

THE EFFECT OF AN EDUCATION PROGRAM ON THE INCIDENCE OF CENTRAL VENOUS CATHETER-ASSOCIATED INFECTION AND CENTRAL VENOUS CATHETER CONTAMINATION IN AN INTENSIVE CARE UNIT

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Clinical investigation to determine whether an education program could decrease the rate of catheter-associated infection in the medical ICU was carried out. One hundred ninety one and two hundred forty five catheters were surveyed during study in precourse and in postcourse period respectively. There were found four-fold decrease rates of catheter-associated infection and two-fold decrease occurrence of positive roll-plate culture of the catheter. The actual number of microbial isolates decreased from 116 to 48, with a decrease in the percentage of fungal isolates, *Corynebacterium* spp, and an increase in the percentage of Gram-negative bacterial isolates during the postintervention period compared to the preintervention period.

Key words: education program, catheter-associated infection.

Introduction

Central venous catheters are commonly employed in the management of critically ill patients. Primary bloodstream infections resulting from central venous catheterization are a common cause of excess morbidity, mortality, and medical-care costs in the ICU setting [3]. The National Nosocomial Infections Surveillance system for the Centers for Disease Control and Prevention (CDC) reports a catheter-associated bloodstream infection rate of 5.7 per 1,000 catheter days [4].

Several recent studies [1, 5] indicate that educating health-care workers on evidence-based approaches for the prevention of these infections can decrease their rates. The utilization of health-care worker education is an important element in programs aimed at the prevention of hospital-acquired infections.

Therefore, we carried out a clinical investigation to determine whether an education program could decrease the rate of catheter-associated infection in the medical ICU (intensive care unit) in Military medical clinical hospital of Central Region in Vinnitsa, Ukraine.

Materials and methods

This study was conducted in a Military medical clinical hospital of Central Region (400 beds). The medical ICU (12 beds) is a closed ICU with a multidisciplinary patient care. Nurse staffing is maintained at a ratio of three patients per nurse, and central venous catheters are usually inserted by physicians. During a 6-year period (January 2006 to December 2012), all patients admitted to the medical ICU were prospectively surveyed for the occurrence of central venous catheter-associated infection. The intravascular catheters (central venous catheters) employed throughout the hospital during this study period were standard catheters without antimicrobial or antiseptic coatings.

The mandatory education program was implemented in DEC 2009. It was directed toward ICU nurses and physicians (13 physicians and 23 nurses). Their main aim is to highlight correct practices for the prevention of catheter-associated infections. The program consisted of a self-study module on risk factors and practice modifications involved in catheter-related infections and briefings at scheduled staff meetings.

Information covered in self-study module:

1. Number of hospital-acquired bloodstream infections in the world annually
2. Percentage ICU bacteremias associated with intravenous devices
3. Aseptic technique
4. Risk of infection in subclavian vein catheterisation
5. Migration of skin organisms and contamination of catheter hub
6. Contamination in long-term catheters
7. Symptoms of catheter-related bloodstream infection
8. Sending catheter tip for culture
9. Timing of scheduled intravenous gauze dressing changes
10. Handwashing and sterile glove usage

11. Mask utilization
12. Antimicrobial ointment usage
13. Frequency of luer-lock cap changes
14. Accessing catheter ports
15. Blood culture technique

Each participant was required to complete a pretest before reviewing the study module and an identical test after completion of the study module. Fact sheets and posters reinforcing the information in the study module were also posted throughout the ICU.

To determine rate of catheter-related infections precourse and post-course surveillance for such infection was performed during 2009-2012 years.

Catheter-related infections were defined as meeting definition three of the CDC Cardiovascular System Infection criteria for arterial or venous infection [2]. Fulfillment of this definition required the presence of fever (temperature 38°C), pain, erythema, or heat at the catheter site plus the presence of a negative blood culture or absence of any blood cultures and the presence of a positive roll-plate culture of the catheter. Catheter with positive roll-plate culture and without symptoms of inflammation considered as contaminated. Blood cultures were predominately drawn only through a peripheral vein. Catheter and bloodstream isolates were not molecularly typed.

Comparison of the rates of catheter-associated infection and the number of cases contaminated catheters in the preintervention period to the postintervention period was done.

Results and discussion

One hundred ninety one and two hundred forty five catheters were surveyed during study in precourse and in postcourse period respectively. The total number is four hundred forty one.

Sixteen episodes (8%) of catheter-associated infection occurred in the 24 months before the introduction of the education program. 67 cases (34%) of positive roll-plate culture of the catheter without symptoms of inflammation occurred. Two cases of catheter-associated bloodstream infection occurred.

During the postintervention period (calendar years 2011 and 2012), a total of 4 (1,6%) episodes of catheter-associated infections were recorded. 36 (15%) cases of positive roll-plate culture of the catheter without symptoms of inflammation occurred. There were no cases of catheter-associated

ed bloodstream infection in postintervention period. This represents four-fold decrease rates of catheter-associated infection and two-fold decrease occurrence of cases of positive roll-plate culture of the catheter.

Table 1

Bacteria identified in the both preintervention and postintervention periods

Microorganisms identified from catheters	Microorganisms identified in the preintervention period	Microorganisms identified in the postintervention period
<i>S. epidermidis</i>	30 (25,9%)	19 (39,6%)
<i>S. haemolyticus</i>	14 (12%)	4 (8,3%)
<i>S. capitis ssp capitis</i>	6 (5,2%)	5 (10,4%)
<i>S. pasteurii</i>	2 (1,7%)	-
<i>S. cohnii ssp cohnii</i>	2 (1,7%)	-
<i>S. hominis ssp. hominis</i>	2 (1,7%)	-
<i>D. nishinomiyaensis</i>	2 (1,7%)	-
<i>K. varians</i>	4 (3,5%)	-
<i>M. luteus</i>	2 (1,7%)	1 (2,1%)
<i>A. calcoaceticus</i>	8 (6,9%)	3 (6,3%)
<i>A. lwoffii</i>	16 (13,8%)	8 (16,6%)
<i>S. mizutae</i>	8 (6,9%)	-
<i>P. aeruginosa</i>	2 (1,7%)	1 (2,1%)
<i>S. faecalis</i>	4 (3,5%)	-
<i>C. albicans</i>	2 (1,7%)	1 (2,1%)
<i>Corynebacterium sp</i>	8 (6,9%)	4 (8,3%)
<i>Myroides sp</i>	4 (3,5%)	2 (4,2%)
Total	116	48

The most common bacteria identified in the both preintervention and postintervention periods were coagulase-negative staphylococci. The actual number of isolates decreased from 116 to 48, with a decrease in the percentage of fungal isolates, coagulase-negative staphylococci and an increase in the percentage of Gram-negative bacterial isolates during the postintervention period compared to the preintervention period (Table 1). The number of patients with multiple microorganisms isolated from catheter by roll-plate culture also decreased from 14 to 6. In two cases of catheter-associated bloodstream infection aerobic Gram-negative rods were isolated.

Conclusion

1. Our study demonstrated that an education program directed at nurses and physicians working in the medical ICU setting may significantly reduce the incidence of catheter-associated infection.

2. The consistent impact of education programs on the reduction of catheter-associated infection suggests that their implementation should be routine in hospitals caring for patients at risk for these infections. Maintaining very low rates of CRI requires a multidisciplinary approach involving the entire health care team, the use of novel technologies in patients with the highest risk of CRSI, and frequent reeducation of staff.

3. Despite the decreased catheter-related infection rate a number of limitations are present in this study. In a pre- and post-observational, nonrandomized study, the ICU staff is not blinded to either the presence of or the recipients of the intervention. Other potential limitations of our study were that we did not evaluate outcomes with catheters inserted in other than subclavian site or catheters with more than one lumen and produced from other polymer material.

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В.П.Ковальчук, Л.М.Хлебовська, В.М.Кондратюк, О.Л.Гончаров, В.М.Олійник, Л.В.Даневич, О.П.Кондратюк. Вплив навчальних курсів для персоналу відділення реанімації на частоту контамінації центральних венозних катетерів та розвиток катетерасоційованих інфекцій. Вінниця, Україна.

Ключові слова: навчальна програма, катетерасоційована інфекція.

У дослідженні визначали, чи може впровадження навчальних програм для персоналу відділення реанімації знизити частоту контамінації центральних венозних катетерів та розвиток катетерасоційованих інфекцій. Методом посіву на цільне поживне середовище досліджено 191 та 245 центральних венозних катетерів у період до та після застосування навчальної програми відповідно. Відбулося чотирикратне зниження частоти випадків катетерасоційованих інфекцій та двократне зниження частоти виділення котамінованих катетерів без ознак інфікування. Кількість виділених мікроорганізмів знизилася зі 116 до 48 зі зниженням частки грибів, коринебактерій та зростанням частки грамнегативних паличок після імплементації навчальної програми.

В.П.Ковальчук, Л.М.Хлебовская, В.Н.Кондратюк, О.Л.Гончаров, В.Н.Олейник, Л.В.Даневич, Е.П.Кондратюк. Влияние обучающих курсов для персонала отделения реанимации на частоту контаминации центральных венозных катетеров и развитие катетерассоциированных инфекций. Винница, Украина.

Ключевые слова: обучающая программа, катетерассоциированная инфекция.

В исследовании определяли, может ли внедрение обучающих программ для персонала отделения реанимации снизить частоту контаминации центральных венозных катетеров и развитие катетерассоциированных инфекций. Методом посева на твердую питательную среду исследовано 191 и 245 центральных венозных катетеров в период до и после внедрения обучающей программы соответственно. Произошло четырехкратное снижение частоты случаев катетерассоциированных инфекций и двукратное снижение частоты выделения контаминированных катетеров без признаков инфицирования. Количество выделенных микроорганизмов снизилось со 116 до 48 со снижением доли грибов, коринебактерий и увеличением доли грамотрицательных палочек после имплементации обучающей программы.