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Research Article

Cardiac arrhythmias during central venous catheter procedures

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ABSTRACT

Introduction: Central venous access is common procedure in critically ill patients. The aim of this study was to determine the prevalence of cardiac arrhythmia during CVC insertion, and to evaluate the relationship between occurrence of arrhythmia and some of other risk factors in patients undergoing internal jugular or subclavian vein catheter insertion.**Method:** 100 patients who referred to Emam Reza hospital during December 2010 and October 2011 for elective CVC insertion were enrolled in the study. Three ml blood sample was taken for evaluating serum Na, K, BUN and Cr. Vital signs and ECG monitoring was performed during and after procedure. **Results:** The rate of arrhythmia in DII long ECG was as follow 3 AF, 6 VT.nonsustain, 6 PAC and 6 PVC. Previous catheter insertion history, gender and serum K and Na levels had significant association with incidence of arrhythmia during CVCs insertion. **Conclusion:** Although the CVCs catheter insertion is considered a small outpatient surgery but since it has life threatening complication like cardiac arrhythmia .it is important that this procedure performed in an equipped operation room with careful cardiac monitoring before, during and after operation.

Keywords: CVCs – VT- AF – PAC –PVC

INTRODUCTION

Central venous access is common procedure in critically ill patients. Central venous catheters (CVCs) allow accurate measurement of hemodynamic variables which is not possible by noninvasive means and also help to provide medications and nutritional support that cannot be given safely through peripheral venous catheters (1). In the United States, more than 5 million central venous catheters are inserted every year (2). The Seldinger technique, which was

introduced in 1953, is a common procedure in the intensive care unit (ICU) to place central venous catheters, hemodialysis catheters, arterial catheters, and chest tubes (3). However this routine procedure has complications, and significant morbidity and mortality can result from complications related to central venous access (4). More than 15 percent of patients who receive these catheters have complications (5). These complications can be divided to immediate and delayed ones. Immediate complications occur during catheter insertion and are related to cardiac, pulmonary, vascular, and placement complications. Delayed complications include device dysfunction and infection (4).

Cardiac arrhythmia is one of the common complications of central venous catheter insertion which is less understood and can be dangerous leading to mortality in patients undergoing central venous catheterization (6-8). Arrhythmias are the result of guide wire contact with the right atrium (4). The incidence of arterial arrhythmia is reported 32-41% and ventricular arrhythmias 6-25% in literature (9,10). However, if the AV node is contacted for a long time, supraventricular tachycardia can occur and lead to fatal arrhythmia and arrest (11, 12). Only a small percentage of arrhythmias are symptomatic and can usually be resolved by adjusting the procedure (13). However, rare cases of death from cardiac arrest related to central venous catheter placement have been reported(14).

It is mentioned in research that some factors are correlated with the possibility of cardiac arrhythmias including previous catheter insertions, heart rate, blood pressure, age , blood level of BUN, creatinine, sodium and potassium. Since in patients with end stage renal disease blood level of some of these factors has changed, this coexistence increases the risk of cardiac arrhythmias (15).

Although the number of patients requiring CVC is increasing every day, and despite potential risk of arrhythmia for patients undergoing CVC especially patients with renal failure, less attention have been paid to this complication compared with others. The aim of this study was to determine the incidence of cardiac arrhythmia during CVC insertion, and to evaluate the relationship between occurrence of arrhythmia and some of other risk factors in patients undergoing internal jugular or subclavian vein catheter insertion. We hoped that the study results help to provide better approach for prevention, recognition and treatment of CVCs induced arrhythmias leading to timely intervention for favorable therapeutic outcomes.

MATERIAL & METHODS

In this prospective study 100 patients who referred to Emam Reza hospital during December 2010 and October 2011 for elective jugular or subclavien catheter insertion were enrolled in the study.

A 3ml blood sample was taken from patients before catheter insertion, which was used to determine serum level of Cr, BUN, K, and Na. Vital signs were checked and a basic ECG was performed before starting the procedure. Vital signs and ECG monitoring were continued during and after catheter insertion. The ECG monitoring was documented in DII long mode. A checklist was used to document patients' demographic information, previous catheter insertion history, and also the results of blood tests, ECG monitoring, vein used and catheter type. All the ECGs and DII longs were handed to a cardiologist (electro-physiologist) for review and determining arrhythmias. Collected data were entered into, and analyzed by SPSS v.11.5. For qualitative variables frequency was calculated and for quantitative variables mean, median, and mode was determined.

RESULTS

One hundred patients who referred to Imam Reza hospital for CVC insertion were enrolled in the study. Out of 100, 54 were males and 46 were females. The most age frequency belonged to age group 60-70 years old (34%). Previous catheter

insertion history existed in 26% (26) of patients. In ninety patients catheter was inserted in right jugular, 8 in left jugular, and one in each right and left subclavian vein. The serum level of Bun, Cr, K and Na are presented in table 1.

The catheter size in 90 patients was 16 cm, in 6 patients was 20 cm and catheter F11 and F12 was used in one person each. Regarding blood pressure 67% had systolic BP>160, 26 had BP 120-160 and 7 patients had BP< 120 mmhg. In the ECG that was taken before procedure 5 patients had arrhythmia (2 AF and 3 PAC). The rate of arrhythmia and its subtypes based on age group is presented in table 2.

Table 1- The serum level of Bun, Cr, Na, and K

Na		**K**		**BUN**		**Cr**	
< 135	12	< 3.5	0	<8	0	0.7-1.4	1
135-154	76	3.5-5	64	8-20	0	1.4-10	70
>145	12	>5	36	>20	100	>10	29

Table 2- The frequency of arrhythmia based on age group

	>49 years	**50-59 years**	**60-69 years**	**≥70 years**	**P value**
No arrhythmia	11	12	22	25	0.503
AF	0	0	1	1	
V.T nonsustain	2	3	3	0	
PAC	0	2	3	0	
PVC	1	2	2	1	
Total patients in age group	14	19	31	27	

The chi2 test showed no significant relation between age and developing arrhythmia (p=0.503). The relation between gender and arrhythmia was significant (p=0.018). The most common arrhythmia in women was non-sustain VT (15.9%, 7 females), and in men was PAC 10.6% (5 males). There was no significant relation between arrhythmia occurrence with patient systolic blood pressure and place of catheter insertion (p=1.000 and p=0.701 respectfully). A significant relation was found between serum K and Na levels and arrhythmia (p=0.016 and p= 0.000 respectfully). However we found no significant difference between different serum levels of BUN and Cr with incidence of arrhythmia (p=1.00 and p=0.676 respectfully). Previous history of catheter insertion had a significant relation with developing arrhythmia during procedure (p=0.010).

DISCUSSION

Central venous catheters are the lifesaving procedure in patients who need hemodialysis either as permanent accesses or transient access whom severe peripheral vascular disease throughout period time that they need for arteriovenous fistula maturation (16). Each year more than 5 million CVCs are inserted in United State (2,17). Despite great advantages of CVC some immediate and late complications expected to occur with them. Symptomatic arrhythmia caused by a guide wire or malposition of a catheter is one of the common acute complications of the central venous access devices (4,18)

In present study we assessed 100 patients, who had been undergone elective CVC insertion for dialysis, regarding developed arrhythmia during procedure. One ECG was taken from patients before starting the process and ECG monitoring was continued during procedure. (DII long). The results showed that 5 patients had arrhythmia at the baseline, out of reminder 95 patients, 16 (84%) developed arrhythmia during catheterization including one AF, 3 nonsustained VT, 3 PAC and 6 PVC. These arrhythmias even AF resolved without complication, but it was not documented how long it was took for heart beat to return to sinus rhythm. In two studies of Stuart et al. with two years interval (1990 and 1992) the incidence of arterial arrhythmia was reported 41% and 32%, and incidence of ventricular arrhythmias was 25% and 6% orderly. They concluded that this

decrease in incidence of arrhythmia is related to the using of new technique that allows the operator to control the length of guide wire inserted (10). The difference in arrhythmia incidence between Stuart studies and our results could also be results of advancement in catheter insertion technique which leads to decreased incidence of arrhythmia. We found no significant relation between age and arrhythmia which was similar to the results of other studies (9).

Acute renal failure has been reported to increase the risk of cardiac arrhythmias during the insertion of the CVCs in patients (19). In Fiaccadori study BUN and serum creatinine levels were reported significantly higher in patients who developed cardiac arrhythmias during central venous catheter ($p<0.01$), but difference in serum electrolytes between patients were not significant. We found a significant association between serum K and Na levels and arrhythmia occurrence, and no significant association between serum BUN and Cr levels and arrhythmia. This dissimilarity could be result of patients group which in Fiaccadori study patients were cases of acute renal failure and our patients generally had chronic renal failure The results of Mozos study about the relation between laboratory markers and ventricular arrhythmia risk in renal failure patients which highlighted the importance of hypokalemia in cardiac arrhythmia in these patients (20) is somehow similar to our results and indicated that underline serum electrolytes imbalance are important risk factors for developing arrhythmia.

Conclusion

Although the CVCs catheter insertion is considered a small outpatient surgery but since it has life threatening complications like cardiac arrhythmias it seems to be crucial that this procedure performed in an equipped operation room with careful cardiac monitoring before, during and after operation. Surgeons awareness and readiness are essential for prevention, timely recognition and treatment of malignant arrhythmia.

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