

Time to Antibiotic in Pediatric Oncology: Nursing Role in Saving Lives

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ABSTRACT

Total survival of childhood cancer in LMIC is estimated to be 20% whereas survival in HIC has exceeded to more than 80%. Pediatric patients undergoing chemotherapy treatment for cancer are at risk for severe infections due to chemotherapy-induced neutropenia, fever in neutropenic oncology patients is an emergency that requires immediate evaluation and intervention. The total Time to Antibiotic (TTA) administration in pediatric oncology patients who present with fever and neutropenia is critical to improving outcomes and decreasing morbidity and mortality. Current guidelines recommend antibiotic administration within 60 minutes of the patient's arrival at the emergency department and delay can result in complications like sepsis and death. There are very strong body of evidence in the literature supporting the Nursing Lead Project in reducing TTA in pediatric oncology patients with febrile neutropenia.

Keywords: Pediatric oncology, nursing role, mortality, time to antibiotic, oncological emergency.

INTRODUCTION

Febrile neutropenia (FN) in pediatric oncology patients is considered a medical emergency. This group of patients is at high risk of infection-related complications because of their poor immunity after receiving radiation and chemotherapy. A substantial cause of morbidity and mortality, FN is a known complication that affects up to 30% of paediatric oncology kids receiving cancer treatment [1].

This review article delves into the paramount importance of timely antibiotic administration in pediatric oncology, particularly in cases of febrile neutropenia. Focusing on the integral role of nursing, the discussion highlights the urgency of reducing Time to Antibiotic (TTA) for enhanced patient outcomes. The challenges and prospects for nursing empowerment in lower and middle-income countries are further examined, emphasizing the need for tailored strategies to optimize care.

REVIEW

Neutropenia affects the body's natural immune response to inflammation and conceals traditional signs and symptoms of infection, meaning that a fever may be one of the only initial signs of sepsis upon presentation [2]. Central lines, for example, can encourage the growth of bacterial bloodstream infections and the systemic spread of sepsis [3]. Due to these factors, it is recommended to promptly administer antibiotics in cases of FN to enhance patient results and decrease potential issues like prolonged hospital stays, intensive care requirements, immediate and long-term harm to organs, and delays in treating the underlying ailment. This approach also aims to optimize cost-effectiveness [4].

Professional medical organizations and FN guidelines recommended the prompt initiation of empiric broad-spectrum antibiotic treatment [5]. Certain studies have reported prolonged time to antibiotic administration (TTA) being associated with mortality and increased rates of intensive care unit (ICU) admission and sepsis in the pediatric population [6-7]. TTA commonly refers to the duration between a patient's arrival at the hospital and the initiation of intravenous antibiotic administration [8]. Subsequently, TTA is usually used as a measure of the quality of care provided in cancer facilities in high-income countries (HICs) [4]. Present recommendations suggest administering the first doses of empiric antibiotic treatment within one hour of triage [9]. As TTA is established as a standard practice in pediatric oncology environments, efforts to reduce negative outcomes and fatalities among cancer patients with febrile neutropenia should focus on ensuring swift and suitable TTA [10].

A systemic review published in 2019 supports the conjecture that delays in the first dose of antibiotics hurt child safety [10]. They are also associated with prolonged hospitalization, delay in cancer therapy, and increased mortality and morbidity [10]. Recently, a prospective study conducted in Australia found a significantly short hospital length of stay in patients with TTA <60 min [11]. A study by Santolaya *et al.* showed that each hour of delay in initiating antibiotics was associated with an increased risk of intensive care unit admission, septic shock, and mortality [12]. These findings show the importance of TTA in pediatric oncology. Numerous additional investigations have similarly indicated that promptly administering antibiotics within a 60-minute timeframe reduces mortality among patients experiencing fever and neutropenia (F&N). This practice is recognized as a standard target for Time to Antibiotic (TTA) initiation upon hospital admission, serving as an indicator of the quality of medical treatment [4, 13-15]. Paediatric cancer

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patients with F&N are the main focus of research and consensus guidelines. The guidelines advise a quick screening for infection, including the urgent delivery of broad-spectrum antibiotics, when these patients arrive at the emergency department (ED) [16].

Numerous quality improvement projects at individual medical centers have been executed to surmount obstacles related to Time to Antibiotic (TTA) delays within pediatric cancer facilities in high-income countries (HICs) [17]. Effective measures aimed at healthcare providers, such as FN-Alert cards, training and education, implementation of FN guidelines, utilization of electronic health record alerts aligned with best practices, and performance feedback to staff, have all resulted in notable reductions in TTA within these environments [18-19]. While the hindrances linked to TTA delays and the triumphant interventions to curtail them in high-income countries have been firmly established [10], the implementation of strategies to diminish TTA and the evaluation of their viability and associated clinical outcomes are lacking in countries with lower and middle-income levels.

Obstacles linked to TTA delays in pediatric cancer centers located in countries with lower and middle-income levels encompass a range of factors that are typically absent in higher-income countries (HICs) [20]. Elements such as reliance on traditional medicine, limited transportation options, caregivers with lower levels of literacy, constrained socioeconomic status, inadequate healthcare providers, and antibiotic supplies have been identified as potential focal points when formulating strategies to enhance TTA [20-21]. The primary impediments to prolonged TTA in high-income countries may differ from the prevalent causes of TTA delays in settings with limited resources. For instance, challenges related to acquiring central venous access due to insufficient topical pain relief do not apply to pediatric cancer facilities that lack access to both central venous catheters and topical pain relief methods. Given the potential variation in barriers across different centers, any enhancement strategy should be tailored to the specific local resources and circumstances.

Central Line-associated Bloodstream Infections (CLABSI) in the Management of FN

Central Line-associated Bloodstream Infections (CLABSI) pose a critical challenge in the management of febrile neutropenia episodes, particularly among patients with compromised immune systems, such as those undergoing cancer treatments. CLABSI occurs when microorganisms gain access to the bloodstream through a central venous catheter (CVC), which is commonly used in the administration of chemotherapy and other treatments [22]. Despite continuous efforts to lower the occurrence of CLABSI, children with cancer continue to face a disproportionate susceptibility to these infections compared to other hospitalized pediatric individuals [23]. CLABSI induces an immune

reaction within the body, resulting in inflammation. This inflammatory response can be intensified and extended in individuals with weakened immune systems. The discharge of inflammatory agents and cytokines adds to the onset of fever and other manifestations seen in febrile neutropenia [24].

Role of Nurses in Management of Febrile Neutropenia

Nurses have been recognized as an underused resource to promote and support programs execution to decrease CLABSI in clinical settings, and there is current interest in recognizing the efficient methods to promote nurses' engagement to take an active role of leadership in these initiatives [25]. Nurses employed in specialized domains such as intensive care, emergency departments, and dedicated haematology and oncology units have been recognized as having the capacity to assume a more involved role in Antimicrobial Stewardship (AMS) initiatives specific to their specialized practice arena [26].

There are a few key principles to empowering nurses to promote CLABSI management and reduce TTA. The initial principle involves timely evaluation of the necessity for antibiotic treatment. This aims to ensure both swift commencement of antimicrobial therapy for high-risk patients and those displaying indications of severe infection while also avoiding antibiotic usage when not clinically warranted. The second fundamental concept entails guiding healthcare providers in the selection of appropriate antibiotic regimens [27]. The third tenet pertains to the proper administration of antibiotics, encompassing dosage, frequency, and early evaluation of treatment response to determine whether continuation, alteration, or cessation of therapy is warranted. Lastly, the significance of ongoing and transparent monitoring of antimicrobial utilization is emphasized. This monitoring serves purposes such as conducting audits and providing feedback to prescribers concerning antimicrobial usage patterns, enhancing staff education, and evaluating the effectiveness of antimicrobial treatments [28].

In the treatment of febrile neutropenia, nurses play an active role in the early detection of sepsis, the use of AMS principles, such as acquiring microbiological samples for a septic screen before antibiotic administration, and the prompt administration of medicines [29]. In emergency rooms and inpatient settings, strategies like sepsis pathways or care bundles have been successfully introduced to encourage early diagnosis and response to suspected sepsis to lower sepsis-related morbidity. To provide evidence-based sepsis management and define critical tasks where nurses can take the lead in starting diagnostic work-up and treatment, sepsis bundles frequently include treatment algorithms [30].

The role of nursing in promoting TTA in pediatric cancer centers, particularly those situated in lower and middle-income countries, is crucial in addressing the multifaceted challenges associated with TTA delays.

Nurses can play a pivotal role in overcoming obstacles by advocating for and implementing strategies that align with the local context and resources.

In low and middle-income countries (LMIC), the role of nurses is limited to very stringent sets of job descriptions. There are many reasons for this which include their appreciation of the healthcare sector, cultural influence, their training, and lack of autonomy and empowerment. The delivery of care by skilled professional nurses is a critical principle of successful pediatric cancer treatment [15]. High workload also plays a part in their limited involvement. In LMIC, the nurse-patient ratio in some public sector exceeds 1:40, which makes it difficult for bedside nurse to expand the scope of care as she is barely able to provide the necessary care. Another important element in patient outcomes is nurse workload. Longer hospital stays, risk of complications, and a higher patient mortality rate have all been linked to insufficient nurse staffing [16]. Specialized training and knowledge are also one of the factors for the lack of initiation or proactive approach to patient care. Specialized training and education are unavailable for LMIC nurses. They don't even have mentors to guide and support them, which contributes to disparities in the outcomes of child cancers [31, 32].

Nursing in Pakistan is no different; it faces the same challenges as other LMICs, like lack of training opportunities, high workload, and lack of empowerment and autonomy. The nursing workforce is based on skill mix models, with three levels of nursing registered nurses, nurse technicians, and nurse aids care dived on task-based patient assignments [33]. There is a lack of trained nurses in Pediatric oncology, except in a couple of centers that introduced general Oncology and pediatric oncology training, which is center-based [34].

Improved supportive care, such as nutritional support and proper management of fever and neutropenia (FN) episodes, has the potential to reduce treatment-related early mortality [35]. LMICs have to find innovative sustainable solutions to reach that goal, and this includes improving supportive care. Since febrile neutropenia is an unavoidable side effect of chemotherapy, many children come to the emergency with complaints of fever during the neutropenic phase. Being a resource-limited setting, there is a high influx of patients and a lack of medical staff, which might cause delays in patient care.

Nursing roles in LMICs are very limited to following orders. It is just logical to train nurses for this critical intervention and empower them to identify and start antibiotics in time to save children's mortality, Nurses in many HICs have taken the lead in Quality projects aiming to reduce TTA, and LMIC should also replicate such projects. Nurses can develop processes, flow charts and guidelines for antibiotics to implement. This will allow nurses to work autonomously for the improvement of patient care and safety, thus improving patient and

family satisfaction and ultimately reducing overall mortality. These projects can have important elements of nursing empowerment, including decision-making, autonomy, managing workflow, fairness, rewards, and recognition [33]. Nurses taking the lead in this will be provided with an opportunity to exercise their leadership and autonomy, which will not only empower them but also ease some burden from physicians.

CONCLUSION

In conclusion, the urgency of timely antibiotic administration in pediatric oncology patients with febrile neutropenia cannot be overstated, as delays significantly impact mortality and morbidity. This editorial underscores the critical role nurses play in managing febrile neutropenia, emphasizing the need for their empowerment and active engagement. While high-income countries have successfully implemented interventions to reduce Time to Antibiotic (TTA), there is a pressing need for tailored strategies in lower and middle-income countries, considering unique challenges. Nurses' leadership in optimizing TTA can enhance patient outcomes, reduce mortality, and improve overall care in pediatric oncology settings.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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