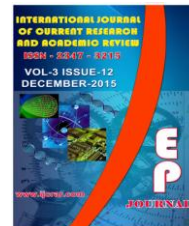




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Evaluation Incidence of Pneumothorax in Patients underwent CV Line through Internal Jugular Vein

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A B S T R A C T

CVP monitoring in critically ill patients, provides the possibility to learn more about the body's fluid balance. Insertion CV Line through Internal jugular vein is a common selected vein. Because, it is readily available and is the minimum amount of problems such as Pneumothorax. The aim of this study was determine the incidence of Pneumothorax in patients underwent CV line through internal jugular vein. In a cross-sectional and descriptive analytical study that performed in Emergency Medicine Department on referred patients, clinical indications for CV Line, incidence of Pneumothorax in patients underwent CV line through internal jugular vein evaluated. 56 of patients were male and 44 of them were female. Mean age of male patients was 48.96 ± 12.15 year and in female patients was 53.79 ± 11.41 year ($P=0.046$). In 5 patients, Pneumothorax occurred after insertion CV Line, only in one case because of the severity of Pneumothorax was requiring invasive interventions and built Chest Tube for prevention of clinical signs; but others Pneumothorax cases was solved only with observation of patients. In 67 of patients CV line catheter insert easily, in 19 cases moderately and in 14 cases hardly. In 23 patients requiring Ultrasound-guided to placement CV Line catheter. Ease of placement CV Line in males significantly more than females ($P=0.001$). Ultrasound-guided to placement CV Line catheter in female patients was significantly more than males ($P=0.019$). Incidence of post CV line Pneumothorax had significant correlation with weight and BMI. Significant correlation was found between Ease of placement CV Line and need to Ultrasound-guided to placement CV Line catheter.

Introduction

CVP (central venous pressure) measurement is vital in the cardiac wards, because CVP is a very important factor in development of hypertension in the right ventricle of the heart. Right ventricle hypertension determines the heart stroke volume, which is the amount of blood pumped by each heartbeat. CVP is an accurate indicator of the end-diastolic volume of the right ventricle (1).

CV-line is inserted into one of the central or peripheral veins by a qualified person, and then enters into the right vestibule, where the superior vena cava meets the inferior vena cava. This operation can only be done in a medical center, where a qualified nurse is available to provide care, management and support to the patient.

Accurate CVP reading is necessary for making proper treatment decisions. CVP monitoring in severely sick patients provides more information on the body fluid balance. A high CVP level reflects fluid overload or cardiac failure, whereas low CVP reflects dehydration or reduced blood volume (1).

Placement of CV-line through the internal jugular vein is one of the most common ways, because this vein is easily accessible and the level of incidence of conditions (such as Pneumothorax) is minimum at this vein. The internal jugular veins (right and left) are short, direct and large. Hence, it is easily possible to enter the catheter into these veins. Catheter obstruction is the most common complication caused by using this vein. This obstruction resulted from the movement of patient's head and may lead to the restlessness and excitation of a conscious patient (1).

Side effects of CV-line insertion include the following: wrong placement of CVP catheter, hematoma formation, arteries perforation, Pneumothorax, hemorrhage, sepsis, air embolism, catheter embolism, thrombosis, Hemothorax, cardiac tamponade, cardiac arrhythmia, and Hydropneumothorax (1).

The body's need for fluids can be estimated through clinical examinations, pulse and blood pressure changes, and urine level controls. Currently, the precise method for estimation of the body's need for fluids is to measure CVP by placing catheter in SVC via the internal jugular vein or the Subclavian vein. Although this method can directly measure CVP, it is an invasive method and may have side effects such as Pneumothorax, Hemothorax, vessel rupture, pulmonary embolism, and cardiac tamponade (2-4).

Central vein catheter is one of the useful devices for monitoring severely sick patients. Depending on the type of catheter, different areas such as jugular, Subclavian, and femoral and brachial veins are used to monitor. The side effects of this device include infection, failure to place the catheter, artery perforation, inappropriate catheter placement, Pneumothorax, hematoma, Hemothorax, and cardiac asystole, which are caused by unknown reasons (5). Infection is the most common side effect occurs in Subclavian veins less than other sites. Moreover, arrhythmia and air embolism may also occur. Actual estimation of prevalence of cardiac damages caused by CV-line insert is difficult, because the information is mostly available in the form of reports. The total mechanical cardiac damage is reported to be approximately 14% (5).

In this study, it was tried to examine patients under CV-line insertion in the emergency ward of Imam Reza Hospital. This hospital is the referral center for patients in the northwest of the country. The objective of this research was to study the side effects of this procedure, especially Pneumothorax more than before.

This research was aimed to determine the frequency of incidence of Pneumothorax in patients under CV-line insertion through jugular veins.

Materials and Methods

In a cross-sectional descriptive-analytical study that was performed in Emergency Medicine Department of Tabriz University of medical sciences on patients, who received CV-line placement due to the indications of their clinical conditions, the frequency of incidence of Pneumothorax was studied in patients under CV-line through their jugular veins.

In this study, 100 patients that were candidates for CV-Line placement were randomly selected from candidates for placement of CVP catheter and were examined.

In this research, the candidates for CVP placement were selected and examined based on the related indications. The required information including demographic findings (such as age, height, and weight) was jotted down. Afterwards, the patients were subjected to CVP placement by the related resident or attendant, and the ease of placement (i.e. easy, moderately hard, or hard placement and the need for ultrasound guide in difficult cases) was also recorded. The patients were then subjected to CXR for Pneumothorax examinations, and CXRs were assessed for presence of

Pneumothorax. The severity of Pneumothorax was recorded and the measures that were taken for the patient (such as chest-tube placement) were also recorded.

Ethical Considerations

Since in this study no intervention was made to the treatment or diagnostic procedures for patients, and since CVP placement was carried out based on the related indications, there was no moral problem with our research, and all of the patients' information will remain confidential.

Statistical Analysis

The collected data were analyzed by SPSS-17 statistical software. The collected data were expressed as percentage and mean \pm SD. Continuous (quantitative) variables were compared by Independent samples and Paired t test. Categorical (qualitative) variables were compared by contingency tables and Chi-square test or Fisher's exact test. P-value ≤ 0.05 was considered statistically significant.

Results and Discussion

In this research, results of CV-Line insertion were examined in emergency patients for the incidence of Pneumothorax. The relationship between the incidence of Pneumothorax and the demographic parameters of patients was also studied and the following results were obtained.

Of the patients under study, 56 were male and 44 were female.

The mean age of male and female patients was 48.96 ± 12.15 and 53.79 ± 11.41 years, respectively (Fig. 1) ($P=0.046$). The mean weight of male and female patients was also

69.98 ± 16.86 and 71.48 ± 16.71 kg, respectively (P=0.657). The mean heights of male and female patients were 1.65 ± 0.08 and 1.59 ± 0.06 m (P<0.001).

The mean BMI of male patients was 25.50 ± 5.43 and the mean BMI of female patients was 28.00 ± 5.70 (P=0.028). Pneumothorax occurred in 5 patients following CV-line insertion, and only in one case there was a need for invasive interventions and placement of chest-tube to control clinical signs due to severe Pneumothorax. However, the other Pneumothorax cases were absorbed by monitoring the patients.

Placement of CV-line catheter was easy, moderately hard and hard in 67, 19, and 14 patients, respectively.

There was a need for ultrasound guide in 23 patients for CV-line catheterization.

No significant difference was observed between the incidences of pneumothorax following CV-line insertion in patients of both genders (P=0.614).

The ease of CV-line placement in male patients was significantly higher than women (P=0.001). The need for ultrasound guide for CV-line placement was higher in women than men (P=0.019). The age distribution of patients under study is shown in Figure (1).

In all of the patients in which CV-line catheter placement was hard, ultrasound guide was used. Of the 19 patients in which placement of catheter was moderately difficult, only on patients needed ultrasound guide for CV-line insertion. Research results also suggest that there was a significant relationship between ease of catheterization and the need for ultrasound guide for CV-line catheter insertion.

One of the means of monitoring patients is to use CV-line, which measures hypertension of the right ventricle, approximate intravascular volume, and performance of the right ventricle. Although CV-line insertion is accompanied by many risks such as vascular damage, damage to nerves, arrhythmia, thromboembolism, infection, and respiratory complications, this method is commonly employed in operation rooms, emergency wards, and intense care units. CV-line is normally inserted in the large vessels of the anterior chest and the jugular vein, but another method for CVP measures is through cephalic or basilica veins. In some patients such as patients suffering from cardiac ischemic, cardiovascular incidents, which are the result of stress during cannulation of arteries or the central vein, lead to unexpected hemodynamic changes.

In this research, Pneumothorax was observed only in 5% patients following CV-line placement. In a study by Tukey et al. in Boston (USA), the side effects of CVP catheter insertion were examined and it was stated that Pneumothorax is one of the important side effects of CVP catheter insertion (6).

In a study by de Oliveria et al. in Piaui State of Brazil, a total of 793 of cases of CVP catheter placement were examined and it was reported that 90% of the patients lacked any side effects. Moreover, Pneumothorax was only observed in one patient (7). Sakamoto et al. (2013) conducted a study in Nagoya University of Japan to examine the extent of side effects of CVP catheter insertion. These researchers stated that the incidence of iatrogenic Pneumothorax following CVP catheter placement was 1.4% in patients under study (8).

Table.1 Demographic Parameters of Patients Based on Ease of Insertion of the Catheter

	Ease of insertion of the catheter			P
	Easy	Moderate	Difficult	
Age	49.13 ± 12.07	54.42 ± 9.73	55.93 ± 13.00	0.063
Weight	66.07 ± 14.35	73.89 ± 17.45	88.14 ± 14.52	<0.001
Height	1.63 ± .08	1.63 ± .09	1.61 ± .05	0.831
BMI	24.84 ± 4.73	27.56 ± 4.96	33.76 ± 4.93	<0.001

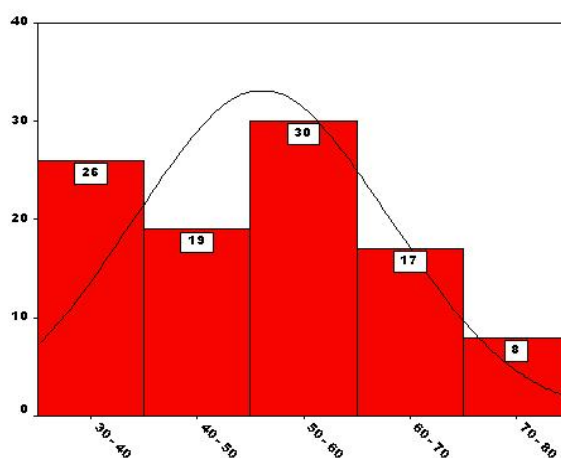
Table.2 Demographic Parameters of Patients based on Need to Ultrasound Guidance

	Need To Ultrasound Guidance		P
	Yes	No	
Age	57.43 ± 11.07	49.19 ± 11.70	0.003
Weight	87.00 ± 12.77	65.76 ± 14.57	<0.001
Height	1.63 ± 0.07	1.62 ± 0.08	0.629
BMI	32.59 ± 4.31	24.82 ± 4.73	<0.001

Table.3 Demographic Parameters of Patients based on Pneumothorax

	Pneumothorax		P
	Yes	No	
Age	49.80 ± 4.02	51.16 ± 12.31	0.807
Weight	101.80 ± 4.49	69.01 ± 15.48	<0.001
Height	1.63 ± 0.05	1.63 ± 0.08	0.918
BMI	38.32 ± 0.85	25.99 ± 5.11	<0.001

Chart.1 Age Distribution of Patients



In a study by Malbezin et al. (2013) in University of Paris, the information on 5434 cases of CVP catheter insertion in 3954 patients during 22 years was examined. It was concluded that the success of catheter

placement was 99.5% in patients under study, and Pneumothorax was a rare side effect in the patients under study (9). In 2013, Nayeemuddin et al. carried out a study in the radiology department of North

Staffordshire University and reported that CVP catheter placement has dangerous side effects such as Pneumothorax, the diagnosis and examination of which necessitates imaging actions after CVP catheter placement (10).

In an investigation by Kaur et al. in Punjab State (India) into the results of CVP catheter placement it stated that the mechanical side effects of this intervention were observed in 17.9% patients, whereas only 2.29% patients under study experienced iatrogenic Pneumothorax following catheter placement (11). In 2012, a study was conducted by McGee et al. in Springfield (USA) to examine the results of CVP catheter placement. The researchers reported a success rate of 96% and stated that none of the patients under study experienced Pneumothorax (12).

Cavanna et al. (2010) carried out a study in Italy to investigate into the results of CVP catheter insertion in patients. They concluded that Pneumothorax was observed in none of the patients under study (13). In the research by Tecklenburg et al. (201) in University of Charleston (United States) the results of CVP catheter placement were studied and no incidence of Pneumothorax was reported (14).

Perbert et al. stated that use of ultrasound guide for placement of CVP catheter in suspicious high-risk cases reduces the risk of side effects such as Pneumothorax (15).

In our research, in all of the cases in which CV-line insertion was hard, ultrasound guide was used for CVP catheter placement. In 9 of the 19 patients in which catheter placement was moderately difficult, ultrasound guide was used for CVP catheter place. In none of the patients in which catheter placement was easy ultrasound guide was used for CVP catheter placement.

This result reflects the significance of accurate application of ultrasound guide to CVP catheter placement.

In a study by Ayas et al. (2007) in University of Vancouver (Canada) the rate of incidence of Pneumothorax after CVC placement was examined in patients and it was stated that the rate of incidence of Pneumothorax following CVC placement was 1.9% in patients under study. Moreover, the difficulty of catheter placement and the time spent for catheter placement had a significant relationship with the rate of incidence of side effects such as Pneumothorax (16).

Similar to the results of the above study, in our research there was a significant relationship between ease of catheter placement and need for ultrasound guide for CV-line catheter insertion.

Conclusion

Of the patients under study, 56 were male and 44 were female. The mean age of male and female patients was 48.96 ± 12.15 and 53.79 ± 11.41 years, respectively ($P=0.046$). Pneumothorax was observed in 5 patients following CV-line placement, and only in one case there was a need for invasive measures and chest-tube placement for the control of clinical signs due to the severity of Pneumothorax. Other Pneumothorax cases were absorbed with monitoring the patients. In 67, 19, and 14 patients the placement of CV-line was easy, moderately hard, and difficult, respectively. Moreover, 23 patients needed ultrasound guide for CV-line catheter insertion. The ease of CV-line insertion was significantly easier in men than women ($P=0.001$). The need for ultrasound guide for CV-line placement was significantly higher in women than men ($P=0.019$).

The rate of incidence of Pneumothorax after CV-line catheter placement had a significant relationship with weight and BMI of patients. There was also a significant relationship between the ease of catheter placement and the need for ultrasound guide for CV-line placement.

Suggestions

In view of the research results, it is recommended to use ultrasound guide for CV-line placement in obese patients with BMI of over 30 to reduce the side effects of this procedure especially Pneumothorax.

Providing retraining courses to the emergency medicine residents on CV-line placement and use of ultrasound guide (if necessary) is a necessity.

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