



EVALUATION OF A MODIFIED TECHNIQUE TO SECURE CENTRAL VENOUS ASSESS BY INFRACLAVICULAR SUBCLAVIAN APPROACH

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ABSTRACT

Background and Aim: To assess the safety and efficacy of infra-clavicular subclavian approach for central venous cannulation in initial three attempts. **Settings and Design:** Study was conducted between 2011-2017 parturients, at JNMC, wardha, India. **Materials and Methods:** The study was conducted in surgical intensive care unit, Dept of Anaesthesiology, JNMC, Sawangi after seeking approval from ethics committee. The study group consisted of patients admitted in surgical ICU. Patients were given sedation if necessary, proper positioning done. Under all aseptic precaution the site of puncture was identified. An imaginary line perpendicular to the junction of medial two third and lateral one third was marked. Another horizontal line from sternal notch perpendicular to the vertical line was drawn, the site marked and infiltrated with 10ml of Inj.1% lignocaine. The y-finder needle inserted at the above mentioned point to hit the clavicle first and then passed below it to puncture the vein. Chest x-ray done to confirm placement. If unsuccessful the procedure was done by another investigator. If still unsuccessful the procedure was abandoned and labeled as failure. Any complication like arterial puncture, number of attempts and number of failures were noted. **Results:** Demographic data Of total 1901 patients in 93.95% cases, subclavian vein cannulation was successful in 1st attempt, 4% cases in 2nd attempt and 1.94% cases in 3rd attempt. In 7 patients of total 1908 patients, procedure was abandoned due to irritability and with >3 attempts. Complications including failure to cannulate occurred in 116 patients (6.07%).

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INTRODUCTION

Central venous catheter are frequently used in ICU for various purposes such as measurement of CVP, haemodialysis, administration of fluids, drugs and blood products. It is also required in emergency care units mainly in cases of hypovolumic shock when peripheral venous assess is very difficult. The subclavian venous catheter is less likely to result in catheter related infection than the internal jugular and femoral catheterization (J.C.de graaff, 2006).

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Cannulation of the subclavian vein has become an accepted and most convenient means of access to the venous system and the right heart chambers. By this technique constant monitoring of the right atrial and even pulmonary arterial pressure can be simply achieved allowing logical decision to be made in the manipulation of fluids balance and cardiac function. It also facilitates the rapid administration with easy monitoring of blood and blood replacement solution. A further advantage of subclavian vein cannulation is the easy and rapid passage (with ECG control) of pacemaker wires into the right ventricle the necessity for fluoroscopic control or venous cutdown (Michael, 1973). Subclavian vein puncture requires the position of deep vein to be identified by only surface

landmarks. The precise location of the vein is not known. Moreover ultrasound guidance is not as such very helpful for subclavian vein cannulation as reported by Paul F. Mansfield. Unfortunately the procedure is associated with potential complication like puncture of the subclavian artery, failure to locate or cannulate the vein, misplacement of the catheter, pneumothorax, mediastinal haematoma, haemothorax, hydrothorax, myocardial damage and injury to the adjacent nerves, catheter transaction, air embolism (if central venous pressure is less than atmospheric).

The most common complication in infraclavicular subclavian vein cannulation is pneumothorax (J.C.de graaff, 2006; Michael, 1973; Paul, 1995; Kangl, 2011 and ROEN, 1980). There are no contraindications to the central venous cannulation. But one should reconsider the cannulation if there is local site infection, carotid artery aneurysm, hypercoagulation or coagulation disorders. Apical emphysema or bullae contraindicate infraclavicular or supraclavicular approaches to the subclavian vein (ROEN, 1980). M. Rosen *et al.* mentioned the infraclavicular subclavian approach for venous cannulation by using midpoint of the clavicle (ROEN, 1980). We have studied and evaluated the modified approach to secure the infraclavicular subclavian central venous cannulation.

MATERIALS AND METHODS

- The study was carried out in surgical intensive care unit, Dept. of Anaesthesiology JNMC, Sawangi (Meghe), Wardha after taking permission from the ethics committee.
- It is a prospective cohort study.
- The study group comprises of patients admitted in surgical intensive care unit at AVBRH, Sawangi (Meghe), Wardha from January 2011 to March 2017 who needed central venous line.

Inclusion criteria

- Patient indicated for central venous cannulation.
- Age > 16 years

Exclusion criteria

- Patient with contra-indicated for central line cannulation.

Conduct of the study

- Approval from the ethics committee was taken.
- Patients were selected as per above criteria.
- Consent from the patient or relative was taken after explaining the procedure to the patients and relatives.
- A protocol for the procedure was followed by the physician experienced in the procedure.
- Maximum 3 attempts were executed.
- Every patient was followed up to 24 hrs after procedure for evidence of complications.

Technique

- Administration of sedation, if necessary.

- Proper positioning of the patients- Trendelenberg's position with ipsilateral upper limb in full adduction and shoulder pulled down, head turned to the opposite side.
- Site selected (right or left)
- All aseptic precautions were taken including barrier precautions like handscrubbing, sterile gown, gloves, cap and mask.
- Identify the medial and lateral end of the clavicle. Draw an imaginary vertical line from a point of junction of medial two third and lateral one third of the clavicle.
- Another horizontal imaginary line drawn from sternal notch perpendicular to the vertical line.
- The point of joining these lines was marked.
- Local site was cleaned with povidone iodine and spirit and was covered with the drapes.
- Infiltrated with 10ml of inj.lignocaine 1%
- I.V administration set checked.
- Attach the leuc lock needle to 16g y-finder needle
- Insert the y-finder needle from the marked point towards the contralateral shoulder at angle of 30 degrees to the skin and hit the clavicle.
- Slightly withdraw the needle and pass below the clavicle under continuous gentle negative pressure while proceeding till the aspiration of the blood.
- If blood is not aspirated withdraw the needle under constant continuous gentle negative pressure.
- If blood is aspirated place the central venous catheter using Seldinger technique.
- Catheter was sutured to the skin and covered with sterile dressing.
- Chest x-ray was performed immediately to confirm the position of the catheter and after 24 hrs to detect pneumothorax.
- If unsuccessful, procedure was done by another investigator.
- If still unsuccessful, the procedure was abandoned and was labeled as failure and another site was chosen.
- Any complication like arterial puncture, number of attempts required, and number of failures was noted.

OBSERVATION AND RESULTS

At the end of study, significance was evaluated with 5% alpha error (95% confidence interval). Complication of the procedure was assessed by proportion, test of significance (qualitative test), for example chi square test.

Baseline parameters of the study participants:

Characteristics	
Sex	<ul style="list-style-type: none"> ➤ Male- 996 ➤ Female- 912
Age	<ul style="list-style-type: none"> ➤ <20 years- 317 ➤ 20-40 years- 786 ➤ 40-60 years- 550 ➤ >60 years- 255
Indication for CVC Indications generally overlap, so cannot divide the patients on this basis	

Table 1. Demographic characteristic

Characteristics	Outcome of the procedure			Statistical significance
	Successful (%)	Failure (%)	Total (%)	
Sex				Chi sq. =0.068 P=0.79
• Male	992	4	996	
• female	909	3	912	
Age				
➤ <20 years	317	0	317	
➤ 20-40 years-	786	2	786	
➤ 40-60 years-	548	2	550	
➤ >60 years-	255	3	255	
<40	1101	2		Chi sq. =2.46
>40	800	5		P=0.11
Indications				
Number of cases	1901	7	1908	

All other factors affecting failure of the procedure	No. of patients Total-7
Uncooperative patient/irritable	4
>3 attempts	3

Table 2. Number of attempts

Number of attempts	1 st attempt	2 nd attempt	3 rd attempt	Procedure abandoned	Total cases
Number of cases	1786 (93.60)	78 (4.09)	37(1.94)	7 (0.37)	1908
Statistical significance	Mantel-Haenszel chi sq for linear trend= 79.35 P<0.000				

Table 3. Incidence of complication

complications	Number of cases	Statistical significance
Arterial puncture	102	5.3%
hematoma	3	0.15%
Pneumothorax/hemothorax	2	0.10%
Nerve injuries	0	0
thrombosis	2	0.10%
failure	7	0.36%
Total	116/1908	6.07%

DISCUSSION

In emergency department the use of central venous access has been increased in patient care. Amongst the available approaches subclavian vein cannulation via the infra-clavicular approach is preferred in intensive care setting because of advantages such as well-defined landmarks, straighter pathways IVC, and lesser proximity to lung. In our study the total selected cases i.e. 1901 were included and 7 were excluded. 1786 patients (93.6%) were cannulated in the first attempt. But Anil Thakur Et al in 2018 have studied 59.2% cases with infra-clavicular approach for subclavian vein cannulation. 78 patients i.e. 4.09% were cannulated in second attempt. Were as Anil Et al have cannulated 40.74% patients in second attempt, so comparatively our technique is better. There were various complications, arterial puncture was seen in 5.7% of cases i.e. 102 cases were as Anil Et al has reported arterial puncture in 7.33% cases. So less arterial puncture was seen in his study compared to our study. Haematoma was seen in 0.5% cases i.e. 3 cases were as Anil et al has not found haematoma as complication in any of his cases Pneumothorax and haemothorax were seen 0.10% cases i.e. 2 cases. Anil Et al has not found any such complication. There are no nerve injuries observed in our study. Failure was seen in 0.36% i.e. in 7 cases but in Anil et al the failure was 10% so our study has lesser failure rate as compared to his study.

RESULTS

93.6% cases were successful in central venous catheterization in first attempt, while 4.1% and 1.94% cases were successful in second and third attempt respectively. Seven cases (0.37%) were not successful in third attempt and the procedure was abandoned thereafter. It suggests that there was significantly high chances of success in first attempt and in subsequent attempts.

Conclusions

- Subclavian vein cannulation is one of the safest route for CVP cannulation in ICU patients but it is associated with specific complications related to the anatomic site close to the Pleural space & neurovascular bundle.
- The modified approach appears to be safe & simple, when practiced under guidance of the trained person. USG guided CVP Cannulation will further reduce the complication rates in this approach.
- Further studies are required for comparing blind versus USG guided CVP Cannulation.

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