



COMPARISON OF INTERNAL JUGULAR VEIN CANNULATION IN NEUTRAL HEAD POSITION VERSUS CLASSICAL CENTRAL APPROACH

Dr. S. Vinodhkumar

M.D.

Dr. M. Vijayasankar*

M.D. *Corresponding Author

ABSTRACT **Background:** The standard conventional technique for placing central venous catheters in the IJV is by using anatomical landmarks. All those techniques are described with the head either turned or significantly extended in order to improve the access which are contraindicated in some situations. Our aim is to compare the ease of placement of IJV catheter in neutral head position with that of classical central approach.

Materials and methods: The study was done in a prospective randomised manner. 66 patients were randomly divided into two groups. Group C for classical central approach and Group N for IJV cannulation in neutral head position. Number of attempts, success at first attempt, ease of guide wire insertion, failure to locate IJV and complications were assessed.

Results: The observation of these parameters between the two groups did not show any statistical significance.

Conclusion: Cannulating the Internal jugular vein with the head in neutral position is a safe and reliable alternative technique in special situations.

KEYWORDS : Central vein cannulation, Positioning, neutral vs classical.

INTRODUCTION

Central venous access is an integral part of patient management in many clinical settings. Standard approaches to internal jugular vein catheterization include the anterior, central and posterior routes¹. All of these techniques are described with the head either turned or significantly extended in order to improve anatomical positioning and access. In trauma patients with unstable neck injuries following traditional approaches for the placement of IJV catheter poses additional neurological injuries during the procedure. Furthermore placing the patient in Trendelenberg position (15° head tilt downwards) increases the intracranial pressure (ICP) which is detrimental to neurosurgical patients and patients with head injury. To circumvent these problems IJV can be cannulated with the head held in neutral position, using simple bony and cartilaginous landmarks². This method will be useful particularly in those with suspected cervical spine injuries and where central venous cannulation is most easily obtained via the internal jugular vein. The aim of this study is to assess the ease of placement of internal jugular venous catheter in neutral head position, and to compare the success rate, failure rate and the complication rate of this technique with that of classical central approach.

MATERIALS AND METHODS:

The study was done in a prospective randomized manner. Sixty six patients of either sex posted for major elective cardiac surgeries satisfying the selection criteria was randomly allocated into two groups. **Group C:** Patients in this group underwent IJV cannulation by classical central approach. **Group N:** Patients in this group underwent IJV cannulation with their head held in neutral position. Materials used standard triple lumen catheter kit (Biosensors international) include a 7-Fr (Fr) triple lumen catheter with 20 cm of usable length, a 0.032 inch diameter guide wire with straight and J tip, 18 gauge thin wall needle, a 7 Fr. vessel dilator, a 22 gauge finder needle, appropriate syringes and suture material. The patients were between 12 to 70 years posted for elective cardiothoracic surgeries. Standard monitoring devices (ECG, NIBP, and Pulse-oximeter) were applied. Intravenous access with two 16 gauge venflons was achieved. Patients were premedicated with Inj. Morphine 0.1 mg/kg iv and Inj Midazolam 0.05 mg/kg iv.

Group C

The patients under this group had their IJV cannulation by classical central approach. Patient was positioned in 15° Trendelenberg position with a small bed roll between the shoulder blades head turned about 30° towards the left side, arms kept by the side of the body. Right IJV region was exposed, cleaned and draped. Infiltration with 3 ml of 1% Xylocaine at the appropriate site of skin puncture given. The operator stood at the head end of the patient. The anatomical landmarks were determined by palpating the two heads of the sternocleidomastoid and

locating the apex of the triangle formed by them. The carotid artery pulsation was felt 1 to 2 cm medial to this point, beneath or just medial to the sternocleidomastoid muscle. A 22-gauge 1.5 inch finder needle mounted on a 5 ml heparin saline loaded syringe was first used to locate the IJV. The carotid artery was just palpated prior to insertion of finder needle to ensure that it was not directly under the insertion point. The finder needle is inserted at the apex of the triangle with an angle of 30°-45° to the frontal plane, directed at the ipsilateral nipple. The needle was advanced steadily with constant back pressure and venepuncture occurred within 3 to 5 cm. The venepuncture is demonstrated by free aspiration of dark venous blood.

The direction of the finder needle and the depth at which venepuncture had occurred were noted. Then 18-gauge thin walled needle mounted on a 5 ml heparin saline loaded syringe was introduced in the identical plane and venepuncture was attempted in the same direction and depth. Once the venepuncture occurred, free aspiration of dark venous blood was demonstrated. The J tip of the guide wire was then inserted freely up to 20cm at which point the 18-gauge needle was withdrawn. With the guide wire in place, a scalpel was used to make a generous 90° stab incision at the skin entry site to facilitate passage of the vessel dilator. The dilator was inserted down the guide wire to the hub, ensuring that control and sterility of the guide wire was not compromised. The triple-lumen catheter was then inserted over the guide wire. After cannulation central venous placement was verified by waveform analysis in all patients, supplemented by chest x-ray later (taken postoperatively) to detect complications and catheter tip position. If the first attempt was unsuccessful a fresh attempt is made 2 mm lateral to the initial puncture site. A decision of failure to locate the vein was made if the vein was not punctured even after fourth attempt. If the venepuncture did not occur with 18-gauge needle after insertion up to a depth of 0.5 cm more than that of successful finder needle insertion was considered as a missed attempt. If the guide wire did not pass easily beyond the tip of the 18-gauge needle, the guide wire was withdrawn, the syringe was reattached and free aspiration of blood was re-established. If this was not possible the 18-gauge needle was withdrawn and a fresh attempt was made.

If the venepuncture or cannulation was unsuccessful after three consecutive attempts with the 18-gauge needle or development of significant hematoma (>2cm in any dimension) due to artery puncture, it was considered as failure in cannulation.

Group N

The patients under this group had their IJV cannulation with the head held in neutral position. The patients were put in supine position (table flat, head in midline, sandbags on either side of head to ensure immobilization of neck). The point of needle entry is directly superior to the lateral border of the bony depression caused by insertion of the

clavicular head of the sternocleidomastoid muscle on the superior surface of the clavicle. The insertion point is easily identified by running the finger firmly along the superior posterior edge of the clavicle to find the indentation. A perpendicular line was drawn in cephalad direction from this lateral edge. A parallel line was drawn at the level of cricoid cartilage. Approach to the IJV is made through the point of intersection of these two lines. A 22 gauge finder needle was inserted at an angle of 60°-90° to the frontal plane with constant negative pressure. Once the vein was located, catheterization proceeded in the same track as the finder needle using the seldinger technique with an 18-gauge thin walled needle. If the first attempt was unsuccessful, a second attempt was performed 2 mm lateral to the initial puncture site. After cannulation, central venous placement was verified by waveform analysis and a chest x-ray later (taken postoperatively) to detect catheter tip position.

Parameters observed:

1. (a) Number of attempts with the finder needle (22-gauge) to locate the IJV
(b) Success at first attempt.
 2. Depth of insertion
 3. Number of attempts with the cannulating needle (18-gauge) to locate the IJV.
 4. Guide wire insertion
 5. Failure in locating the IJV.
 6. Failure in cannulating the IJV.
- Acute Complications
1. Carotid artery puncture
 2. Hematoma
 3. Others (if any)

RESULTS

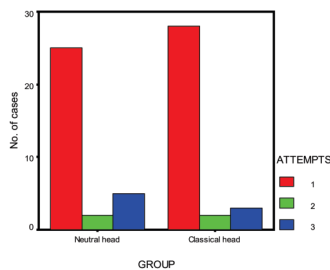
Sixty six patients of either sex posted for major elective cardiac surgeries satisfying the selection criteria were randomly divided into two groups.

Group N: Patients under this group had their internal jugular vein cannulated in neutral head position.

Group C: Patients under this group had their internal jugular vein cannulated through classical central approach.

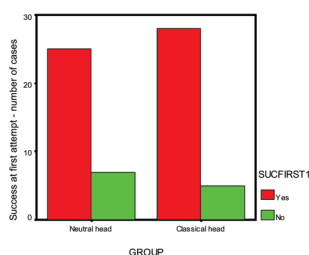
The two groups were similar with respect to age, sex, height, weight and BMI.

Number of attempts to locate with finder needle by groups



In group N 25 patients had their IJV located with first attempt, 2 patients required two attempts while 5 patients required a third attempt. In Group C 28 patients had their IJV located with first attempt, 2 patients required two attempts while 3 patients required a third attempt. The difference of results between the groups did not show any statistical significance. (p = 0.72).

The success at first attempt



IJV was located exactly where it was predicted i.e. with the first attempt in 78.1% patients of group N and 84.8% patients in group C. The difference of results between the two groups did not show any statistical significance (p = 0.48).

MEAN DEPTH OF INSERTION OF CASES

The depth at which IJV is punctured from the skin margin ranges from 2.4 to 3.7 cm with a mean of 3.07 cm in Group N patients and 3.06 cm in group C patients. The difference between the two groups did not show any statistical significance. (p = 0.97).

Number of attempts with cannulating needle

Group N: Mean = 1.034 (0.07) Group C: Mean = 1.030 (0.07)
The mean number of attempts with the cannulating needle (18-gauge) for successful venepuncture was 1.03 (0.07) for both group of patients. The results did not show any statistical significance. (p=0.54).

Nature of guide wire insertion

The guide wire insertion was found to be difficult in three patients (9.7%) of Group N. Only one patient (3.1%) in Group C had this difficulty.

The results did not show any statistical significance (p = 0.67).

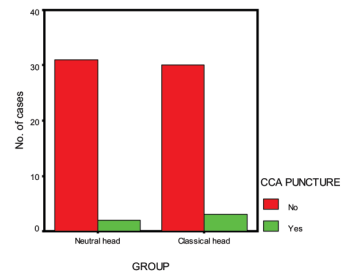
Failure to locate by finder needle and groups

In one patient (3%) of Group N the internal jugular vein could not be located with the finder needle even after 4 attempts. But there was no such failure in Group C patients. The analysis of results did not show any statistical significance (p = 1).

FAILURE TO CANNULATE

Failure in cannulation occurred in two patients (6.1%) of Group N while it occurred in one patient (3%) in Group C. The difference of results between the two groups did not show any statistical significance.

Carotid Artery (CA) puncture and groups



The incidence of carotid artery puncture in Group N was 6.1 % (2/33) while in Group C it was 9.1 % (3/33). The difference of results between two groups did not show any statistical significance. The incidence of hematoma in Group N was 6.1 % (2/33) while in Group C it was 3 % (1/33). The analysis of results between the two groups did not show any statistical significance

STATISTICAL METHODS

A total of 33 cases were randomly allocated to one of the following two groups of study viz. Group N – Neutral Head and Group C – Classical Head. The descriptive statistics of the variables studied are represented as two-way tables. The categorical factors are represented by the number and frequency (%) of cases. The continuous variables are represented by measures of central frequency (mean, median & mode) and deviation (standard deviation and range). The differences in the proportions are tested for statistical significance using non-parametric Chi-square test for variables measured on nominal scale. Fisher's exact probability test is used to find out the statistical significance when the number of cases is nil or wherever indicated. For variables measured on a continuous scale, Student "t" test is employed to elicit the statistical significance of differences of the means of a single variable in two groups.

DISCUSSION

The observations and results show that cannulating internal jugular vein with the head held in neutral position doesn't differ significantly with that of classical central approach. The overall success rate, number of needle passes, failure rate, and complication rate were

similar to that of classical central approach.

Number of attempts required to locate the IJV with finder needle (22-gauge):

Willeford KL et al² conducted a study in 55 patients, where the average number of needle passes (finder needle) required to locate the vein was 1.4(0.2) per patient. **Lew YS et al**, conducted a study in 40 patients where the average number of needle passes required to locate the vein was 1.3(0.1) per patient. In the present study the mean number of attempts required to locate the IJV with the finder needle, in Group N (Neutral head) was 1.33 (0.2) per patient. For patients in Group C the mean number of attempts was 1.24(0.1) per patient.

Success at first attempt

Willeford KL et al² they showed that IJV was located with the first attempt in 84% of patients with their head held in neutral position. **Lew YS et al**, they showed that IJV was located with the first attempt in 72.5% of patients with their head held in neutral position. In the present study IJV was located exactly with the first attempt in 78.1% for the patients in Group N and 84.8% for the patients in Group C. The differences between the two groups did not show any statistical significance ($p=0.48$).

DEPTH OF INSERTION

Chandrakant Pandey et al¹ they showed that complications during IJV cannulation can be minimized if the depth from skin to vein was measurable after successful venepuncture with the finder needle. The 18-gauge needle was then inserted to the prefixed distance to hit the IJV. In the present study the depth at which IJV punctured from skin margin ranges from 2.4 to 3.7 cm, with a mean depth of 3.07 in Group N patients and 3.06cm in Group C patients. There was no statistical difference between the two groups.

Number of attempts to locate the IJV with the cannulating needle (18-gauge)

In the present study the mean number of attempts with the 18-gauge thin walled needle was 1.03 (0.07) for both group of patients.

Guide Wire Insertion

In the present study the guide wire insertion was found to be difficult in three (9.7%) patients of Group N after successful venepuncture with the 18-gauge needle. Only one patient (3.1%) in Group C had difficulty in guide wire insertion. There is no statistical significance ($p=0.67$) between the two groups.

FAILURE TO LOCATE THE VEIN

Failure to locate the vein was defined as one in which the venepuncture had not occurred with the finder needle even after four attempts. **Kaushik S, et al¹**, in their study of 120 patients the failure rate was 1.66% **Willeford KL**, in their study of 55 patients the IJV could not be located in one (2%) patient.

In the present study for one patient (3%) in Group N the vein could not be located even after 4 attempts. But there was no such failure in Group C patients.

The difference in the results did not show any statistical significance.

Failure to cannulate the vein:

Failure to cannulate the vein is defined as one in which cannulation was unsuccessful even after 3 consecutive attempts with the cannulating needle or there is development of significant hematoma (>2 cm in any dimension). In the present study failure in cannulation occurred in 2 patients (6.2%) of Group N while it occurred in one patient (3.0%) of Group C. The difference in the results did not show any statistical significance.

Acute complications observed:

Arterial puncture was the most common acute complication observed. **Wang R et al¹** In the present study 2 patients (6.1%) of Group N and 3 patients (9.1%) of Group C suffered carotid artery puncture. The difference of results between the two groups did not show any statistical significance ($p = 1.00$). The second major complication was hematoma which occurred in 2 patients (6.1%) of Group N and 1 patients of Group C (30%).

SUMMARY

In this study an alternative approach was used to cannulate internal jugular vein where the head and neck were kept in neutral position.

Venous puncture is made along an axial line drawn superiorly from the lateral edge of the bony depression at the insertion of the sternocleidomastoid on the superior edge of the clavicle. This line at the level of cricoid cartilage directly overlies the internal jugular vein. In this study of sixty six patients, the neutral head position technique was compared with that of classical central approach in terms of following parameters; the mean number of attempts with the finder needle (22 gauge) to locate the IJV in Group N (neutral head) was 1.33(0.2) per patient while in Group C (central approach) it was 1.24(0.1) per patient. The percentage of success at first attempt in Group N was 78.1% while in Group C it was 84.8%. The mean depth at which IJV was punctured from the skin margin in Group N was 3.07cm while in Group C it was 3.06cm. The mean number of attempts with the cannulating needle (18-gauge) to locate the IJV was 1.03(0.07) per patient in both the groups. Guide wire insertion was found to be difficult in 9.7% of patients in Group N and 3.1% of patients in Group C. Failure in locating the IJV in Group N was 3%(1/33) while no such failure happened in Group C patients. Failure in cannulating the IJV in Group N was 6.1% and in Group C it was 3%. The incidence of carotid artery puncture in Group N was 6.1% while in Group C it was 9.1%. The incidence of hematoma in Group N was 6.1% while in Group C it was 3.1%. The difference of results between the two groups did not show any statistical significance.

CONCLUSION

From this study it is concluded that cannulating the internal jugular vein with the head in neutral position is a safe and reliable alternative technique that can be followed in situations where the head should not be extended or rotated as in trauma patients.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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