Original Article

# A comparative study of classical blind anatomical landmark technique of subclavian venous cannulation with ultrasound guided technique with respect to access time and success rate

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## Abstract

**Introduction:** Catheterization of central venous vessels allows access for hemodynamic monitoring, administration of drugs, fluids and parenteral nutrition, placement of a difficult peripheral IV cannula and hemodialysis. **Aims and Objectives:** To study comparison of classical blind anatomical landmark technique of subclavian venous cannulation with ultrasound guided technique with respect to Access time and Success rate. **Methodology:** Prospective randomised comparative study conducted in the Department of Anaesthesiology and Intensive Care at Government Medical College Hospital, Jammu *w.e.f.* February 2015 to June 2015. Patients admitted in Government Medical College Hospital, Jammu who required subclavian vein cannulation were the subject of the study. 60 patients .Group-I (anatomical landmark technique) Group-II (ultrasound-guided technique) Patients subclavian vein was cannulated under strict aseptic precaution via infraclavicular approach. The Statistical analysis done by Unpaired t-test and Chi-square test calculated by SPSS (SPSS Inc, Chicago) software packages. **Result:** The Average Access time was more i.e. 5.368333 ±2.096528 in LMG group as compared to USG group where it was 2.365 ± 1.079843 this observed difference is statistically significant (t= 6.975; p<0.001) 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 versus 23 (76.66%) patients in LMG technique was cannulated on the first attempt this observed difference is statistically significant (Fisher's exact test – P< 0.0105). **Conclusion:** USG guided SCV cannulation can be practised in future as the access time and success rate are better than the LMG group.
**Keywords:** LMG Technique, USG guided SCV cannulation.

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## INTRODUCTION

Catheterization of central venous vessels allows access for hemodynamic monitoring, administration of drugs, fluids and parenteral nutrition, placement of a difficult peripheral IV cannula and hemodialysis. Percutaneous techniques revolutionized vascular cannulation. They essentially eliminated the need for open cutdown procedures and the associated wound-related morbidity, but percutaneous techniques left the operating physician exclusively reliant upon the relationships between surface anatomic landmarks and the underlying deep anatomic structures. Clinicians now insert more than five million percutaneous central venous catheters annually, with an overall complication rate of 15%.[1] These complications include infection, thrombosis, occlusion, and, in particular, mechanical complications which usually occur during insertion and are intimately related to the anatomic relationships of the central veins. Working knowledge of surface and deep anatomy minimizes these latter

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complications. Use of surface anatomic landmarks to orient the deep course of cannulating needle tracts appropriately comprises the crux of complication avoidance. Mind's eye visualization of relevant deep anatomic relationships[2–4] not only increases the safety and efficiency of the procedure but also enhances the operator's ability to troubleshoot difficult cannulations The subclavian vein can be cannulated using a supraclavicular approach.5 This route is preferred by some authors.6 The essential landmark for the supraclavicular approach is the junction of the lateral border of the clavicular head of the sternocleidomastoid with the clavicle. The point of cutaneous puncture lies 1 cm superior and 1 cm lateral to this junction. The junction of the sternocleidomastoid with the clavicle defines the claviculosternomastoid angle. The cannulating needle tip is angled posteriorly 5°–15° off a coronal plane and advanced along a line that bisects the claviculosternomastoid angle. This will lead to subclavian venipuncture between the clavicle and the anterior scalene muscle.5 Others suggest cutaneous puncture directly at the claviculosternomastoid angle and advancing the needle along the claviculosternomastoid angle bisector parallel and inferior to the clavicle to enter the vein at an insertion depth of 1–2 cm.7 Anatomic data from three-dimensional computed tomography reconstructions suggest that, with the sternocleidomastoid-clavicular junction as a cutaneous puncture point, the needle should be oriented approximately 11° medially and 35° posteriorly as it is advanced approximately 1.4 cm to enter the vein; unfortunately relatively large standard deviations for these mean values limit their clinical utility.8 The subclavian vein can also be cannulated using infraclavicular approach.[5] In this approach the goal of subclavian venipuncture is to pass a needle inferior to the clavicle and superior to the first rib to access the subclavian vein as it courses over the first rib. The appropriate course for the needle passes immediately beneath the junction of the medial one-third and lateral two-thirds of the clavicle. This junction *i.e.*, the "break" of the clavicle, is the point at which the anterior convexity of the medial clavicle transitions into an anterior concavity laterally. The appropriate point for cutaneous puncture lies 1–2 cm inferior and lateral to the clavicular transition point. Cutaneous puncture at this point facilitates passage of the needle inferior to the clavicle. A cutaneous puncture site closer to the clavicle creates difficulty maneuvering the needle beneath the clavicle. More medial cannulation may be impeded by calcification of the costoclavicular ligament. As the needle is advanced, it must remain absolutely parallel to the floor; if the needle is directed posteriorly to negotiate the clavicle, the risk of pneumothorax is greatly increased. Only gentle pressure from the operator's non-dominant thumb is necessary to depress the needle in a flat coronal plane beneath the clavicle if the correct cutaneous puncture site is chosen. As the needle is advanced from the cutaneous puncture site to a point beneath the clavicular transition point, its tip should be aimed just above the tip of the operator's non-dominant index finger placed in the sternal notch. The needle is advanced along this course passing through the subclavius muscle until the subclavian vein is accessed. Ultrasound visualization of the subclavian vein can confirm patency and identify thrombosis. However, the anatomic position of the subclavian vein between the clavicle and first rib complicates real-time ultrasound localization during venipuncture. 1Ultrasound localization without real-time ultrasound guidance does not improve success of subclavian venipuncture attempts, nor does it decrease complication rates.[9] Real-time ultrasound localization of the subclavian vein through the window between the clavicle and first rib is difficult and may generate unsatisfactory images.41 However, the axillary vein and artery can be easily visualized with ultrasound more laterally on the chest wall anterior to the lateral clavicle. Here, the axillary vein can be recognized as a compressible structure lying anterior to the non-compressible, pulsating axillary artery. The probe is kept in the infraclavicular region of the neck to see the transverse or cross section with light pressure without compressing the vein. The subclavian vein will be visualized as a medial continuation of the axillary vein near the subclavian artery with the thick wall and pulsations. The needle is advanced in real-time towards the lumen of the vein. When the tip of the needle touches the anterior wall of the vessel, the vessel is usually momentarily indented. With further needle advancement, the lumen may be collapsed until the needle pops through the anterior wall. Then the vessel re-expands and the tip is seen within the lumen. When the anterior wall of the vein is compressed against the posterior wall, the needle may pierce both the walls rather than just the anterior wall. The longitudinal view enables the operator to monitor the passage of needle at all times and give accurate control of entry through the anterior wall of the vein23Ultrasound-guided cannulation of the axillary vein may prove to be a safer technique than blind subclavian cannulation,[11,12]especially for those operators without extensive experience with the latter approach.[13]

## MATERIAL AND METHODS

Prospective randomised comparative study conducted in the Department of Anaesthesiology and Intensive Care at Government Medical College Hospital, Jammu *w.e.f.*

February 2015 to June 2015. Patients admitted in Government Medical College Hospital, Jammu who required subclavian vein cannulation were the subject of the study. 60 patients, 30 in each group.60 patients were selected using simple random sampling (using computer generated tables) and patients were divided into two groups of 30 each. Patients with Age between 18-60 years, Patients requiring central venous cannulation for - Hemodynamic monitoring, Long term administration of fluids and drugs, Total parenteral nutrition were included into study while patients with Previous catheter placement, Abnormal coagulation profile, Local site infection were excluded from the study. Patients were randomly allocated into two groups (computer generated): Group-I (anatomical landmark technique) Group-II (ultrasound-guided technique) Patients subclavian vein was cannulated under strict aseptic precaution via infraclavicular approach. The Statistical analysis done by Unpaired t-test and Chi-square test calculated by SPSS (SPSS Inc, Chicago) software packages.

## RESULT

**Table 1:** Distribution of the lmg and usg technique groups with respect to access time

| | Groups | N | Mean | SD | t | Df | Sig. (2-Tailed) |
|---|---|---|---|---|---|---|---|
| Access Time | LMG | 30 | 5.368 333 | 2.09652 8 | 6.9 75 | 58 | <0.001 |
| | USG | 30 | 2.365 | 1.07984 3 | | | |

The Average Access time was more i.e. 5.368333±2.096528 in LMG group as compared to USG group where it was 2.365 ± 1.079843 this observed difference is statistically significant( t= 6.975 ;p <0.001 )

**Table 2:** Distribution of the lmg and usg technique groups with respect to success rate

| Technique | In 1st Attempt | Not in 1st Attempt | Total |
|---|---|---|---|
| LMG | 23 (76.66%) | 7 (33.34%) | 30 (100%) |
| USG | 30 (100%) | 0 (0%) | 30 (100%) |
| **Total** | **53 (83.33%)** | **7(11.66%)** | **60 (100%)** |

Fisher's exact test – P<0.01

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 versus 23 (76.66%) patients in LMG technique was cannulated on the first attempt this observed difference is statistically significant (Fisher's exact test – P< 0.01).

## DISCUSSION

Initially considerable attention was directed towards the importance of right atrial pressure monitoring during the latter half of the nineteenth century in experimental laboratory environments. It was not until the 1950s and 1960s that the application of the principles governing the adequacy of cardiac function led to the understanding of blood volume, preload, cardiac performance and their interrelationship. These findings and enthusiasm to measure the right heart pressure by passing a catheter was sidelined to a certain extent by the proponents of invasive arterial pressure monitoring. However, its simplicity, not requiring any electronic monitor or heparinisation, and multipurpose that it serves made it acceptable as a monitoring mode. Thus central venous cannulation became popular during the 1960s and 1970s. Further widespread application of long term total parenteral nutrition popularized subclavian cannula placement. Introduction of dedicated sets for placement of cannula in a large vein by Seldinger technique using spring loaded 'J' wires made central venous cannulation simple and safe (Seldinger S I 1953). During this period the balloon tipped pulrnonary artery catheter was introduced and accepted as a standard method of monitoring left sided pressures. Over the past 25 years, monitoring of intracardiac pressures during anaesthesia has become a widespread routine practice in patients with ventricular dysfunction. In particular, this form of monitoring is used in those patients when major changes in intravascular volume, after load or contractility occur. Monitoring of the filling pressure by measuring central venous pressure allow differentiation between hypovolemia and myocardial depression. In practice, surface markings are always not reliable means of locating the Subclavian Vein as its position, particularly in a lateral plane tends to vary considerably. We also in our study found that using LMG technique is not always convenient method of cannulating SCV when compared to USG technique. In our study we have found The Average Access time was more i.e. 5.368333 ±2.096528 in LMG group as compared to USG group where it was 2.365 ± 1.079843 this observed difference is statistically significant ( t= 6.975; p <0.001). The probable reasons for this could be USG technique being a under vision technique so easier to perform and more success rate while as LMG technique being a blind 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 versus 23 (76.66%) patients in LMG technique were cannulated on the first attempt this observed difference is statistically significant (Fisher's exact test – P< 0.0105). The probable reason for this being real time under vision passing of needle into the SCV made the cannulation easier and faster as compared to LMG technique where finder needle is used to blindly find the SCV When compared with the LMG and USG techniques for SCV cannulation on first attempt the results of DimitriosKarakisos *et al* 100% vs 94.4%, Piero Antonio *et al* 100% vs 91.6%, WgCdr[14], R M Sharma *et al* 100% vs 98%, Tista A *et al*[17] 100% vs 82%, Bart G.[16] Deny *et al* 78% vs. 43.3%, Mallory *et al* a with 85% vs.l5% 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* 2.3 ± 1.3 vs 1.2 ± 0.4 and Daniel Dugere *et al*[29] 5 versus 2.3. This is evident from the fact the USG technique being under vision has easy access to the SCV vein as the needle passes into the vein while we observe it in contrast to LMG technique.

## CONCLUSION

USG guided SCV cannulationcan be practised in future as the access time and success rate are better than the LMG group.

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