (50.39%) patients underwent internal jugular catheterization, in 207 (49.64%) patients subclavian catheterization was performed. 256 (61.39%) were males while 161 (38.60%) were females.

In the patients who underwent internal jugular catheterization for central venous catheterization 26 (12.3%) patients were reported to shown arterial puncture as compared to 3 (1.44 %) patients who have gone through subclavian approach. [p-value = 0.00002<0.05]

In subclavian catheterization 24 (11.59 %) patients had catheter malposition compared to internal jugular 4 (1.9 %). [p-value = 0.00011 < 0.05]

The incidence for blood stream infections was 12 (5.71%) with the jugular access and 8 (3.86 %) with the subclavian access. [p-value = 0.3775 > 0.05] Acute thrombosis of vein was observed in the patients with inter jugular access. Twenty three (10.9%) patients who underwent jugular access showed the obstruction in blood flow through the vessel compared to 5 (2.41 %) patients in which subclavian approach was used. [p-value = 0.00063 < 0.05]

There was no significant difference in the incidence of hemothorax and pneumothorax in the two approaches, 5 (2.41%) patients showed hemothorax with subclavian catheterization compared to 2 (1.42 %) patients with this complication who have gone through jugular cannulation. There was no significant difference in the incidence of vessel occlusion in both study groups. [p-value =0.4612 > 0.05]

Further reported complications were insertion site infection and local hematoma. Nine (4.28 %) patients showed hematoma with jugular venous lines compared to subclavian approach where only 1 (0.48%) patient showed this complication. [p-value = 0.01187 < 0.05]

Failure rate was significantly higher in cases with internal jugular vein catheter 20 (9.5%) compared to cases with subclavian vein catheter 4 (1.93%). [p-value = 0.00105< 0.05]

Site of catheterization	Arterial puncture	Catheter tip malposition	Blood stream Infections	Thrombosis	Hemothorax	Hematoma	Failure
Internal jugular	26 (12.3%)	4 (1.91%)	12 (5.71%)	23 (10.92%)	3 (1.42%)	9 (4.28%)	20 (9.53%)
Subclavian	3 (1.44%)	24 (11.59%)	8 (3.86%)	5 (2.41%)	5 (2.41%)	1 (0.48%)	4 (1.93%)

DISCUSSION

Central venous catheterization is a major technique that performs variety of functions, including volume regulation, pressure monitoring, hemodialysis access, hypertonic substance infusion andtransvenous cardiac pacing. Insertions are normally done into the internal jugular, subclavian, or femoral veins. The choice of insertion site is very crucial for the success of procedure. Now a days, various methods of placement have been described, each technique has its own advantages and complications[12].

Literature review reports that overall complication rates range up to 15%, with mechanical complications observed in 5-19% of patients, infectious complications in 5-26%, and thrombotic complications in 2-26%. These complications impose severe risks to the life of the patients and require significant resources for treatment[13].

Laceration of the subclavian artery is quite possible, however the risk of this puncturing is higher when other approaches are used. It is difficult to compress the subclavian vein so, this approach cannot be used for anticoagulated patients[14]. The findings in this study were matched with these previously reported cases. In the present study there is a relatively low incidence of arterial puncture associated with venous catheterization of the subclavian vein as only 3(1.44%) patients showed the laceration of artery. On the other hand, a higher incidence of arterial puncture of the internal jugular vein was observed 26 (12.3%) patients. Many studies reported the higher incidence of arterial puncture during dialysis catheter placement by seeing through anatomical features compared to ultrasound guided catheter placement in both the internal jugular vein and in subclavian vein[15].

Researchers reported that compared with internal jugular access, subclavian approach was associated with a lower risk of blood stream infections related to the insertion of catheters[16]. The studies were consistent with our findings as we reported 3.86% incidence of blood stream infections with subclavian catheterization compared to jugular access (5.71%).

In our study, only 5 (2.41%) patients showed thrombosis in the group of the patients who have undergone through subclavian vein cathetrizarion. This was contrary to Previous studies contradicted this finding as it was reported by the investigators that insertion at subclavian vein increases the chances of thrombosis and pneumothorax risks. Many factors contribute to the increase success rate of subclavian vein catheterization especially the experience of clinicians in doing the implantation by anatomical landmark technique. Life threatening complications such as hemothorax, hemomediastinum and cardiac tamponade can occur by multiple attempts and accidental arterial punctures[17]**.**The risk of these complications including the stenosis can be minimized if the catheter is inserted in the center of a larger vein with blood flowing away from the junctions with other veins.

In the present study significantly less hematomas were reported in the subclavian group than in the internal jugulargroup. Only 1(0.48%) patient in subclavian group showed this complication. This finding could be attributed to the difficulty in identifying hematomas in the subclavicular location[18]. Previous data indicated a reduction in the failure rate from 55% to 8% and the complication rate from 41% to 4% with the use of this blind subclavian vein approach[19]**.**

Conclusion:-

From our study it can be concluded that there are decreased chances of complications after the implication of subclavian based catheterization. It is also suggested that to improve the safety and success of procedure anatomical landmarks should be followed carefully.

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