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Original Article

COMPARISON BETWEEN EFFECT OF HEAD POSITIONS ON THE PLACEMENT OF CATHETER IN THE INTERNAL JUGULAR VEIN

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ABSTRACT

The position of the head of the patient play an important role in the ease and success of Right Internal Jugular Vein (RIJV) cannulation using external landmark-guided technique. Sixty patients undergoing open heart surgery for both acquired and congenital heart diseases were studied in three groups-neutral head position, head rotated to 20 degree and head rotated to 30 degree to the left for RIJV cannulation.

The overall success rate irrespective of number of attempts and head positions in this study was 93.3%. Complications were a bit higher than in other studies. Available literature did not compare between different degree of position of head rotation. This study compared between these groups in terms of number of attempts required for RIJV cannulation, but no significant difference was found between or within the groups (P>0.05). From this study it can be proposed that, some degree of rotation (upto 20 degree) may be allowed to make landmark prominent but extreme degree of rotation which result in more number of attempts and complications is not desired.

INTRODUCTION

Central venous pressure catheters are used to measure the filling pressure of the right ventricle of the heart and to give an assessment of the intravascular volume and right ventricular function. The use of central venous catheters is an integral part of management of patients in the Intensive Care Unit and patient undergoing cardiac surgery. The accuracy and reliability of CVP monitoring depends on many factors, including the functional status of the right and left ventricles, the presence of pulmonary disease, and ventilatory factors such as positive end expiratory pressure. The CVP correlates with left heart filling pressure only in patients with good left ventricular function.

The clinical use of CVP measurement in man was reported by Huges and Mcgovern in 1959[1]. Access to the central venous circulation may be obtained by at least five routes: antecubital, internal and external jugular, subclavian and femoral veins. Each of the veins may be entered by a variety of approaches. The preferred approach depend on several factors, including the reason for cannulation, the acuity of situation, the anticipated duration of cannulation, ease of access, anatomic anomalies, skill and experience of the operator and the ability of the patient to tolerate the position required for catheter insertion. The most direct access route to the right ventricle and pulmonary artery is the right internal jugular vein, followed by the left internal jugular and left subclavian veins. These approaches are recommended for pulmonary artery catheters and temporary pacemakers, when possible. For long term parenteral nutrition the subclavian approach is the easiest to maintain in a reasonably clean condition. The femoral and subclavin veins are the easiest to cannulate rapidly in a patient who needs urgent resuscitation[7].

The internal jugular vein is the safest access site to the superior central ciruclation and is the most common access route for the cardiac anesthesiologist[2]. Cannulation of internal jugular vein was first described by English et al in 1963[3]. Its popularity among anesthesiologist has steadily increased since that time because of its low incidence of complications. Successful cannulation of the internal jugular vein depends upon operator skill,

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experiences, ease of the internal jugular vein depends upon operator skill, experiences ease of access and patients factors[4]. Cannulation of the internal jugular vein has various advantages: (1) the high success rate as a result of the usually constant relationship of the anatomic structure; (2) short and straight course to the right atrium that almost always assures right atrial or superior vena caval localization of the catheter tip; (3) easy access from the head of the table; and (4) fewer complications than with subclavian vein catheterization. The JV is located under the medial border of the lateral head of the sternoclei-domastoid muscle. The carotid artery is consistently deep and medial to IJV. The right IJV is preferred, since this vein leads straight into the SVC, the right cupula of the lung is lower than the left, and the thoracic duct is on the left side'.

Various approaches of IJV cannulation exist, of which three standard approaches are: middle or central, anterior or medial and posterior. All the approaches have their advantages and disadvantages - the central approach has low incidence of pneumothorax while the posterior approach has higher incidence of carotid artery puncture[6]. The position of the head of the patients also play important role in the ease and success. Neutral or mid position of the head is a safe and reliable method of gaining central venous access in patients with possible cervical spine injury following trauma[6]. Some of the cannulations of RIJV are done with the head rotated 30° to the left[s]. This rotation may be harmful to some of the patients. Altering the position of the head may lead to diminution in internal jugular vein blood flow; thus the neutral position would appear to be the preferred alignment for a more distended vein[6]. Most of the studies in the literature were carried out with either head in the mid or lateral position with or without specifying the degree of rotation. The aim of the study was to investigate the effect of various head positions on the likelihood of successful cannulation and thus to find out the easiest puncture position with less complications.

MATERIAL & METHODS

The study was carried out in the Department of Anesthesiology, National Institute of Cardiovascular Diseases, Sher-e-Bangla Nagar, Dhaka. 60 patients of both sexes scheduled for open heart surgery for both acquired and congenital heart diseases were included in the study. The following categories of patients were excluded from the study- i) Below 12 years of age. ii) Undergoing emergency cardiac operations. iii) Having NYHA grade IV. iv) Unwilling to participate in the study.

Degree of rotation of head of the left of the sagittal plane was measured by protractor and divider. Multilumen central venous catheterisation set was used for RIJV cannulation.

After institutional approval, patients selected for inclusion in the study were given a detailed explanation of the procedure and informed consent was obtained from them. Height in centimeters and weight in kilogram was taken and noted. The degree of various angulations were measured by a protractor and a divider.

After induction of anaesthesia and endotracheal intubation, patients were placed in 10-15 degree Trendelenburg position and the skin over the area prepared and draped in sterile position. Patients were randomly divided into 3 groups according to the various position of head during RIJV cannulation:

Group-A : Neutral or mid position of the head.
Group-B : Head rotated 20 degree to the left &
Group-C : Head rotated 30 degree to the left.

In all the groups the anterior or medial approach for RIJV cannulation was adopted.

PROCEDURE

On arrival in the operating room, the patients were transferred to the operating table and all the preparations including ECG, invasive and non-invasive arterial BP, oxymetry were performed. After induction of anesthesia and endotracheal intubation, patients were placed in 10-15 degree Trendeleburg position, the pillow removed and the neck extended approximately 10 degree[8]. The skin over the entire anterior surface of the neck between the mandible and clavicle was prepared with antiseptic solution and draped in a sterile fashion. Standing at the head of the patients bed, the procedure was performed by using a blind, external anatomical landmark- guided technique[9]. The cricoid cartilage, SCM muscle, the cartoid artery & the clavicle are the landmark involved in the procedure.

Anatomically, the level of the cricoid cartilage appears to be in a an optimal frontal plane for

introduction of the cannulating needle because it is easily identified and crosses the internal jugular vein where it become widened[6]. The middle three fingers of the left hand were then positioned such that the pads of the fingers lay on the lateral aspect the larynx and the fingers tips pointing directly at right angles to the coronal plane. If the artery had been palpable lateral to the fingers then the fingers were positioned more laterally. Seeking puncture was done with 22 gauge finder needle attached with a syringe at the level of the cricoid cartilage immediately lateral to the fingers at the medial border of the SCM muscle. The needle was directed inferiorly & laterally towards the junction of the middle and medial thirds of the ipsilateral clavicle and making a posterior angle of 30° to 45° with the coronal plane of the body[10]. A syringe was always attached to the needle and a constant aspiration was done to cause reflux of blood uninterrupted by bubbles to signal entry into the vein. When venous blood was aspirated through the finder needle, the needle and syringe were withdrawn leaving a small trial of blood on the drape to indicate the direction of the vein. Then a 16 guage needle and syringe was used to puncture the vessel in an identical fashion. When a good blood return was obtained, the syringe was removed and a guide wire was introduced through the needle, while watching the ECG monitor for arrhythmia. Then the needle over the guide wire was withdrawn and a dilator was passed over the guide wire after making an incision with a no 11 scalpel blade where the guide wire enters the skin. Then the dilator was withdrawn and a triluminal CVP catheter was passed over the guide wire and the guide wire removed. Correct location of the catheter was confirmed by easy aspiration of non-pulsatile blood, transducing the venous waveform and comparing the blood color or Pa02 with an arterial blood sample. The catheter was then secured and sterile dressings applied. The catheter was connected to the source of fluid with the middle port connected to the water manometer.

The same procedure was applied to all three groups of patients, with the head in mid or neutral position, head rotated 20^0 to the left & head rotated 30" to the left from the sagittal plane. Immediately after arrival in the intensive care unit chest radiographs were taken to see the location of the catheter tip.

RESULTS

Demographic characteristics of the patients of the three groups were recorded in Table no. 1. A total of 60 patients, 20 patients in each group with age ranging from 15-60 years were included in the study. There was no significant difference in age and height between or within the group (P>0.05).

Catheterisation was recorded in Table-II in terms of total success rate irrespective of attempts and also in number of attempts required to locate the RIJV with introducing needle. Overall success rate in group A i.e. patients with head in neutral or mid position & in group B i.e. patients with head 20 degrees rotated to the left were same (95%). But in group C i.e. patients with head rotated to 30 degrees to the left the success rate was lower (90%) than the other two groups. The mean number of attempts in group A is 1.55, in group B is 1.45 and in group C is 1.65 are comparable but in group B the mean number of attempts are less. To see whether these differ significantly within and between the groups, "ANOVA" test was done which showed no significant difference (P>0.05).

Complications such as hematoma, arrhythmia and carotid artery puncture were recorded and shown in Table III. Complications occurred equally (10%) in group A and in group B, but slightly higher (15%) in group C. Radiograph location of catheter tip in different groups are shown in Table – IV.

Table -I

Demographic characteristics of the three groups. Mean (± SD)

Characteristics	Group A (n = 20)	Group B (n = 20)	Group C (n = 20)
Age (years)	35.40 (±12.52)	34.25 (±12.57)	36.60 (±13.22)
Sex (M/F)	14/6	13/7	18/2
Height (cm)	16.20 (±10.15)	159 (±16.92)	162(+6.31)
Weight (kg)	35.20 (±12.51)	49.35 (±9.41)	61.05 (±15.83)

Table-II

Number of attempts required and success rate for RIJV access in three groups

No. of attempts	Group A	Group B	Group C
1	12(60%)	14(70%)	10(50%)
2	6(30%)	4(20%)	7(35%)
3	1(5%)	1(5%)	3 (15%)
4	1(5%)	1(5%)	0(0%)
Success	19(95%)	19(95%)	18(90%)
Failure	1(5%)	*1(5%)*	2(10%)

Table - III

Complications in RIJV cannulations in three groups

Complications	Group A	Group B	Group C
Hematoma	1(5%)	1(5%)	1(5%)
Arrhythmia	1(5%)	0(0%)	0(0%)
Carotid artery puncture	0(0%)	1(5%)	2(10%)
Total	2(10%)	2(10%)	3(15%)

Table - IV

Radiographic Location of CVP catheter tip

Positions	Group A N=19	Group B N=19	Group C N=18
S.V.C	14(70%)	16(80%)	13(65%)
R.A.	4(20%)	2(10%)	3(15%)
S.V.C & R.A Junction	1(5%)	1(5%)	2(10%)

S.V.C = Superior Vena Cava R.A. = Right Atrium

DISCUSSION

Internal jugular vein catheterisation is a common & safe route for central venous access in critically ill patients in the accident and emergency department, the intensive car unit and operating theatre. It has various advantages over other routes of central venous cannulation. There are many techniques to guide the cannulation-external anatomical landmark-guided technique, percutaneous ultrasound assisted cannulation, Echo-guided cannulation, Transesophageal Echocardiography imaging to guide IJV cannulations[8,9,10]. In this study external anatomical landmark guided technique has been used-cricoid cartilage, SCM muscle, carotid artery and clavicle, are being the landmarks, which are superficial, easily identifiable and constant in relation. There are various approaches of RIJV cannulation-central or middle, anterior or medial and posterior. A new approach called the 'very high' approach, described by F.M. Messahel and A.A. AL-Mazroa[11] had the success rate of IJV puncture at the first attempt was 85.4%. This study utilizes the anterior or medial approach for all the cases.

The position of the head of the patient may also play in important role in the ease and success of RIJV cannulation. This study was designed and formulated chiefly to find out the best degree of head position or rotation to obtain a successful cannulation. The overall success rate irrespective of number of attempts and head positions in this study was 93.3% which is comparable. to other landmark guided technique like 98% by I.P. Latto et al and 97.5% by George A. Kellner et al[1].

The neutral head position technique utilises standard technical aspects with simple bony and cartilaginous landmarks. This position is useful in all patients, but particularly in those with suspected or unstable neck injuries. K.L. Willeford and J.A. Reitan[6] showed 98% success rate which is comparable to this study of 95% success.

With 30^0 to the left head position group- our rate was 90% which is comparable to the study by H. Hayashi et al[5], which shows 92.5% success rate. All the studies in the literature were carried out with either head in the mid position or in the lateral position with or without specifying the degree of rotation. This study included another group of 20 degree head rotation in between the two extremes. This group has success rates of 95% which is equal to the group A but better than group C. But on statistical analysis no significant difference was found between or within the three groups in terms of success.

Complications were a bit higher than other studies- in our study it was 11.66% and in the study by H. Hayashi et al the complication rate was 6.8% which may due to sole dependency upon landmark guidance only. It may be improved by newer techniques like echo, ultrasound, or TEE. Patients with high body mass index (>30) showed difficulty in catheterization which may be due to obscuration of the anatomical landmarks. Head rotation to the 30^0 has less success

and more complications which may be due to diminution in internal jugular vein blood flow, thus the mid position would appear to be preferred alignment for a more distended vein[6]. Some rotation (20^0) may be allowed to make landmark SCM muscle more prominent.

Location of the catheter tip above the pericardial sac can be confirmed on chest x-ray by the carina which in no case was located below the pericardial sac in the study by Schuster et al[12]. The carina is a reliable, simple anatomical landmark for the correct placement of CVCs. In our study we did chest x-rays after returning the patient to the ICU from operating theatre.

CONCLUSION

From this study it can be concluded that the position of head of the patient on the success of Right Internal Jugular Vein cannulation does not have a clinically important significant effect. To make the result statistically significant, study with a larger sample size can be undertaken.

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