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The Contribution of Oncology Nurses in Addressing Cancer Treatment Side Effects

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Abstract
Background: Cancer remains one of the leading causes of death globally, making the effective management of treatment side effects, especially chemotherapy extravasation, crucial. Extravasation can cause severe complications, highlighting the pivotal role of oncology nurses in patient care.
Methods: This systematic review examined literature from 2004 to 2023, using databases such as Web of Science, Scopus, and PubMed. The focus was on oncology nurses' knowledge and practices regarding the management of chemotherapy extravasation. Key search terms were based on MeSH descriptors, with Boolean operators used to refine the search results.
Results: The review identified significant barriers in nursing practice, including inadequate knowledge of the signs, risk factors, and management protocols related to extravasation. It emphasized the need for specialized training programs, which have been shown to improve nurses' competency and reduce patient complaints about extravasation. Evidence also indicated that well-structured educational initiatives enhanced nurses' ability to recognize early signs of vascular damage and implement the necessary interventions.
Conclusion: Effective management of chemotherapy extravasation is critical for improving patient outcomes and quality of life. This review emphasizes the need for continuous education and training for oncology nurses to equip them with the skills necessary to address and reduce complications associated with chemotherapy. Future research should focus on developing targeted training programs and evaluating their impact on nursing practice and patient safety.
Keywords: Chemotherapy, extravasation, oncology nursing, training programs, patient safety.

1. Introduction

Cancer now ranks among the leading causes of mortality globally and is a significant public health issue. The World Health Organization said that it was responsible for over 10 million fatalities in 2020, about one-sixth of the total global deaths that year. As a result of the rising cancer incidence, there was a corresponding increase in the utilization of various treatment modalities, with intravenous chemotherapy being the most prevalent. This approach employs diverse antineoplastic agents that inhibit or completely arrest the proliferation of cancer cells [1-3].

Antineoplastic drugs are among the most often used techniques for cancer treatment. They are classified as chemotherapeutic agents used in the treatment of cancer. Their primary activity is eliminating malignant cells by stopping their division, therefore disrupting their cell cycle and averting disease proliferation. Nevertheless, these agents are unable to differentiate between healthy and malignant cells, thereby affecting both and leading to detrimental consequences [4]. Extravasation refers to the inadvertent leakage of antineoplastic agents during the venous infusion process outside the selected vein. This may result from many inherent features of the blood vessel, the cannula's displacement outside the vessel, or improper implantation. It is among the most serious consequences of intravenous chemotherapy treatment [5]. Extravasation encompasses several outcomes, ranging from mild discomfort or irritation at the infusion site to tissue necrosis, potentially resulting in irreversible functional impairment of the afflicted limb, which is regarded as a medical emergency. This circumstance results in a postponement of therapy and a lack of confidence among patients [6]. This sort of mishap may result in significant clinical consequences for the patient, including heightened morbidity, prolonged hospitalization, and changes in quality of life [6].

The extravasation rate ranges from 0.1% to 6% for peripheral administration and from 0.26% to 4.7% for central venous access infusions [7]. The extravasation rates correlate with various risk factors: patient-related factors (e.g., age or overall health), product-related factors (e.g., irritant potential or toxicity), and procedural factors (e.g., puncture technique or medication administration), with the latter being the most critical to consider [8]. The nurse plays a crucial role in the administration process of intravenous chemotherapy, including patient preparation, medication delivery, monitoring of side effects, documentation management, and communication with the medical team [9].

In 2018, the Andalusian Health Service sanctioned the training of Advanced Practice Nurses (APNs) in cancer to address the need for more specialized nursing care. This position was established in 1971 in the United States, where it was instituted and delineated [10]. An APN is a proficient nursing practitioner who has acquired additional educational qualifications and clinical experience beyond the foundational nursing education and licensure needed for a registered nurse (RN). APNs are trained via postgraduate degrees, such as master's or doctorate programs, which equip them to provide advanced care and assume positions in direct patient care, consulting, teaching, research, and administration [11]. In the global arena, advanced practice nursing is progressively gaining traction in many nations. Nonetheless, a common factor exists, namely the need to elucidate its function in the delivery of health care [12-16]. Despite the existence of certification systems and particular rules at the regional level, this entity remains unregulated and uncertified at the national level [10]. It is astonishing that this position, which entails significant responsibility in chemotherapy administration and extravasation scenarios, remains uncontrolled in the nation.

The objective of this research was to examine the current state of knowledge on the role of nursing in the treatment of chemotherapy extravasation, acknowledging potential risk factors and finding appropriate training programs for nurses.

2. Methods

The systematic review was performed from 2004 to 2023 using the Web of Science (WOS), Scopus, and PubMed databases. The search terms were derived from the MeSH descriptors created by the National Library of Medicine and the thesauri of descriptors used in Health Science (DeCS). The Boolean operators AND and OR were used.

3. The Function of Nursing in Extravasation Management

Regarding the role of nursing in extravasation, research by Coyle et al. [10] noted a direct correlation with the essential education that must be provided to patients commencing chemotherapy, both before and during the treatment, resulting in enhanced satisfaction levels.

Sivabalan and Upasani [12] determined that for nurses to deliver effective health education, they must obtain sufficient training in extravasation, underpinned by a robust foundation of knowledge, comprehension, and attentiveness, to ensure comprehensive care for all cancer patients. The cited writers illustrate that effective planning may enhance the quality of life for patients and their families. The nursing interventions were shown to alleviate the physical symptoms of chemotherapy, including pain and exhaustion, as well as anxiety and depression, consequently enhancing the patient's emotional well-being [13]. Yu et al. [14] emphasized the significance of educational initiatives for patients with a fully implantable venous access port (TIVAP) and the critical nature of managing and promptly identifying issues to avoid extravasation. As a result, therapies conducted by nurses are highly regarded by patients, hence enhancing the efficacy of the intervention [15,16].

Nursing has a critical role in addressing extravasation, as shown by Mas et al. [17], who describe it as a surgical emergency with potentially severe consequences. The cited research examined the saline wash treatment in children, indicating that it is a safe and straightforward method that decreases the incidence of skin necrosis.

4. Factors Contributing to Extravasation

One discovered risk factor in the research was the nurses' insufficient understanding of them [18]. Insufficient understanding may compromise the quality of treatment provided to patients who have had extravasation. Furthermore, the research conducted by Lima and Silva et al. [16] discovered three signs of vascular damage that, if not promptly recognized, might result in extravasation. The most accurate markers were the reduction in vascular elasticity, discomfort, and symptoms of infection. By using these signs and identifying them early, nurses may provide a more accurate diagnosis of vascular injuries in chemotherapy patients, thereby facilitating appropriate intervention planning and enhancing health outcomes for cancer patients. Separate research [19] shows a significant failure rate of peripheral intravenous (PIV) catheters, mostly attributed to problems such as blockage or infiltration, dislodgement, and phlebitis. All these issues might result in extravasation if not promptly identified, potentially causing sequelae such as treatment delays, hence deteriorating the quality of life for patients undergoing cancer therapy. This investigation identified a robust correlation between the use of non-sterile fastening tapes and a significant reduction in dislodgement. Finally, Yu et al. [14] noted that catheter blockage is a recent consequence linked to the central venous catheter (TIVAP), with age and certain malignancies (breast, lung, and stomach) identified as primary risk factors.

5. Efficient Training Programs for Nurses

Mohammed et al. [15] documented the significant effectiveness of the training program implemented for the nursing staff, including chemotherapy material, risk factors, and preventative strategies. A questionnaire was conducted before and during the training to assess learning outcomes, yielding very satisfactory results among the nurses and a reduction in the incidence of extravasation, with patient complaints decreasing from 20% to 8% post-implementation of the program. Corbitt et al. [18] reached analogous conclusions in their study, demonstrating that the simulation of vincristine administration via a mini bag and the training of nurses enhanced patient safety and well-being, while also yielding promising results in the prevention of extravasation.

6. Discussion

This review aimed to analyze the current state of knowledge about the role of nursing in managing chemotherapy extravasation, identifying potential risk factors, and effective training programs for nurses. Sharour [11] indicated that oncology nurses have sufficient information on the signs and symptoms of extravasation, but exhibit inadequate understanding of particular therapies, cannula features, and insertion sites. These results align with the conclusions of Kosgeroglu et al. [19], who identified similar knowledge deficiencies among nurses. Further research [20] indicated that contrary to Sharour's results [11], the nurses exhibited inadequate

knowledge of the recognition of signs, symptoms, and risk factors. These data suggest that a significant factor contributing to extravasation is the nurse's inadequate understanding of many elements of chemotherapy treatment [21].

Additionally, concerning the identification of extravasation risk factors, Lima and Silva et al. [16] noted that vascular trauma is an iatrogenic occurrence that has increased in prevalence over the years. The discovered signs were extravasation, discomfort, and changes in skin color. The results align with earlier studies [22,23] that observed a reduction in elasticity, discomfort, and infection indicators at the catheter puncture site, accompanied by good specificity values. Nurses are crucial in the treatment of patients undergoing antineoplastic chemotherapy, and they must oversee potential adverse events to prevent extravasation and toxicity. In this setting, the prompt diagnosis of vascular trauma by clinical indications is essential, since three precise clinical signs suffice to predict vascular trauma and subsequent extravasation, hence enhancing the quality of patient care [24,25].

7. Nursing Protocols and Interventions in Chemotherapy Administration

Sivabalan and Upasani [12] indicated that patients undergoing chemotherapy had various physical and psychological problems, resulting in diminished overall well-being. Miaskowski et al. [26] noted that the majority of cancer patients experience pain (80%), making it the most prevalent symptom. Fatigue and alterations in appetite are prevalent complaints noted in this group [19,27]. Additional research, like that conducted by Jadoon et al. [28], similarly showed that more than fifty percent of these individuals had despair and anxiety. These circumstances may be mitigated by the execution of nursing interventions, as the planning of these measures can enhance the physical and mental well-being of patients [19,29-34]. Psychological symptoms, including anxiety, sadness, and emotional well-being, may substantially improve by nursing treatments such as massages, progressive muscle relaxation, breathing exercises, psychoeducational support, and prayer [35,36].

The results of Larsen et al. [13], along with previous research, indicate that negative outcomes mostly stem from problems associated with occlusion and infiltration [36,38]. Other studies revealed other risk factors, including the use of non-sterile fastening tape applied secondary to the main dressing as a protective factor [39,40], and several efforts to reinsert the catheter [41]. Improvements in the insertion, care, maintenance, and extraction of PIV in cancer patients are essential to ensure the long-term health and preservation of blood vessels, thereby adhering to the practice standards for access devices in oncology nursing [42,43].

The research by Yu et al. [14] showed a generally low incidence of late problems associated with the use of the central venous catheter (TIVAP) in cancer therapy. This rate parallels findings from earlier research, which also identified other adverse effects, including infection [44]. Conversely, other articles indicate elevated rates [45,46]. Other authors [47] concur with Yu et al. [14] about age and certain underlying conditions, which are linked to an elevated risk of late complications. Nonetheless, the infection incidence in this investigation was much lower than the rate previously reported [48]. The latter study reported a singular instance of extravasation, characterized by localized subcutaneous edema, discomfort, and warmth. The problem was addressed with hydropathic dressings and managing the blockage. The results of this study about the chosen intervention for catheter exposure align with prior research [56], indicating that the most effective treatment option is surgical removal of the catheter. The findings of these studies emphasize the need for qualified nurses to manage TIVAP to reduce the risk of medication extravasation [49].

Mas et al. [17] concluded that extravasation injuries may result in severe and irreversible damage, including skin necrosis, skin infections with abscess formation, and necrotizing fasciitis. In this context, several research revealed similar results, along with sequelae like anesthetic skin, muscular spasms, and digit amputation [50,51]. These findings underscore the

significance of preventing chemotherapy extravasation as a public health enhancement, as it not only yields economic savings in the management of potential future extravasation injuries but also enhances the quality of life for cancer patients and the efficacy of healthcare delivery.

8. Education of Nursing Professionals in Chemotherapy Administration

The research by Mohammed et al. [15] implemented a training program for nurses on chemotherapy extravasation and evaluated its outcomes. Certain findings align with the results of analogous studies [52,53]. The findings gained from implementing the program indicated an improvement in understanding the mitigation of extravasation. In this regard, analogous research demonstrates enhancements in the clinical practice scores of nurses after the implementation of the program [54-56]. Additionally, another research [25] revealed an enhancement in professional competencies related to extravasation avoidance after the implementation of simulation-based practice training. Likewise, interdisciplinary training and intervention have shown significant enhancements in the treatment and prevention of extravasation, as reported in two papers included in this systematic review [17,25]. These findings advocate for the education of nursing personnel on this subject to reduce extravasation and enhance patient safety [28].

9. Constraints and Prospective Research Directions

Finally, it is crucial to emphasize that this investigation uncovered a significant volume of relevant information for managing chemotherapeutic extravasation. Nonetheless, it also has certain limits. Initially, it was challenging to locate a substantial variety of papers about the research issue inside the databases. This may result from research characterized by inadequately analyzed aims and unconventional inclusion criteria, of which there is little information. Furthermore, the results provide broad implications; thus, to implement intervention strategies targeting more specific demographics, it is essential to integrate information from further studies concerning certain groups since this research does not concentrate on a singular population group. This systematic review serves as a pilot study, providing the researchers with fundamental insights into the study issue. In the future, other particular aspects of the issue will be examined. This first evaluation only encompasses open-access works due to its status as pilot research, aimed at providing an overview. Additionally, to enhance the specificity of searches within nursing, it would be advantageous to use the CINHAL database.

Consequently, forthcoming research should advocate for novel systematic reviews tailored to the distinct characteristics of particular populations, specific cancer types, and corresponding chemotherapeutic regimens, while considering an extended timeframe for publication dates in database searches, thereby acquiring the requisite findings for the formulation of both general and targeted interventions grounded in scientific evidence. Conducting a meta-analysis on forthcoming systematic reviews is essential to get meaningful findings. Furthermore, conducting implementation studies and quality improvement initiatives to guarantee practical use would be suitable.

10. Conclusion

The management of chemotherapy extravasation is a critical responsibility for oncology nurses, given the potential complications that can arise from this adverse event. This systematic review highlights the significant gaps in knowledge and practice among nursing professionals regarding the signs, risk factors, and management strategies associated with extravasation. These deficiencies can lead to delayed recognition and treatment, ultimately impacting patient outcomes and quality of life. The findings emphasize the importance of specialized training programs that enhance nurses' understanding and skills in managing extravasation. Implementing structured educational initiatives not only empowers nurses but also fosters a culture of safety and vigilance within healthcare settings. By equipping nurses with the necessary tools and knowledge, we can improve early detection of extravasation and ensure timely interventions, thereby reducing patient morbidity and enhancing overall care.

Moreover, as the prevalence of cancer continues to rise globally, the role of oncology nurses will become increasingly vital in navigating the complexities of cancer treatment. Future research should focus on developing standardized training protocols and evaluating their effectiveness in real-world settings. Additionally, interdisciplinary collaboration among healthcare professionals is essential to create comprehensive care strategies that prioritize patient safety and optimize treatment outcomes.

In conclusion, investing in the education and training of oncology nurses is imperative for mitigating the risks associated with chemotherapy extravasation and improving the quality of care for cancer patients. This commitment will ultimately lead to better health outcomes and a more supportive environment for patients undergoing treatment.

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مساهمة ممرضات الأورام في معالجة الآثار الجانبية لعلاج السرطان

الملخص

الخلفية :يظل السرطان أحد الأسباب الرئيسية للوفاة على مستوى العالم، مما يجعل الإدارة الفعّالة للآثار الجانبية للعلاج، وخاصة تسرب أدوية العلاج الكيميائي، أمرًا بالغ الأهمية. يمكن أن يتسبب التسرب في مضاعفات خطيرة، مما يبرز الدور الحاسم لممرضات الأورام في رعاية المرضى.

الطرق :تم فحص الأدبيات من عام 2004 إلى 2023 في هذه المراجعة المنهجية، باستخدام قواعد بيانات مثل Web of Science وScopus وPubMed. كان التركيز على معرفة وممارسات ممرضات الأورام فيما يتعلق بإدارة تسرب أدوية العلاج الكيميائي. تم استخدام مصطلحات البحث الرئيسية المستخلصة من مصطلحات MeSH مع استخدام المشغلات المنطقية لتحسين نتائج البحث.

النتائج :حددت المراجعة حواجز كبيرة في ممارسة التمريض، بما في ذلك نقص المعرفة بعلامات التسرب، وعوامل الخطر، وبروتوكولات الإدارة المتعلقة بالتسرب. أكدت على الحاجة إلى برامج تدريبية متخصصة، والتي أظهرت أنها تحسن كفاءة الممرضات وتقليل الشكاوى المتعلقة بالتسرب. كما أشارت الأدلة إلى أن المبادرات التعليمية المنهجية حسّنت من قدرة الممرضات على التعرف على العلامات المبكرة لتلف الأوعية الدموية وتنفيذ التدخلات اللازمة.

الخاتمة :تعد الإدارة الفعّالة لتسرب أدوية العلاج الكيميائي أمرًا بالغ الأهمية لتحسين نتائج المرضى وجودة حياتهم. تؤكد هذه المراجعة على الحاجة إلى التعليم المستمر والتدريب للممرضات في مجال الأورام لتزويدهن بالمهارات اللازمة لمعالجة وتقليل المضاعفات المرتبطة بالعلاج الكيميائي. يجب أن تركز الأبحاث المستقبلية على تطوير برامج تدريبية مستهدفة وتقييم تأثيرها على ممارسة التمريض وسلامة المرضى.

الكلمات المفتاحية :العلاج الكيميائي، التسرب، تمريض الأورام، برامج التدريب، سلامة المرضى.