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**THE ROLE OF NURSE-DRIVEN PROTOCOLS IN THE
PREVENTION OF URINARY TRACT INFECTIONS
IN INDWELLING CATHETERIZED PATIENTS**

**Rola „nurse-driven protocols” w zapobieganiu zakażeniom układu moczowego
u pacjentów przewlekle cewnikowanych.**

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A - Koncepcja i projekt badania, B - Gromadzenie i/lub zestawianie danych, C - Analiza i interpretacja danych, D - Napisanie artykułu, E - Krytyczne zrecenzowanie artykułu, F - Zatwierdzenie ostatecznej wersji artykułu

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Abstract (in Polish):

Wstęp

W codziennej praktyce klinicznej cewnikowanie pacjentów należy do jednej z najczęściej wykonywanych inwazyjnych procedur medycznych. Czas zacewnikowania pacjenta stanowi najważniejszy modyfikowalny czynnik ryzyka odcewnikowych zakażeń układu moczowego. Po okresie miesiąca u blisko 100% pacjentów wykrywalna jest już w badaniach moczu bakteriuria. Odcewnikowe infekcje układu moczowego stanowią według WHO poważne wyzwanie dla zdrowia publicznego. Celem naszej pracy jest podsumowanie aktualnej wiedzy na temat odcewnikowych infekcji układu moczowego oraz przegląd najnowszych dostępnych doniesień o skuteczności „nurse-driven protocols” w zapobieganiu tym infekcją.

Metodologia

Przeszukaliśmy internetowe bazy danych „Google Scholar” oraz „PubMed”. Ostatecznie wybraliśmy 11 prac oryginalnych opublikowanych po 2016 roku.

Nurse-driven protocols w zapobieganiu odcewnikowym zakażeniom układu moczowego

Badania przeprowadzone w ostatnich latach potwierdzają skuteczność „nurse-driven protocols” w prewencji odcewnikowych infekcji układu moczowego. W każdym przytoczonym badaniu uzyskano redukcję przypadków w zakresie od ok. 20% do nawet blisko 100%. W badaniach brała udział zróżnicowana liczba personelu pielęgniarskiego, najkrótsze badanie trwało kilka tygodni, a najdłuższe 12 lat.

Wnioski

W zapobieganiu zakażeniom niezwykle istotną rolę odgrywa personel pielęgniarski, będący najbliżej pacjenta i sprawujący nad nim bezpośrednią opiekę. Stosowanie przez pielęgniarki specjalnych protokołów, opierających się na odpowiednio dobranych check-listach, regularne audyty z informacją zwrotną oraz szeroka edukacja personelu i podnoszenie jego kompetencji zdają się mieć kluczowy wpływ na zmniejszenie przypadków odcewnikowych zakażeń układu moczowego.

Abstract (in English):

Introduction:

Catheterizing patients is one of the most frequently performed invasive medical procedures in daily clinical practice. The time a patient is catheterized is the most important modifiable factor that increases the risk for urinary tract infections. After a period of one month, bacteriuria is already detectable in urinalysis in nearly 100% of patients. Catheter-associated urinary tract infections (CAUTI) are recognized by the World Health Organization as a serious public health problem. The purpose of our paper is to summarize the current knowledge about catheter-associated urinary tract infections and review the latest available reports on the effectiveness of „nurse-driven protocols” in preventing these infections.

Materials and Methods

We searched the online databases of Google Scholar and PubMed. We finally selected 11 original articles published after 2016.

Nurse-driven protocols in the prevention of CAUTI

Studies in recent years confirm the effectiveness of „nurse-driven protocols” in the prevention of urinary tract infections. Each study achieved case reductions ranging from about 20% to as close as 100%.

The studies involved varying numbers of nursing staff, with the shortest study lasting a few weeks and the longest 12 years.

Conclusions

Nursing staff, who are closest to the patient and provide direct care, play an extremely important role in preventing infections. The use of special protocols by nurses, based on appropriately selected check-lists, regular audits with feedback, and extensive staff education and competency improvement seem to have a key impact on reducing the incidence of urinary tract infections.

Keywords (in Polish): odcewnikowe zakażenie układu moczowego, nurse-driven protocols, pacjent cewnikowany.

Keywords (in English): CAUTI, nurse-driven protocols, catheterized patients.

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B. Ludwig et al.

Introduction

Urinary catheter insertion in hospitalized and chronically ill patients is among the most common invasive procedures used in medical care. It is estimated that between 12% and 16% of inpatients experience catheterization at least once during their stay in an inpatient facility [1]. The percentage of patients who are catheterized will vary depending on the hospital department in which they are admitted to, as well as the country's guidelines and the awareness of healthcare providers [1, 2].

Many factors predispose to the development of catheter-associated urinary tract infection (CAUTI). The most important of these, and at the same time modifiable, is the length of time a patient has been catheterized. Bacteriuria develops in 3% to 10% of catheterized patients per day, and after a period of one month, it is already present in 100% of the tested subjects [3, 4]. Other modifiable risk factors for the development of CAUTI include nonadherence to aseptic catheter care, little experience of the person performing the procedure, catheter insertion in an inappropriate room, catheter insertion after sixth day of hospitalization. Non-modifiable risk factors include

female sex, age > 50 years, severe concomitant diseases, diabetes, serum creatinine > 2mg/dL and stool incontinence [3, 5].

The incidence of CAUTIs varies for different areas on Earth. Examining Intensive Care Unit patients worldwide, the highest incidence per 1,000 catheter days was recorded for Southeast Asia (14.7), followed by Eastern Mediterranean (10.0), Europe (9.5), Western Pacific (7.2) and in the Americas (4.4). The average value was 7.8 incidence per 1,000 catheter days [6].

The most common pathogens isolated in patients with CAUTI include gram-negative bacteria (47.5%), fungi (27.8%), gram-positive bacteria (19.1%). The most common bacterial strain isolated is *Escherichia* spp. [6, 7].

The diagnosis of CAUTI is often made by ruling out other causes with additional factors supporting the catheter as the source of infection. Often the only symptom is fever. Catheter obstruction, suprapubic pain, visible abnormal coloured urine may be helpful in making the proper diagnosis [8].

Healthcare-associated infections, including CAUTI, are recognized by the World Health Organization (WHO) as a serious public health problem. They significantly prolong patient length of stay in inpatient care facilities, increase mortality, patient suffering and treatment-related costs [9, 10]. Chronic bladder catheterization accounts for nearly 80% of healthcare-associated urinary tract infections [1, 11, 12].

Lo et al. summarized the most important points in the prevention of catheter-associated urinary tract infections. Among them, they singled out the following as recommendations with the highest strength of evidence (I and II): no routine use of antimicrobial/antiseptic-impregnated-catheters, no routine antibiotic therapy in catheterized patients (except those undergoing urological procedures), catheterizing the patient only if there are clear reasons for doing so, and the shortest necessary time for the catheter to remain in the urinary tract [13].

Based on the above-mentioned guidelines, among others, a number of protocols and bundles aimed at reducing the incidence of CAUTIs have been developed in recent years. Our paper aims to review the currently available literature in terms of CAUTI prevention, with a particular focus on nurse-driven protocols, and summarize the role that nursing staff providing direct patient care play in this.

Materials and Methods

During the writing of our paper, we searched the online databases of Google Scholar and PubMed for articles, using various combinations of phrases and titles incorporating the following terms: “urinary track infection”, “CAUTI”, “indwelling catheterized patients”, “nurse-driven protocols”, “prevention”, “knowledge” and “nurse”. In total, we analysed 63 articles, from which we finally selected 11 articles that we considered most related to our work. We excluded articles that were not related to urinary tract infections, as well as those that were not related to the knowledge and skills of nursing staff. In the main part of the article, we only included original articles published after 2016. More than half of the included articles were published after 2019.

Nurse-driven protocols in the prevention of CAUTI

Pashnik et al. conducted a study aimed at developing an educational strategy for nurses, and its evaluation, to prevent cases of CAUTI. The study included 814 nurses. It consisted of auditing the conduct of nursing staff with catheterized patients based on a previously compiled bundle list.

If misconduct was detected, feedback from the auditor followed. The strategy also included regular education of nurses on CAUTI prevention methods, hands-on training in patient catheterization techniques and proper catheter care. There was a decrease in CAUTI cases from 1.3 per 1,000 device-days to 0.9 per 1,000 device-days, a reduction in cases by as much as about 30%. There was an increase in the CAUTI pre-vention bundle compliance from 79.6% to 88% and a marked reduction in hospital costs [14].

Russel et al. decided to introduce the Model for Improvement (MFI) based on the “Plan, Do, Study, Act” (PDSA) cycles into daily practice for a period of 6 weeks. During this time, there was daily supervision and education of the nursing staff by designated staff members. Thirty-eight nurses participated in the study, and the whole was divided into three cycles. During the first one, the PDSA focused on direct education of nurses (P), daily audits and investigation of the reasons for inability to remove catheters (D), analysis of the collected data (S) and continuation of the procedure revised by lessons learned so far and early bladder scanning (A). The second cycle began with further education of nurses, early bladder scanning and posting evidence-based practices in a prominent place (P), followed by bladder scanning of patients 4 hours after catheter removal instead of 6 hours (D), found that patients were repeatedly catheterized and released home with it (S), and finally encouraged nurses to place temporary catheters, bladder scan more frequently and administer diuretics (A). Finally, the final third cycle began with tracked patients who had been repeatedly re-hospitalized (P), then educated nurses about patients at post-operative risk of micturition retention (D), reviewed vascular patients who had not experienced urinary retention (S), and finally, based on the data collected so far, continued to educate nurses and encourage them to use the established catheter removal algorithm (A). At the end of the study, a decrease in CAUTI cases of about 40% was achieved, from 4.8 per 1,000 catheter days to 3.1 per 1,000 catheter days [10].

Meneguetti et al. conducted a study lasting 12 years, consisting of 4 major phases. Initially, various factors potentially influencing the development of CAUTI were studied for 2 years, and then a proprietary protocol was constructed based on the results. The next phase, lasting 4 years, consisted of educating and improving the competence of hospital staff. Over the next 4 years, the acquired competencies were deepened and daily evaluation based on the prepared checklists was initiated. Finally, for the last 2 years, additional previously educated staff took over roles in educating newly hired staff. The average number of patient-days throughout the study period was at a similar level. A successive decrease in catheter-days was observed as the phases of the study progressed. Also, the amount of catheter utilization decreased as the study progressed from a level of 75% in the first phase to a level of 44% in the last phase. The number of recorded CAUTI cases for subsequent phases per 1,000 catheter-days was: 14.9 (phase 1), 7.3 (phase 2), 3.8 (phase 3), 1.1 (phase 4), which ultimately resulted in a more than 90% reduction in infection cases [9].

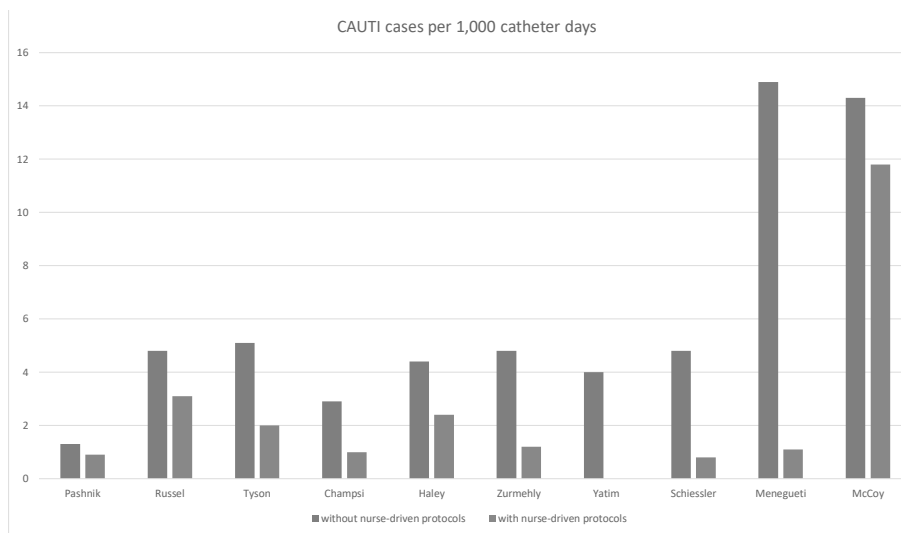
Similarly beneficial effects were also obtained in other numerous studies (Table 1, Figure 1) [15–20]. Tyson et al. evaluated the usefulness of using a nurse-driven protocol in preventing CAUTIs on a surgical trauma intensive care unit. The study period covered 15 months and was compared to a 19-month follow-up period. With the appropriate protocol in place, there was an overall decrease in the number of urinary catheters inserted. There was also a significant decrease in CAUTI in patients from 5.1 per 1,000 catheter-days to 2.0 per 1,000 catheter-days [15]. Champsi et al. conducted a study with the undoubted advantage of a long follow-up period. A strategy was developed in the first year and then implemented into daily practice for 2 years. A 2-person catheter-insertion checklist, an assessment of manual skills for catheterizing nurses, standardized procedures and audits with

feedback were created. Finally, follow-up was conducted for another 2 years. In addition, throughout this five-year period, staff education was conducted, lessons were learned on an ongoing basis, and management strategies were optimized. Ultimately, a 65% decrease in CAUTI cases was achieved from 2.9 per 1,000 catheter-days to 1.0 catheter-days [16]. Schiessler et al. evaluated the created nurse-driven protocol based on PDCA methodology on a pediatric intensive care unit. They noted a decrease in indwelling urinary catheter-days after 6 months of the study by almost 30%, and after a year of the study, they noted a decrease in CAUTI cases by more than 80% from 4.8 per 1000 catheter-days to 0.8 per catheter-days [21].

Table 1. Nurse-driven protocols in clinical practice.

Tabela 1. Nurse-driven protocols w praktyce klinicznej.

Article	Methodology	Result	Comments
Pashnik (2017)	Auditing patients and nurses based on a check-list of 11 items with follow-up feedback and staff education..	Reduction of CAUTI cases by about 30%. Reduction in hospital expenses.	A total of 814 nurses took part in the study.
Russel (2019)	Auditing patients and nurses with MFI based on three cycles of PDSA for 6 weeks.	Reduction of CAUTI cases by about 40%.	38 nurses participated in the study.
Tyson (2020)	Use of nurse-driven protocol and auditing of nurses for 15 months.	Reduction of CAUTI cases by about 60%.	The study had the advantage of a long data collection period.
Champsi (2020)	Use of nurse-driven protocol and auditing of nurses for five years.	Reduction of CAUTI cases by about 65%.	The study had the advantage of a very long data collection period.
Haley (2018)	Use of nurse-driven protocol based on PDSA model for 2 years.	Reduction of CAUTI cases by about 45%.	The study had the advantage of a long data collection period.
Zurmehly (2018)	The use of a nurse-driven protocol based on the ten-part CAUTI questionnaire.	Reduction of CAUTI cases by about 75%.	A total of 70 nurses participated in the study.
Yatim (2016)	The use of the ‚HOUDINI‘ nurse-drive protocol for 6 months.	Reduction of CAUTI cases by 100%.	The result of the test statistically insignificant ($p = 0.06$).
Schiessler (2019)	Use of nurse-driven protocol based on PDSA model for 1 year.	Reduction of CAUTI cases by about 80%.	
Meneguetti (2019)	Use of nurse-driven protocol and auditing of nurses for 12 years.	Reduction of CAUTI cases by about 90%.	The study had the advantage of a very long data collection period.
McCoy (2017)	Use of nurse-driven protocol and auditing of nurses for 2 months.	Reduction of CAUTI cases by about 20%.	



A slightly different perspective on the issue at hand was thrown by Mong et al. He decided to study nurses' awareness and practical skills in preventing CAUTIs, without prior training in this area or the introduction of special protocols. He based his study on questionnaires returned by 301 nurses covering 68 issues. The authors assumed that a score of correct answers above 80% was classified as a good result, and below that as insufficient. The results obtained were satisfactory. Nearly 70% of the nurses demonstrated good substantive preparation in CAUTI prevention, and nearly 65% also showed good practical preparation. Importantly, knowledge and skills increased with age and staff experience. Nurses under the age of 25 had the lowest scores [22].

Conclusions

Nurse-driven protocols are effective tools for reducing both the number of catheter-days among patients and CAUTI cases per catheter-days. They contribute to an effective decrease in hospital-acquired infections, thereby reducing hospital costs and the risk of isolating multidrug-resistant strains. They are a simple and non-invasive tool that can be successfully applied in any environment, both in hospital wards and nursing homes for chronically ill elderly people. Properly designed and implemented, it can help reduce cases of urinary tract infections by as much as 60 to nearly 100%.

Studies show that despite the high level of awareness and practical skills of nursing staff on the topic of CAUTIs, there is still room for even better education and awareness of nurses who provide direct patient care and are closest to the patient in daily clinical practice. That's why continuous education and deepening of professional competence is so important.

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