

Chances of Pneumothorax and Malpositioning of Central Venous Catheters in Internal Jugular Vein Vs Subclavian Vein Routes

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ABSTRACT

Background: Central venous catheterization (CVC) is being done all over the world. It has specific indications and should be reserved for the patient who has the potential to benefit from it.

Aim: To compare the incidence of pneumothorax and mal-positioning with internal jugular vein (IJV) and subclavian vein (SCV) routes of central venous catheters.

Methodology: This randomized control trial was conducted at Department of Anaesthesia, Shaikh Zayed Hospital, Lahore, from 8-12-2014 to 7-6-2015. The non-probability purposive sampling technique was used in this study. After the approval of Hospital Ethical Committee, 290 patients were included in this study and informed consent was obtained. Demographic profile was also obtained. Patients were randomly divided in two groups by using lottery method.

Conclusion: Our study results concluded that IJV showed fewer incidences of pneumothorax and mal-positioning than SCV technique. However, the difference was not statically significant.

Keywords: Internal Jugular Vein, IJV, Central Venous Catheterization, CVC, Jugular subclavian (SCV),

INTRODUCTION

Central venous catheterization (CVC) is being done all over the world. It has specific indications and should be reserved for the patient who has the potential to benefit from it.¹ The indications for CVC include central venous pressure monitoring, inadequate peripheral venous access, cardiopulmonary resuscitation, long term intravenous therapy (chemotherapy, hemodialysis, hyperalimentation) as an adjunct to pulmonary artery catheterization and inotropic support². Central venous access can be achieved by different routes, utilizing femoral, axillary, internal jugular and subclavian veins, but the route favored by most centers is the internal jugular or subclavian veins. All complications and side effects depend on vascular access route³.

Mal-positioning and pneumothorax related to mal-positioning are the most common complications of CVC insertion, reportedly representing up to 30% of all mechanical adverse events. Its incidence varies when the number of needle pricks increases in emergency situations and when the catheters inserted are large, such as those used for dialysis⁴. Overall complication rates range up to 15% with mechanical complications reported in 19% of patients, infectious complications in 26%, and thrombotic complications in 26%.⁵ It is seen that incidence of pneumothorax varies in different studies⁶.

Luyt et al., conducted a randomized trial and reported that the incidence of mal-position was reported to be low with IJV (1.8%) as compared to SCV (7.4%), however, the difference was insignificant ($p=0.07$) and the incidence of pneumothorax was also nil (0) with IJV as compared to SCV (3.2%), ($p=0.09$).⁷

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METHODOLOGY

This randomized control trial was conducted at Department of Anaesthesia, Shaikh Zayed Hospital, Lahore, from 8-12-2014 to 7-6-2015. The non-probability purposive sampling technique was used in this study. After the approval of Hospital Ethical Committee, 290 patients were included in this study and informed consent was obtained. Demographic profile was also obtained. Patients were randomly divided in two groups by using lottery method. In Group A, CVC was inserted through internal jugular vein while in Group B, CVC was inserted through subclavian vein. During the procedure, mal-positioning and pneumothorax were monitored immediately and after 36 hours and were labeled.

RESULTS

The mean age of the patients was 45.42 ± 15.89 years with minimum and maximum ages of 18 & 70 years respectively (Table 1). In our study out of 290 cases 61.72% patients were males and 38.28% patients were females. The male to female ratio was 1.6:1 (Figure 1). The study results showed that mal-positioning was found in 18 (6.2%) patients and it was not found in 271 (93.8%) patients (Table 2). In this study the pneumothorax was observed in 12 (4.14%) patients whereas it was not observed in 278 (95.86%) patients (Figure 2).

Mal-position was found in 18 cases in which 6 patients were from IJV group and 12 were from SCV group, similarly mal-position was not found in 272 cases in which 139 were from IJV group and 133 were from SCV group. Statistically insignificant incidence of mal-positioning was found in both groups (p value 0.144) (Table 3).

Pneumothorax was observed in 12 cases, in which 3 patients were from IJV group and 9 were from SCV group,

similarly pneumothorax was not observed in 278 cases in which 142 were from IJV group and 136 were from SCV group. Statistically the difference of incidence of pneumothorax between the two groups was insignificant (p 0.077) (Table 4).

Data was stratified for age and it was noticed that in patients of age <40 years, mal-positioning was found in 2 cases in IJV group and 6 in SCV group. While in patients of age ≥40 years, mal-positioning was found in 4 cases in IJV group and 6 in SCV group. Statistically the difference was insignificant with a p value >0.05 (Table 5). Data was stratified for age and it was noticed that in patients of age <40 years, the pneumothorax was observed in 1 case in IJV group and 4 in SCV group. Similarly, pneumothorax was observed in 2 cases in IJV group and 5 in SCV group. Statistically the difference was insignificant with p value >0.05 (Table 6).

Data was stratified for gender and it was noticed that in male patients, mal-positioning was found in 3 cases in IJV group and 5 in SCV group. While in female patients, mal-positioning was found in 3 cases in IJV group and 7 in SCV group. Statistically insignificant difference was found between the two groups with p >0.05 (Table 7). Data was stratified for gender and it was noticed that in male patients, the pneumothorax was observed 1 case in IJV group and 3 in SCV group. Similarly, pneumothorax was observed in 2 cases in IJV group and 6 in SCV group. Statistically the difference was insignificant between the two groups with a p value >0.05 (Table 8).

Fig. 1: No. distribution of gender

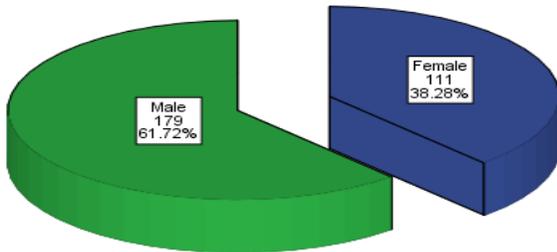


Fig. 2: No. distribution of pneumothorax

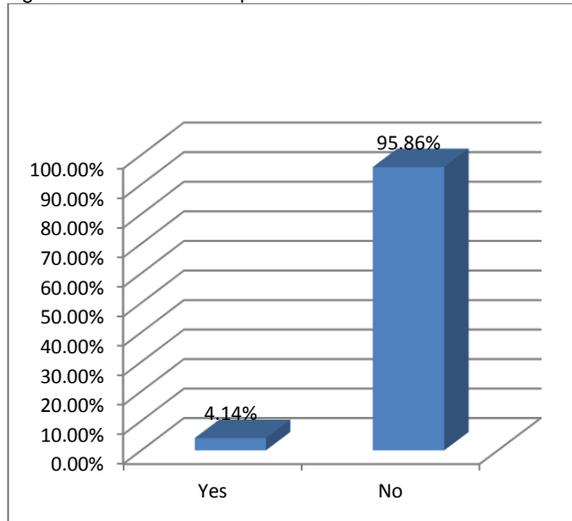


Table 1: Descriptive statistics of age (years)

Age (years)	N	Value
	290	
Mean		45.42
SD		15.89
Minimum		18.00
Maximum		70.00

Table 2: Distribution of mal-position

Mal-position	Yes	No.	Percent
	18		6.2
	271		93.8

Table 3: Comparison of mal-positioning in both groups

Pneumothorax	Study Groups		Total
	IJV	SCV	
Yes	6	12	18
No	139	133	272
Total	145	145	290

Table 4: Comparison of pneumothorax in both groups

Malpositioning	Study Groups		Total
	IJV	SCV	
Yes	3	9	12
No	142	136	278
Total	145	145	290

Table 5: Comparison of mal-positioning in both groups stratified by age

Malpositioning	Study Groups		P value
	IJV	SCV	
<40 years of age			
Yes	2	6	0.157
No	55	53	
≥40 years of age			
Yes	4	6	0.491
No	84	80	

Table 6: Comparison of pneumothorax in both groups stratified by age

Pneumothorax	Study Groups		P value
	IJV	SCV	
<40 years of age			
Yes	1	4	0.183
No	56	55	
≥40 years of age			
Yes	2	5	0.235
No	86	81	

Table 7: Comparison of malpositioning in both groups

	Study Groups		P value
	IJV	SCV	
Male			
Yes	3	5	0.513
No	51	52	
Female			
Yes	3	7	0.175
No	88	81	

Table 8: Comparison of pneumothorax in both groups

Pneumothorax	Study Groups		P value
	IJV	SCV	
Male			
Yes	1	3	0.335
No	53	54	
Female			
Yes	2	6	0.135
No	89	82	

DISCUSSION

In many institutions, the anatomical site of CVC insertion is chosen on the grounds of personal experience or local policies rather than on evidence-based guidelines. The data on catheter mal-positioning may have more impact on clinical decision-making. Mal-positioning has been reported in 14% of CVCs even when they were inserted by experienced clinicians¹⁰.

In our study results the overall complication of mal-position was found in 18(6.2%) patients and complication of pneumothorax was observed in 12(4.14%) patients. The IJV and SCV procedures were applied to our study patients. According to our study we did not find any significant difference between the complications (pneumothorax & mal-position) among the study groups. Some of the studies are discussed below showing the results in favor of our study.

Ruesch et al, concluded in their study that some evidence are more arterial punctures but less catheter mal-positions with the internal jugular compared with the subclavian access. There is no difference in the incidence of hemo or pneumothorax and vessel occlusion⁹.

Luyt et al, conducted a randomized trial and found that mal-position was reported to be low with IJV (1.8%) as compared to SCV (7.4%, however the difference was insignificant ($P=0.07$) as well as No. of pneumothorax was also nil (0) with IJV as compared to SCV (3.2%, $p 0.09$)⁷.

Eisenhauer et al, reported overall complication rate was 13.7%. 12 out of 13 complications with morbidity occurred with 286 subclavian catheterizations (4.2%), while just 1 of the 13 complications with morbidity happened with 248 interior jugular catheterizations (0.4%). In light of these information, it is recommended that the internal jugular methodology be utilized in most of patients, saving the subclavian methodology for patients on long-term parenteral nutrition or when the internal jugular methodology is not feasible technically¹⁶.

Different studies showed their results related to mal-position complication. They stated that the catheter mal-position was significantly less often reported with the jugular access^{9,12,13,14,15}.

Peres et al, disagreed with the results of Luyt studies and found that mal-position was 18.97% with IJV but 33.6% with SCV which was significant ($p 0.01$) however, pneumothorax was nil in both groups⁹.

McGee et al, reported the use of 16cm central venous catheters (CVC) minimized intracardiac catheter placements. Consecutive patients ($n=127$) who required a CVC via either the internal jugular (IJV) or the subclavian vein (SCV) were assessed using 16 ($n=102$) or 20cm ($n=25$) catheters. They demonstrated that the use of a 16cm CVC to access the central circulation from either the SCV or the IJV results in a significantly greater proportion of safe catheter placements than using longer CVCs, and it should become the standard of care¹⁷.

Haapaniemi et al, introduced an alternative technique with a puncture site 2-3cm above the clavicle near the posterior border of the sternocleidomastoid muscle. The site of venipuncture was the confluence of the SCV and IJV. In a study of 600 patients, this technique had a 94% success rate and a 5% complication rate with two cases of

pneumothorax, four arterial punctures and six thoracic duct punctures¹⁸.

Non randomized comparative studies report equivocal findings for arterial puncture, pneumothorax, hematoma, hemothorax, or arrhythmia when the internal jugular insertion site is compared with the subclavian insertion site^{11,16,18}.

CONCLUSION

It is concluded that the incidence of mal-positioning and pneumothorax is related more to the subclavian vein route as compared to the internal jugular route, however, the difference is not statistically significant.

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