

Research Article

A study on complications in land mark technique catheterization of internal jugular vein

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ABSTRACT

Background: 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. 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.

Methods: Thirty critical care patients were selected for IJV cannulation either by Land mark technique. This study conducted in department of anaesthesiology and critical care, M. S. Ramaiah medical college, Bangalore, India.

Results: In our study there was 83.3% success in LMG technique. The mean access time was 323.23 ± 146.19 sec and the distribution of complications encountered during the study, Carotid artery was accidentally punctured in 1 (3.3%) cases. In LMG technique, there were no cases of arrhythmias, haematoma, pneumothorax, haemothorax, nerve injury and catheter malposition were noted during the study.

Conclusion: Land mark technique catheterization of internal jugular vein was shown complications than newly developed ultrasound guided method.

Keywords: Internal jugular vein, Land mark technique, Catheterization, Carotid artery puncture

INTRODUCTION

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. Paul F. Mansfield et al.¹ showed that femoral catheterization had more mechanical complications of arterial puncture and hematoma, and catheter related infections were high and were grossly contaminated in inguinal region. The mechanical complication in subclavian vein catheterisation was severe pneumothorax and was less likely to be tolerated in severe hypoxemic patients necessitating avoidance in them. Pat O. Daily et al.² showed that internal jugular vein could easily be

identified by anatomical position in the neck, usually positioned in intimate contact, and laterally and anteriorly to the carotid artery. Hence, the essential anatomical landmarks are the sternal and clavicular attachments of sternocleidomastoid muscle and the clavicle forming a triangle with internal jugular vein located in the groove between the two portions of sternocleidomastoid muscle. The specific anatomical relationship between the internal jugular vein and carotid artery has previously been well elucidated by Troinos et al.³ and others. P J Alderson et al.⁴ study revealed that internal jugular vein catheterisation is difficult in morbidly obese patients, in whom the landmarks of the neck are obscured. Also, the insertion of central venous lines is not without hazard and carries the potential for serious complications. The

occurrence of these complications has been the stimulus for the continuing search for safer routes of access as concluded by Machi J et al.⁵ Bart G Denys et al.⁶ reported that anatomical variation in the position of the internal jugular vein in adults may complicate venous access when a landmark-guided approach was used.

The anatomy of the internal jugular vein is relatively constant, regardless of body habitus.⁷ The Internal Jugular Vein drains blood from the skull, brain, superficial parts of the face and much of the neck. It begins at the base of the posterior compartment of the jugular foramen, where it is continuous with the sigmoid sinus. The right and left jugular veins emerge from their respective jugular foramen. The internal jugular vein emerges deep to the posterior belly of the digastric muscle. At its origin the internal jugular vein courses adjacent to the spinal accessory, vagus and hypoglossal nerves as well as the internal carotid artery. Several tributaries enter the internal jugular vein at the level of the hyoid bone. The internal jugular vein, the internal (and later the common) carotid artery and the vagus nerve course together in the carotid sheath. The internal jugular vein occupies the antero-lateral position in the carotid sheath. The only structure that maintains a fixed anatomic relationship with the internal jugular vein is the carotid artery. The vein invariably lies lateral and slightly anterior to the carotid artery and the course of the artery serves as a guide to venous cannulation. At the level of the thyroid cartilage the internal jugular vein can be found just deep to the sternocleidomastoid muscle. The internal jugular vein emerges from under the apex of the triangle of the two heads of the sternocleidomastoid muscle and unites with the subclavian vein below the root of the neck posterior to the sternal end of the clavicle to form brachiocephalic vein which in turn unites with its left counterpart to form superior vena cava which ends in to right atrium. As the vein approaches its supraclavicular junction with the subclavian vein, it assumes a more medial position in the triangle formed by the sternocleidomastoid muscles, following the anterior border of the lateral head. In this lower cervical region the common carotid artery assumes a deep paratracheal location. The brachial plexus is separated from the internal jugular vein by the scalenus anterior muscle. The phrenic nerve is anterior to the scalenus anterior muscle. Although quite deep the stellate ganglion lies anterior to the lower brachial plexus.

The study conducted by Dimitrios Karakissos et al.⁸ revealed that using land mark method, the rate of successful internal jugular vein cannulation was 94.4% and the rates of mechanical complications like carotid artery puncture were 10.6%, haematoma 8.4% and pneumothorax 2.4%. While by using ultrasound guided method the success rate of internal jugular vein cannulation was 100% and the incidence of mechanical complications were negligible. Piero Antonio et al.⁹ revealed that while using land mark technique success rate was 91.6%, two or more attempts were needed for

internal jugular vein cannulation and the carotid artery was accidentally punctured in up to 7.7%. Using ultrasound guidance, the maneuver was 100% successful at the first attempt and no accidental carotid puncture occurred. Wg Cdr RM Sharma et al.¹⁰ concluded that the overall success rate with land mark.

technique was 98%, average access time 70 seconds, complication and failure rate 2% while the use of ultrasound guidance for internal jugular vein cannulation, increased the success rate to 100% and the number of complications, the number of catheter placement failures and the time required for insertion were reduced.

Tista A et al.¹¹ showed that using land mark technique successful cannulation rate was 82%, successful first attempt was 26%, average number of attempts 2.3 ± 1.3 , average access time 114.5 ± 68 seconds, arterial puncture 15%, pneumothorax 5.8%. While using ultrasound guidance they were 100%, 76%, 1.2 ± 0.4 , 60.9 ± 55 , 6.9% respectively and no case of pneumothorax occurred. Daniel Dugere et al.¹² showed that with ultrasound guidance for central venous cannulation success rate was 90%, average number of attempts 2.3 and zero incidence of arterial puncture while the same with land mark technique were 65%, 5 times and 20% respectively. The present study is complications in land mark technique catheterization of internal jugular vein.

METHODS

Thirty critical care patients were selected for IJV cannulation either by ultrasound guided technique. This study conducted in department of anesthesiology and critical care, M. S. Ramaiah medical college, Bangalore.

RESULTS

The distribution of sites of cannulation in LMG technique, 10 (33.3%) patients underwent IJV cannulation on the left side while 20 (66.7%) patients underwent on the right side.

Table 1: Distribution of site of IJV cannulation among study population.

Site	Methods
	LMG
LT IJV	10
	33.3%
RT IJV	20
	66.7%
Total	30
	100.0%

Access time

Access time (time take in seconds from initial skin puncture to skin suturing) to successfully cannulate the

IJV has been described in Table 2. The access time in LMG technique was 323.23 ± 146.197 seconds.

Table 2: Distribution of mean access time in seconds among study population.

Access time	N	Mean access time (secs)	Std. deviation	Minimum	Maximum
LMG	30	323.23	146.197	180	900

Cannulation attempts

The distribution of attempts to successfully cannulation 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.

Table 3: Distribution of cannulation attempts among study population.

Number of attempt	LMG
1	25 83.3%
2	2 6.7%
3	3 10.0%
Total	30 100.0%

Complications

Carotid artery was accidentally punctured in 1 (3.3%) cases in the LMG technique. In LMG technique, there were no cases of arrhythmias noted during the study.

No cases of haematoma, pneumothorax, haemothorax, nerve injury and catheter malposition were noted during the study in USG technique.

Table 4: Distribution of complications among study population.

Complications	LMG
Artery puncture	1 3.3%
Arrhythmias	0 0.0%
Haematoma	0
Pneumothorax	0
Haemothorax	0
Nerve injury	0
Catheter	0

Technical problems

In LMG technique, difficulty in threading guide wire after successful IJV cannulation was encountered in 2 (6.7%) cases. Difficulty in cannulating the IJV during the study was encountered in 4 (13.3 %) cases of LMG.

Table 5: Distribution of technical problems among study population.

Technical problems	LMG
Guide wire problems	2 6.7%
Cannulation problems	4 13.3%
Classic head low position	1 3.3%

DISCUSSION

Venous access through a central vein gives wide variety of advantages in the management of patient care.¹³ These are grouped under diagnostic, monitoring, and therapeutic indications. Actually the list is endless. To mention a few: central venous pressure monitoring, long term infusion of hypotonic/hypertonic, highly irritant solutions like potassium containing solution and medications which are highly thrombogenic when given in the peripheral veins, need for long term parenteral alimentation or chemotherapy or venous haemodialysis, burns patients, as an access to the placement of pacing catheter/internal defibrillator or pulmonary artery catheter or during port access minimal invasive cardiac surgery, rapid infusion of fluids as in case of trauma or major surgery, aspiration of air in case of venous air embolism, as a sampling site for repeated blood sampling, as an access during endocardial biopsy following heart transplant etc. With increasing longevity and changes in lifestyle, more and more patients undergo major/multiple or combined surgeries in one sitting. In addition there is a major inflow of patients requiring various interventions requiring continuous monitoring of central venous pressure to achieve better outcome. Thus it has become mandatory on the part of every anaesthesiologist to be familiar with the technique of monitoring central venous pressure. Central venous catheterization can be accomplished, using a number of different venous accesses, including the internal jugular, external jugular, brachiocephalic, subclavian, axillary, cephalic, basilic, femoral and umbilical.¹⁴ However, the most popular site for placement of central venous cannula is right sided internal jugular vein. This is mainly due to the fact that it has consistent, predictable anatomic location, its valveless, straight course to the superior vena cava and right atrium, makes it possible to cannulate the right internal jugular vein repeatedly. Less popular options include the subclavian, external jugular, basilic and femoral veins. There are several techniques of CVC.

There are various studies and data of different approaches and sites of central venous cannulation.¹⁵⁻²⁰

This study took various anthropometric measurements, anatomical considerations & biochemical parameters into considerations. As suggested by Thomas Surez et al.²¹ 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. In landmark-guided technique, the 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 are inserted lateral to CA to find the IJV. 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. 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 LMG technique with a mean of 323.23 ± 146.197 seconds which in agreement with the study of Tista A et al.¹¹ where the access time 114.5 ± 68 seconds for landmark technique. In our study cannulated on first attempt in 25 (83.3%) patients by LMG technique. Our study in agreement with studies of Karakisis et al.⁸ 94.4%, Piero Antonio Conz et al.⁹ 91.6%, Wg Cdr RM Sharma et al.¹⁰ 98%, Tista A et al.¹¹ 82%, Bart G. Deny et al.⁶ 43.3%, Mallory et al.²¹ a with 85% vs.15% respectively, the results obtained in our study were almost similar. The complication rates were 7 (23.33%) in LMG group. The carotid artery was punctured in 1 patient (3.3%) in landmark technique. No case of skin hematoma occurred in LMG technique this one in agreement with Dimitrios Karakisis et al.⁸ 8.4%, Bart G. Denys et al.⁶ 2.66%, M. Leon Skolnick et al.²² 3.3% in LMG group. There were no serious complications like pneumothorax or nerve injuries when compared to the occurrence of pneumothorax in 2.4%, Dimitrios Karakisis et al.⁸ study and Tista A et al.¹¹ study of 5.8% in LMG technique. The present study results are very helpful in giving anesthesia with help of Land mark technique.

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