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A COMPARATIVE STUDY OF SUPRACLAVICULAR VERSUS INFRACLAVICULAR APPROACH FOR CENTRAL VENOUS CATHETERIZATION

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ABSTRACT

OBJECTIVE: Supraclavicular approach to subclavian vein catheterization is still being employed less often than traditional infraclavicular approach. The purpose of this study was to compare the two techniques regarding number of attempts, success rate of catheterization and complications associated with the procedure.

SETTING: Medical College Hospital

DESIGN: Controlled randomized trial.

PLACE OF STUDY: Intensive Care Unit (ICU) of Jawahar Lal Nehru Medical College & Hospital , Bhagalpur , Bihar.

Duration of study: 1st June 2017 to 30th December 2017

METHOD: We included 100 adult patients of either sex undergoing central venous catheterization for various indications, selected by nonrandom sampling, in the study. They were divided into the supraclavicular and infraclavicular groups (50 in each group). Right subclavian vein of the patient was chosen in all patients for catheterization. Variables for comparison included number of attempts, success or failure of catheterization and complications associated with the procedure in each group. Statistical analysis was done by applying Chi-square test and Student's Independent Samples T-test.

RESULTS: The overall success rate was 95.83% for right infraclavicular and 87.50% for right supraclavicular approach ($p>0.05$). The number of successful attempts for infraclavicular and supraclavicular approaches were 1.13 ± 0.42 and 1.35 ± 0.69 respectively ($P=0.029$). The complication rate was higher in the supraclavicular group, but the difference was not statistically significant.

CONCLUSION: The infraclavicular approach to subclavian vein cannulation was found to be a more successful method for adult central venous catheterization with complications comparable to the more commonly used supraclavicular approach.

KEYWORDS : Central venous catheterization; infraclavicular approach; supraclavicular approach

INTRODUCTION

Central venous catheter (CVC) placement is a routine procedure in the management of critically ill patients in Intensive Care Units (ICU) and Operating Rooms (OR). Central venous access is indicated when peripheral veins are inaccessible, for volume resuscitation, administration of potent vasoactive drugs, frequent blood sampling, total parenteral nutritional support, hemodialysis, hemodynamic monitoring, transvenous cardiac pacing, and administration of long term chemotherapy.[1-3]

The subclavian vein access has been the standard recommended approach for central venous catheterization both for short and long term use. The advantages are attributed to its large size, patient comfort and lowest rate of catheter related infections.[4,5] It also carries a lower risk of thrombosis when compared to femoral or internal jugular vein cannulation.[6,7]

Since the first report of percutaneous catheterization of the subclavian vein, the infraclavicular approach has been widely used.[8,9]Unfortunately this approach is associated with a few well known complications like subclavian arterial puncture, pneumo- and hemothorax, which may be due to vague anatomical landmarks such as controversial skin entry points and ambiguous targets located far from the insertion site.[10] Sometimes these complications are life-threatening.[11-13] Moreover, the approach is influenced by changes in patient's position and shoulder retraction.[14]

As an alternative, the supraclavicular approach for subclavian vein was suggested by Yoffa.[15] This route to the subclavian vein has some distinct advantages over the infraclavicular approach. However, it is less often taught and utilized for reasons that are not clear[14]. Perhaps most of the practitioners have not been trained and taught this technique. Secondly, there may be a fear of directly entering into the pleural cavity and damage to vital structures, and there may be initial difficulty in identifying the landmarks, the angle and proper direction of the needle, resulting in failures.

We compared the two techniques regarding number of attempts, success rate of catheterization and complications associated with the procedure.

METHODOLOGY

This prospective, randomized, comparative study was conducted in the ICU of Jawahar Lal Nehru Medical College & Hospital, Bhagalpur , Bihar , India , from 1st June 2017 to 30th December 2017. Permission was obtained from hospital ethical committee and informed consent was obtained either from the patient or from next of kins to carry out the procedure. A total of 50 patients, requiring subclavian vein catheterization for various indications, were included in each of the two groups by nonrandom selection. Right sided infraclavicular and supralavicular approaches were used in Group A and Group B patients respectively. Both groups were studied with respect to number of attempts, success or failure of procedure and any complications associated with the procedures. Size 7 F , 15 cm certofix trio, B Braun International central venous catheters (Saldinger technique) were used in the study. Size of the catheter and single or triple lumen were selected according to need of the individual patients. Size 18 (No-33) and size 16 (No-39) catheters were used in Group A and size 18 (No-42) and size 16 (No-30) catheters were used in Group B patients. Each skin puncture was defined as an attempt and maximum 3 attempts were allowed in either approach and in case of failure, alternate approach (internal jugular) was used for catheterization. All successful cannulations were confirmed by post-procedure chest radiography.

Data were analyzed by SPSS version 15.0 for calculation of descriptive and inferential statistics. The Chi square test was used for comparing qualitative variables, while the Student's Independent Samples T-test was used to compare means. A $p \leq 0.05$ denoted significance.

PROCEDURE:

Patients to be catheterized were placed in supine position with head turned to the left side. No roll towel was kept between interscapular region, nor a head down position was used in the study, as it was impracticable on ICU beds. Anterior region of neck and upper chest

was cleaned with povidone-iodine solution. All aseptic precautions were used by the operator. Procedure site was draped with sterile towels. Lignocaine plain 1% solution (3-4 ml) was injected to anaesthetize the puncture site and subcutaneous tissue. The claviculosternomastoid angle was identified either by asking the patient to raise his/her head or by palpation. Correct identification of this angle is critical to the success of supraclavicular approach. The needle with attached syringe was inserted at the claviculosternomastoid angle, bisecting it in a direction, 10 degrees from the sagittal plane and 35 degrees posteriorly from the coronal plane. Needle was advanced behind the clavicle and directed towards the contralateral nipple. This approach allows for the shortest distance to the target vessel (2-3 cm) and for the first rib to act as a physical barrier to reduce the risk of pneumothorax. Bevel of the needle was directed medially (9 o'clock position) to facilitate threading of the guide wire in the direction of superior vena cava (Fig. 1). Right sided approach was used because of the lower location of pleural dome, more direct route to superior vena cava, being away from subclavian artery and absence of thoracic duct on this side.

Standard approach was used for the infraclavicular approach by selecting point of needle entry 1 cm below the clavicle at the junction of middle and medial third of the clavicle and directing the needle towards the suprasternal notch.

RESULTS

There were 54 males and 18 females in Group A, and 47 males and 25 females in group B; the differences were not statistically significant. The mean age of the patients in group A was 38.26±8.72 years and in group B it was 40.42±9.52 years (p=N.S.)

Results of the successful attempts and the frequency distribution of successful catheterizations are given in Table 1.

Table 1: Frequency distribution of No. Of attempts

Attempts	Approaches n(%) Infraclavicular n=50	Total n(%) n=100 Supraclavicular n=50	P value
1	43(86.11)	34(68.05)	111(77.08)
2	4 (7.50)	05(10.00)	11(7.64) 0.042
3	02(4.00)	08(11.11)	10(6.94)
Unsuccessful	01(0.06)	03(6.00)	12(8.33)

Overall success rate was 87.5% (69/72) for right supraclavicular approach and 97.5% (63/72) for right infraclavicular approach. Catheterization failed in 3 patients (4.16%) in Group A and in 9 patients (12.50%) in Group B. Comparison of successful attempts is given in Table 2.

Table 2: Comparison of successful attempts of CVC (n=132)

Approach	Infraclavicular (n=50)	Supraclavicular (n=50)	Total (n=100)	P value
Mean±SD	1.13 ± 0.42	1.35 ± 0.69	1.23 ± 0.58	0.029

Malpositioning of catheter (threaded in contralateral subclavian) was noted in 2 patients in Group A and ipsilateral internal jugular vein in 1 patient in Group B, whereas pneumothorax and subclavian arterial puncture was encountered in 1 and 3 patients respectively in Group A; only 1 arterial puncture was seen in Group B as shown in Table 3. The complication rate was not significant within or inbetween the two groups.

Table 3: Comparison of complications in two Groups (n=72 each)

Complication	Group A n(%)	Group B n(%)	Total n(%)	P value
Malposition	2(2.80)	1(1.40)	3(2.08)	N.S.
Pneumothorax	1(1.40)	0	1(0.07)	
Arterial puncture	3(4.20)	1(1.40)	4(3.47)	
Total	6(8.33)	2(2.80)	8(5.55)	

DISCUSSION

Numerous modifications of Yoffa's original supraclavicular technique[15] have been suggested and tested in cadaver studies and prospective case series. Garcia et al evaluated 83 attempts at subclavian vein catheterization using a modified supraclavicular approach.[17] Successful catheterization was achieved in 98.6% of the attempts with 2 pneumothoraces and 3 subclavian artery punctures.

These findings were not in agreement with our present study, where the right supraclavicular approach (as per Yoffa technique) showed success in 95.83% of cases, as compared to a success rate of 87.50% for the right infraclavicular approach. However, the complication rates of the present study were similar with 1.4% pneumothorax and 4.2% arterial punctures recorded, and total complications of 8.33% compared well to Yoffa's 6.02%.

Identification of landmarks was critical to the success of supraclavicular approach. We found that supraclavicular approach was comparatively easy in thin medium build patients but was difficult in obese patients with short necks. Further, difficulty was faced in unconscious patients who could not lift their head for identification of claviculosternomastoid angle. In such cases manual palpation of the angle was used which usually led to success.

The literature disagrees with the effectiveness of the supraclavicular approach using Yoffa's original technique and modifications to landmarks, angles and patient position. No central venous access is without potential complications and no one technique is ideal for every patient.

Large scale, multicentre studies may help in better comparison between the two techniques. A thorough knowledge of anatomy and familiarity with multiple approaches is the route to successful CVC.

CONCLUSION

We conclude that the infraclavicular approach was the more successful method of central venous catheterization compared to the supraclavicular approach which is contrary to most previous studies.

REFERENCES

1. Oksuz H, Senoglu N, Yildiz H, Demirkiran H. Anatomical variations of the clavicle and main vascular structures in two pediatric patients: subclavicular vein cannulation with supraclavicular approach. International Journal of Anatomical Variations 2009;2:51–53.
2. Celinski SA, Seneff MG. Central venous catheterization. Procedures, Techniques and Minimally Invasive Monitoring in Intensive Care Medicine 4th Edition. Edited by: Irwin RS, Rippe JM, Lisbon A, Heard SO. Lippincott Williams and Wilkins. Philadelphia. 2007:19-37.
3. Czarnik T, Gawda R, Perkowski T, Weron R. Supraclavicular Approach is an Easy and Safe Method of Subclavian Vein Catheterization Even in Mechanically Ventilated Patients: Analysis of 370 Attempts. Anesthesiology 2009;111:2:334-9
4. Paoletti F, Ripani U, Antonelli M, Nicoletta G. Central Venous Catheters: Observations on the Implantation Technique and its Complications. Minerva Anesthesiol. 2005;71:555-580.
5. Jessen MO. Anatomical Basis of Central Venous Catheter Fracture. Clin Anat. 2008;21:108-110.
6. Patrick SP, Tijunelis MA, Johnson S, Herbert ME. Supraclavicular Subclavian Vein Catheterization: The Forgotten Central Line. West JEM. 2009;10:110-114.
7. McGoo DC, Gould MK. Preventing Complications of Central Venous Catheterization. N Engl J Med. 2003;348:1123-33.
8. Aubaniac R. Subclavian intravenous injection; advantages and technic. Presse Med. 1952;60:1456.
9. Jung CW, Seo JH, Lee W, Bahk JH. A novel supraclavicular approach to the right subclavian vein based on three-dimensional computed tomography. Anesth Analg. 2007;105:200-4.
10. Moosman DA. The anatomy of infraclavicular subclavian vein catheterization and its

complications. Surg Gynecol Obstet.1973;136:71-4.
11. McGee DC, Gould MK. Preventing complications of Central Venous Catheterization. N Engl J Med. 2003;348:1123-33.
12. Schummer W, Schummer C, Rose N, Niesen WD, Sakka SG. Mechanical Complications and Malpositions of Central Venous Cannulations by Experienced Operators. A Prospective Study of 1794 Catheterizations in Critically Ill Patients. Intensive Care Med. 2007;33:1055-9.
13. Fortune JB, Feustel P. Effect of Patient Position on Size and Location of the Subclavian Vein for Percutaneous Puncture. Arch Surg. 2003;138:996-1000.
14. Bahk JH, Ryu HG. Position of the Shoulder for Subclavian Approach. Anesthesiology. 2005;103:208-9.
15. Yoffa D. Supraclavicular Subclavian Venepuncture and Catheterization. Lancet. 1965;2:614-17.
16. Singh PK, Ali Z, Rath GP, Prabhakar H. Catheter Malposition following Supraclavicular Approach for Subclavian Vein Catheterisation. M.E.J. Anesth. 2008;19:1405-10
17. Garcia JM, Mispreta LA, Pinho RV. Percutaneous Supraclavicular Superior Vena Caval Cannulation. Surg Gynecol Obstet. 1972;134:839-41.