

Ease of Internal Jugular Venous Cannulation by Anterior V/S Posterior Approach: A Randomized Interventional Study

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ABSTRACT

Background: Percutaneous cervical central venous cannulation is now common practice during Perioperative care in major surgical procedures, critically ill patients in intensive care units for long term hyperalimentation and for rapid restoration of blood volume in cases of acute blood loss. Proper route of insertion is essential for its success. The objective of this study is to compare procedural parameters and complications associated with anterior and posterior approaches for Internal Jugular Venous cannulation.

Methods: Our study was conducted as a prospective randomized interventional trial in 60 patients undergoing scheduled cardiac surgeries requiring Right internal jugular venous cannulation in a tertiary level hospital after obtaining clearance from ethics committee, patients were randomly allocated into two groups either Anterior approach (Group A; n=30) or Posterior Approach (Group B; n=30). Number of attempts, time for identification of IJV, duration of cannulation, ease of insertion, complications were compared in both the groups.

Results: The number of attempts (p value 0.036), mean time taken for vein identification (p value 0.0003), catheterization time (p value <0.001), incidence of arterial puncture and hematoma are less with posterior approach, ease of threading is comparable among both the group. There were no statistically significant intergroup differences with respect to the Age, Sex, ASA grade.

Conclusion: The posterior approach is better than anterior approach for Internal Jugular Vein Cannulation, as it improves the success rate, permits easy threading of catheter, reduces access time and duration of cannulation, complications like arterial puncture, hematoma, pneumothorax are lesser in posterior approach.

Introduction

Central venous cannulation is a common practice during Perioperative care in major surgical procedures, critically ill patients in intensive care units for long term hyperalimentation and for rapid restoration of blood volume in cases of acute blood loss [1]. Cannulation of the internal jugular vein (IJV) is an essential skill of critical care physicians. The choice of sites for insertion of an internal jugular venous catheter will depend on the indications, relative contraindications, risk of complications, patient factors predisposing to

difficult cannulation, and clinical conditions. The technique of introducing an internal jugular vein catheter is the same for single-, double- and triple-lumen catheters as well as dialysis lines. Internal Jugular Venous catheterization is a vital intervention in critically ill patients and in major elective & emergency surgeries [2]. Common indications for IJV cannulation are haemodynamic monitoring, administration of drugs likely to induce phlebitis, haemodialysis, lack of peripheral venous access.

Relative contra-indications for IJV cannulation [3] are contralateral diaphragmatic dysfunction. Local Infection,

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distorted local anatomy, coagulopathy, presence of carotid disease, recent cannulation of the IJV.

Aim of the study was to study the difference between Anterior and Posterior approach for Internal Jugular venous cannulation.

Primary objective was to assess and compare mean time taken for the cannulation in both the groups.

Secondary objective was to determine number of attempts to identify the vein, time taken to identify the vein, ease of threading, and difference in percentage of cases who develop side effects during the procedure in both the groups.

Methods

After obtaining due permission from the hospital ethical committee and registering in Clinical Trial Registry India with CTRI trail registration number CTRI/2021/01/030551, study was conducted between February 2021 and April 2021. A sample size of 30 cases in each group is required at 95% confidence and 80% power to verify the expected difference of 1.21 ± 0.58 minutes in mean time duration taken for successful catheterization in both the groups [2].

Patients undergoing scheduled cardiac surgeries, willing to give written informed consent, of either sex, ASA Grade II & III, Age Groups- 18-60 years, Weight between 40-65 kg were included in the study. Patients not fulfilling inclusion criteria, SVC syndrome, Infection at the site of cannulation, Coagulopathy, Presence of carotid disease, Contra lateral diaphragmatic dysfunction, Thyromegaly, Prior neck surgery were excluded from the study.

Participants were allocated into two groups of 30 each. Randomization was done by sealed envelope technique

Group A-Right IJV cannulation by Anterior approach.

Group B- Right IJV cannulation by Posterior approach.

Procedure

After taking informed written consent, the patient was placed in supine position with a 20-degree head down position. And connected to monitoring devices like spo2, ECG and Blood Pressure Monitor. The head was turned to the opposite side, under sterile all aseptic precautions the following landmarks were identified: medial & lateral heads of sternocleidomastoid muscle, clavicle, carotid artery pulsations, ipsilateral nipple, external jugular vein and suprasternal notch.

Anterior approach-For anterior approach, we have to first identify the triangular area at the base of the neck formed by the two heads of the sternocleidomastoid muscle and the clavicle [4]. This triangle contains Internal Jugular Vein and Common Carotid Artery, the carotid artery at the medial end of the triangle is palpated and gently retracted towards the midline away from the Internal Jugular Vein, needle is then inserted into apex of the triangle and then needle is advanced towards the ipsilateral nipple with constant aspiration, the position in

the vein is identified by the aspiration of the dark blood, the vein is then cannulated by the modified Seldinger's technique, catheter is sutured to skin.

Posterior approach-In the Posterior Approach, the point of needle entry is along the lateral edge of the sternocleidomastoid muscle, cephalad from the point in which External Jugular Vein crosses the muscle, the direction of the needle is medially towards the Suprasternal notch. The posterior approach used in this study was described by Brenkman and Cartleg (high lateral approach).

Statistical Analysis

Primary outcome variables were to assess and compare the mean time taken for the cannulation in both the groups. Secondary outcome variables were to compare the number attempts to identify the vein, time taken to identify the vein, ease of threading, and difference in percentage of cases who develop side effects during the procedure in both the groups. Statistical analysis was performed with the SPSS, version 21 for Windows. The Categorical data was presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if less than 0.05.

Results

Patients demographic data (age, sex, weight, ASA grading) were found comparable in both the groups (Table 1).

In group A 63.33% of patients catheterized in first attempt, 36.66% of patients catheterized in second attempt, and none of the patient required third attempt. In Group B had 86.67% of patients catheterized in first attempt, 10% of patients catheterized in second attempt, and 3.33% of patients in third attempt. The difference between both the groups was statistically significant with p-value of <0.05 (Table 2).

In our study, group A had mean cannulation time of 94.47 sec with the SD + 17.39, while group B had mean cannulation time of 63.50 sec with SD+19.68. The difference between both the group is statistically significant with p- value <0.05 (Table 3).

In our study, in group A mean time taken for vein identification was 16.77 sec with SD of +8.89. In Group B mean time taken for vein identification was 10.33 sec with SD of +2.99. The difference between both the group was statistically significant with p-value of <0.05 (Table 3).

In our study, in group A 76.66% of patients easily threaded and 23.33% of patients had difficulty in ease of threading the catheter. In group B 86.67% of patients easily threaded and 13.33% of patients had difficulty in ease of threading the catheter. The difference between both the group is statistically not significant with p- value of >0.05 (Table 3).

In our study, 16.66% of the group A patients had complications compared to 6.67% of patients in group B. The difference between both the groups is statistically not significant with the p-value of >0.05 (Table 4).

Table 1- Demographic data

Parameter	Group A (n=30)	Group B (n=30)	P value
Age	42.63±15.02	44.03±12.89	0.429 (NS)
Sex (M/F)	19/11	25/5	0.144 (NS)
ASA (Grade II/III)	29/1	29/1	0.472 (NS)

Table 2- Number of attempts taken to identify the vein

No of Attempts	Group A(n=30)		Group B(n=30)	
	No.	%	No.	%
1	19	63.33	26	86.67
2	11	36.66	3	10.00
3	0	0.00	1	3.33
Total	30	100.00	30	100.00
Result (p- value)	0.036 (S)			

Table 3- Results in both the group

Parameter	Group A	Group B	P value
Time taken to identify the vein(sec)	16.77±8.8 9	10.33±2.9 9	0.0003 (S)
Duration of cannulation(s ec)	94.47±17. 39	63.50±19. 68	0.001(S)
Ease of threading	23(yes) 7(no)	26(yes) 4(no)	0.505(N S)

Table 4- Complications in both the group

parameter	Group A(n=30)	Group B(n=30)
Carotid puncture	4/30	1/30
Hematoma	4/30	2/30
Pneumothorax	1	nil
haemothorax	nil	nil

Discussion

This study compares the widely popular technique of Anterior approach of cannulation of the Internal Jugular Vein to the Posterior approach. Our study was conducted as a prospective randomized interventional trial in 60 patients undergoing scheduled cardiac surgeries. Patients undergoing Internal jugular vein cannulation by Anterior approach were categorized as Group A (n=30) and those by Posterior approach as Group B (n=30). Probability was considered to be significant if less than 0.05. We have planned to conduct this study with the aim to

compare Internal Jugular Venous cannulation by Anterior versus Posterior approach in relation to number of attempts, time taken to identify the vein, ease of threading, time taken for identification, and complications (carotid puncture, hematoma, pneumothorax, haemothorax).

In the study conducted by Babu et al. [2] 80% of the people were cannulated successfully in the first attempt by the Posterior approach compared to only 52% of the people by the Anterior approach. Mohan Chandralkha et al. [5] observed in their study that successful cannulation with few attempts was more in Posterior approach than in Anterior approach. Similar results were obtained in our study 86.67% of the people were cannulated successfully in the first attempt by the Posterior approach compared to only 63.33% of the people by the Anterior approach.

In our study the average time taken to identify the vein was 16.77 ±8.89 seconds in the Anterior approach and 10.33 ±2.99 seconds in the Posterior approach. This was found to be strongly significant. Indicating that it took a shorter duration of time to identify vein using Posterior approach. This result was similar to a study conducted by Manjula B et al. [1] and Babu et al. [2].

In our study the mean duration of cannulation was 94.47±17.39 seconds in the Anterior approach compared to 63.50 ±19.68 seconds by posterior approach. The results were statistically significant. Babu et al. [2] also supported our findings and concluded that duration of cannulation was significantly lower with Posterior approach.

In a study conducted by Chaudhari LS et al. [6] 90.5% canulae were easily threaded by Anterior approach and 95.8% by Posterior approach, which is statistically significant. Similar results were obtained in our study threading of the catheter was easier in the Posterior approach (86.67%) compared to Anterior approach (76.66%).

Mohan Chandralkha et al. [5] noted that the incidence of arterial puncture was less in Posterior approach (7/80) compared to central approach (18/80). The study by Chudhari LS et al. [6] also concluded that overall incidence of carotid puncture was higher in the Anterior approach (5%) compared to Posterior approach (2%). Similar results were obtained in our study carotid puncture was overall higher in the Anterior approach (4/30) compared to the Posterior approach (1/30).

Haematoma can develop rapidly following carotid puncture or slowly following multiple punctures on the vein due to difficult cannulation or threading [7]. Chudhari LS et al. [6] reported that by the Anterior approach there were 6 cases of haematoma but only 3 cases of Haematoma by the Posterior approach. In our study also by the Anterior approach there were 4 cases of haematoma but only 2 cases of haematoma by Posterior approach.

Pneumothorax is a dreaded complication of Internal Jugular Vein cannulation. We have encountered one case of pneumothorax by Anterior approach, whereas none by Posterior approach. As cannulation by Posterior approach is anatomically at a higher level than the Anterior approach, so the incidence of pneumothorax is less with Posterior approach.

Cook et al. [8] described tension pneumothorax following internal jugular venous cannulation under General Anesthesia, but we have not encountered these complications in both of the approaches.

Conclusion

The Posterior approach is better than the Anterior approach for Internal Jugular Venous cannulation as it improves the success rate, permits easy threading of the catheter, reduces time taken to identify the vein, reduces duration of cannulation.

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