

# Comparision of Posterior and Anterior Approaches for Internal Jugular Venous Cannulation – A Prospective & Randomised Controlled Study

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## Abstract

**Introduction:** Of the numerous approaches for internal jugular venous cannulation, anterior approach is being widely practiced. But the major complications of this approach are carotid artery puncture and hematoma. With posterior approach, there is lesser incidence of arterial puncture and hematoma.

**Materials and Methods:** This study was conducted over a period of 9 months. The aim of this study is to compare posterior and anterior approaches for internal jugular vein cannulation in terms of number of attempts, duration of cannulation, ease of insertion and complications of approach by each route. 50 patients were considered for the study and they were randomly allocated into two groups to be cannulated with either anterior approach (Group A; n = 25) or posterior approach (Group B; n = 25). Demographic data was comparable in both groups.

**Results:** The number of attempts, duration of cannulation, incidence of arterial puncture, incidence of arterial puncture and hematoma are less with posterior approach. Ease of threading and chance of catheter displacement were comparable among both groups.

**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 the access time and duration of cannulation. It reduces complications like arterial puncture, hematoma, pneumothorax, catheter displacement and thrombophlebitis.

**Keywords:** Anterior approach, Internal jugular venous cannulation, Posterior approach

## INTRODUCTION

Central venous cannulation is an essential skill for critical care physicians. The choice of Central venous catheter insertion sites will depend on the indications, relative contraindications, risk of complications, patient factors predicting difficult cannulation, and the clinical conditions. The technique for Central venous catheter insertion is the same for single, double, and triple lumen catheters, as well as dialysis lines. Central venous catheterization is a vital intervention in critically ill patients and in major elective & emergency surgeries.

### Common indications for Central Venous Cannulation

- Hemodynamic monitoring
- Administration of drugs likely to induce phlebitis

- Temporary cardiac pace maker
- Hemodialysis
- Lack of peripheral venous access

### Relative contraindications to Central Venous Cannulation

- Inexperience, unsupervised operator
- Local infection
- Distorted local anatomy
- Coagulopathy
- Previous radiation therapy
- Suspected proximal vascular injury

### Predictors of Difficult Cannulation

- Emergency Placement
- Obesity
- Coagulopathy

- Intubated
- Hypotensive/Hypovolemic
- Edematous patient and known previous difficult cannulation.

The proper choice of insertion is essential for success. Advantage of internal jugular vein cannulation relates to its consistent & predictable anatomic location,<sup>1,2</sup> its valveless course to the superior vena cava, the possibility of repeated cannulation and low incidence of complication in experienced hands.

Of the numerous approaches for Internal Jugular Venous cannulation, the anterior approach is being practiced widely, since the identification of landmarks & palpation of carotid artery permits a beginner to learn the procedure easily. The major complications of this approach are carotid puncture & hematoma. Posterior approach is relatively less practiced due to myths regarding the complications.<sup>3-5</sup>

L. S. Kumar chowdhari *et al.*<sup>6</sup> showed that access time and duration of cannulation were significantly less with posterior approach compared to anterior approach. Mohan chandralekha *et al.*<sup>7</sup> have compared posterior approach with central approach for internal jugular venous cannulation and showed that posterior approach was superior to anterior approach with lesser incidence of complications.

V. P. Chandrasekharan *et al.*<sup>8</sup> showed by a color Doppler study that anatomic variations of internal jugular vein in relation to carotid artery permits lesser chances of arterial puncture with posterior approach compared to anterior approach. It is also easier to perform in critically ill patients as the Trendelenburg position is not mandatory for this approach.

Our study compares the posterior and anterior approaches for internal jugular vein catheterization in terms of number of attempts, duration of cannulation, ease of insertion and complications of approach by each route.

## MATERIALS & METHODS

After obtaining institutional ethical committee approval, 50 patients between 16-60 yrs of age of ASA (American Society of Anesthesiologists) Grade I/II/III pts requiring central venous catheterization including both critically ill & patients posted for elective & emergency surgeries were randomly selected for study. The study was undertaken over a period of 9 months between July 1<sup>st</sup> 2011 to March 31<sup>st</sup> 2012 in Government General Hospital, Kakinada.

These patients were randomly allocated into two groups of 25 patients each.

- Group A: Patients were cannulated by Anterior approach.
- Group P: Patients were cannulated by Posterior approach.

### Inclusion Criteria

American Society of Anesthesiologists Grades I, II and III, both males and females, adult patients aged 16 to 60 years with scheduled elective and emergency surgeries and critically ill patients in intensive care.

### Exclusion Criteria

Patients not fulfilling inclusion criteria, lack of patient consent, SVC syndrome, infection at the site of cannulation, coagulopathy, presence of carotid disease, contra lateral diaphragmatic dysfunction, thyromegaly, prior neck surgery, recent cannulation of Internal Jugular Vein.

## PROCEDURE

The patient is placed in supine position with 20 degree head down position.<sup>4</sup> Patient has been connected to monitoring devices like Pulse oximeter, ECG and Non Invasive Blood Pressure Monitor. The head was turned to opposite side & a support was placed under the shoulders to accentuate the landmarks. Under sterile aseptic precautions the following landmarks were identified: medial & lateral heads of sternocleidomastoid, clavicle, carotid artery pulsations, ipsilateral nipple, external jugular vein and suprasternal notch.<sup>1,2</sup>

### Anterior Approach

The triangle formed by the two heads of sternocleidomastoid muscle and clavicle should be identified.<sup>3</sup> The carotid artery at the medial end of this triangle was palpated. Near the apex of the triangle, a skin wheal was raised with 1 ml of 2% lignocaine. Skin puncture was made at 30 degree to the skin with needle. The direction of the needle was towards ipsilateral nipple. With constant aspiration, the needle was slowly advanced until two tissue pops were felt at the prevertebral fascia and the vein wall. The position in the vein was confirmed by aspiration of dark blood. The vein was cannulated by modified Seldinger's technique. The hub of the cannula was anchored with sutures.

### Posterior Approach

The point where the external jugular vein crosses the posterolateral border of sternocleidomastoid muscle is the entry point.<sup>4</sup> A skin wheal was raised at this point with 1 ml of 2% Lignocaine. The body of the muscle was lifted and the needle was then advanced at an angle of 30 degree to the skin, directed towards the suprasternal notch. The rest of the procedure is similar to anterior approach.

### Parameters Observed

Parameters observed during the procedure are number of attempts to identify the vein, time taken for identification of vein, time taken for cannulation (This was recorded as the time for skin puncture by the needle to complete threading of the catheter), ease of threading, arterial puncture and hematoma formation.

The parameters which were observed after the procedure are pneumothorax, hemothorax, catheter displacement and thrombophlebitis.

### Statistical Analysis

A sample size of 25 per group was decided during the pilot study. Randomization of subjects to the two groups was done by using sealed envelopes. Data was expressed as mean  $\pm$  Standard Deviation. Quantitative analysis was compared with independent sample student's t-test. P value  $< 0.05$  was taken as statistically significant. P value  $< 0.0001$  was taken as highly statistically significant.

## RESULTS

Both groups were comparable in terms of demographic variables like age, gender and body mass index, as shown in Table 1.

When compared to anterior approach, number of attempts required to successfully cannulate are less with posterior approach. 80% of the people were cannulated successfully in the first attempt by posterior approach compared to only 52% of the people by anterior approach, as shown in Table 2.

Time required to identify the vein was significantly less with posterior approach with a mean value of 0.18 min, compared to 1.06 min with anterior approach, which is highly significant statistically. Also the duration of cannulation was significantly lower with posterior approach with a mean value of 2.43 min, compared to a mean value of 3.64 min with anterior approach. The ease of threading was relatively better with posterior approach, although it is not significant statistically, as shown in Table 3.

The incidence of arterial puncture and hematoma are significantly lower with posterior approach, compared to anterior approach. We have encountered three cases of arterial puncture with anterior approach, compared to only one case with posterior approach, as shown in Table 3.

The incidence of other complications was also lower with posterior approach. We have encountered two cases of pneumothorax with anterior approach, where as none of the cases cannulated with posterior approach had

pneumothorax or hemothorax. Also the incidence of catheter displacement and thrombophlebitis are lower with posterior approach although not statistically significant, as shown in Table 4.

## DISCUSSION

This study compares the widely popular technique of anterior approach of cannulation of the internal jugular vein to the posterior approach. In posterior approach the point of entry is higher up in the neck<sup>4</sup> and thus providing a longer length of vein for cannulation and avoiding the dangers of hemothorax, pneumothorax and arterial puncture.

The aim of the study was comparison of anterior and posterior approaches for internal jugular cannulation in patients undergoing elective & emergency surgeries and in the critically ill. All patients were comparable in terms of age, gender and body mass index. The number of attempts to identify the vein was lesser with posterior approach.

**Table 1: Demographic data**

Parameter	Group A (n-25)	Group P (n-25)	P value
Age	43.87 $\pm$ 18.97	44.86 $\pm$ 16.54	0.84 (NS)
Gender (M/F)	17/8	16/9	-
Body mass index	24.96 $\pm$ 4.82	23.87 $\pm$ 4.96	0.43 (NS)

**Table 2: Number of attempts in both the groups**

No of attempts	Group A (n-25)	Group P (n-25)
1	13 (52%)	20 (80%)
2	6 (24%)	4 (16%)
3	3 (12%)	1 (04%)
4	3 (12%)	-

**Table 3: Results in both the groups**

Parameter	Group A (n-25)	Group P (n-25)	P value
Time to identify the vein (min)	1.06 $\pm$ 0.56	0.18 $\pm$ 0.12	$< 0.0001$
Duration of cannulation	3.64 $\pm$ 0.58	2.43 $\pm$ 0.32	$< 0.0001$
Ease of threading	18 (yes) 7 (no)	20 (yes) 05 (no)	-
Arterial puncture	3/25	1/25	-
Hematoma	1	0	-

**Table 4: Complications in both the groups**

Parameter	Group A (n-25)	Group P (n-25)
Pneumothorax	2	Nil
Hemothorax	Nil	Nil
Catheter displacement	3	2
Thrombophlebitis	3	2

52% of pts were cannulated by first attempt by anterior approach while it was 80% by posterior approach which was highly significant statistically.

The access time & duration of cannulation was lesser with the posterior approach. It took around 1.06 mins to identify vein by anterior approach whereas it is only 0.18 mins on an average to identify vein by posterior approach which is highly significant statistically. Also the duration of cannulation is much shorter by posterior approach (2.43 min) compared to anterior approach (3.64 mins) which is significant statistically.

The posterior approach permits easier threading than anterior approach even though it is not significant statistically. Cannulation by posterior approach reduced the rate of arterial puncture and hematoma significantly. We have encountered 1 case of arterial puncture in posterior approach compared to 3 cases with anterior approach which is highly significant statistically. We found no cases of pneumothorax & hemothorax by posterior approach whereas 2 cases cannulated by anterior approach had pneumothorax.

Wisheart et al.<sup>5</sup> reported a case of injury to the ascending cervical artery by the posterior approach. We have not encountered any case of cervical artery injury in our study.

In the posterior approach there was a low rate of catheter displacement, although it was not significant statistically. Other complications like Thrombophlebitis were less in posterior approach. The posterior approach improves the success rate, permits easier access and threading in obese patients. The posterior approach provides a safe alternative route in patients like short necked, obese, critically ill, patients on tracheostomy, and pathology in lower part of the neck.

Lamkinsi et al.<sup>9</sup> have shown that posterior approach in internal jugular venous cannulation is more efficient than and as safe as the anterior approach.

Brown et al.<sup>10</sup> have reported a case of chronic hematoma following percutaneous internal jugular venous cannulation which required surgical removal two months later. In our study we have encountered a case of hematoma with anterior approach but the swelling spontaneously subsided within 2 hrs after applying continuous pressure.

Arnold S et al.<sup>11</sup> described bilateral pneumothorax and subcutaneous emphysema as a complication of internal jugular vein puncture.

Cook FL et al.<sup>12</sup> described tension pneumothorax following internal jugular venous cannulation under General anaesthesia. But we have not encountered these complications in both of these approaches.

## CONCLUSION

In 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 the access time and duration of cannulation. It reduces complications like arterial puncture, hematoma, pneumothorax, catheter displacement and Thrombophlebitis. The posterior approach permits easier access, improves the success rate and reduces the complications in obese patients.

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