



CENTRAL VENOUS CATHETERIZATION: INTERNAL JUGULAR VERSUS SUPRACLAVICULAR APPROACH TO SUBCLAVIAN VEIN PUNCTURE

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ABSTRACT

BACKGROUND AND OBJECTIVE: Central venous catheterization can be performed through subclavian (supraclavicular or infraclavicular), internal jugular or femoral route, each having its advantages and disadvantages. This study was designed to compare success rate and complications of supraclavicular approach for subclavian puncture with the internal jugular vein puncture.

METHODS: One hundred twenty six consecutive patients, 63 in each group, requiring central venous catheterization were enrolled. Alternate patients were placed in internal jugular (IJ) and subclavian (SC) groups. Both groups were compared with respect to difficulty in threading and procedural success in three attempts and frequency of complications like catheter malposition, catheter kinking, arterial puncture and pneumothorax.

RESULTS: IJ Group (21 men and 42 women) had a mean age of 41.77 ± 15.05 years and SC group (17 men and 46 women) 38.67 ± 17.14 years. The procedure was successful in 55 (87.3%) patients in IJ versus 53 (84.1%) patients in SC group. Difficulty in threading, catheter malposition and catheter kinking had almost similar frequency in both groups. The procedure was complicated by arterial puncture in 5 (7.93%) patients in IJ and 3 (4.76%) patients in SC group. Pneumothorax occurred in 2 (3.33%) patients in IJ group and 1 (1.59%) patient in SC group. Both groups were equal with respect to all these findings.

CONCLUSIONS: Supraclavicular approach to subclavian puncture has similar success rate and complication rate as internal jugular vein puncture for central venous catheterization.

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INTRODUCTION

Central venous catheterization is a common procedure performed in operation rooms and critical care units for fluid resuscitation, hemodynamic monitoring, transvenous cardiac pacing and hemodialysis access. Central venous line is particularly useful for long term total parenteral nutrition and for administration of large volume solutions for hemodialysis.

The possible routes for central venous catheterization are internal jugular vein, subclavian vein and femoral vein. Most of anesthetists prefer internal jugular vein over other routes as there are less chances of pneumothorax associated with this technique. However, inadvertent arterial puncture still remains a common complication during inter-

nal jugular catheterization. Femoral route is avoided due to greater chances of infection. Subclavian vein may be accessed by supraclavicular or infraclavicular approaches. Infraclavicular approach to subclavian vein is avoided due to greater risk of pneumothorax.¹ Supraclavicular approach to subclavian vein provides an excellent route as there are fewer chances of pneumothorax and arterial puncture with supraclavicular approach.² It can serve as a good alternate to the internal jugular approach.^{3,4} Even some texts refer it as the easiest possible approach for central venous catheterization.^{5,6} Supraclavicular approach has well defined landmarks, the shortest skin to vein distance and straight path if performed from right side.⁷ Supraclavicular approach for subclavian vein puncture is particularly useful during cardiopulmonary resuscitation as it has fixed anatomical landmarks.⁸ However, supraclavicular approach to subclavian vein is not being practiced routinely despite its theoretical superiority.⁹ There have been many comparisons of supraclavicular and infraclavicular approaches to subclavian vein. But there are few studies comparing supraclavicular approach to subclavian with internal jugular vein

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puncture for central venous line placement. We designed this study to compare the most commonly used method, i.e., internal jugular with most neglected method, i.e., supraclavicular approach to subclavian vein.

MATERIALS AND METHODS:

It was a prospective comparative study. The study was performed at Sir Ganga Ram Hospital, Lahore from 05.01.2012 to 04.01.2013. After approval by hospital research and ethical committee and informed consent from every patient or his close relative, 126 patients needing central venous catheterization for any indication during anesthesia or in critical care unit were enrolled in the study. Alternate patients were placed in internal jugular (IJ) and subclavian (SC) groups, each comprising 63 patients. The sample size was calculated by using expected percentage of complication in IJ group as 7% and SC group as 1.7%.² We used 5% precision and 95% confidence level.

Data was collected for the following variables: name, age, gender, hospital registration number, number of attempts, complications, success of catheterization and usage of alternate route in case of failure. Each skin puncture was considered as an attempt. The following were defined as complications related to the insertion of the catheter: difficulty in threading, catheter malposition, catheter kinking, arterial puncture and pneumothorax. Portable Chest x-rays were taken immediately after the procedure to assess catheter position and detect other complications.

All the collected information was entered and analyzed using SPSS version 10.0. Continuous variable, age, was presented as mean±SD and compared in the two groups using independent sample T test. All qualitative variables were presented as frequencies and percentages and compared using chi square test. P < 0.05 was taken as significant.

PROCEDURE:

The procedure was performed by an experienced anesthesiologists or senior resident, using an aseptic technique with local anesthesia and with the patient in a supine, 15 degree Trendelenburg position with head slightly rotated towards the opposite side.¹⁰

For supraclavicular approach, whenever possible, lateral border of the sternocleidomastoid muscle just above the clavicle was used as the insertion point. When not well demarcated, junction of medial and middle third of the clavicle was used as the insertion point. A 22 gauge long seeker

Table 1: Demographic data.

Characteristics	Group IJ (n=63)	Group SC (n=63)	P Value
Age in years (Mean + SD)	41.77 ± 15.05	38.67± 17.14	0.056
Gender	Male n(%)	21 (30)	0.56
	Female n(%)	42(70)	

Table 2: Success Rate in 2 groups.

Characteristics	Group IJ (n=63)	Group SC (n=63)	P Value
Overall Success n (%)	55 (87.3)	53 (84.1)	0.806 ^a
Success in 1 st attempt n (%)	40 (63.5)	43(68.1)	1.0 ^a
Success in 2 nd attempt n (%)	11(17.5)	8(12.7)	0.617 ^a
Success in 3 rd attempt n (%)	4(6.3)	4(6.3)	1.0 ^b
Alternate route use n(%)	8(12.7)	10(15.9)	0.806 ^b

^a Pearson chi square test, ^b Fisher Exact test
 needle was inserted bisecting the sternocleidomastoid-clavicular angle with 10 degrees above the horizontal plane and directed towards the opposite nipple, which was similar to the technique described by Yoffa.¹¹ After each pass the barrel of the syringe was elevated a few degrees. Each attempt was made slowly with gentle aspiration applied continuously. If the first pass was unsuccessful the subsequent attempts were performed by bringing the needle to a subcutaneous position and re-entering at a new angle. After locating the site of the vein with the seeker, direction and the depth was marked and proper needle was inserted. Modified Seldinger technique was used to place the catheter. Once guide wire was in place, the catheter was introduced and flushed with normal saline after aspiration. Fixing was done at 12 cm with silk sutures and sterile dry dressing was used to cover the insertion point.

For Internal Jugular approach, the topographic landmarks used were those described by Civetta et al.¹² the point of entry was 5 cm above the clavicle and 1 cm medial to the lateral edge of the sternocleidomastoid muscle with the needle angled 30° to the coronal plane and inserted along a path parallel to the anterior border of the sternocleidomastoid muscle. A 22 gauge long seeker needle

Table 3: Comparison of Complications with two different approaches.

Complication	Group IJ (n=63)	Group SC (n=63)	P value ^a
Difficulty in threading n(%)	4 (6.35)	3 (4.76)	0.698
Catheter Malposition n(%)	2 (3.17)	3 (4.76)	0.646
Catheter kinking n(%)	3 (4.76)	3 (4.76)	1.0
Arterial puncture n(%)	3 (4.76)	3 (4.76)	0.466
Pneumothorax n(%)	2 (3.17)	1 (1.59)	0.558

^a Fisher Exact test



was inserted to confirm the position of vein. After locating the site of the vein with the seeker, direction and the depth was marked and the proper needle inserted. Rest of the procedure was same as described above for supraclavicular approach.

If inadvertent arterial puncture occurred with either technique, the needle was removed and pressure was applied over the puncture site for at least 5 minutes. The alternate route was used if arterial puncture occurred or if the vein could not be located in three attempts and it was labeled as unsuccessful. Successful central catheter placement was assumed when there was easy passage of the catheter and when aspiration yielded free return of venous blood, with maximum 3 attempts without any complication.

RESULTS

One hundred twenty six patients were studied, 63 in each group (SC and IJ). Demographic data are summarized in Table I. Procedure was successful in 87.3% patients in IJ group and 84.1% patients in SC group in three attempts (table II). In all unsuccessful cases, alternate route was successfully used for central venous catheterization. Rate of complications in both groups is summarized in table III and is similar.

DISCUSSION

Our single center study showed that Supraclavicular approach to subclavian vein puncture is as safe as internal jugular vein puncture for central venous catheterization. This is in agreement with a previous study by Muhm et al.⁷ who found su-

praclavicular approach to be as safe as other techniques. Ruesch et al.¹³ concluded from a meta-analysis that there are no significant differences in complication rates between internal jugular vein puncture and subclavian vein puncture except for slightly increased risk of arterial puncture with internal jugular approach. These findings are mostly in agreement with our results. However, we did not find any significant differences in the frequency of arterial puncture between these two approaches (Table 3). Biffi et al.¹⁴ also found insignificant differences in complication rates between subclavian and jugular approaches. A meta-analysis revealed no significant differences in the complication rates between supraclavicular approach to subclavian vein and internal jugular vein puncture.¹⁵ The results of this meta-analysis are also in agreement with our study. Different studies have demonstrated a success rate of 79 to 100 percent with supraclavicular approach.⁶ Our study has demonstrated a success rate of 84 percent with supraclavicular approach which is quite similar to what is cited in literature.⁶

CONCLUSIONS

Supraclavicular approach to subclavian vein puncture has similar success rate as internal jugular vein puncture for central venous catheterization. Complication rates with these two approaches are not significantly different. The choice of central venous access site and approach should depend upon individual patient's circumstances and experience of the operator.

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