

A COMPARATIVE STUDY BETWEEN ULTRASOUND GUIDED CATHETERIZATION OF THE INTERNAL JUGULAR VEIN AND CLASSICAL LAND MARK TECHNIQUE

Henjarappa K S ¹, Pavan P Havaladar ², Hussain Saheb Shaik ^{*3}.

¹Assistant Professor in Anaesthesia, Kidwai Memorial Institute Of Oncology, Bangalore, Karnataka, India.

^{*2&3} Assistant Professor of Anatomy, JJM Medical College, Davangere, Karnataka, India.

ABSTRACT

Background: Catheterization of Internal Jugular Vein (IJV) is commonly attempted to obtain central venous access for hemodynamic monitoring, long term administration of fluids, total parenteral nutrition and hemodialysis in critical care patients. The safe puncture of the IJV is achieved by using anatomical land marks on skin surface. Ultrasound guidance could be beneficial in placing central venous catheters by improving the success rate, reducing the number of needle passes, decreasing access time and decreasing complications.

Material and Methods: Sixty critical care patients were selected for IJV cannulation either by land mark technique or by ultrasound guided technique in two groups of thirty each.

Results: In our study there was 100% success rate for first attempt cannulation in USG technique and where as it was 83.3% in LMG technique. The mean access time in USG technique was 152.50 ± 63.90 sec as against 323.23 ± 146.19 sec in LMG group.

Conclusion: Ultrasound guided technique improves the cannulation of the IJV with respect to safety, rapidity and comfort to the patient during the procedure.

KEY WORDS: Central venous cannulation, Internal Jugular Vein, Land marks, Ultrasound.

Address for Correspondence: Shaik Hussain Saheb, Assistant Professor of Anatomy, JJM Medical College, Davangere. Karnataka, India. M.No: +919242056660 **E-Mail:** anatomyshs@gmail.com

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INTRODUCTION

With the advanced knowledge in medical monitoring, ever increasing value has been placed on the establishment of central venous catheter. During the past few years, monitoring of central venous pressure has become an important aid in the management of critically ill patients [1]. Over the past 25 years, the monitoring of intracardiac pressures during anesthesia has become widespread practice in patients with ventricular dysfunction. In particular, this form of monitoring is used in

those patients where major changes in intravascular volume, after load or contractility occur [2,3]. The differentiation between hypovolemia and ventricular failure is difficult under anesthesia, consequently, the assessment of intracardiac pressure or volume is necessary to make accurate diagnosis [4]. Central venous pressure has become the standard monitoring process for at-risk patients who will undergo major alteration of pre-load, after-load or contractility during the perioperative period. Central venous pressure monitoring is carried out during perioperative period on a patient who

is undergoing a surgical or cardiac procedure [5].

Cannulation of the IJV was first described in 1969. Various positions were used to access cannulation but they were frequently associated with complications such as arterial puncture, pneumothorax, neurological damage, infection, dysrhythmias, atrial thrombus, cardiac rupture etc[6]. The traditional methods of using anatomic landmarks to guide cannulation of the IJV have yielded various rates of successful access and complications. Moreover, central venous catheterization requires considerable expertise.

Doppler ultrasound was first used to assist central venous catheter insertion in 1984. Ultrasound has been applied to describe the anatomy of the IJV and to evaluate various techniques for percutaneous cannulation. Real time sonography improves access to the vein compared with the traditional method. Ultrasound guided cannulation limits complications and also the decreases the cannulation time. However this facility may not be available in many centres because of its high cost. It also needs an experienced operator which is an additional limiting factor for its use. Real time ultrasonography can be used to view the in vivo vascular anatomy of the neck and in ascertaining the size of IJV and its anatomical relations. These features make this instrument a useful tool to study various body positions and in finding out the position which maximize IJV diameter, thereby increasing the first pass success rate. The present study is concentrated to compare the effectiveness of ultrasound guided IJV cannulation with the classical land mark technique.

MATERIALS AND METHODS

Sixty critical care patients at the intensive care units of M S Ramaiah Medical College and Teaching Hospital, Bangalore, who needed central venous cannulation, who willingly gave their informed written consent.

METHODOLOGY

Sixty Patients who met inclusion criteria were selected and randomly divided into two groups namely the landmark guided technique group

(LMG) and the ultrasound guided group (USG) with 30 patients in each group. The two groups were compared for success rate between two techniques and also observed that average access time from skin prick to suturing and average number of attempts. SPSS software used for statistical analysis.

RESULTS

A total of 60 patients were included in this clinical study and randomly assigned to either land mark guided technique group (LMG) or to ultrasound guided technique group (USG) and there were 30 patients in each group.

The mean ± standard deviation for age in land mark guided technique was 61.77 ± 18.46 years (ranging from 21 to 91 years) and for Ultra Sound Guided Technique was 49.3 ± 18.42 years (ranging from 17 to 90 years) as shown in [Table 1].

Table 1: Distribution of mean age in years among study population.

		Mean Age	Std. Deviation	Minimum	Maximum	t' value	p' value
LMG	30	61.77	18.461	21	92	6.174	0.016
USG	30	49.93	18.428	17	90		
Total	60	55.85	19.236	17	92		

Site of Cannulation: In Ultrasound guided technique 23(38.3%) patients underwent IJV cannulation on the left side while 37(61.7%) patients underwent IJV cannulation on the right side. In Land mark guided technique 10(33.3%) patients underwent IJV cannulation on the left side while

20(66.7%) patients underwent on the right side. In Ultrasound guided technique, 17(56.7%) patients underwent IJV cannulation on the right side while 13(43.3%) patients underwent on the left side [Table 2].

Table 2: Distribution of site of IJV cannulation among study population.

Site	Method		Total
	LMG	USG	
LT IJV	10	13	23
	33.30%	43.30%	38.30%
RT IJV	20	17	37
	66.70%	56.70%	61.70%
Total	30	30	60
	100.00%	100.00%	100.00%
Chi-Square Value		df	p' value
0.635		1	0.426

Access Time: Access time - time take in seconds from initial skin puncture to skin suturing in LMG technique was 323.23 ± 146.197 seconds, whereas in USG technique it was 152.50 ± 63.907 seconds of the mean ± standard deviation in this study. It can be noticed here that the mean access time in LMG technique was much higher than that of USG technique. Which was observed to be statistically significant [p<0.001][Table 3].

Table 3: Distribution of mean access time in seconds among study population.

Access Time	N	Mean Access Time in secs	Std. Deviation	Minimum	Maximum	't' value	'p' value
LMG	30	323.23	146.197	180	900	34.351	0.000
USG	30	152.5	63.907	60	315		
Total	60	237.87	141.153	60	900		

Cannulation attempts: In this study, in LMG technique only 25 (83.3%) cases were cannulated in first attempt, followed by 2 (6.7%) cases in second attempt and 3(10.0%) cases in the third attempt. However in USG technique, all cases 30 (100%) were cannulated in the first attempt itself. Therefore, the success rate of IJV cannulation attempt by LMG technique was 83.3% as against USG technique which had a 100% success rate. However the observed variable i.e cannulation attempts was not statistically significant. (p=0.065)[Table 4].

Table 4: Distribution of cannulation attempts among study population.

Number of Attempt	Method		Total
	LMG	USG	LMG
1	25	30	55
	83.30%	100.00%	91.70%
2	2	0	2
	6.70%	0.00%	3.30%
3	3	0	3
	10.00%	0.00%	5.00%
Total	30	30	60
	100.00%	100.00%	100.00%
Chi-Square Value		df	'p' value
5.455		2	0.065

DISCUSSION

This study took various anthropometric measurements, anatomical considerations & biochemical parameters into considerations to know whether any of these have significance in either of the techniques compared. As suggested

by Thomas Surez et al [7]. The knowledge of anatomy of neck is vital and the relationship of the IJV to the sternocleidomastoid muscle and CA is the key for understanding the position of the vein in the neck. In practice, surface markings are always not reliable means of locating the Internal Jugular Vein as its position, particularly in a lateral plane tends to vary considerably. The position of the patient throughout the study was supine with 15 degree Trendelenburg position. In this study, in either of the technique, the triangle of sternocleidomastoid muscle comprising of sternal and clavicular heads of the sternocleidomastoid and the medial third of the clavicle in the neck, also the carotid artery pulsations were felt. In landmark guided technique, these anatomical landmarks were taken into considerations while cannulating IJV. The carotid artery was palpated in the landmark-guided technique in the sternocleidomastoid triangle and both the finder and seeker needles were inserted lateral to CA to find the IJV.

The mean age in years in land mark guided technique was 61.77 ± 18.46 years (ranging from 21 to 92 years) while in USG technique it was 49.93 ± 18.42 years (ranging from 17 to 90 years). In LMG technique, 20(66.67%) patients underwent IJV cannulation on the right side and 10(33.33%) patients under went on the left side. In USG technique, 17(56.67%) patients underwent IJV cannulation on the right side while 13(43.33%) patients underwent on the left side. The distribution of the site of cannulation of IJV between the two study groups was not statistically significant.

The access time (time from the penetration of the skin to suturing the catheter) included the skin passes with finder and seeker needle together. The access time corresponded with an increase in number of attempts. The access time was shorter in USG technique with a mean of 152.50 ± 63.907 seconds compared with land mark technique mean of 323.23 ± 146.197 seconds (P<0.001) comparable with the study of Tista A et al [8] with 60.9 ± 55 seconds for USG technique and 114.5 ± 68 seconds for landmark technique. With USG technique more veins were entered on the first attempt. In our study, in USG technique all the 30 (100%) patients were cannulated on first attempt vs 25

(83.3%) patients in LMG technique was cannulated on the first attempt. When compared with the LMG and USG techniques for IJV cannulation on first attempt the results of Dimitrios Karakissos et al[9] 100% vs 94.4%, Piero Antonio et al[10] 100% vs 91.6%, Wg Cdr R M Sharma et al[11] 100% vs 98%, Tista A et al [8] 100% vs 82%, Bart G. Deny et al[12] 78% vs. 43.3%, Mallory et al[13] a with 85% vs.15% respectively, the results obtained in our study were almost similar. A maximum of 3 attempts were made in LMG technique compared with only 1 attempt in USG group with similar results seen with Tista A. et al [8] 2.3 ± 1.3 vs 1.2 ± 0.4 and Daniel Dugere et al[14] 5 vs 2.3. There were no serious complications like pneumothorax or nerve injuries in either group when compared to the occurrence of pneumothorax in 2.4% vs 0% in Dimitrios Karakissos et al [9] study and Tista A. et al [8] study of 5.8% vs 0% in LMG technique and USG technique respectively. All the IJV cannulation cases of both the technique were subjected to chest X-ray postero-anterior view for confirmation of catheter position. The ideal placement of catheter tip is parallel to Superior Venacava, just below the inferior border of clavicle, above 2-3 ribs, at the tracheal carina. There is no standard formula to measure the length of the cannula to be cannulated in superior vena cava. In this study all the chest radiographs in both the groups were found to be normal.

CONCLUSION

The study validates that ultrasound guidance is beneficial in placing central venous catheters when compared to traditional land mark guided technique by improving the success rate. The sonological guidance of CVC is better tool for training and teaching CVC to trainees and paramedics.

Conflicts of Interests: None

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