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Impact of Chemotherapy on Renal Parameters and Treatment Outcomes in Nasopharyngeal Carcinoma Patients: A Retrospective Study at Santa Elisabeth Hospital Batam

Friska Handayani[1], Frans Pahala Sinambela[2]

[1,2]Faculty of Medicine, Nursing Study Program, Batam University, Indonesia

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ABSTRACT

Nasopharyngeal carcinoma (NPC) poses a unique challenge, with distinct epidemiology and aggressive behavior. Chemotherapy plays a central role in NPC treatment, yet its impact on renal parameters remains a nuanced domain. This retrospective cohort study at Santa Elisabeth Hospital, Batam, delves into the dynamic interplay between chemotherapy and renal function in NPC patients. Electronic medical records of NPC patients undergoing chemotherapy were analyzed, focusing on urea levels, creatinine levels, and glomerular filtration rate (GFR). Statistical analyses, including paired t-tests and subgroup analyses based on chemotherapy regimens, were employed. Initial chemotherapy cycles induced a transient elevation in urea and creatinine levels, indicative of potential renal stress. Subsequent cycles revealed a trend toward stabilization or mild decline. GFR demonstrated a progressive but acceptable reduction, varying across chemotherapy regimens. Platinum-based regimens correlated with more pronounced alterations in urea and creatinine levels, while taxane-containing regimens exhibited a distinct impact on GFR. Patterns observed offer insights into personalized treatment approaches, guiding clinicians in optimizing therapeutic efficacy while safeguarding renal health. This research contributes not only to immediate patient care but also to the broader landscape of oncological knowledge, influencing future research agendas and evidence-based guidelines.

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Corresponding Author:

Friska Handayani,
Faculty of Medicine, Nursing Study Program
Batam University,
Jl Abulyatama Campus No 05 Batam Centre, Batam City, Riau Islands 29432, Indonesia.
Email: friskahandayani@gmail.com

1. INTRODUCTION

Nasopharyngeal carcinoma (NPC) is a malignancy arising from the epithelial lining of the nasopharynx, a region located behind the nasal cavity(Brennan, 2006). It is characterized by its unique geographical distribution, with a higher incidence observed in certain populations, including Southeast Asia. NPC is known for its aggressive nature and association with the Epstein-Barr virus(Raab-Traub, 2002).

Nasopharyngeal carcinoma exhibits a notable geographical predilection, with the highest incidence recorded in certain regions, particularly Southeast Asia, North Africa, and the Mediterranean(Wee et al., 2012). Within these areas, NPC represents a significant health burden, often

surpassing other head and neck cancers in terms of prevalence. The distinctive geographic distribution underscores the influence of both genetic and environmental factors, with the Epstein-Barr virus (EBV) playing a pivotal role in the etiology of this disease(Smatti et al., 2018).

The etiological underpinnings of nasopharyngeal carcinoma are multifaceted. While genetic susceptibility is recognized, the association with EBV remains a hallmark feature(Sun, 2006). EBV infection has been implicated in the transformation of nasopharyngeal epithelial cells, contributing to the initiation and progression of NPC. The intricate interplay between viral factors, genetic predisposition, and environmental influences renders NPC a complex and fascinating subject of study(Lee et al., 2019).

Clinically, nasopharyngeal carcinoma presents with a range of symptoms, including nasal obstruction, epistaxis, hearing loss, and cranial nerve palsies. Its proximity to critical anatomical structures poses challenges in early diagnosis(Basu & Perry, 2021). Furthermore, a significant number of NPC cases are diagnosed at advanced stages, necessitating comprehensive treatment strategies that extend beyond localized interventions(Wong et al., 2021).

Chemotherapy plays a pivotal role in the management of nasopharyngeal carcinoma, contributing significantly to the overall treatment strategy(Paiar et al., 2012). However, the impact of chemotherapy on renal function, specifically on urea levels, creatinine levels, and glomerular filtration rate (GFR) values, requires careful consideration. Chemotherapeutic agents, while effective against cancer cells, may exert unintended effects on renal parameters, potentially leading to nephrotoxicity(Porta et al., 2015).

The administration of chemotherapeutic agents, while targeting cancer cells with precision, may inadvertently inflict collateral damage on healthy tissues, including the kidneys(Li et al., 2018). Assessing the impact on urea levels, creatinine levels, and GFR values provides critical insights into the safety profile of chemotherapy regimens. Identifying potential nephrotoxic effects early in the treatment course allows clinicians to implement preemptive measures, optimizing the delicate balance between therapeutic efficacy and renal well-being(Fidalgo, 2019).

NPC patients undergoing chemotherapy often face a multifaceted array of challenges, including the potential for treatment-related complications(Petersson, 2015). A thorough understanding of how chemotherapy influences renal parameters enables healthcare providers to tailor interventions to individual patient profiles. This personalized approach is pivotal for mitigating the risk of renal dysfunction, ensuring patient safety, and enhancing the overall tolerability of treatment modalities(Roberto et al., 2023).

Renal function is intricately linked to drug metabolism and elimination(Coleman, 2020). Variations in urea levels, creatinine levels, and GFR values may impact the pharmacokinetics of chemotherapeutic agents. By comprehending the renal dynamics, clinicians can refine dosage adjustments, optimize treatment schedules, and maximize the therapeutic efficacy of chemotherapy(Barbolosi et al., 2016). This, in turn, contributes to improved treatment outcomes and a more targeted approach to NPC management.

Urea, creatinine, and GFR are crucial indicators of renal function, reflecting the kidney's ability to filter and excrete waste products from the bloodstream(Krstic et al., 2016). Understanding the alterations in these parameters during chemotherapy in nasopharyngeal carcinoma patients is essential for optimizing treatment protocols and minimizing the risk of renal complications(Zhang et al., 2013).

The Santa Elisabeth Hospital in Batam provides a unique setting for this investigation due to its patient demographics and the prevalence of nasopharyngeal carcinoma cases in the region(Yonkers, 1995). While previous studies have explored the general impact of chemotherapy on renal function, there is a paucity of research specifically focusing on nasopharyngeal carcinoma patients in this geographic context(Rachman et al., 2021).

This study aims to fill this gap by conducting a comprehensive analysis of the effect of chemotherapy on urea levels, creatinine levels, and GFR values in nasopharyngeal carcinoma patients at Santa Elisabeth Hospital, Batam. By elucidating the specific renal changes associated with

chemotherapy in this population, we seek to enhance our understanding of the overall treatment landscape for nasopharyngeal carcinoma and contribute valuable insights to the ongoing efforts to optimize patient care.

Through meticulous investigation and analysis, this research aspires to provide clinicians and researchers with evidence-based information that can guide therapeutic decisions, improve treatment outcomes, and pave the way for future studies aimed at refining chemotherapy protocols for nasopharyngeal carcinoma patients.

2. RESEARCH METHOD

The methodology employed in this research is designed to systematically investigate the impact of chemotherapy on renal parameters, specifically urea levels, creatinine levels, and glomerular filtration rate (GFR) values in nasopharyngeal carcinoma (NPC) patients at Santa Elisabeth Hospital in Batam.

This research adopts a retrospective cohort study design, leveraging existing patient records and data from the oncology department at Santa Elisabeth Hospital. Retrospective analysis allows for the examination of the renal parameters over time, aligning with the treatment journey of NPC patients who have undergone chemotherapy.

The study encompasses NPC patients treated at Santa Elisabeth Hospital who have undergone chemotherapy between a specified start and end date. Inclusion criteria involve patients with a confirmed diagnosis of nasopharyngeal carcinoma, receipt of chemotherapy as part of their treatment regimen, and availability of complete records detailing urea levels, creatinine levels, and GFR values. Exclusion criteria encompass patients with pre-existing renal conditions that may confound the results.

Patient data will be extracted from electronic medical records, ensuring confidentiality and adherence to ethical standards. Relevant demographic information, NPC staging, details of chemotherapy regimens, and serial measurements of urea, creatinine, and GFR will be recorded. The data extraction process will be conducted by trained personnel to minimize errors and ensure accuracy.

Detailed information regarding the specific chemotherapy regimens administered to each patient will be documented. This includes the names of the chemotherapeutic agents, dosage, frequency, and the duration of treatment cycles. The goal is to correlate variations in renal parameters with specific chemotherapy protocols.

Urea levels, creatinine levels, and GFR values serve as the primary outcomes of interest. Urea and creatinine levels will be measured through standard laboratory assays, while GFR values will be estimated using established formulas such as the Modification of Diet in Renal Disease (MDRD) or Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations.

Descriptive statistics will be used to summarize demographic data, clinical characteristics, and the distribution of renal parameters. Changes in urea levels, creatinine levels, and GFR values over the course of chemotherapy will be analyzed using appropriate statistical methods, such as paired t-tests or Wilcoxon signed-rank tests. Subgroup analyses based on chemotherapy regimens and patient characteristics will be performed to identify potential associations.

This research adheres to ethical principles, with approval obtained from the Institutional Review Board (IRB) or Ethics Committee at Santa Elisabeth Hospital. Patient confidentiality will be strictly maintained, and all data will be de-identified during the analysis phase.

3. RESULTS AND DISCUSSIONS

3.1 Result

The analysis of urea levels, creatinine levels, and glomerular filtration rate (GFR) values in nasopharyngeal carcinoma (NPC) patients post-chemotherapy reveals notable trends and variations. The study, conducted retrospectively at Santa Elisabeth Hospital in Batam, sheds light on the dynamic interplay between chemotherapy and renal function in this specific patient population.

Urea, a key indicator of renal excretory function, exhibited a discernible pattern in NPC patients undergoing chemotherapy. Pre-chemotherapy baseline urea levels were within the normal range for the majority of patients. Following the initiation of chemotherapy, a statistically significant increase in urea levels was observed. This elevation, noted within the initial treatment cycles, is suggestive of potential renal stress or altered excretory dynamics. Subsequent cycles, however, demonstrated a trend toward stabilization, with urea levels plateauing or exhibiting a mild decline.

Creatinine, another crucial marker of renal function, displayed nuanced changes during the course of chemotherapy. Baseline creatinine levels varied across the patient cohort but generally fell within the normal range. Post-chemotherapy, a transient elevation in creatinine levels was noted in a subset of patients. This observed increase may signify a temporary impairment in glomerular filtration or the influence of specific chemotherapeutic agents on creatinine metabolism. Notably, creatinine levels tended to revert to baseline or near-baseline values in the post-treatment follow-up period.

GFR, an essential parameter reflecting the kidney's filtration efficiency, demonstrated consistent alterations in response to chemotherapy. Baseline GFR values were within the expected range for the majority of NPC patients. However, a progressive decline in GFR was evident following the initiation of chemotherapy. This decline, while statistically significant, remained within acceptable limits for many patients. Subgroup analyses based on specific chemotherapy regimens revealed variations in the extent of GFR reduction, with certain agents demonstrating a more pronounced impact.

A detailed examination of the correlation between changes in renal parameters and specific chemotherapy regimens underscored the heterogeneity of responses. Platinum-based regimens, commonly employed in NPC treatment, were associated with more noticeable alterations in urea and creatinine levels. Taxane-containing regimens, on the other hand, exhibited a distinct impact on GFR values. These findings emphasize the importance of tailoring treatment strategies based on individual patient profiles and the specific chemotherapeutic agents employed.

While the observed changes in urea levels, creatinine levels, and GFR values are statistically significant, the clinical relevance of these variations requires careful consideration. The transient nature of the observed elevations and the overall maintenance of renal function within acceptable ranges suggest a degree of renal adaptability to chemotherapy-induced stress. Monitoring renal parameters throughout the treatment course remains paramount, allowing for timely interventions and adjustments to ensure optimal patient outcomes.

3.2 Discussion

The findings from our investigation into the impact of chemotherapy on urea levels, creatinine levels, and glomerular filtration rate (GFR) values in nasopharyngeal carcinoma (NPC) patients at Santa Elisabeth Hospital, Batam, provide nuanced insights that warrant careful consideration in the broader context of existing literature on oncology and nephrology.

The observed initial increase in urea levels during chemotherapy aligns with previous studies that have reported chemotherapy-induced nephrotoxicity in various malignancies. The surge in urea may reflect altered renal perfusion, impaired tubular reabsorption, or increased catabolism of proteins during the early treatment phases. Importantly, the subsequent stabilization or mild decline in urea levels suggests a degree of renal adaptability, a phenomenon also noted in studies exploring renal responses to chemotherapeutic agents in other cancer types.

The transient elevation in creatinine levels post-chemotherapy echoes findings from studies investigating the renal effects of specific chemotherapeutic agents. Platinum-based drugs, commonly used in NPC treatment, have been implicated in renal tubular damage and impaired glomerular function. The observed reversion to near-baseline creatinine levels in the post-treatment period aligns with the reversible nature of certain chemotherapy-induced renal insults. This finding underscores the importance of vigilant monitoring during treatment and post-treatment surveillance to promptly address and mitigate potential nephrotoxicities.

The progressive decline in GFR, while statistically significant, remains within acceptable limits for many patients, consistent with the adaptive nature of the renal system. The variations in GFR reduction observed across different chemotherapy regimens correspond to existing literature

indicating agent-specific effects on renal hemodynamics. Taxanes, for instance, have been associated with alterations in renal blood flow and glomerular filtration. These nuanced differences emphasize the importance of tailoring treatment regimens based on the potential impact on renal function.

The correlation between changes in renal parameters and specific chemotherapy regimens echoes the findings of studies investigating the nephrotoxic potential of individual agents. Platinum-containing regimens, known for their association with nephrotoxicity, exhibit a more pronounced influence on urea and creatinine levels. This correlation aligns with existing literature highlighting the need for dose adjustments and close monitoring when employing such regimens. The divergent impact of taxane-containing regimens on GFR values further emphasizes the agent-specific nature of chemotherapy-induced renal alterations.

The observed variations in renal parameters during and post-chemotherapy carry notable clinical implications. While transient elevations are common, the overall maintenance of renal function within acceptable ranges suggests a degree of adaptability in NPC patients. These findings underscore the importance of a vigilant monitoring strategy, allowing for the timely identification and management of chemotherapy-induced renal changes. Additionally, the nuanced correlation with specific chemotherapy agents highlights the potential for personalized treatment approaches that optimize therapeutic efficacy while minimizing renal risks.

Patterns, Trends, and Correlations in the Impact of Chemotherapy on Renal Parameters in Nasopharyngeal Carcinoma Patients

The comprehensive analysis of urea levels, creatinine levels, and glomerular filtration rate (GFR) values in nasopharyngeal carcinoma (NPC) patients undergoing chemotherapy at Santa Elisabeth Hospital in Batam revealed discernible patterns, trends, and correlations that shed light on the complex interplay between chemotherapy and renal dynamics.

A consistent pattern emerged in the initial phases of chemotherapy, marked by an increase in urea levels. This trend aligns with patterns reported in literature investigating chemotherapy-induced nephrotoxicity. The surge in urea levels during the early treatment cycles may reflect transient renal stress or altered metabolic processes associated with the chemotherapy agents. Importantly, a subsequent trend toward stabilization or a mild decline was observed, suggesting a potential adaptive response of the renal system to the initial insult.

The trend in creatinine levels exhibited a transient elevation post-chemotherapy, a pattern noted in studies focusing on platinum-based chemotherapeutic agents. This trend may signify a temporary impairment in renal function, possibly related to the nephrotoxic effects of specific agents. The subsequent reversion to near-baseline creatinine levels is indicative of the reversible nature of certain chemotherapy-induced renal insults. This temporal pattern underscores the importance of monitoring creatinine levels during and after treatment cycles to promptly identify and address potential nephrotoxicities.

The analysis of GFR values revealed a progressive decline during chemotherapy, with variations noted across different chemotherapy regimens. This pattern corresponds to existing literature indicating agent-specific effects on renal hemodynamics. Taxanes, for example, have been associated with alterations in renal blood flow and GFR reduction. The observed heterogeneity in GFR changes emphasizes the importance of considering specific chemotherapy agents when assessing their impact on renal function.

A noteworthy correlation emerged between changes in renal parameters and specific chemotherapy regimens. Platinum-based regimens exhibited a more pronounced impact on urea and creatinine levels, aligning with the known nephrotoxic potential of these agents. Taxane-containing regimens, on the other hand, demonstrated a distinct influence on GFR values. This correlation emphasizes the importance of tailoring treatment strategies based on individual patient profiles and the specific chemotherapeutic agents employed.

The identified patterns and correlations carry important clinical implications. The transient nature of the observed elevations in urea and creatinine levels, coupled with the overall maintenance of renal function within acceptable ranges, suggests a degree of adaptability in the renal system of NPC

patients during chemotherapy. These findings underscore the importance of vigilant monitoring to promptly identify and manage potential nephrotoxicities, allowing for treatment adaptations that optimize therapeutic efficacy while safeguarding renal health.

The observed patterns and correlations warrant further exploration in prospective studies with larger cohorts and longer follow-up periods. Understanding the sustained impact of chemotherapy on renal function, as well as the potential implications for long-term renal health, remains an important avenue for future research. Additionally, investigating strategies to mitigate chemotherapy-induced renal stress and optimizing treatment regimens to minimize nephrotoxic effects could enhance patient outcomes.

Clinical Implications and Relevance to Treatment of Nasopharyngeal Carcinoma (NPC) Patients

The findings from our study investigating the impact of chemotherapy on urea levels, creatinine levels, and glomerular filtration rate (GFR) values in NPC patients at Santa Elisabeth Hospital in Batam carry significant clinical implications, shaping the landscape of treatment strategies and patient care.

The observed patterns of transient elevations in urea and creatinine levels underscore the importance of vigilant monitoring during chemotherapy. Early detection of these changes is paramount to the timely initiation of interventions to mitigate potential nephrotoxicities. Regular renal function assessments, especially in the initial treatment cycles, can guide clinicians in adapting chemotherapy regimens, considering dose adjustments, or incorporating renoprotective measures to minimize renal stress.

The correlation between specific chemotherapy regimens and renal parameter alterations highlights the need for personalized treatment approaches in NPC patients. Tailoring chemotherapy regimens based on individual patient profiles, including pre-existing renal conditions, can optimize therapeutic efficacy while minimizing the risk of nephrotoxic effects. Clinicians should consider the potential impact of specific agents on renal function when selecting and adjusting treatment protocols.

The transient nature of the observed elevations in urea and creatinine levels suggests that renal adaptability plays a role in the response to chemotherapy. However, the relevance of continued monitoring in post-treatment periods cannot be overstated. Regular follow-up assessments of renal parameters allow clinicians to track the persistence or resolution of chemotherapy-induced renal changes and implement further interventions if needed. This approach ensures that any delayed or lingering effects on renal function are promptly addressed.

Understanding the nuances in renal responses to specific chemotherapy agents provides an opportunity to optimize treatment protocols. Clinicians can weigh the therapeutic benefits against potential renal risks, making informed decisions regarding drug selection, dosages, and treatment schedules. This optimization is crucial not only for the management of nasopharyngeal carcinoma but also for preventing long-term renal complications that could impact the overall quality of life for NPC patients.

Incorporating the findings into patient education is essential for fostering informed decision-making and shared responsibility in the treatment journey. NPC patients should be apprised of the potential impact of chemotherapy on renal function, empowering them to actively engage in discussions about treatment options, potential side effects, and the importance of ongoing renal monitoring. Patient-centered care that integrates their perspectives and preferences ensures a more comprehensive and collaborative approach to treatment.

The clinical implications of our study extend beyond immediate patient care to contribute to the development of future research agendas and clinical guidelines. Our findings underscore the need for further prospective studies that delve into the sustained impact of chemotherapy on renal function in NPC patients. The data generated from such studies could inform the creation of evidence-based guidelines, assisting clinicians in making informed decisions about renal monitoring and adapting treatment strategies.

4. CONCLUSION

In the realm of nasopharyngeal carcinoma (NPC) management, our research at Santa Elisabeth Hospital in Batam sought to illuminate the intricate relationship between chemotherapy and renal dynamics. The comprehensive analysis of urea levels, creatinine levels, and glomerular filtration rate (GFR) values in NPC patients undergoing chemotherapy has unveiled nuanced patterns, trends, and correlations that hold profound implications for clinical practice. The observed transient elevations in urea and creatinine levels during the early phases of chemotherapy align with existing literature on chemotherapy-induced nephrotoxicity. These changes, indicative of potential renal stress, are, however, accompanied by a remarkable adaptability in renal function, evidenced by the subsequent stabilization or mild decline in these parameters. This adaptability underscores the resilience of the renal system in the face of chemotherapy-induced insults and prompts a reevaluation of the temporal dynamics of renal responses during NPC treatment. The transient elevation in creatinine levels, primarily associated with platinum-based regimens, accentuates the importance of vigilant monitoring and underscores the reversible nature of certain chemotherapy-induced renal insults. Notably, the subsequent reversion to near-baseline creatinine levels emphasizes the resilience of the kidneys and the potential for recovery, contributing to the overall safety profile of chemotherapy in the context of nasopharyngeal carcinoma. The progressive decline in GFR, while statistically significant, remains within acceptable limits for many patients, revealing the dynamic nature of renal hemodynamics during chemotherapy. The variations in GFR changes across different chemotherapy regimens emphasize the agent-specific effects on renal function, providing crucial insights for personalized treatment approaches. In the clinical context, these findings offer tangible guidance for healthcare providers navigating the chemotherapy landscape for NPC patients. The importance of early detection and management of nephrotoxicities, personalized treatment approaches, and continued monitoring in post-treatment periods cannot be overstated. These insights pave the way for optimizing chemotherapy protocols, balancing therapeutic efficacy with the mitigation of potential renal risks. Moreover, our research contributes not only to immediate patient care but also to the broader canvas of oncological knowledge. The identified patterns and correlations offer a foundation for future research agendas, influencing the development of evidence-based guidelines and shaping the discourse on renal considerations in NPC treatment.

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