



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

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ABSTRACT

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. Catheter related infections are an important cause of morbidity and mortality worldwide. All complications and side effects are dependent on vascular access route. International data shows malpositioning and pneumothorax related to malpositioning to be the most common complications of central venous cannulation. However there is paucity of local data regarding which of the two, IJV or SCV routes are more prone to develop these complications.

Aims & Objectives: To compare the incidence of pneumothorax and malpositioning with internal jugular vein (IJV) and subclavian vein (SCV) routes of central venous catheters. **Place and duration of study:** This randomized control trial was conducted at Department of Anesthesia, Shaikh Zayed Hospital, Lahore, from 8-12-2014 to 7-6-2015. **Material & Methods:** 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, malpositioning and pneumothorax were monitored immediately and after 36 hours and were labeled. Patients were shifted to the ward after procedure and were followed-up there. During first 36 hours, chest x-ray for placement of tip of catheter and development of pneumothorax was carried out. Chi-square was used to compare complications in both groups taking p value ≤ 0.05 as significant. **Results:** Malposition was found in 18 cases, (6 from IJV group and 12 from SCV group) (p-value 0.144). Pneumothorax was seen in 12 cases (3 from IJV and 9 from SCV group) (p-value 0.077). **Conclusion:** Our study results concluded that IJV showed fewer incidences of pneumothorax and malpositioning than SCV technique. However, the difference was not statistically significant.

Key words: Internal Jugular Vein: IJV, Central Venous Catheterization: CVC, Subclavian Vein: SCV, Complications.

INTRODUCTION

Central venous catheterization 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 support.² 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 route.³

Malpositioning and Pneumothorax due to malpositioning are the most common complications of passing central lines, upto 30% of all mechanical detrimental events. varying with the number of

attempts in emergent conditions where large catheters like dialysis catheters are inserted.⁴ Overall complication rates range upto 15%, mechanical complications reported in 19% of patients, 26% infectious complications, and 26% thrombotic complications.⁵ It is seen that incidence of pneumothorax varies in different studies.⁶ Luyt et al., conducted a randomized trial and reported that the incidence of malposition 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 Due to the presence of conflicting international data and scarcity of our own, the research was designed to determine these complications in relation to IJV & SCV routes in our local setting.

MATERIAL AND METHODS

Study Design: Cross sectional survey.

Setting: Department of Anesthesia, Shaikh Zayed Medical Complex, Lahore.

Duration: Six months after the approval of synopsis.

Sample Size: Sample size of 60 cases (30 in each group) is calculated in both groups with 95% confidence level, 10% margin of error, and taking expected percentage of complications in both groups i.e. 26%.

Sampling Technique: Non probability consecutive sampling.

Statistical analysis:

All the data was entered and analyzed through SPSS version 20.0. The quantitative variables like age were presented as mean & standard deviation. The qualitative variable like gender, Malpositioning and pneumothorax were presented as frequency and percentages. Chi-square was used to compare complications in both groups taking p value ≤ 0.05 as significant.

RESULTS

The mean age of the patients was 45.42 ± 15.89 years with minimum age of 18 years and maximum age of 70 years (Table-1). In our study out of 290 cases 61.72% patients were males and 38.28% patients were females, (male to female ratio of 1.6:1) (Fig-1). The study results showed that malpositioning 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 (Fig-2).

Malposition was found in 18 cases in which 6 patients were from IJV group and 12 were from SCV group, similarly malposition was not found in 272 cases in which 139 were from IJV group and 133 were from SCV group. Statistically insignificant incidence of malpositioning was found in both groups (p value0.144) (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 nonsignificant ($p0.077$) (Table-4).

Data was stratified for age and it was noticed that in patients of age <40 years, malpositioning was found in 2 cases in IJV group and 6in SCV group. While in patients of age ≥ 40 years, malpositioning was found in 4 cases in IJV group and 6 in SCV group. Statistically the difference was nonsignificant 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 5in SCV group. Statistically the difference was nonsignificant with p value >0.05 (Table-6).

Data was stratified for gender and malpositioning was found in 3 cases in IJV group and 5in SCV group in male participants. While in female patients, malpositioning was found in 3 cases in IJV group and 7 in SCV group. Statistically nonsignificant 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 6in SCV group. Statistically the difference was nonsignificant between the two groups with a p value >0.05 (Table-8).

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

Table-1: Descriptive statistics of age (years)

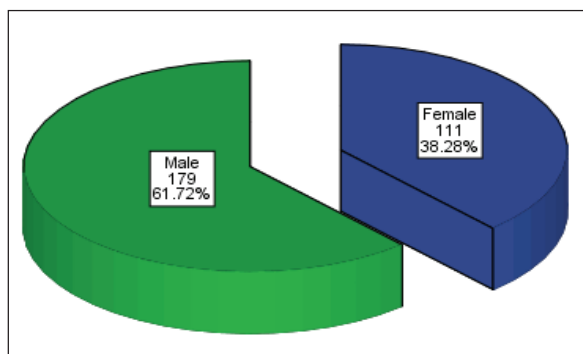


Fig-1: Percentage. distribution of gender

		No.	Percent
Malposition	Yes	18	6.2
	No	271	93.8

Table-2: No. distribution of Malposition

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

Table-3: Comparison of Malpositioning in both groups

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

Table-4: Comparison of Pneumothorax in both groups

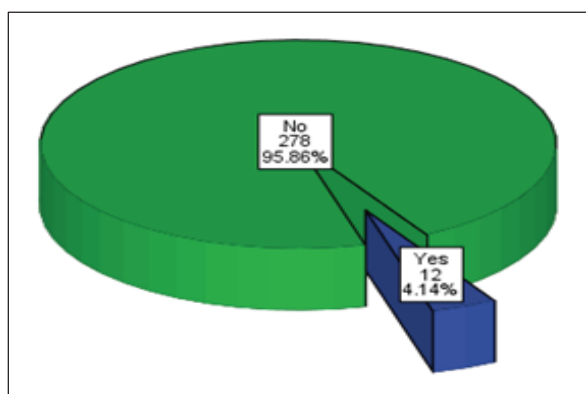


Fig-2: No. distribution of Pneumothorax

Age	Mal-positioning	Study Groups		P value
		IJV	SCV	
<40 years	Yes	2	6	0.157
	No	55	53	
≥40 years	Yes	4	6	0.491
	No	84	80	

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

Age	Pneumothorax	Study Groups		Pvalue
		IJV	SCV	
<40 years	Yes	1	4	0.183
	No	56	55	
≥40 years	Yes	2	5	0.235
	No	86	81	

Table-6: Comparison of Pneumothorax in both groups stratified by age

Gender	Malpositioning	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-7: Comparison of mal-positioning in both groups stratified by gender

Gender	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	

Table-8: Comparison of pneumothorax in both groups stratified by gender

DISCUSSION

The choice of anatomical site of central catheter insertion should be on evidence based guidelines instead of personal preferences. The data on catheter malpositioning may have more impact on clinical decision-making. Malpositioning was reported in 14% of cases even with expert practitioners.¹⁰

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

Sibylle Ruesch et al concluded in their study that there was lesser incidence of catheter malposition and more incidences of arterial punctures with internal jugular vein route compared with the other access. There was no difference in incidence of hemothorax, pneumothorax or vessel occlusion.⁸

Luyt et al., conducted a randomized trial and found that malposition 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 number of pneumothorax was also nil (0) with IJV as compared to SCV (3.2%, p0.09).⁷

Eisenhauer et al reported in their study that the rate of complications was 13.7%. There were 286 cannulations done in subclavian vein, having 12 complications out of 13 total morbidities in the study (incidence 4.2%), whereas in 248 internal jugular cannulations, there was only 1 case of morbidity (0.4%). So it is recommended on the basis of these results, that internal jugular vein route should be preferred, and the subclavian route should be reserved for cases where internal jugular approach is technically difficult or for patients requiring parenteral nutrition.¹⁶

Different studies have showed results related to malposition. They have stated that jugular access was reported to have lesser catheter malposition.^{9,12,13,14,15}

Peres et al., disagreed with the results of Luyt and Reusch studies and found that malposition was 18.97% with IJV but 33.6% with SCV which was significant (P0.01) however, pneumothorax was nil in both groups.⁹

McGee, et al., investigated if the use of 16cm central venous catheters minimized intracardiac placements. 127 patients were assessed using either of the two routes. 16cm catheters were used in 102 patients and 20cm in 25 cases. In conclusion, using 16cm catheters through either of the internal jugular or subclavian routes had more incidences of safe catheterizations. It was recommended to make smaller catheter use as standard practice.¹⁷

In a case series, a technique was introduced in which the site of venous puncture was at the junction of subclavian and internal jugular veins, 2 to 3 cm above clavicle, close to the posterior border of sternocleidomastoid. It was successful in 94% cases, with complications (5%) of, 6 thoracic duct cannulations, 4 arterial punctures and 2 cases of pneumothorax in a total of 600 cases.¹⁸

Non-randomized studies have reported ambiguous conclusions for complications like arterial puncture, arrhythmias, hematoma, pneumothorax or hemothorax when the internal jugular vein route is compared to the subclavian route.^{11,16,18}

CONCLUSION

It is concluded that the incidence of malpositioning 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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