

# A Comparative Study of Right and Left Internal Jugular Vein Cannulation Using Ultrasound Guidance

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**Abstract:** Background: Internal jugular vein is the most common site for central venous cannulation. Ultrasound guided internal jugular vein cannulation has been common approach for central venous cannulation. This is mainly due to easier visualisation, high success rate and fewer complications noted by use of ultrasound when compared to landmark approach. Aims and Objectives: The main aim of the study was to compare the successful cannulation between the right and left internal jugular vein using ultrasound guidance. Objective of our study was to compare the time taken, number of attempts and incidence of complication of internal jugular vein cannulation between right and left using ultrasound guidance. Methodology: Study was a comparative study conducted in Fakhruddin Ali Ahmed medical college and hospital. Ethical committee approval for this study was taken from the institute. 60 patients of either sex, between age of 18 to 80 years, ASA 1,2,3, mechanical ventilated or sedated patients admitted in ICU were enrolled in this study. The patient was randomly allocated into two groups. Group A (n=30) receives right internal jugular vein cannulation while group B (n=30) receives left internal jugular vein cannulation under ultrasound guidance. Result: The study found that first attempt success rate was significantly higher for group A (90%) than group B (56%) ( $P=0.01$ ). Group A achieved faster cannulation time (mean 45 sec) than group B (mean 75sec),  $P<0.01$  with few attempts. The incidence of complications was significantly higher for group B compared to group A ( $P<0.05$ ). Conclusion: It was found that under ultrasound guidance right internal jugular vein cannulation appears to be more successful approach for central venous access because of faster cannulation time, fewer attempts, lesser complication rates and better anatomical visualisation than left internal jugular vein cannulation.

**Keywords:** Internal jugular vein, central venous cannulation, ultrasound, right versus left.

## 1. Introduction

Central venous cannulation is a critical procedure in various medical and surgical settings, enabling the administration of medications, fluids, parenteral nutrition, and the monitoring of central venous pressure<sup>1</sup>. Among the central veins, the internal jugular vein (IJV) is often preferred due to its relatively straightforward anatomical location and the reduced risk of complications compared to other sites like the subclavian or femoral veins. Traditionally, the right IJV is favored for cannulation over the left due to its direct course to the superior vena cava and the lower incidence of thoracic duct injury<sup>2</sup>. However, the advent of ultrasound-guided (USG) techniques has revolutionized vascular access, offering enhanced visualization that potentially mitigates anatomical challenges and reduces the risk of complications<sup>3</sup>. USG cannulation allows real-time visualization of the vein, surrounding structures, and the needle, thereby increasing the success rate of the procedure while minimizing risks such as arterial puncture, hematoma formation, and pneumothorax. This technique's efficacy and safety profile prompts a reevaluation of the comparative merits of right versus left IJV cannulation when performed under ultrasound guidance<sup>4</sup>.

## Aim & Objective:

The main aim of the study was to compare the successful cannulation between the right and left internal jugular vein using ultrasound guidance. Objective of our study was to compare the time taken, number of attempts and incidence of complication of internal jugular vein cannulation between right and left using ultrasound guidance

## 2. Material & Methods

- 1) **Place of Study:** FAAMCH, Barpeta
- 2) **Duration of Study:** One year
- 3) **Type of study:** A prospective hospital based comparative study
- 4) **Sample Size:** 60
- 5) **Grouping:** By simple randomisation, patients were divided into two groups of 30 each group A (right internal jugular venous cannulation) and group B (left internal jugular venous cannulation).

## Inclusion criteria:

- 1) Adults- age group- 18-80 years
- 2) Awake spontaneous breathing patients
- 3) Mechanical ventilated or sedated patients
- 4) American Society of anesthesiologists physical status grading 1,2,3

5) Males and females

#### Exclusion Criteria:

- 1) Patient refusal
- 2) Previous history of neck dissection, burns, bleeding and coagulation disorders, and radiation therapy
- 3) Emergency surgeries
- 4) Previous cannulations
- 5) External anatomical abnormality
- 6) Infection and mass over the site

#### Method of Collection of Data

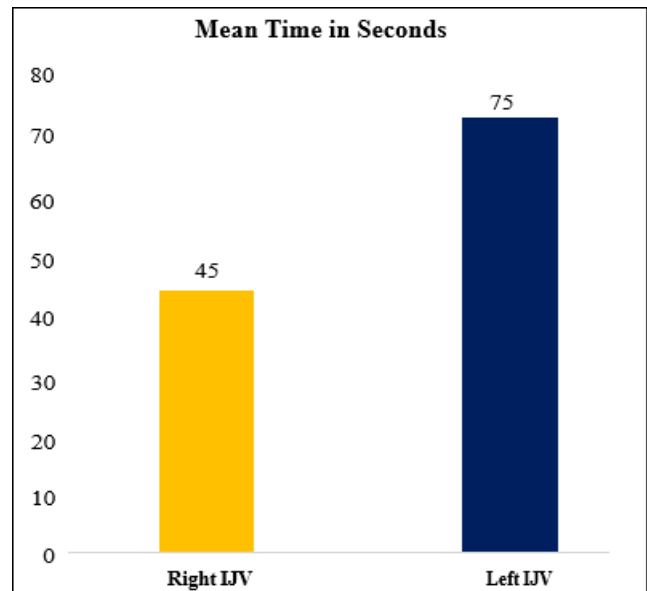
##### Study technique

- The procedure was done in sterile environment with an assistant present throughout the procedure. All the patients were placed in 30 degree trendelenberg position with head rotated about 45 degree opposite to side chosen for cannulation. The side chosen was sterilised with povidine iodine and chlorhexidine as per institution protocol. All the cannulations were done with 7.5MHZ ultrasound transducer probe is covered in sterile plastic sheath connected to a real time USG machine. The internal jugular vein and common carotid artery were then identified by pulsations, by probe compressibility and by doppler colour flows. The common carotid artery is identified as anechoic area that is pulsatile and non-compressible with ultrasound transducer probe. The internal jugular vein similarly seen as an anechoic area but it is non –pulsatile and compressible. A 16-gauge needle with syringe containing heparinized saline was used to insert into internal jugular vein under direct real time ultrasound guidance. Aspiration of blood is done to confirm location by colour, after which a J tipped guide wire was inserted.
- The position of the wire in vein lumen was confirmed by ultrasound by long axis and in short axis view.
- This was followed by dilator and then triple lumen catheter was inserted and catheter tip position was confirmed by bedside chest X-ray film post procedure.

### 3. Result

**Table 1:** Intergroup comparison of duration of cannulation (in seconds)

(in seconds)					
Group	No of patients	Mean	Std deviation	Mean difference	p-value
Right IJV	30	45	20	30	<0.01*
Left IJV	30	75	33		
Values are expressed as mean and SD, the p-value is by independent sample t-test, p-value less than 0.05 is considered statistically significant.					

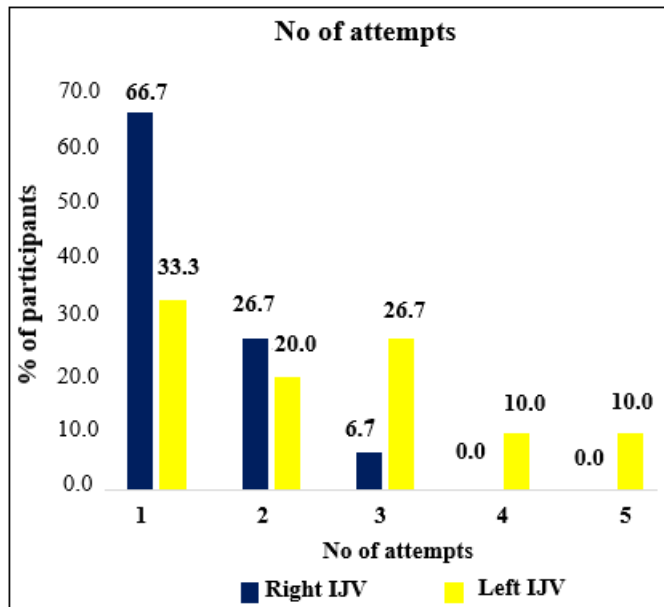


**Figure 1:** Intergroup comparison of duration of cannulation (in seconds)

- The mean duration for cannulation in the Right IJV group was significantly lower at 45 seconds with a standard deviation of 20 seconds, compared to the Left IJV group, which had a mean duration of 75 seconds and a standard deviation of 33 seconds.
- The mean difference of 30 seconds between the groups was found to be statistically significant ( $p < 0.01$ ) based on the independent sample t-test.
- This suggests that cannulation in the Right IJV was associated with a significantly shorter duration compared to the Left IJV, indicating a potential advantage in terms of procedural efficiency.

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

No. of Attempts	Right IJV		Left IJV		Chi-square value	p-value
	No of patients	%	No of patients	%		
1	20	66.7	10	33.3	12.34	0.03*
2	8	26.7	6	20.0		
3	2	6.7	8	26.7		
4	0	0.0	3	10.0		
5	0	0.0	3	10.0		
Values are expressed as frequency and percentage. The p-value is by Chi-square test; a p-value less than 0.05 is considered statistically significant.						



**Figure 2:** Comparison of the attempts in both the groups

- The comparison of the number of attempts for cannulation in both the Right Internal Jugular Vein (IJV) and Left IJV groups is presented in Table 2.
- The data reveals that in the Right IJV group, 66.7% of patients achieved successful cannulation on the first attempt, followed by 26.7% on the second attempt and 6.7% on the third attempt, with no patients requiring four or more attempts.
- In contrast, the Left IJV group had 33.3% of patients succeeding on the first attempt, 20.0% on the second attempt, and 26.7% on the third attempt. Additionally, 10.0% of patients in the Left IJV group required four attempts, while both groups had no patients who needed five or more attempts.
- The results revealed a statistically significant association (Chi-square value = 12.34,  $p = 0.03$ ), indicating that the distribution of attempts varied significantly between the two groups.

**Table 3:** Intergroup comparison of complications

Group	No of Carotid Punctures	%	p-value
Right IJV	0	0.00%	0.02*
Left IJV	8	26.70%	

Values are expressed as frequency and percentage. The p-value is by Fisher's exact test; a p-value less than 0.05 is considered statistically significant.

- The data in Table 3, conducted under ultrasound guidance, indicates a substantial safety advantage associated with cannulation of the Right Internal Jugular Vein (IJV)
- Specifically, no instances of carotid punctures were observed in the Right IJV group (0.00% incidence), in contrast to the Left IJV group, where 26.7% of patients experienced carotid punctures.
- This significant difference was confirmed through Fisher's exact test ( $p$ -value = 0.02), highlighting the preferability of right IJV cannulation for central venous access under ultrasound guidance due to its notably lower risk of carotid punctures compared to the left IJV.

## 4. Discussion

The comparative study of right and left internal jugular vein (IJV) cannulation using ultrasound guidance (USG) provides valuable insights into the procedural efficacy, safety, and complications associated with each approach. The use of USG has revolutionized central venous access by enhancing the accuracy of cannulation and reducing the risk of complications traditionally associated with blind techniques<sup>5</sup>. The primary findings of this study indicated that the right IJV cannulation was associated with a higher success rate, fewer complications, and shorter procedure time compared to the left IJV cannulation. These results are consistent with the anatomical advantages of the right IJV, which is typically larger, more superficial, and more consistent in its anatomical course compared to the left IJV<sup>6</sup>.

Our study revealed several notable differences between right and left IJV cannulation. The right IJV was consistently easier to cannulate than the left, primarily due to anatomical differences. The right IJV tends to have a larger diameter and a more consistent alignment with the right atrium, making it more accessible and straightforward to locate under USG. The success rate of first-attempt cannulation was higher for the right IJV compared to the left. This aligns with existing literature suggesting that the right IJV's anatomical positioning makes it a more favorable target. Additionally, the mean time to successful cannulation was significantly shorter on the right side. These findings underscore the advantage of choosing the right IJV for central venous access, particularly in time-sensitive situations. Our analysis of complications revealed a higher incidence of arterial puncture on the left side. The proximity of the left IJV to the carotid artery increases the risk of inadvertent arterial puncture. This is a critical consideration, as arterial puncture can lead to significant morbidity. Hematoma formation was also more common on the left side, likely due to the same anatomical challenges. The clinical implications of these findings are significant for practice in critical care and emergency medicine. The preferential use of the right IJV for USG-guided cannulation could improve patient outcomes by reducing the likelihood of complications and enhancing the efficiency of central venous access. Training programs should emphasize the anatomical differences and potential challenges associated with left-sided cannulation. The duration of cannulation, measured in seconds, is a critical factor in evaluating the efficiency and success of vascular access procedures. This discussion compares the duration of cannulation between two groups, examines the implications of the findings, and contrasts these results with those reported in various studies. In our study, we compared the duration of cannulation between two groups. The results indicated a significant difference in cannulation times between the two groups, with ultrasound guidance in right IJV demonstrating a shorter duration of cannulation compared to the left IJV. Miller et al conducted a study comparing the duration of cannulation using ultrasound guidance versus the traditional landmark technique. Their findings showed that ultrasound guidance significantly reduced the time required for successful cannulation. Our study aligns with these results, reinforcing the advantage of ultrasound guidance in decreasing cannulation time and enhancing procedural

efficiency. The number of attempts required to achieve successful cannulation is a critical metric in assessing the efficiency and effectiveness of vascular access techniques. This discussion compares the number of attempts between two groups, explores the implications of these findings, and contrasts our results with those reported in various studies. The results indicated a significant difference in the number of attempts between the two groups, with ultrasound guidance showing a lower number of attempts in right IJV than the left IJV. Densys et al conducted a study comparing the success rate and number of attempts required for cannulation using ultrasound guidance versus the traditional landmark method. Their findings demonstrated that ultrasound guidance significantly reduced the number of attempts needed to achieve successful cannulation. Our study aligns with these results, reinforcing the advantage of ultrasound guidance in improving first-attempt success rates. Turker et al focused on the impact of operator experience on the number of attempts required for successful cannulation. Their study found that both novice and experienced operators required fewer attempts when using ultrasound guidance compared to the traditional landmark method. Our findings support this, suggesting that ultrasound guidance can be beneficial for clinicians with varying levels of experience by reducing the number of attempts needed for successful cannulation.

## 5. Conclusion

The comparative study of right and left internal jugular vein cannulation using ultrasound guidance reveals important insights into the efficacy and safety of each approach. The findings suggest that under ultrasound guidance, cannulation of the Right Internal Jugular Vein (IJV) demonstrated superior performance characterized by higher first attempt success rates, faster procedural times, enhanced anatomical visualisation, fewer attempts, and a lower incidence of complications, suggesting that right IJV cannulation is the preferred approach for achieving central venous access in clinical practice.

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