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Correlation between early patient mobilization and length of stay and readmission among surgical cancer patients with hypoalbuminemia

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ABSTRACT

Background: Early mobilization is an important component of postoperative care and a commonly used indicator of patient prognosis. Postoperative complications, prolonged length of stay, and hospital readmission are common after cancer surgery. The purpose of this study was to evaluate the relationship between early mobilization in hypoalbuminemia cancer patients and length of stay and readmission after surgery.

Methods: We conducted a retrospective cohort study with total sampling of eligible cancer patients treated at Prof. Dr. R.D Kandou General Hospital. Patients were categorized based on initiation of postoperative early mobilization. The main outcomes were prolonged length of stay (LOS > 10 days) and 30-day readmission.

Results: Thirty-four patients met inclusion criteria, with 52.94% receiving early mobilization. Prolonged hospitalization was frequent, affecting 88.88% of patients, and one-third required readmission within 30 days. No significant association was found between early mobilization and either length of stay or readmission.

Conclusion: Although early mobilization did not show measurable benefits in these outcomes, lack of statistical association does not imply clinical irrelevance. Early mobilization therefore remains clinically justified, not as a guarantee of shorter hospitalization, but as a strategy to preserve functional independence and mitigate the physiological costs of immobility.

Keywords: early mobilization, cancer, surgery, length of stay, readmission..
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INTRODUCTION

Hypoalbuminemia refers to abnormally low serum albumin levels. Hypoalbuminemia is often associated with malnutrition and a higher risk of postoperative complications, including impaired wound healing. Preoperative and postoperative hypoalbuminemia are recognized markers of malnutrition and increased surgical risk, and therefore require targeted nutritional management. Serum albumin levels are often assessed in critically ill or malnourished patients, as hypoalbuminemia is common in clinical practice.[1] In practice, patients undergoing surgery are required to have normal albumin levels before surgery. Many studies have concluded that hypoalbuminemia in patients undergoing surgery and postoperatively is associated with prolonged wound healing, length of stay, readmission, and increased hospital costs.[2,3]

Early mobilization plays a key role in postoperative care, as it supports functional recovery and helps prevent complications related to prolonged bed rest. Starting mobilization soon after surgery has been shown to shorten hospital stays and reduce the negative physiological effects of immobility.[4] For optimal postoperative recovery, appropriate nutritional support must therefore be combined with timely functional interventions, including early mobilization.

Although early mobilization has been widely studied across different surgical populations, its effects on clinical outcomes in cancer patients with hypoalbuminemia are still not well established. As a result, this study aims to examine the relationship between early mobilization and clinical outcomes, specifically hospital length of stay and readmission rates, in surgical cancer patients with hypoalbuminemia.

METHODS

This retrospective cohort study used medical records of surgical cancer patients with hypoalbuminemia treated at Prof. Dr. R.D. Kandou General Hospital, Indonesia, between November 2024 and April 2025. Adult patients (≥18 years) with serum albumin levels <3.0 g/dL at admission who received albumin therapy were included. Of the 34 eligible patients, 18 underwent early mobilization, as documented in postoperative rehabilitation records by medical rehabilitation physicians or nursing staff. Patients with incomplete records were excluded.

Collected data included demographic characteristics, cancer diagnosis, lengths of hospital stay, discharge status, and admission laboratory values (serum albumin and hsCRP). Information on albumin therapy was obtained from pharmacy records. Descriptive analyses

were performed using IBM SPSS version 27, with results reported as means ± standard deviations or percentages. Ethical approval was granted by the Ethics Review Committee of Prof. Dr. R.D. Kandou General Hospital, Manado, Indonesia (registration number: 105/EC/KEPK-KANDOU/VI/2025).

RESULTS

A total of 34 surgical cancer patients with serum albumin levels below 3.0 g/dL were included in this study. The baseline characteristics of the study population are summarized in **Table 1**.

Among the 34 patients, 18 (52.94%) underwent early mobilization, while the remaining patients did not receive early mobilization for various clinical reasons. As presented in **Table 2**, the timing of mobilization in the treatment group ranged from 1 to 16 days after surgery, with an average mobilization time of 7.9 days. In the control group, mobilization occurred within a broader range of 1 to 27 days, with a mean of 8.35 days.

The lengths of hospital stay differed slightly between the two groups. Patients in the treatment group had an average length of stay of 14.85 days, whereas those in the control group stayed an average of 15.59 days. Most patients in both groups were discharged alive. Only one patient had a length of stay of five days, which was consistent with the institutional Clinical Pathway for cancer patients. Although the control group had a longer average length of stay, this difference was not statistically significant (**Tables 3** and **4**).

Readmission within 30 days after discharge was observed in 33.33% of the study population. Of these cases, readmission occurred more frequently in the treatment group than in the control group, although this difference did not reach statistical significance (p = 0.153), as presented in **Table 5**. In the treatment group, readmission occurred between 11 and 16 days after discharge, whereas in the control group, readmission tended to occur earlier, with the shortest interval being two days after discharge. Detailed readmission timelines for both groups are shown in **Table 6**.

Overall, the results indicate that while early mobilization was associated with

Table 1. Baseline characteristics of the sample

Characteristics	Total	Treatment (n = 17)	Control (n = 17)	p-value
Gender				0.728
Male	14 (41.2%)	8 (57.1%)	6 (42.9%)	
Female	20 (58.8%)	9 (45.0%)	11 (55.0%)	
Age (years)				0.714
18–59	23 (67.6%)	11 (47.8%)	12 (52.2%)	
≥60	11 (32.4%)	6 (54.5%)	5 (45.5%)	
Occupation				0.871
ASN	5 (14.7%)	3 (60.0%)	2 (40.0%)	
Private	13 (38.2%)	6 (46.2%)	7 (53.8%)	
Unemployed	16 (47.1%)	8 (50.0%)	8 (50.0%)	
Education				1.000
Elementary–High School	25 (73.5%)	13 (52.0%)	12 (48.0%)	
Bachelor–Doctorate	9 (26.5%)	4 (44.4%)	5 (55.6%)	
Type of cancer				0.339
Female organs	11 (32.4%)	6 (54.5%)	5 (45.5%)	
Male organs	3 (8.8%)	2 (66.7%)	1 (33.3%)	
Digestive tract	13 (38.2%)	5 (38.5%)	8 (61.5%)	
Others	7 (20.6%)	4 (57.1%)	3 (42.9%)	
Nutritional status				0.919
Underweight	9 (26.5%)	4 (23.5%)	5 (29.4%)	
Normal	17 (50.0%)	9 (52.9%)	8 (47.1%)	
Overweight / Obese	8 (23.5%)	4 (23.5%)	4 (23.5%)	
Comorbidities				0.515
Chronic disease	12 (35.3%)	5 (41.7%)	7 (58.3%)	
None	22 (64.7%)	12 (54.5%)	10 (45.5%)	
Laboratory results				
Admission albumin (g/ dL)	2.28 ±0.51	2.68 ±0.26	0.838	
hsCRP (mg /L)	183.31 ±156.07	186.54 ±142.49	0.812	

Table 2. Research Sample Mobilization Period.

Mobilization			
Treatment Group		Control Group	
P1	No	K1	No
P2	1 day	K2	No
P3	No	K3	No
P4	10 days	K4	No
P5	5 days	K5	11 days
P6	No	K6	No
P7	16 days	K7	6 days
P8	No	K8	2 days
P9	7 days	K9	7 days
P10	12 days	K10	No
P11	2 days	K11	10 days
P12	No	K12	No
P13	No	K13	No
P14	No	K14	No
P15	8 days	K15	27 days
P16	10 days	K16	1 day
P17	8 days	K17	3 days

numerically shorter hospital stays and later readmission in some cases, these differences were not statistically significant in this study population.

DISCUSSION

The results of the study show that female patients were more prevalent in this study. This is due to the fact that in this study there were more gender-specific cancers in women, namely ovarian, cervical, and breast cancer. Most patients in this study were of working age (18–59 years). Increasing age is the most important risk factor for cancer overall and for many individual types of cancer. The overall incidence of cancer increases steadily with age.[5]

The average albumin level upon admission to the hospital in this study was < 2.5 g/dL, thus meeting the criteria for intravenous albumin administration according to the national formulary. Previous studies have shown that albumin levels are an important and independent prognostic predictor of clinical outcomes in cancer patients. Low albumin levels are significantly associated with length of stay, readmission, morbidity and mortality rates in cancer patients. Various studies have demonstrated a relationship between hypoalbuminemia and poor clinical outcomes. In patients with colorectal cancer, preoperative hypoalbuminemia increases the risk of postoperative morbidity and mortality.[6] Hypoalbuminemia also increases the risk of death in elderly cancer patients.[7] Rohit et al. concluded that patients with low albumin levels are more likely to experience increased length of hospital stay after colorectal cancer surgery.[2] This can be useful for surgeons in identifying 'high-risk' patients post-surgery and enabling early intervention.[2] The results of the study found that patients with lower albumin levels upon admission to the hospital were independently associated with higher 30-day readmission rates in elderly patients with hip fractures. These findings suggest that serum albumin may aid in perioperative risk assessment, and that prompt correction of hypoalbuminemia and malnutrition may reduce short-term readmission after hip fracture surgery in this high-risk

Table 3. **Length of Stay Samples Study.**

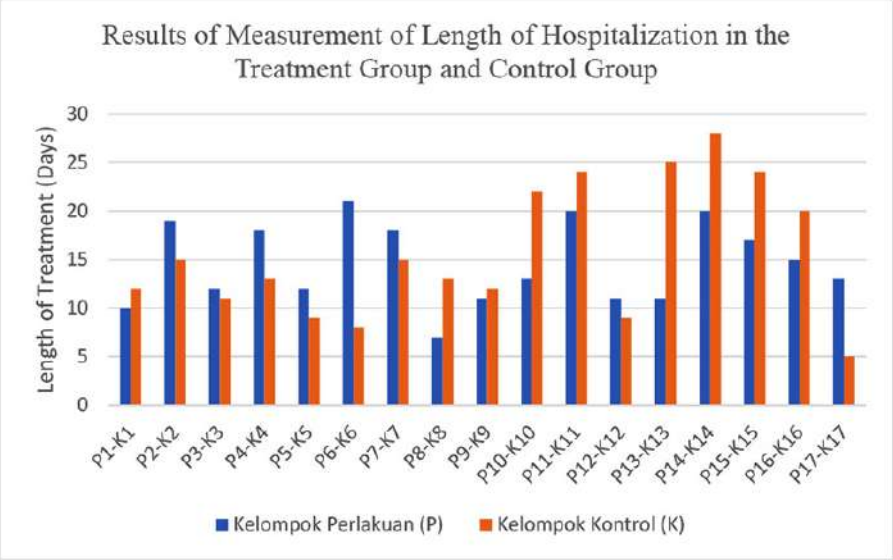

Table 4. **Results Measurement Statistics the Effect of Early Mobilization on Length of Hospitalization in Cancer Patients with Hypoalbuminemia**

Outcome	*p*-value
Prolonged length of stay	0.703

Table 5. **Results Measurement Statistics the Effect of Early Mobilization on Readmission of Cancer Patients with Hypoalbuminemia**

Readmission within 30 days	Total n (%)	Treatment Group n (%)	Control Group n (%)	*p*-value
Yes	6 (33.3%)	4 (22.2%)	2 (11.1%)	0.153
No	12 (66.7%)	6 (33.3%)	6 (33.3%)	–

Table 6. **Readmission Sample Study**

Readmission			
Treatment Group		Control Group	
P1	No	K1	No
P2	Readmission 12 days after KRS	K2	No
P3	No	K3	No
P4	Readmission 12 days after KRS	K4	Readmission 5 days after KRS
P5	No	K5	Readmission 2 days after KRS
P6	No	K6	No
P7	Readmission 11 days after KRS	K7	No
P8	No	K8	No
P9	Readmission 16 days after KRS	K9	No
P10	No	K10	Readmission 25 days after KRS
P11	No	K11	No
P12	No	K12	No
P13	No	K13	No
P14	No	K14	No

population.[8] Previous research findings have prompted the administration of albumin supplements to cancer patients, although evidence regarding the effects of albumin on cancer patients remains limited. Based on current guidelines, the administration of intravenous albumin for malnutrition and hypoalbuminemia in cancer patients is not an appropriate indication.

The average length of stay for patients in the study was calculated from the time of admission to the hospital until discharge, and data was obtained showing a longer length of stay (>5 days according to the Clinical Pathway) in both the treatment and control groups. This discrepancy may be explained by postoperative complications, unexpected comorbidities, and deviations from the institutional clinical pathway. Previous research by Oster et al. showed that 31.3% of patients with hypoalbuminemia had longer and higher lengths of stay than patients with normal serum albumin levels.[9] Another previous study in colorectal cancer patients also showed that hypoalbuminemia had a negative correlation with length of stay.[10] These results support the use of serum albumin levels as a predictor of clinical outcomes in cancer patients undergoing surgery. As the most abundant plasma protein in the body with various important functions, hypoalbuminemia is more likely to have adverse effects on patients, such as prolonged wound healing, infections, and suboptimal drug and nutrient distribution, which can prolong patient care duration and increase the likelihood of readmission.

Of the 34 cancer patients who underwent surgery with hypoalbuminemia, 52.94% underwent post-operative mobilization. In the treatment group, 58.82% underwent early mobilization and 47.05% in the control group. A total of 47.06% of patients did not undergo mobilization in this study. Early mobilization is associated with pain, anxiety, and motivation of patients.[11] Immobilization is very likely to occur in major surgeries, especially in critical illnesses such as cancer. For cancer patients, immobility is a lack of movement that can be caused by joint pain, muscle pain and stiffness, malnutrition, cancer metastasis, medication, anxiety, or depression. Immobility can also be a symptom of soft tissue sarcoma cancer that forms in muscles, fat, blood vessels, nerves, tendons, and joint linings.[12]

Surgery is a medical solution to health problems but often causes slow-healing surgical wounds if mobilization is not performed. This condition is influenced by nutrition, circulation, and metabolism and causes respiratory distress due to anesthesia and pain medication. Adequate nutrition, early mobilization, and breathing exercises are necessary for post-operative recovery.

Early mobilization after surgery is widely practiced by hospitals to reduce post-operative complications and ensure adequate discharge planning.[13] Early mobilization in surgical patients is greatly influenced by the patient's knowledge, pain, and emotions.[14]

In this study, 47.06% did not perform early mobilization, with 43.75% in the treatment group and 56.25% in the control group. In the treatment group that did not perform early mobilization, the average length of stay was 13.14 days, while in the control group, the average length of stay was 15.88 days. The prolonged length of stay in patients who were not mobilized is in line with the study conducted by Twomey,[15] which concluded that delayed mobilization (after the second day post-surgery) in major head and neck surgery with free flap reconstruction is a significant predictor of postoperative complications and length of hospital stay (>10 days). Delayed or absent mobilization may contribute to prolonged hospitalization, particularly in patients with underlying malnutrition.[16] Early mobilization is an important component of enhanced recovery after surgery (ERAS), which counteracts the adverse physiological consequences of surgical stress and immobilization. Early mobilization reduces the risk of postoperative complications, accelerates the recovery of functional walking capacity, and reduces the length of hospital stay, thereby reducing healthcare costs.[17]

Statistical results show a relationship between early mobilization and length of stay above 0.05, indicating no statistically significant association. This differs from the study conducted by Yulianto,[18] which concluded that there is a relationship between early mobilization and length of stay in patients after laparotomy. Different results were also obtained from a study conducted in Aceh, which showed a relationship between the independence of patients after laparotomy surgery and length of stay.[19] Patient independence after surgery greatly affects the activities carried out during the treatment period. Early weight-bearing significantly affects patients' ability to maintain independence and increases their chances of returning home.[20]

Patient readmission is the return of a patient for inpatient care at a hospital within a certain period of time, usually within 30 days after the patient has been discharged from previous inpatient care. Readmission is an important indicator of healthcare quality because it can reflect problems in care coordination, patient education, or uncontrolled chronic conditions, and has significant cost implications.[21]

In this study, the overall readmission rate among patients who underwent early mobilization was 33.33%. Of these readmissions, 66.67% occurred in the treatment group, while 33.34% were from the control group. Readmission is commonly used as an indicator of care quality and can be affected by several factors, including how well patient mobilization is managed following surgery or illness.

Early mobilization is widely recognized as an important component of patient care, as it helps prevent complications and may reduce unnecessary hospital readmissions. Many hospitals routinely encourage early mobilization after surgery to support recovery, minimize postoperative complications, and improve discharge planning. Although some studies suggest that early mobilization does not significantly affect readmission rates and report limited evidence supporting its benefits in gynecological and oncological surgeries,[22,23] it remains strongly recommended. This is largely due to its role in preventing the harmful physiological effects of prolonged bed rest and ensuring that patients are discharged in a timely manner and in a more independent condition, which can also influence the overall length of hospital stay.

Reducing hospital readmissions is often framed as a quality-of-care issue, but in reality it is just as much a financial and system-level concern. Readmissions place a measurable burden on healthcare resources and have been consistently linked to fragmented transitions of care rather than isolated clinical failure.[23] Evidence suggests that meaningful reductions do not come from single interventions, but from coordinated strategies that prioritize patient education, continuity across care settings, and early identification of social and environmental barriers after discharge.[23] Recovery does not end at hospital discharge, and readmission risk is shaped by a complex mix of medical vulnerability, health literacy, and post-discharge support. When healthcare systems acknowledge this complexity and adopt patient-centered, multidisciplinary approaches, the impact extends beyond fewer readmissions, driving greater cost-efficiency and more sustainable care delivery across the system as a whole.

One of the main drawbacks of this study is its relatively small sample size of just 34 patients, which lowers the analysis's statistical power and could mask more subtle relationships. Furthermore, the study group includes a very diverse range of cancer kinds, which means that the unique pathophysiological pathways of various cancers were not taken into account. Uncontrolled procedural factors were introduced into the sample by the mobilization procedures themselves, which differed significantly based on the particular type of operation carried out. Additionally, as early mobilization monitoring relied on different reporting standards between medical rehabilitation physicians and nursing personnel, the use of retrospective medical records raises the possibility of documentation bias. Lastly, the results may not be as generalizable to surgical cancer patients treated under diverse clinical procedures or institutional settings because the study was conducted just at one institution over a rather short six-month period.

CONCLUSION

Although early mobilization was not significantly associated with length of stay or readmission in this study, it remains a clinically important component of postoperative care to prevent functional decline and the adverse effects of prolonged bed rest. Early mobilization of cancer patients after surgery, even with hypoalbuminemia, is necessary because it accelerates organ function recovery, reduces the risk of complications, and speeds up overall healing. Hypoalbuminemia itself is a risk factor for complications, but early mobilization helps reduce these negative effects. Overall, early mobilization is a key component in programs to optimize post-operative outcomes, regardless of nutritional challenges such as hypoalbuminemia.

ETHICAL APPROVAL

This study was approved by the Health Research Ethics Committee of Prof. Dr. R.D. Kandou General Hospital, Manado, Indonesia (registration number: 105/EC/KEPK-KANDOU/VI/2025)

CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

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AUTHORS CONTRIBUTION

NA, S, EGK, and HUR conceptualized and designed the study, as well as contributed to the data collection and analysis. All authors participated in drafting, critically revising the manuscript for intellectual content, and approving the final version for submission.

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