

CENTRAL VENOUS CATHETERIZATION AND CARDIAC SURGERIES

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ABSTRACT

Objective: To compare the rate of complications and ease of insertion between internal jugular vs subclavian central venous catheterization in patients undergoing cardiac surgeries.

Material and Methods: This randomized clinical control study was conducted in the department of Cardiothoracic Anesthesia PGMI/Lady Reading Hospital, Peshawar from April 2013 to November 2014. A total number of 200 patients were randomly assigned in one of the two groups, i.e 100 in internal jugular group and 100 patients in subclavian group for central venous catheterization. Patients's demographic data, rate of complications and ease of insertion between the two groups were recorded and compared. Calculations were done using the SPSS, software package, Version 17.

Results: There was no statistically significant difference between the Ages, sex, weight and the type of surgery in the two studied groups. Efficacy in terms of ease of insertion was more in internal jugular group as the number of attempts were less, compared to subclavian group. Rate of complications were more in subclavian group compared to internal jugular group (P value < 0.05) except infection rate which was noted to be high in internal jugular group (P value < 0.05).

Conclusion: Internal jugular vein is an easy access having less complications for central venous catheterization compared to subclavian vein.

Key Words: Central, venous, catheterization, internal jugular, subclavian, vein.

INTRODUCTION

Central venous catheterization (CVC) is becoming common more and more for the last two decades in emergency rooms and intensive care units (ICU). It is a vital intervention in patients undergoing cardiac surgeries. CVC is used for administration of drugs, blood and its products, for central venous pressure (CVP) monitoring, total parenteral nutrition, dialysis in renal failure, transverse cardiac pacing and when peripheral veins are not accessible.^{1,2,3} Although CVC has vital importance for the management of conditions listed above, it has also some complications due to its misplacement. Subclavian vein is used to be preferred because of its large diameter, ease of insertion, low rate of complications, can be used for prolong time period and its high degree of patient acceptance.⁴ Unfortunately this particular approach is associated with

several critical complications such as arterial puncture and pneumo-haemothorax due to variation in anatomical landmarks.⁵

Internal jugular cannulation, has some distinct advantages because of its fewer complications of pleural or arterial puncture even in less experienced hands.⁶ The aim of this study was to compare the risk of malposition and complications between the catheterizations of internal jugular vein and subclavian vein.

MATERIAL AND METHODS

Primary open heart surgery (CABG, valve replacement and intra cardiac repairs) performed on cardiopulmonary bypass were included in the study. This study was conducted in the department of Cardiothoracic Anesthesia PGMI/LRH from April 2013 to November 2014. A total number of 200 patients were randomly assigned in one of the two groups, i.e 100 in internal jugular group and 100 patients in subclavian group. Approval to use any one technique in human subjects was obtained from Institutional Research and Ethical board Post Graduate Medical Institute Lady Reading Hospital, Peshawar. An informed consent was obtained from each patient enrolled in the study. Patients were anaesthetized with a

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standardized technique including propofol 1-2 mg/kg, morphine 0.1mg/kg, dromicum 0.1mg/kg and atracurium 0.5 mg/kg to facilitate tracheal intubation. Anesthesia was maintained with 2% sevoflurane in 60% oxygen/air mixture together with incremental boluses of atracurium 10 mg when required. Data collected included age, sex, site of catheterization (jugular and subclavian region), catheter misplacement. Neck and infraclavicular region were cleaned by antiseptic solution after routine monitoring. When the patient was in the supine position, a point at the junction of the medial one third and lateral two thirds of the clavicle in the right infraclavicular area was used as a puncture point for subclavian approach. During subclavian vein catheterizations, the ipsilateral internal jugular vein was manually compressed in the supraclavicular area. Catheters were fixed after blood aspiration.

Internal jugular vein was punctured in the neck at a point, medial to the upper end of sternocleidomastoid at right angle to the thyroid cartilage and lateral to the carotid pulsation. Needle was inserted downward, inward and towards the ipsilateral shoulder. Central venous catheters were easily inserted with Seldinger's technique after blood aspiration through internal jugular vein or subclavian vein. Misplaced catheters were removed and replaced with new ones. Data was collected and analysed in SPSS version 17, Mean \pm SD were used for numerical variable. Chi-square test was used for statistical analysis. $P < 0.05$ was considered statistically significant.

RESULTS

Age, sex, weight and the type of surgery in the two groups were compared and is given in Table 1. There was no statistically significant difference between the Ages, sex, weight and the type of surgery in the two studied groups. Efficacy in terms of ease of insertion was more in internal jugular group as the number of attempts were less i-e 8% in internal jugular group compared to 14% in subclavian group. (P value < 0.05) Rate of complications were more in subclavian group i-e Arterial puncture was seen in 5% of patients, while it was only 1% in internal jugular group (P value < 0.05). Catheter malposition was seen in 5% internal jugular vs 10% in subclavian group (P value < 0.05). Haemo/pneumothorax in subclavian group were noted in 4% patients compared to 1% in internal jugular group (P value < 0.05). Rate of infection was noted to be high in internal jugular group i-e 9% vs 5% in subclavian group (P value < 0.05). The complications of both the procedures are shown in Table 2.

DISCUSSION

Multiple complications can occur with central venous catheterization including arterial puncture, bleeding, misplacement, pneumothorax, haematoma, vessel and nerve injury, infection, thrombosis, and kinking of the catheter.^{7,8} Correct placement of the central venous catheter is necessary for accurate monitoring of CVP and long-term use of catheter. Incorrect placement of the catheter tip is the most common cause of early

Table 1: Preoperative patient profiles

Patient Profiles	Internal jugular group (n=100)	Subclavian group (n=100)	P Value
Age (years)	42 \pm 13.04	41 \pm 14.2	$P > 0.05$ (not significant)
Sex (M / F)	64/36	71/29	
Weight	85 \pm 12.02	80 \pm 10.03	$P > 0.05$ (not significant)
CABG/Valve replacement/ICR	25/44/31	28/38/34	$P > 0.05$ (not significant)

Table 2: Complications of the procedure

Complications	Internal jugular group(n=100)	Subclavian group(n=100)	P -Value
Number of attempts	8%	14%	$P < 0.05$ (significant)
Arterial puncture	1%	5%	$P < 0.05$ (significant)
Catheter malposition	5%	10%	$P < 0.05$ (significant)
Haemo/pneumothorax	1%	4%	$P < 0.05$ (significant)
Infection rate	9%	5%	$P < 0.05$ (significant)

catheter malfunction. This is usually detected by chest radiography⁹. In a metaanalysis of Ruesch et al¹⁰ the rates of misplacement were reported to be 5.3% in the internal jugular vein site and 9.3% in the subclavian vein site. In two large case series, malposition rates for subclavian route were 4.2%¹¹, and 6%¹² Lovino et al¹³ found the rate of misplacement to be 1.8% both in the internal jugular vein site and subclavian vein site. Janik et al¹⁴ reported 7.3% misplacement rate in children under the age of 5 years. In our study, the rates of misplacement were 05% in the internal jugular site, 10% in the subclavian site. In seven of the cases attempted for subclavian approach misplacement was toward the contralateral subclavian vein, and three towards ipsilateral internal jugular vein. Failure of the first attempt at subclavian catheter insertion dramatically increases the risk for mechanical complications, Increased attempt number also increases the risk of complication⁷. Furthermore, CVC misplacement may be lethal.¹⁵ Number of attempts were more in subclavian group i-e 14% compared to 8% in internal jugular group, the lower rate of misplacements in the internal jugular site compared to that of the subclavian site found in our study may be due to our experience with the internal jugular vein access.

Subclavian and jugular sites are safe accesses when they are controlled with bedside chest radiography, but the necessity of radiography is controversial. Radiographs and other methods should be used if there is any suspicion.^{12,16} Guth¹⁷ has claimed that the radiological control is not needed for catheterizations if complication is not suspected, while Whicky at al¹ and Gladwin at al¹⁸ have suggested routine control of chest radiography. Catheters were being inserted in blind manner. Chest radiography still remains the gold standard and the most commonly used diagnostic tool to detect misplacement of the catheter or pneumothorax¹⁹. In our study, routine confirming of chest radiography has been taken after central venous catheterization in ICU.

Only 1% of patients showed haemothorax in internal jugular group compared to 4% in subclavian group, similarly carotid artery puncture was seen in 1% of cases while it was 5% in subcalvian artery injury, which was controlled when the chest was opened for bypass surgery. Tomer etal concluded in his study that both the approaches are safe in experience hands.²⁰ Although, subclavian access is associated with fewer infectious complications, mechanical complications are

common and can have serious results. Because the risk for infection increases with the duration of catheter use, subclavian access is probably the best choice if the catheter is expected to stay for 5 days. Rate of infection was higher in our internal jugular group i-e 9%, while it was 5% in subclavian group.

CONCLUSION

Internal jugular vein is an easy access having less complications for central venous catheterization compared to subclavian vein.

Recommendation

Further research needs to be done to provide a definitive answer on the benefits of internal jugular catheterization in Patients undergoing cardiac surgery.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

- Laiq N:** Concept and idea.
Majid A: Operating surgeon.
Nawab J: Operating surgeon.
Malik A: Operating surgeon.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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