

SUBCLAVIAN VEIN CATHETERIZATION: SUPRACLAVICULAR VERSUS INFRACLAVICULAR APPROACH

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ABSTRACT

Objective: To compare the success of supraclavicular and infraclavicular approaches for subclavian vein cannulation.

Material and Methods: This study was conducted in department of anaesthesia & Surgical ICU of Khyber Teaching Hospital and Rehman Medical Institute, Peshawar. A total of 139 adult patients of either sex, undergoing central venous cannulation for various indications, were included in the study. Random allocation was done in two groups by lottery method. Group A (n=69) patients were cannulated by supraclavicular approach while patients in Group B (n=69) by infraclavicular approach. All the procedures were done by experienced anesthetists. Variables for comparison taken were success and failure rates on first attempt without any major or minor complications.

Results: In both groups, sex and age were in significant with p-values of 0.446 and 0.264 respectively. Efficacy in terms of success rate shows that supraclavicular approach was successful as compared to infraclavicular approach and was highly significant with p-values of 0.016 by statistical analysis was done by chi square test.

Conclusion: Subclavian vein catheterization via the supraclavicular approach is an easy method of central venous access irrespective of age and gender.

Key Words: Subclavian vein, cannulation, supraclavicular, infraclavicular.

INTRODUCTION

Central venous catheterization is a vital intervention in critically ill patients for a variety of purposes including volume resuscitation, CVP monitoring, transvenous cardiac pacing hemodialysis access hypertonic or irritant substance infusion and when peripheral veins are inaccessible^{1,2}. Central lines are typically introduced into the internal jugular, subclavian or femoral veins. The subclavian vein is being preferred for central venous cannulation because of larger diameter, ease of insertion, absence of valves, low complication rate and high degree of patient acceptance once the catheter is in place³. It also carries a low risk of catheter related infection and thrombosis than femoral or internal jugular vein catheterization^{4,5}.

First described by Aubaniac in 1952, subclavian vein catheterization by infraclavicular approach has been widely used as a time honored and tested technique of accessing the major venous system^{6,7}. Unfortunately this approach is associated with several critical complications such as arterial puncture and

pneumo- haemothorax, which may be due to vague anatomical land marks, such as controversial skin entry points and ambiguous targets located far from the insertion site. Sometimes these complications are life threatening⁸. Moreover this approach is influenced by changes in patient position and shoulder retraction⁹.

As an alternative, the supraclavicular approach for subclavian vein cannulation was first described in 1965 by Yoffa¹⁰. Although an under used method, less often taught and utilized for reasons that are not clear, this approach has some distinct advantages over the infraclavicular approach. Right sided approach offers a straight path into superior vena cava, fewer complications of plural or arterial puncture, reliable way of obtaining central venous access without interruption of CPR, less complications even in less experienced hands and less distorted even in obese patients^{11,12}. Keeping in view the above mentioned facts, the current study is designed to find out the best approach for subclavian vein cannulation in first attempt (single puncture) defining the success rate.

MATERIAL AND METHODS

Our study design is a comparative randomized controlled trial. It was conducted in the department of anaesthesia & Surgical ICU of Khyber Teaching Hospital and Rehman Medical Institute, Peshawar, from

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October 2011 to April 2012. Sample size was 69 in each group, using 85.6% success rate of supraclavicular approach and 64.2% success rate of infraclavicular approach for subclavian vein cannulation, 95% confidence interval and 90% power of the test under WHO sample size calculation. Consecutive (non probability) sampling technique was applied. Patients were distributed by lottery method into two groups. In group A (n=69) patients were cannulated by supracavicular approach and in group B (n=69) by infraclavicular approach to subclavian vein.

All adult patients of either sex requiring subclavian vein cannulation for various indications were included, except those patients who had infection at the site of insertion. Patients having fracture of clavicle, first rib or with cervical spine injury were not included. Obesity with BMR > 29, bleeding disorders and patients with chest deformities were also excluded. The above mentioned conditions act as confounders and if included introduce bias in the study results. After approval from the hospitals ethical and research committees, informed written consent were obtained after explaining the purpose and benefits of the study, either from the patients or their relatives.

For supraclavicular approach landmark taken was sternocleidomastoid muscle angle, which is critical to success. This angle was identified either by raising patient's head or by palpation. After needle insertion at this point, it was advanced behind the clavicle, directed towards contralateral nipple.

For supraclavicular approach, objective is to puncture the subclavian vein in its superior aspect just as it joins the internal jugular vein. The key to success according to Yoffa, is correct identification of clavisternomastoid angle formed by the junction of the lateral head of sternocleidomastoid muscle and clavicle. Active raising of head may make this apparent. Needle is inserted 1cm lateral to the lateral head of sternocleidomastoid muscle and 1cm posterior to the clavicle and directed at 45 degree angle to the sagittal and transverse planes, aiming towards the contralateral nipple. Needle advances in avascular plane, away from subclavian artery and dome of pleura, entering into junction of subclavian and internal Jugular vein. This approach allows for the shortest distance (2-3cm) of subclavian veins, the 1st rib act as physical barrier to reduce risk as pneumothorax. Right sided approach allows lower location of plural dome, more direct route to subclavian vein and absence of thoracic duct. Trendelenburg position decreases risk of air embolism and helps distend the veins.

For infraclavicular approach, the traditional/standard approach was used. Puncture site 1cm below the clavicle at the junction of middle and medial 3rd of clavicle and directing the needle towards suprasternal notch. Data were stored and analyzed in SPSS version 10. Mean \pm SD were calculated for numerical variable like age. Frequencies and

percentages were calculated for categorical variables like gender and success. Chi square test was used to compare the success between two groups by keeping p value of < 0.05 as significant. Also, success was stratified among age and gender to see the effect modifications by applying chi-square test.

RESULTS

A total of 138 patients were divided in two equal groups. Patients in Group A (n=69) were catheterized by right supraclavicular approach and patients in Group B (n=69) by right infraclavicular approach to subclavian vein. Gender wise distribution showed that there were 21(30.4%) males or 48(69.6%) females in Group A, with M:F ratio of 1:2.3. while Group contained 17 (24.6%) males and 52(75.4%) female with M:F was 1:3.1. Overall male to female ratio was 1:2.63. Sex distribution among the groups was insignificant with p-value of 0.446.

Average age was 48.71 years \pm 15.51SD in Group A and contained 10(14.5%) patients having less than 30 years 21(30.4%) patients between 31-45 years, 17(24.6%) patients between 46-60 years and 21(30.4%) patients with age more than 60 years. While in Group B, average age was 47 years \pm 16.11SD and contained 14(20.3%) patients with less than 30 years age, 18(26.1%) between 31-45 years, 18(26.1%) between 46-60 years and 19(27.5%) patients with more than 60 years. The overall average age of the patients was 47.95 years \pm 15.77SD. The age distribution among the groups was also insignificant with p-value 0.264.

Efficacy in terms of successful 1st attempt at cannulation showed that supraclavicular procedure was effective in 64(92.8%) patients while infraclavicular procedure was effective in 54(78.3%) patients which shows that efficacy was highly significant in both the procedure with p-value = 0.016. Age wise distribution of success rate shows that majority of the success was in less than 30 years of age. i.e 91.7%. Gender wise distribution of success rate shows almost equal success. Thus, age and gender have no role over the efficacy of subclavian vein cannulation.

DISCUSSION

Subclavian vein catheterization via the infraclavicular approach overall success rate is 80% — 95% and successful venipuncture on first attempt rate is estimated to be 64.2%. Similarly for supraclavicular approach, overall success rate is from 74% — 98%, with 85.6% success rate during first attempt.

In our study the success rate via both approaches is defined as proper central venous catheterization without major or minor complications in the first attempt. First attempt is single skin puncture site, where the needle may be redirected to obtain success. Our results are comparable to the above results, supraclavicular approach estimated at

92.8% success and infraclavicular approach at 78.3% success. Hussain et al¹³ reported overall success rate of 95.8% (69/72) for right supraclavicular approach and 87.5% (63/72) for right infraclavicular approach in three attempts. Czarnik T et al¹ analysis of 370 attempts of subclavian vein catheterization via the supraclavicular approach success rate has been found to be 85.6%, while via the infraclavicular approach, success rate on first attempt is estimated at 64.2%.

Garcia et al¹⁴ evaluated 83 attempts for supraclavicular approach by modified Yuffa technique, and achieved 98.6% success, with very few complications. However, Dronen et al¹² evaluated the two techniques in 76 patients undergoing CPR, with 90% success rate with supraclavicular approach and 84% with infraclavicular approach and found the supraclavicular as a technique of choice when central venous access is required during CPR also success rate 98 % during cardiac surgery after sternal retractor expansion¹⁵. His study was relatively on a smaller size. Sterner et al¹⁶ compared the two approach on a larger scale in 500 patients and found both the approach to have similar success rates. Supraclavicular group 245/500 patients success rate of 84.5% and infraclavicular group 255/500 patients success rate of 80%. Sterner concluded that familiarity with both the approaches is the key to successful subclavian vein catheterization. similarly, as ultrasound guided placement of central lines is not always available, for this reason, lone landmark based central line access will remain a skill physicians need to have in their armamentarium. Tomar et al¹⁷ also concluded that this approach is as safe as other approaches with greater ease of performance and less chances of misplacement.

Identification of land marks is critical to success of supraclavicular approach. Land marks was found comparatively easy in most of the patients irrespective of gender but difficult in obese and unconscious patients who could not lift their heads. Literature demonstrate success of supraclavicular approach using Yuffa modified technique. Large scale multi center studies may help in better comparison between the two approaches. However the key to success is through knowledge of anatomy and familiarity with approach.

CONCLUSION

A thorough knowledge and familiarity with multiple approaches is the route to successful central venous catheterization.

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