ORIGINAL RESEARCH

Examining the Impact of Major Orthopedic Surgery on Patients' Nutritional Status: A Prospective Study in a Hospital Setting

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Received: 12 November, 2023 Accepted: 16 December, 2023

ABSTRACT

Background:Malnutrition presents a significant challenge for individuals residing in long-term care facilities, and it remains a concern for patients entering hospitals, many of whom may already be malnourished or susceptible to malnutrition. This study seeks to assess how major elective orthopaedic surgery impacts the nutritional status of patients within a recently established tertiary care center.**Methods**:This prospective study involved 100 patients admitted and undergoing orthopaedic procedures within the Department of Orthopaedics over a one-year period. Nutritional assessments were conducted utilizing both anthropometric measurements (BMI) and biochemical markers (Pre-albumin and Transferrin). Evaluations were performed at three key time points: preoperative, postoperative (at suture removal), and during a three-month follow-up. A comprehensive proforma was completed for each patient, capturing essential information such as demographics, diagnosis, surgical procedures, existing comorbidities, and nutritional parameters.**Results**:Throughout the one-year duration, a total of 100 patients were assessed, with 62 cases (62% follow-up) being actively monitored. Notably, the pre-albumin and transferrin values at various stages (preoperative, postoperative, and follow-up) exhibited significant differences among patients with humerus shaft fractures and tibia shaft fractures. Additionally, when comparing mean pre-albumin values between the humerus shaft fracture and lower limb surgery groups, a statistically significant difference was observed ($p<0.05$**).**Conclusion**:Our findings lead us to conclude that pre-albumin proves to be a dependable nutritional marker. It can be employed as a routine assessment tool for patients identified as at risk of malnutrition. This proactive use of pre-albumin allows for timely nutritional interventions, aiming to prevent potential complications associated with malnutrition.

Keywords:Nutritional Status, Pre-Albumin, Transferrin, Upper Limb, Lower Limb

INTRODUCTION

Trauma and surgical interventions elicit a complex array of physiological changes collectively known as the acute phase reaction (APR). This intricate response is set in motion by various stimuli, encompassing nociceptive stimulations, tissue injury, episodes of tissue ischemia and subsequent reperfusion, as well as hemodynamic disturbances commonly encountered in patients undergoing such medical procedures.[1] The APR manifests primarily through the release of counter-regulatory hormones, intricate metabolic alterations, and the hepatic synthesis of numerous acute phase factors, including but not limited to C-reactive protein, haptoglobin, and complement proteins.A distinctive feature of the acute phase reaction is the development of resistance to nutritional support. This implies that patients undergoing trauma or surgery may exhibit challenges in effectively utilizing nutritional interventions. In instances of non-complicated surgery or trauma of low to moderate severity, the metabolic changes associated with the APR are typically minor and self-limited.[2]Conversely, in cases involving complicated surgical procedures or major trauma, the acute phase reaction becomes more pronounced and can extend over a significant duration. The intensity and prolonged nature of the APR in such situations underscore the importance of understanding and managing the associated physiological changes to optimize patient outcomes and guide appropriate nutritional support strategies.Malnutrition, whether arising from inadequate nutrient intake or heightened energy demands during periods of illness, signifies a complex imbalance that extends beyond a mere

quantitative reduction in body weight. This condition intricately involves the depletion of essential resources, encompassing not only body fat but also lean body mass, including crucial components like muscle tissue.At the core of malnutrition's profound effects lies the body cell mass, a comprehensive entity constituting the fat-free portion comprised of muscle, internal organs, and the immune system. The body cell mass is a dynamic reservoir that plays a pivotal role in maintaining physiological homeostasis. When this vital component descends below 60% of the normal levels observed in young adults, a critical threshold is breached, ushering in a precarious state where the ability to sustain life becomes significantly compromised.Beyond the immediate threat to survival, malnutrition exacts a toll on various physiological systems. A diminished body cell mass results in a weakened immune response, making individuals more susceptible to infections and impairing their ability to mount effective defenses against illnesses. Furthermore, the breakdown of muscle tissue not only contributes to physical frailty but also hampers overall organ function.[3]Recognizing the intricate web of consequences associated with malnutrition emphasizes the urgency of holistic interventions. Timely nutritional support, coupled with comprehensive healthcare strategies, becomes paramount in addressing the root causes of malnutrition and mitigating its far-reaching impacts. By understanding the multifaceted nature of this health challenge, healthcare professionals can implement targeted measures to restore and maintain the delicate balance within the body, thereby enhancing the overall well-being and resilience of individuals facing malnutrition.

Severe wasting, with its ultimate consequence being mortality, represents a critical endpoint that underscores the gravity of physiological imbalances. However, it is crucial to acknowledge that factors beyond direct malnutrition contribute to body wasting, including trauma, the natural aging process, and chronic diseases.In the aftermath of trauma, injury, or surgical procedures, the body orchestrates a complex response involving the production of catabolic cytokines.[4,5] This intricate biochemical cascade results in an augmented expenditure of energy and the breakdown of protein stores, particularly within muscle tissues. This catabolic phase serves a dual purpose—it facilitates the activation of inflammatory processes essential for healing and triggers reparative mechanisms crucial for recovery.The interplay between catabolism and the subsequent reparative phase is a dynamic process. In individuals who are in good health and receive adequate nutrition, the transition through these phases is typically smooth.[6] The reparative phase is characterized by constructive physiological activities, promoting the restoration of normal bodily functions without significant long-term consequences.It is essential to recognize the adaptive nature of these catabolic responses, which play a pivotal role in the body's ability to heal and recover from trauma. However, the importance of nutrition cannot be overstated, as it serves as a foundational element supporting the body's resilience during these phases. Optimal nutrition facilitates a more efficient transition from catabolism to repair, reducing the risk of prolonged consequences associated with body wasting and enhancing overall recovery outcomes. This nuanced understanding of the intricate relationship between physiological responses, nutrition, and recovery is paramount in developing comprehensive strategies for managing the aftermath of trauma, aging, and chronic diseases.[7]Protein-energy malnutrition (PEM) is a complex clinical condition characterized by the chronic or acute loss of lean body protein, leading to a state of specific nutrient deficiency that manifests in measurable changes in body function. This multifaceted state involves not only the depletion of muscle and body fat but also a decline in visceral proteins, emphasizing the systemic impact on overall health. PEM is recognized as a significant health concern due to its association with unfavorable outcomes during illness, emphasizing the imperative for timely intervention and nutritional support.

Within the realm of hospitalized patients, the prevalence of PEM is staggering, with estimates suggesting that 30% to 60% of individuals admitted for acute illnesses experience malnourished states. What exacerbates this situation is the observation that nutritional status tends to deteriorate further during the hospitalization period. This alarming trend underscores the urgent need for proactive measures, including the recognition of malnutrition and the implementation of robust monitoring protocols and nutritional interventions to address the unique needs of patients during their hospital stay.A substantial contributing factor to the high incidence of malnutrition in hospital settings lies in the inadequate recognition and monitoring of nutritional status.[8] This, coupled with suboptimal nutrient intake during hospitalization, necessitates a paradigm shift towards comprehensive nutritional assessment and intervention strategies.Moreover, malnutrition casts its shadow over residents in long-term care facilities, further emphasizing the pervasive nature of this issue. Additionally, patients entering hospitals may already be malnourished or at risk of malnutrition, warranting a nuanced and targeted approach to nutritional assessment and intervention from the moment of admission.[9]The specific focus of this study is to delve into the repercussions of major elective orthopaedic surgery on the nutritional status of patients within a recently established tertiary care center.

MATERIALS AND METHODS

In conducting this prospective study, our primary focus was on a cohort of 100 patients who were not only admitted to the hospital but also underwent orthopaedic procedures within the Department of

Orthopaedics over the course of a one-year period. Our objective was to delve deeply into the nutritional status of these individuals, employing a comprehensive approach that combined anthropometric measurements, specifically Body Mass Index (BMI), with selected biochemical markers—Pre-albumin and Transferrin.Recognizing the superior predictive capabilities of pre-albumin and transferrin in reflecting the intricacies of nutritional status, we made a deliberate choice to concentrate our analysis on these markers. Consequently, other commonly used biochemical indicators, such as albumin and total lymphocyte count, were not included in our assessments.

To capture the nuanced changes in nutritional parameters across different stages of the orthopaedic journey, we strategically implemented a multi-time point evaluation strategy. This involved assessing patients preoperatively, during the immediate postoperative phase (at the time of suture removal), and at a three-month follow-up postoperatively. By adopting this systematic approach, we aimed to gain a comprehensive understanding of how the nutritional status of patients evolves throughout the orthopaedic treatment continuum.Ensuring a meticulous and standardized data collection process was paramount to the success of our study. To this end, we utilized a detailed proforma for each patient, encompassing a wide array of information. This included demographic details to establish a comprehensive patient profile, the primary diagnosis prompting the orthopaedic intervention, specifics of the surgical procedure undertaken, any existing comorbidities, and the detailed nutritional parameters of interest.The integration of both anthropometric measurements and biochemical markers, coupled with a thorough evaluation at distinct time points, provides a robust and holistic perspective on the nutritional landscape of patients undergoing orthopaedic procedures. By adopting this comprehensive study design, we anticipate shedding light on potential correlations between nutritional markers and clinical outcomes. Ultimately, our findings aim to contribute valuable insights into the impact of major elective orthopaedic surgery on the nutritional well-being of individuals within the unique context of a newly established tertiary care center.

In our study, the categorization of wound-related complications revolves around two distinct classifications: superficial wound infection and deep wound infection. To provide clarity, we define superficial wound infection as an instance where the infection has not breached the deep fascia. In this scenario, the infection is confined to the superficial layers of the wound, and there is no necessity for surgical intervention to control the infection. Instead, this type of infection typically responds well to dressings and antibiotic therapy, constituting a more manageable and less invasive form of wound complication.On the other hand, deep wound infection, as characterized in our study, occurs when the infection extends beyond the superficial layers and breaches the deep fascia. In these cases, a more intensive approach is required for the control of the infection. This involves a combination of surgical intervention, such as washout and drainage procedures, in conjunction with antibiotic therapy. The need for surgical measures underscores the severity and depth of the infection, necessitating a comprehensive strategy to address the underlying issues and ensure effective control of the infectious process.By clearly delineating between superficial and deep wound infections in our study, we aim to provide a detailed and precise classification of wound-related complications. This distinction allows for a nuanced analysis of the nature and management of these complications, contributing to a more comprehensive understanding of the impact of major elective orthopaedic surgery on patient outcomes within the scope of wound healing.

RESULTS

During the course of our study spanning one year, a total of 100 patients underwent comprehensive assessment within the Department of Orthopaedics. This cohort served as the foundation for our investigation into the impact of major elective orthopaedic surgery on the nutritional status of individuals. Subsequently, to gauge the long-term effects and outcomes, a total of 62 cases were actively followed up. This follow-up, constituting 62% of the initially assessed patients, provides a substantial and meaningful subset for a more in-depth analysis of the study parameters and patient outcomes. The decision to follow up on this percentage of cases allows us to draw insightful conclusions regarding the sustained effects and trajectory of nutritional changes beyond the immediate postoperative period, contributing to the robustness of our study findings.

Table 1: Patients distribution and follow-up at three months according to surgery

Type of surgery	No. of patients	Patients follow-up at three months
Humerus shaft fracture	76	46
Tibia shaft fracture	24	16
Total	100	62

Figure 1: Patients distribution and follow-up at three months according to surgery

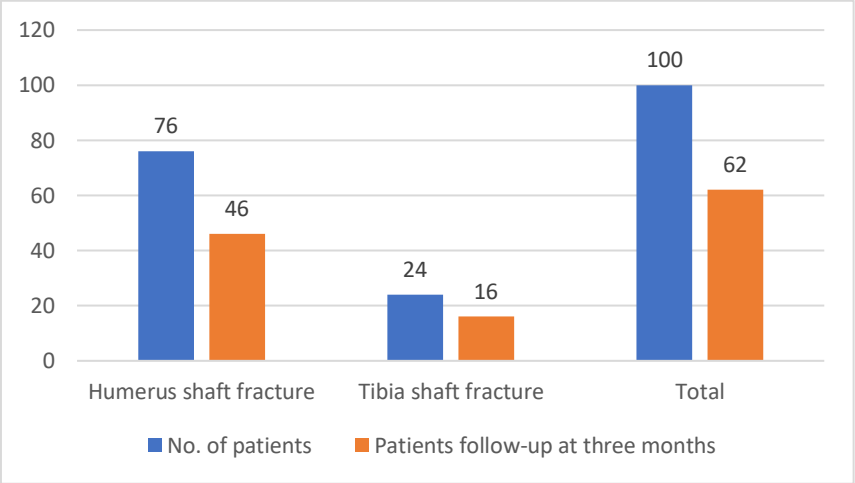

Table 2: Demographic profile of patients evaluate at three month follow-up

Demographic profile		Humerus shaft fracture (N=46)	Tibia shaft fracture (N=16)	P-value
Age (yrs)		49.52	52.58	<0.05*
Gender	Male	22	6	>0.05
	Female	22	10	
Comorbidity	Diabetes mellitus	8	4	>0.05
	Hypertension	6	6	
BMI	<20kg/m2	2	0	>0.05
	>25 kg/m2	18	2	
Complications	Superficial infection	2	4	>0.05
	Deep infection	0	2	

The comparative analysis of pre-albumin and transferrin values among patients undergoing major elective orthopaedic surgery, specifically those with humerus shaft fractures and lower limb surgeries, revealed significant variations across the three designated time points: preoperative (pre-op), postoperative (post-op), and during the follow-up period.The pre-albumin and transferrin values exhibited discernible differences, highlighting the dynamic nature of these nutritional markers in response to the orthopaedic interventions. These variations signify distinct phases in the nutritional trajectory of patients, likely influenced by the surgical procedure, the subsequent postoperative period, and the recovery phase during follow-up.The observed significant differences underscore the importance of monitoring these specific nutritional parameters throughout the orthopaedic journey. Such insights not only contribute to our understanding of the immediate impact of surgery but also shed light on the recovery and long-term nutritional implications associated with major orthopaedic interventions. This nuanced analysis enriches our comprehension of the nutritional dynamics in patients undergoing humerus shaft fracture and lower limb surgery, potentially informing tailored nutritional interventions for optimized patient care.

In our study, a detailed comparison of mean values was conducted between two distinct groups of patients undergoing major elective orthopaedic surgery: those with humerus shaft fractures and those with tibia shaft fractures. The focus of this comparison centered around pre-albumin and transferrin values.The analysis revealed a statistically significant difference in pre-albumin values between the two groups. This disparity suggests that individuals with humerus shaft fractures and those with tibia shaft fractures exhibit distinct pre-albumin levels preoperatively, underscoring potential variations in their nutritional status at the onset of the study.In contrast, the comparison of transferrin values between the two groups did not yield a statistically significant difference, as indicated by a p-value greater than 0.05. While there may be variations in transferrin levels between the humerus and tibia fracture groups, these differences did not reach statistical significance in our study.

This differentiation in pre-albumin and transferrin values between the two fracture groups provides valuable insights into the specific nutritional nuances associated with different types of orthopaedic surgeries. Understanding these distinctions can contribute to tailored nutritional management strategies for patients undergoing major elective orthopaedic procedures, promoting more targeted and effective care in the context of humerus and tibia shaft fractures.

DISCUSSION

In our comprehensive exploration of the nutritional dynamics in patients undergoing major elective orthopaedic surgery, the significant and consistent differences observed in the values of biochemical markers, specifically Pre-albumin and transferrin, across the preoperative, postoperative, and follow-up phases, contribute substantively to the growing body of knowledge surrounding orthopaedic trauma care.[10,11]The identified association between the nutritional status of trauma patients and critical factors such as the duration of hospitalization, surgical procedures, and anesthesia highlights the intricate interplay between nutritional well-being and the various facets of patient care. These findings resonate with existing literature emphasizing the profound impact of nutritional status on recovery outcomes and the overall trajectory of orthopaedic interventions.Of particular interest is the relatively lower incidence of undernutrition reported in our study, amounting to 3.22%. This stands in contrast to the higher prevalence figures, around 40%, frequently cited in the literature for orthopaedic inpatients. This discrepancy is elucidated by our deliberate inclusion criteria, focusing exclusively on patients undergoing planned elective major orthopaedic surgery. By adopting this targeted approach, we sought to isolate a cohort characterized by a more controlled health condition, thus offering a unique perspective on nutritional status in the context of elective orthopaedic procedures.

The deliberate choice to include patients undergoing planned elective major orthopaedic surgery not only refines our study's focus but also underscores the critical influence of patient selection criteria on the observed prevalence of undernutrition.[12] This approach enriches the specificity and applicability of our findings, providing nuanced insights for clinicians and researchers alike into the intricate relationship between nutritional status and the outcomes of planned orthopaedic interventions.In conclusion, our study adds a valuable layer to the understanding of nutritional dynamics in orthopaedic trauma care. The identified correlations between biochemical markers and key clinical parameters offer a foundation for more targeted nutritional interventions, thereby enhancing patient care and outcomes in the realm of elective orthopaedic surgery.The nuanced examination of biochemical parameters in our study has unveiled an intriguing aspect—the values, while notably improved at follow-up compared to the postoperative level, do not fully return to the preoperative baseline even at the three-month mark. This observation suggests that the recovery trajectory of these biochemical markers extends beyond the immediate postoperative period, necessitating a more prolonged follow-up to ascertain the precise duration required for these parameters to normalize and reach preoperative levels.[13]The persistent disparity between postoperative and preoperative levels, even at the three-month follow-up, raises pertinent questions about the extended impact of major elective orthopaedic surgery on the patients' biochemical profile. This finding underscores the need for a more protracted monitoring period to capture the full spectrum of recovery and to discern the precise timeline for these biochemical parameters to revert to their preoperative states.The call for extended follow-up is particularly crucial in optimizing patient care. It informs healthcare practitioners about the duration and trajectory of recovery, allowing for tailored interventions and a more informed management of patients undergoing major elective orthopaedic surgery. This proactive approach aligns with the evolving understanding of the postoperative recovery continuum, emphasizing the importance of a comprehensive and prolonged assessment to ensure optimal patient outcomes.In summary, our study hints at the necessity for extended follow-up to accurately delineate the recovery timeline of biochemical parameters post-major elective orthopaedic surgery. This insight contributes to the refinement of postoperative care strategies, fostering a more nuanced and patient-centered approach in managing the aftermath of these procedures.[14]

The meticulous comparison of nutritional parameters between patients with humerus shaft fractures and those with tibia shaft fractures yielded intriguing insights. Surprisingly, no substantial differences were observed in the behavior of these nutritional markers, indicating a uniform response regardless of the fracture type. Similarly, when extending the comparison to patients with humerus shaft fractures versus those undergoing lower limb surgery, the nutritional parameters exhibited comparable patterns, suggesting that the location and type of surgery did not significantly influence the observed nutritional dynamics.[15]Within the subgroup of patients with tibia shaft fractures, a distinctive trend emerged. Overweight patients in this category were found to be more predisposed to wound infections. This specific association underscores the multifaceted interplay between body weight, postoperative complications, and the potential impact on wound healing processes. The recognition of such associations emphasizes the importance of individualized patient assessments to anticipate and mitigate specific risks.Delving deeper into the analysis, a unique consideration surfaced when focusing on upper limb patients. Hypertension, in this context, emerged as a significant factor affecting the patterns of changes in nutritional marker levels. The proposed hypothesis links this finding to the potential influence of blood loss during surgery. The intricate relationship between hypertension, surgical procedures, and alterations in nutritional markers in upper limb patients warrants further exploration, offering valuable insights into the nuanced dynamics within this specific subgroup.In essence, these findings underscore the complexity of factors influencing nutritional parameters in the

context of orthopaedic surgery. While no distinct variations were identified based on fracture type or surgical location, the associations with overweight status, hypertension, and surgical factors in specific subsets highlight the need for a tailored and patient-centered approach. Understanding these nuanced relationships not only contributes to the refinement of orthopaedic care strategies but also reinforces the importance of personalized considerations in managing the nutritional aspects of patients undergoing diverse orthopaedic interventions.[16,17]

The investigation into wound infections among patients in our study revealed a noteworthy observation: there was no apparent correlation between the occurrence of wound infections and the nutritional status of the patients. This finding stands in contrast to existing literature that often cites a positive correlation between undernutrition and the incidence of wound infections. One potential explanation for this disparity in our study is the relatively low prevalence of undernutrition, which was detected in only 3.22% of the study population. The limited number of undernourished individuals within the cohort may have mitigated the expected correlation between nutritional status and wound infections, highlighting the importance of considering the baseline characteristics of the study population in interpreting these outcomes.[18]A key insight derived from our study relates to the comparison of nutritional markers, specifically pre-albumin and transferrin. While both markers are commonly utilized in nutritional assessments, our findings suggest that pre-albumin may serve as a more reliable correlate of nutritional status compared to transferrin in the context of our study population. Despite previous studies indicating the effectiveness of transferrin as a nutritional marker, the observed correlation with nutritional status was stronger for pre-albumin in our investigation. This nuanced distinction suggests that the choice of nutritional markers may impact the accuracy and sensitivity of nutritional assessments, and in our study, pre-albumin emerged as a potentially superior marker.These findings contribute valuable insights to the ongoing discourse on nutritional assessment in the context of orthopaedic surgery. They underscore the need for a nuanced understanding of the specific patient population under investigation and emphasize that the choice of nutritional markers warrants careful consideration based on the characteristics of the study cohort. As our understanding of nutritional markers continues to evolve, the identification of markers that exhibit superior correlations with nutritional status is crucial for refining clinical assessments and optimizing patient care.

CONCLUSION

The conclusion drawn from our study underscores the effectiveness of pre-albumin as a reliable nutritional marker. Our findings indicate that pre-albumin demonstrates a robust correlation with nutritional status, making it a valuable tool for routine use in patients at risk of malnutrition. By incorporating pre-albumin assessments into routine clinical practice, healthcare professionals can proactively evaluate the nutritional status of individuals and take timely and appropriate measures to prevent complications.The proactive use of pre-albumin as a nutritional marker serves a dual purpose. First, it facilitates the early identification of patients at risk of malnutrition, allowing for prompt intervention and the implementation of targeted nutritional measures. Second, it enables healthcare providers to take preventive actions, mitigating the potential complications associated with malnutrition. This preventive approach aligns with the broader goal of optimizing patient outcomes and promoting overall well-being.In essence, the recognition of pre-albumin as a reliable nutritional marker in our study supports the integration of routine pre-albumin assessments into the care protocols for patients at risk of malnutrition. This proactive strategy not only enhances the quality of nutritional care but also contributes to a more comprehensive and patient-centered approach in managing individuals with heightened nutritional vulnerabilities.

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