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Health care workers' knowledge and practices regarding the prevention of central venous catheter-related infection

Sameer A. Alkubati PhD, RN^{a,*}, Nadia T. Ahmed PhD, RN^b, Osama N.E. Mohamed PhD^c, Akram M. Fayed PhD^d, Hayam I. Asfour PhD, RN^b^a Department of Nursing, Faculty of Medicine and Health Sciences, Hodeidah University, Hodeidah, Yemen^b Department of Critical Care and Emergency Nursing, Faculty of Nursing, Alexandria University, Alexandria, Egypt^c Department of Microbiology, High Institute of Public Health, Alexandria University, Alexandria, Egypt^d Department of Critical Care Medicine, Faculty of Medicine, Alexandria University, Alexandria, Egypt

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Background: Central venous catheter-related infection (CVC-RI) is considered a common cause of increased morbidity, mortality, and medical care costs in intensive care units (ICUs). The objective in this descriptive study was to assess the knowledge of health care workers in ICUs about guidelines for the prevention of CVC-RI and their adherence to these guidelines in practices.

Methods: Health care workers were assessed for their actual practices during central venous catheter (CVC) insertion and care. Then a questionnaire was distributed to the health care workers to assess their knowledge regarding the prevention of CVC-RI.

Results: All the health care workers (N = 100; 40 physicians, 60 nurses) in the ICUs (levels I and III and triage) of Alexandria Main University Hospital participated in the present study. The response rate was 100%. The total percentage of correct answers of the health care workers about the guidelines for the prevention of CVC-RI was low. There was no significant difference between physicians' and nurses' knowledge regarding the total score on the questionnaire ($P = .134$). However, physicians had a significantly higher knowledge about the pathophysiology of CVC-RI and skin antisepsis items than nurses. There were no significant differences between the knowledge of physicians and nurses in other items except for CVC care, where nurses showed significantly higher knowledge than physicians ($P = .001$).

Conclusion: The results of the present study revealed health care worker's low knowledge regarding the prevention of CVC-RI and low compliance with the standard guidelines of CVC care. Therefore, health care workers should be periodically evaluated for their knowledge and practices regarding guidelines for the prevention of CVC-RI.

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Central venous catheter-related infection (CVC-RI) is considered the first cause of health care-associated infections in intensive care units (ICUs). The infections occur in the range of 3%–8% of inserted catheters.^{1,2} The term is used to describe the following 3 conditions: central venous catheter (CVC) colonization, CVC bloodstream infection, and skin exit site infection.³ It is considered a common cause of medical care costs, excess morbidity, and mortality in ICUs. Although the rates of CVC-RI are high, they can be prevented by several interventions, and efforts have been made to eliminate it.^{4,5}

The Centers for Disease Control and Prevention emphasize the major areas for prevention of CVC-RI, which include educating and training health care workers who insert and maintain CVCs. These areas include the following: using maximal sterile barrier precautions during CVC insertion, using a 2% chlorhexidine skin preparation with alcohol for antisepsis, avoiding routine replacement of CVCs as a strategy to prevent infection, and using chlorhexidine-impregnated sponge dressings.⁶ Maintaining proper procedures for insertion and maintenance of CVCs and appropriate infection control measures (eg, assessment of health care workers' knowledge and practices) should be regularly repeated and stimulated in ICUs.⁶ Compliance of health care workers with the clinical practice guidelines during insertion and care of CVCs has been proven to reduce CVC-RI.^{7,8} In addition, they are directly involved in preventing infection by performing, monitoring, and assuring compliance with aseptic work

* Address correspondence to Sameer A. Alkubati, PhD, RN, School of Nursing, Alexandria University, Postal code 21527, Edmon Fremon St, Smouha, Alexandria, Egypt.

E-mail address: alkubatisa@yahoo.com (S.A. Alkubati).

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practices.⁹ Studies illustrate a difference in the rates of knowledge among health care workers in different countries.¹⁰⁻¹³ In a survey conducted among health care workers in all hospitals in the Calabria region (Italy), the correct answers about the knowledge of physicians and nurses ranged from 43%-72.9%.¹¹ Labeau et al¹⁰ expected a wide diversity of practices and a lack of consistent adherence to the Centers for Disease Control and Prevention guidelines after conduction of a study to determine nurses' knowledge of guidelines for prevention of catheter-related bloodstream infection among 3,405 critical care nurses from 22 European countries. The mean test score of their knowledge was 44.4%.

Knowledge of guidelines for the prevention of CVC-RI among health care workers has not been fully assessed, and little is known about the difference between their knowledge and practices. To our knowledge, there is only 1 study¹⁴ that has evaluated health care workers' knowledge for the prevention of CVC-RI in an Egyptian governorate. Therefore, the objectives of this study were to assess the knowledge of health care workers in ICUs about the guidelines for the prevention of CVC-RI and to assess the adherence to these guidelines in their practices.

METHODS

Study design

A descriptive design was used in the present study, which was conducted in the period from June 2012-March 2013.

Setting and study participants

The present study was carried out in ICUs of the Critical Care Medicine Department of Alexandria Main University Hospital. The hospital includes ICU levels I and III and triage. It is a major adult teaching (primary and tertiary care facility) hospital with 3,000 beds.

Tools of the study

Two research tools were used in the study. They are described as follows.

Tool I: health care workers' knowledge of guidelines for preventing CVC-RI questionnaire

This tool was developed by the researchers after reviewing the related literature to assess health care workers' knowledge regarding the prevention of CVC-RI after reviewing the related literature.^{6,15-17} The questionnaire consists of 9 main items, which include pathophysiology of CVC infection, diagnosis of CVC infection, catheter insertion site, frequency of CVC changes, skin antiseptics, dressing type, frequency of dressing changes, use of antibiotic and antiseptic ointments, and CVC care. Each main item is composed of 2 multiple choice questions with 5 response options (1 correct and 4 incorrect answers). For each test item, 1 of the response options includes the phrase "I do not know" to avoid gambling by the participants.¹⁵ Each question was scored a 1 for a correct answer and a 0 for an incorrect one. Total scores for the tool range from 0-18. In addition, health care workers' sociodemographic status (eg, age, sex, level of education, years of experience) and their information about CVC-RI prevention and its source were included in this tool.

Before embarking on the full study, a pilot study was undertaken by distributing the questionnaire to 6 physicians and 6 nurses to evaluate the feasibility of the study design, readability of the items, and reliability of the questionnaire. The pilot study results indicated that the questionnaire was in general easy to understand, clear, and readable. The interview to complete the questionnaire lasted for 15-20 minutes for each health care worker. Content validity of the

questionnaire was tested by 7 medical and nursing staff. Internal consistency reliability of the developed questionnaire was confirmed with Cronbach α coefficient ($\alpha = 0.895$). The questionnaires were distributed to the participants at their break time and were then filled out by one of the researchers at the same time.

Tool II: CVC management observational checklist

This tool was designed by the researchers to observe health care workers' practices while caring of patients with CVCs before, during, and after the insertion after reviewing the related literature.^{6,11,16-19} The score of each item was rated as 2 (done completely and accurately), 1 (done incompletely or inaccurately), or 0 (not done).

Ethical consideration

The study was ethically approved by the Ethics Committees of the Faculty of Nursing, Alexandria University and the Alexandria Main University Hospital. Written consent, which illustrated the purposes, risks, and benefits of the study, was obtained from all participants. Participants were assured that participation in this study was voluntary, and they were able to withdraw at any time. The participants were assured that every effort would be made to protect their anonymity and that only aggregated data would be communicated. Signed consent forms were placed in separate envelopes to maintain confidentiality. Forms were coded, and data were reported as aggregates.

Statistical analysis

SPSS version 16 (SPSS Inc, Chicago, IL) was used for processing and analysis of the data. Following data entry, checking and verification processes were carried out to avoid any errors during data entry. Descriptive statistics (means, SDs, frequencies, percentages) were used to describe the characteristics of the study population and main variables. Quantitative variables with means were compared among groups with an independent *t* test. The significance level for all tests was set at $P \leq .05$.

RESULTS

All the health care workers (N = 100; 40 physicians, 60 nurses) in the ICUs (Units I and III and triage) of Alexandria Main University Hospital participated in the present study. The response rate was 100%. **Table 1** shows the participant's sociodemographic characteristics. The mean ages for the physicians and nurses were 28 and 33 years, respectively. Most (57.5%) physicians held a master degree, whereas most (55%) nurses held a baccalaureate degree. The work experience of most (82.5%) physicians was <5 years, whereas most (40%) nurses had 15-19 years of experience. Regarding the source of information for prevention of CVC-RI, practice was the primary source of information for physicians, whereas infection control was the source for nurses.

Table 2 illustrates the comparison between physicians and nurses regarding their knowledge about the guidelines for prevention of CVC-RI. There was no statistically significant differences between the physicians' and nurses' knowledge based on the total score of the questionnaire ($P = .134$). Physicians had significantly higher knowledge than nurses on the following items: pathophysiology of CVC-RI and skin antiseptics. There were no significant differences between the knowledge of physicians and nurses in other items except for the CVC care item, where the nurses had significantly higher knowledge ($P = .001$).

Table 3 demonstrates health care workers' practices during insertion of CVCs. Most physicians (87.5%) performed hand hygiene, whereas only 22.5% of nurses performed it. Regarding maximal

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