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COMPREHENSIVE STRATEGIES FOR REDUCING CATHETER-ASSOCIATED URINARY TRACT INFECTIONS (CAUTIs): A NARRATIVE REVIEW OF EVIDENCE-BASED APPROACHES IN HOSPITAL SETTINGS

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ABSTRACT Implementing evidence-based infection control practices is essential to reducing catheter-associated urinary tract infections (CAUTIs), the most common and preventable healthcare-associated infections. CAUTIs contribute significantly to morbidity, mortality, and healthcare costs, particularly in cases of prolonged or inappropriate catheter use. This narrative review evaluates various evidence-based strategies for reducing CAUTI incidence, with a focus on decreasing catheter days, utilizing alternative catheterization methods, and optimizing urinary catheter management practices. The review utilized PubMed, Cochrane Collaboration, and Google Scholar databases, selecting articles centered on CAUTI prevention strategies, including nurse-driven protocols, educational interventions, and alternative catheterization techniques. Data extraction emphasized catheter utilization rates, CAUTI incidence, and patient safety outcomes to assess strategy effectiveness. The findings highlight that multidisciplinary strategies effectively reduce catheter use and CAUTI rates. The Urinary Catheter Alleviation Navigator Protocol (UCANP) demonstrated significant reductions in catheter reinsertion rates and average catheter days, while nurse-driven protocols, such as daily audits and educational initiatives, led to notable decreases in CAUTIs. Intermittent straight catheterization (ISC) further minimized infection risks by reducing catheter duration. Female external urine wicking devices (FEUWDs) also decreased indwelling catheter usage, illustrating the impact of non-invasive alternatives. Integrating education, decision-support tools, and alternative methods consistently improved patient outcomes and reduced catheter dependency. In conclusion, a comprehensive, evidence-based approach involving timely catheter removal, alternative methods, and healthcare staff education is critical for reducing CAUTI rates. Nurse-driven protocols and multidisciplinary collaboration play pivotal roles in mitigating CAUTI risks. Future research should explore the scalability and long-term sustainability of these interventions across varied clinical settings.

KEYWORDS : CAUTI, indwelling urinary catheter, urinary retention, catheter management, nurse-driven protocols, Intermittent Catheterization, Female External Urine Wicking Devices (FEUWDs), Multidisciplinary Collaboration, Healthcare-Associated Infections (HAIs), Catheter Utilization Rates, Alternative Urinary Management, CAUTI Prevention Strategies, Hospital-Acquired Infections, Quality Improvement in Healthcare.

INTRODUCTION

Catheter-associated urinary tract infections (CAUTIs) are among the most common healthcare-associated infections (HAIs) in hospital settings, representing a significant public health concern due to their association with increased morbidity, mortality, and healthcare costs [1, 2]. CAUTIs occur when indwelling urinary catheters (IUCs) remain in place for extended periods, increasing the risk of complications such as pyelonephritis, bacteremia, and urethral injuries. Despite the necessity of urinary catheterization in up to fifty percent of hospitalized adults, many of these catheters are often left in place beyond their medical need, contributing significantly to CAUTI rates [3].

The risks associated with prolonged catheter use are well-documented, with studies highlighting the impact of unnecessary catheterization on infection rates. For instance, research has shown that a substantial percentage of catheter insertions lack a valid medical indication, increasing the risk of complications [3]. Catheter-associated urinary infections contribute to significant healthcare costs, extended hospital stays, and adverse patient outcomes. Therefore, it is crucial to develop and implement evidence-based strategies to mitigate these risks by reducing unnecessary catheterization and enhancing catheter management practices.

Over the years, various strategies have been proposed to reduce CAUTI rates. These strategies range from educational interventions for healthcare staff to the adoption of alternative catheterization methods, such as intermittent catheterization. More recently, nurse-driven protocols and interdisciplinary collaboration have emerged as critical elements in reducing CAUTI incidence.

2. The Need for Improved Catheter Management

The overuse and misuse of urinary catheters remain central to the persistence of CAUTIs in hospital settings. Standard practices often involve catheter reinsertion in patients who experience urinary retention, particularly after surgical procedures or in response to fluid management challenges. However, these practices fail to consider the potential benefits of alternative catheter management strategies, such as intermittent catheterization, which can reduce the risk of CAUTIs while still addressing the needs of patients with urinary retention [3, 4].

Emerging evidence suggests that a more systematic approach to catheter management, which includes protocols such as the Urinary Catheter Alleviation Navigator Protocol (UCANP), can significantly reduce catheter use and associated infections [5, 6]. These protocols emphasize the importance of individualized care, timely catheter removal, and the use of bladder scanning protocols to guide clinical decision-making. Recent guidelines from professional organizations advocate for these approaches, highlighting the need for a paradigm shift in catheter management practices to minimize infection risks while ensuring appropriate patient care.

3. Study Aim

This study evaluates the effectiveness of multidisciplinary, evidence-based strategies to reduce CAUTIs in hospitalized patients by minimizing unnecessary catheter use, implementing management protocols, promoting alternative

urinary methods, and enhancing education and surveillance, focusing on impacts in both ICU and general hospital settings.

Research Methodology

A narrative review was conducted to explore strategies for preventing catheter-associated urinary tract infections (CAUTIs) and managing urinary catheters effectively. Using a broad literature search on PubMed, Cochrane Collaboration, and Google Scholar, relevant studies were identified based on their focus on CAUTI prevention strategies such as nurse-driven protocols, educational interventions, and alternative catheterization methods.

Articles were selected based on their contribution to understanding best practices in catheter utilization, CAUTI incidence rates, and patient safety outcomes. This review provides a synthesis of evidence, aiming to assess the effectiveness of these strategies in reducing CAUTIs and offering insights for improving catheter management in hospitalized patients.

RESULTS

i. Catheter Utilization and Infection Rates

The implementation of multidisciplinary strategies and nurse-driven protocols has shown significant success in reducing both catheter utilization rates and the incidence of catheter-associated urinary tract infections (CAUTIs). A prime example is the Urinary Catheter Nurse-Driven Protocol (UCANP), which yielded a 14% reduction in indwelling urinary catheter (IUC) utilization. This reduction is substantial because IUCs are often a major risk factor for CAUTIs due to prolonged exposure and the potential for bacterial colonization. More impressively, the UCANP protocol also achieved an 84% decrease in the standardized infection ratio (SIR), a metric used to compare the number of observed infections to the number expected in a given healthcare setting. This drastic reduction in SIR underscores the efficacy of structured, nurse-led interventions in targeting CAUTIs and enhancing patient safety [7].

Other studies further validated the role of evidence-based interventions in managing catheter use and minimizing infection risks. The impact of incorporating daily chart reminders and decision-support tools into routine care has been shown to be significant [8, 9]. These tools prompt healthcare providers to assess the necessity of catheter continuation daily, with the goal of reducing unnecessary catheter use. Such reminders foster a more mindful evaluation process, enabling clinicians to discontinue catheter use when clinically appropriate, thus reducing patient exposure to potential infections.

ii. Effectiveness of Alternative Catheterization Methods

Intermittent straight catheterization (ISC) has gained attention as a valuable alternative to prolonged indwelling catheterization, particularly for patients who require temporary catheterization but do not need continuous bladder drainage. Unlike traditional indwelling urinary catheters (IUCs), which remain in place for extended periods, ISC involves periodic insertion and removal of the catheter, reducing prolonged exposure to potential pathogens and decreasing the likelihood of bacterial colonization. This method is especially beneficial for patients in settings where frequent monitoring and support are available, allowing for catheterization only when necessary, rather than leaving the device in place continuously.

A study by Lilley et al. (2023) [10] underscored the advantages of ISC, demonstrating that it significantly reduced the overall duration of catheterization by nearly two days per patient. This reduction in catheter exposure time is crucial because the risk of CAUTI increases with each day that a catheter remains in place. By lowering catheterization duration, ISC effectively minimizes the window of infection risk, providing a safer approach without compromising the quality of patient care. Lilley et al.'s findings suggest that ISC not only meets clinical needs but also supports a proactive approach to infection prevention, making it a viable strategy in CAUTI management.

In addition to ISC, the use of female external urine wicking devices (FEUWDs) has shown promising results in reducing the need for IUCs, particularly in female patients. FEUWDs offer a non-invasive alternative that can effectively manage urine collection without the insertion of a catheter. Pryor et al. (2024) [11] reported a 14% reduction in IUC utilization among patients using FEUWDs. By providing an external solution for urine management, FEUWDs eliminate the need for direct bladder catheterization, thereby reducing CAUTI risk associated with IUCs. This method is particularly advantageous in scenarios where catheterization is not strictly necessary but was previously used for convenience, thus offering an effective alternative that aligns with infection control goals.

iii. Impact of Education and Nurse-Driven Protocols

Education and training of healthcare staff play an essential role in reducing catheter use and improving adherence to guidelines designed to prevent catheter-associated urinary tract infections (CAUTIs). Effective CAUTI prevention hinges not only on implementing evidence-based protocols but also on ensuring that healthcare providers particularly nurses, who are often at the front lines of patient care are well-informed and empowered to make catheterization decisions. Training programs provide the knowledge, skills, and confidence required for staff to follow stringent infection control measures, which are crucial in settings where catheter-related infections are a common risk.

Studies like those by Gupta et al. (2017) [12] and Russell et al. (2019) [13] illustrate the impact of nurse-driven protocols in catheter management. In these protocols, nurses are given the authority to evaluate the necessity of urinary catheters and make decisions about their placement, continued use, or removal, based on patient-specific criteria and adherence to CAUTI prevention guidelines. Such nurse-driven initiatives empower nurses to assess each patient's condition, thereby reducing unnecessary catheter usage. These studies reported a remarkable 36% reduction in CAUTI rates following the implementation of nurse-driven protocols, highlighting the effectiveness of enabling nurses to take active roles in catheter management.

DISCUSSION

Reducing urinary catheter use is crucial for lowering CAUTI rates and associated complications, as demonstrated by multiple studies. This review highlights the development of nurse-driven protocols, supporting findings by Ruan et al. (2023) [14], which show that limiting indwelling catheter duration directly reduces infection risks. While previous reviews, such as Van Decker et al. (2021) [15], have noted the effectiveness of bundled interventions in CAUTI prevention, fewer studies have focused on nurse-led protocols specifically targeting urinary retention and reducing catheter use. The routine use of indwelling urinary catheters (IUCs), especially for durations exceeding two days, should be reconsidered, particularly in acute myocardial infarction (AMI) patients, as this prolonged use raises complication risks [16]. Expanding nurse-driven protocols like the Urinary Catheter Nurse-Driven Protocol (UCANP) across hospital units represents a move towards standardized urinary management and aligns with the 2024 guidelines endorsing interdisciplinary approaches to CAUTI prevention [7]. Collectively, these studies underscore the importance of structured protocols, nurse empowerment, and collaborative strategies in reducing CAUTIs effectively.

Reducing catheter-associated urinary tract infections (CAUTIs) requires a multifaceted, evidence-based approach that involves limiting unnecessary catheterization, promoting the use of alternative urinary management strategies, and enhancing the education and engagement of healthcare staff [17, 18]. The findings of this review emphasize the effectiveness of interventions such as nurse-driven protocols [19] multidisciplinary collaboration, and structured catheter management algorithms in reducing catheter utilization and lowering infection risks. Strategies for managing post-catheter removal urinary retention have shown considerable success in lowering catheter reinsertion rates and reducing the average number of catheter days. These approaches contribute significantly to preventing CAUTIs, while also reducing patient morbidity, healthcare costs, and the length of hospital stays.

Multidisciplinary collaboration plays a crucial role in CAUTI prevention by promoting adherence to best practices, improving surveillance, and ensuring continuous quality improvement [20]. The inclusion of education programs for healthcare providers is vital to maintain high levels of awareness regarding CAUTI risks and proper catheter management techniques. Nurse-driven interventions, such as daily audits, visual management tools, and educational debriefings, empower frontline staff to make informed decisions, further reducing the unnecessary use of indwelling urinary catheters [13]. The implementation of daily reminders, adopting educational interventions, decision-support tools, multidisciplinary involvement [21], and bladder scanning protocols has been proven to effectively guide clinical decisions and reduce catheter days.

Alternative urinary management techniques, including intermittent straight catheterization (ISC) and the use of female external urine wicking devices (FEUWDs) [11], provide safer and less invasive options for managing urinary incontinence and retention. These alternatives contribute to a reduction in indwelling catheter use and consequently lower the risk of CAUTIs. The bundled care model, which combines education, alternative devices, and standardized catheter use protocols, has also proven effective in critical care settings by significantly reducing infection rates and improving patient safety [15].

CONCLUSIONS

This review highlights the effectiveness of a comprehensive, evidence-based approach in reducing catheter-associated urinary tract infections (CAUTIs) in hospitals. Implementing nurse-driven protocols, alternative catheterization methods like intermittent straight catheterization (ISC) and female urine wicking devices (FEUWDs), along with structured management practices and robust staff education, has significantly reduced catheter use, infection risks, and improved patient outcomes. Multidisciplinary collaboration and adherence to best practices further bolster these efforts. While promising, the review calls for larger, multi-centre trials to validate these strategies across diverse settings and assess long-term sustainability. Adopting these interdisciplinary approaches is key to advancing CAUTI prevention and improving patient safety in healthcare environments.

While the findings of this review are encouraging, several limitations should be noted. Many of the studies were conducted in single-centre settings or targeted specific patient populations, which may restrict the broader applicability of the results. Additionally, variations in study design and sample sizes across the studies underscore the need for more rigorous, large-scale, multi-centre trials to validate the effectiveness of these interventions across diverse clinical settings. Future research should focus not only on confirming these findings but also on assessing the long-term sustainability of these protocols and their impact on broader patient outcomes, particularly in reducing CAUTIs across varied healthcare environments.

REFERENCES:

[1]. Parihar, S., Sharma, R., Kinimi, S. V., & Choudhary, S. (2023). An Observational Study from Northern India to Evaluate Catheter-associated Urinary Tract Infection in Medical Intensive Care Unit at a Tertiary Care Center. *Indian journal of critical care medicine : peer-reviewed, official publication of Indian Society of Critical Care Medicine*, *27*(9), 642–646.

[2]. Soundaram, G. V., Sundaramurthy, R., Jeyashree, K., Ganesan, V., Arunagiri, R., & Charles, J. (2020). Impact of care bundle implementation on incidence of catheter-associated urinary tract infection: a comparative study in the intensive care units of a tertiary care teaching hospital in South India. *Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine*, *24*(7), 544.

[3]. Meddings, J., Manojlovich, M., Fowler, K. E., Ameling, J. M., Greene, L., Collier, S., ... & Saint, S. (2019). A tiered approach for preventing catheter-associated urinary tract infection. *Annals of internal medicine*, 171(7_Supplement), S30-S37.

[4]. Parker, V., Giles, M., Graham, L., Suthers, B., Watts, W., O'Brien, T., & Searles, A. (2017). Avoiding inappropriate urinary catheter use and catheter-associated urinary tract infection (CAUTI): a pre-post control intervention study. *BMC health services research*, *17*, 1-9.

[5]. Jamil, M. L., Wurst, H., Robinson, P., Rubinfeld, I., Suleyman, G., Pollak, E., & Dabaja, A. A. (2022). Urinary catheter alleviation navigator protocol (UCANP): an overview of protocol and review of initial experience. *American journal of infection control*, 50(1), 81-85.

[6]. Jamil, M., Wurst, H., Robinson, P., Suleyman, G., Rubinfeld, I., Pollack, E., & Dabaja, A. (2021). Mp29-12 Urinary Catheter Alleviation Navigator Protocol (Ucanp): Pilot To Reduce Urinary Catheter Reinsertion In Patients In Urinary Retention. *The Journal of Urology*, *206*(Supplement 3), e494-e494.

[7]. Suleyman, G., McCormick, M. E., McLenon, N., Chami, E., Pollak, E., & Dabaja, A. A. (2024). Urinary catheter alleviation navigator protocol (UCANP): Update to the hospital-wide implementation at a single tertiary health care center. *American journal of infection control*, S0196-6553(24)00537-6.

[8]. Au, A. G., Shurraw, S., Hoang, H., Wang, S., & Wang, X. (2020). Effectiveness of a simple intervention for preventing catheter-associated urinary tract infections on a medical hospital unit. *Journal of Infection Prevention*, *21*(6), 221–227.

[9]. Ellahi, A., Stewart, F., Kidd, E. A., Griffiths, R., Fernandez, R., & Omar, M. I. (2021). Strategies for the removal of short-term indwelling urethral catheters in adults. *The Cochrane database of systematic reviews*, 6(6), CD004011.

[10]. Ellahi, A., Stewart, F., Kidd, E. A., Griffiths, R., Fernandez, R., & Omar, M. I. (2021). Strategies for the removal of short-term indwelling urethral catheters in adults. *The Cochrane database of systematic reviews*, 6(6), CD004011.

[11]. Pryor, N., Wang, J., Young, J., Townsend, W., Ameling, J., Henderson, J., & Meddings, J. (2024). Clinical outcomes of female external urine wicking devices as alternatives to indwelling catheters: a systematic review and meta-analysis. *Infection Control & Hospital Epidemiology*, 1-9.

[12]. Gupta, S. S., Irukulla, P. K., Shenoy, M. A., Nyemba, V., Yacoub, D., & Kupfer, Y. (2017). Successful strategy to decrease indwelling catheter utilization rates in an academic medical intensive care unit. *American journal of infection control*, *45*(12), 1349–1355.

[13]. Russell, J. A., & Watters, R. (2018). Implementation of a Nurse-Driven CAUTI Prevention Algorithm. *The Nursing clinics of North America*, *54*(1), 81-96.

[14]. Ruan, C., Shi, S., Shen, Z., Guo, L., & Gong, L. (2023). Effect of precision management scheme based on the best evidence summary on reducing catheter-associated urinary tract infection. *Zhong nan da xue xue bao. Yi xue ban = Journal of Central South University. Medical Sciences*, *48*(9), 1333-1342.

[15]. Van Decker, S. G., Bosch, N., & Murphy, J. (2021). Catheter-associated urinary tract infection reduction in critical care units: a bundled care model. *BMJ open quality*, *10*(4), e001534.

[16]. Van Decker, S. G., Bosch, N., & Murphy, J. (2021). Catheter-associated urinary tract infection reduction in critical care units: a bundled care model. *BMJ open quality*, *10*(4), e001534.

[17]. Atkins, L., Sallis, A., Chadborn, T., Shaw, K., Schneider, A., Hopkins, S., ... & Lorencatto, F. (2020). Reducing catheter-associated urinary tract infections: a systematic review of barriers and facilitators and strategic behavioural analysis of interventions. *Implementation Science*, *15*, 1-22.

[18]. Saade, E. A., Thatcher, E. J., Lewis, T., Carr, S., Cornell, M., Arnold, R., ... & Pronovost, P. (2024). Reducing catheter-associated urinary tract infections in a large health system: a quality improvement approach using a fractal management system. *Antimicrobial Stewardship & Healthcare Epidemiology*, *4*(1), e147.

[19]. DePuccio, M. J., Gaughan, A. A., Sova, L. N., MacEwan, S. R., Walker, D. M., Gregory, M. E., DeLancey, J. O., & McAlearney, A. S. (2020). An Examination of the Barriers to and Facilitators of Implementing Nurse-Driven Protocols to Remove Indwelling Urinary Catheters in Acute Care Hospitals. *Joint Commission journal on quality and patient safety*, 46(12), 691–698.

[20]. Chandramohan, S., Navalkele, B., Mushtaq, A., Krishna, A., Kacir, J., & Chopra, T. (2018). Impact of a Multidisciplinary Infection Prevention Initiative on Central Line and Urinary Catheter Utilization in a Long-term Acute Care Hospital. *Open forum infectious diseases*, *5*(7), ofy156.

[21]. Scott, R. A., Oman, K. S., Makic, M. B., Fink, R. M., Hulett, T. M., Braaten, J. S., Severyn, F., & Wald, H. L. (2014). Reducing indwelling urinary catheter use in the emergency department: a successful quality-improvement initiative. *Journal of emergency nursing*, *40*(3), 237–293.