

Postoperative Decline in Serum Albumin as an Independent Predictor of Delirium in Elderly Patients Following Total Joint ArthroplastyLaxmi Narayan Dash¹, Suraj Kumar Jain², Rakesh Ranjan Swain³, Gopabandhu Patra⁴¹Assistant Professor, Department of Anesthesiology, Saheed Rendo Majhi Medical College & Hospital, Bhawanipatna, Kalahandi, Odisha, India²Associate Professor, Department of Orthopaedics, VIMSAR, Burla, Odisha, India³Associate Professor, Department of Surgery, Bhima Bhoi Medical College & Hospital, Balangir, Odisha, India⁴Associate Professor, Department of Orthopaedics, SCB Medical College & Hospital, Cuttack, Odisha, India

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Abstract:**Background:** Elderly patients undergoing total joint arthroplasty frequently experience postoperative delirium, a serious complication that can result in higher morbidity, longer hospital stays, and long-term cognitive deterioration. Finding delirium risk factors that can be changed is essential to enhancing patient outcomes.**Aim:** To investigate whether a postoperative decrease in serum albumin levels independently predicts the development of delirium in elderly patients undergoing total joint arthroplasty.**Methods:** In this retrospective observational study, ninety senior patients (aged 65 and above) who underwent total joint arthroplasty were included. We gathered demographic information, serum albumin levels before and after surgery, and delirium rates. After adjusting for confounders, delirium and serum albumin reduction were examined in connection to each other using logistic regression. The statistical software SPSS 23.0 was used.**Results:** Of the patients, 24.4% experienced postoperative delirium (22 out of 90). Serum albumin levels decreased substantially more in delirium-affected patients (1.1 ± 0.4 g/dL) than in non-delirium-affected patients (0.6 ± 0.2 g/dL), with a p-value of less than 0.001. A almost fourfold increase in the probability of delirium was linked to each 1 g/dL drop in serum albumin, according to a logistic regression analysis (OR: 3.96, 95% CI: 2.02 – 7.76, $p < 0.001$). The best cut-off for delirium prediction, according to Receiver Operating Characteristic (ROC) curve analysis, was a serum albumin drop of >0.9 g/dL, with an AUC of 0.81, sensitivity of 72.7%, and specificity of 83.8%.**Conclusion:** A postoperative reduction in serum albumin strongly predicts delirium in elderly total joint arthroplasty patients. Monitoring serum albumin levels may help identify individuals at risk for postoperative delirium, allowing early management.**Recommendations:** Clinicians should regularly monitor older patients' serum albumin levels after total joint arthroplasty and intervene to prevent large declines. Further prospective trials are needed to validate these findings and investigate postoperative serum albumin maintenance techniques.**Keywords:** Postoperative delirium, Serum albumin, Total joint arthroplasty, Elderly patients, Risk factorsThis is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

A frequent and dangerous consequence for senior patients having major procedures, such as total joint arthroplasty, is postoperative delirium. It is typified by an abrupt and erratic disruption of awareness and thought processes, which frequently results in higher rates of morbidity, longer hospital stays, and more expensive medical care. In surgical treatment, delirium must be prevented and detected early since it is linked to higher mortality and long-term cognitive loss [1].

For older patients with problems like osteoarthritis, total joint arthroplasty—especially of the hip and

knee—is a common treatment used to relieve pain and restore function. Even though outcomes have improved due to advancements in perioperative care and surgical procedures, postoperative delirium is still a substantial problem in this population, with rates ranging from 10% to 40% depending on the research population and the diagnostic criteria utilised [2]. A number of variables, including advanced age, pre-existing cognitive impairment, comorbidities, and the surgical stress response, are involved in the multifactorial aetiology of delirium [3].

The goal of recent study has been to pinpoint modifiable risk factors that can be addressed in order to lower the prevalence of delirium. Among these, serum albumin levels as a measure of nutritional status have drawn interest. A reliable indicator of nutritional status and a significant predictor of surgical outcome is serum albumin. Infections, problems with wound healing, and death rates following surgery have all been linked to low preoperative blood albumin levels [4]. Less is understood, though, regarding how alterations in serum albumin following surgery affect the likelihood of delirium.

The physiological strain of surgery, in addition to fasting, fluid changes, and inflammation, can cause a postoperative drop in serum albumin levels that is substantial [5]. Given the function of albumin in regulating inflammation, transferring hormones, and preserving oncotic pressure, this reduction may make elderly individuals more susceptible to delirium. Gaining knowledge about the connection between delirium and postoperative serum albumin reduction may help avert this consequence.

This study aims to investigate the factors associated with postoperative delirium in elderly patients undergoing total joint arthroplasty.

Methodology

Study Design: A retrospective observational study.

Study Setting: The study was conducted at a tertiary care hospital in the Department of Orthopedics. The data collection period spanned from January 2021 to December 2022.

Participants: The study included 90 elderly patients, aged 65 years and above, who underwent total joint arthroplasty during the specified period.

Inclusion Criteria:

- Patients aged 65 years and above.
- Patients who underwent total hip or knee arthroplasty.
- Patients with a preoperative cognitive assessment available.
- Patients with complete medical records, including preoperative and postoperative laboratory data.

Exclusion Criteria:

- Patients with a history of psychiatric disorders or pre-existing delirium.
- Patients who underwent revision arthroplasty.
- Patients with incomplete medical records.
- Patients who were transferred to another facility postoperatively.

Bias: By adding all eligible patients who satisfied the inclusion criteria, an attempt was made to reduce selection bias. In order to mitigate potential biases, confounding variables, including age, gender, comorbidities, and kind of operation, were corrected throughout the statistical analysis.

Data Collection: Data were collected retrospectively from the hospital's electronic medical records. Information gathered included demographic details, preoperative serum albumin levels, postoperative serum albumin levels, incidence of postoperative delirium, and other relevant clinical variables.

Procedure: Serum albumin levels in the patients were assessed both before and after surgery on the first day after surgery. The Confusion Assessment Method (CAM) was used to measure delirium within the first 72 hours following surgery. We assessed the relationship between the occurrence of delirium and the postoperative serum albumin reduction.

Statistical Analysis: SPSS version 23.0 was used to analyse the data. Categorical variables were expressed as frequencies and percentages, and continuous variables were shown as means \pm standard deviations. After accounting for possible confounders, logistic regression models were used to examine the relationship between delirium and the drop in serum albumin following surgery. Less than 0.05 was the threshold for statistical significance.

Result

The study included 90 elderly patients who underwent total joint arthroplasty. The mean age of the participants was 72.5 ± 6.3 years, with 52 (57.8%) being female and 38 (42.2%) being male. The incidence of post-operative delirium was 24.4% (22 out of 90 patients).

Table 1: Baseline Characteristics of Patients

Characteristic	Total (N=90)	Delirium Group (N=22)	Non-Delirium Group (N=68)	p-value
Age (years)	72.5 ± 6.3	75.2 ± 5.7	71.7 ± 6.4	0.031*
Gender (Male/Female)	38/52	10/12	28/40	0.457
Preoperative Albumin (g/dL)	4.1 ± 0.5	4.0 ± 0.4	4.2 ± 0.5	0.089
Postoperative Albumin (g/dL)	3.4 ± 0.6	2.9 ± 0.4	3.6 ± 0.5	<0.001**
Serum Albumin Decrease	0.7 ± 0.3	1.1 ± 0.4	0.6 ± 0.2	<0.001**

(g/dL)				
Comorbidities (Yes/No)	62/28	18/4	44/24	0.048*

*p < 0.05, **p < 0.01

Serum albumin levels decreased significantly more in patients with postoperative delirium than in those without it (1.1 ± 0.4 g/dL vs. 0.6 ± 0.2 g/dL, $p < 0.001$). In comparison to the non-delirium group, the mean postoperative serum albumin level in the delirium group was considerably lower (2.9 ± 0.4 g/dL vs. 3.6 ± 0.5 g/dL, $p < 0.001$).

Table 2: Logistic Regression Analysis of Factors Associated with Postoperative Delirium

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age	1.07	1.01 – 1.13	0.028*
Male Gender	0.89	0.44 – 1.79	0.743
Preoperative Albumin (g/dL)	0.78	0.45 – 1.35	0.379
Postoperative Albumin (g/dL)	0.52	0.34 – 0.81	0.003**
Serum Albumin Decrease (g/dL)	3.96	2.02 – 7.76	<0.001**
Comorbidities	2.15	1.01 – 4.58	0.047*

*p < 0.05, **p < 0.01

A higher drop in serum albumin levels was independently linked to a higher likelihood of postoperative delirium, according to a logistic regression analysis. In particular, the likelihood of experiencing delirium increased by almost four times for each 1 g/dL drop in serum albumin (OR: 3.96, 95% CI: 2.02 – 7.76, $p < 0.001$).

Table 3: Receiver Operating Characteristic (ROC) Curve Analysis for Serum Albumin Decrease Predicting Delirium

Variable	Area Under Curve (AUC)	95% Confidence Interval (CI)	Cut-off Value (g/dL)	Sensitivity	Specificity
Serum Albumin Decrease	0.81	0.70 – 0.92	>0.9	72.7%	83.8%

With an AUC of 0.81 (95% CI: 0.70 – 0.92) according to the ROC curve analysis, the blood albumin reduction exhibited a good predictive value for postoperative delirium. For serum albumin decline, a cut-off value of >0.9 g/dL was found to be appropriate, with a sensitivity of 72.7% and specificity of 83.8%.

Additionally, it was discovered that comorbidities were substantially linked to a higher risk of postoperative delirium (OR: 2.15, 95% CI: 1.01 – 4.58, $p = 0.047$). Another important variable was age, where the odds of delirium increased by 7% with every year of age (OR: 1.07, 95% CI: 1.01 – 1.13, $p = 0.028$).

Discussion

The purpose of the study was to determine the risk variables for postoperative delirium in older individuals having total joint arthroplasty. The findings showed a strong correlation between the prevalence of delirium and a postoperative drop in serum albumin levels. More specifically, blood albumin levels declined much more in patients with delirium than in those without it. The statistical study demonstrated the significance of serum albumin as a predictor of postoperative cognitive problems by showing that the probabilities of developing delirium virtually quadrupled for every 1 g/dL reduction in serum albumin.

The study also found that age and the existence of comorbidities were important predictors of delirium. Delirium following surgery was more common in older patients and those with pre-existing medical issues. After correcting for these confounding variables, the decline in serum albumin levels continued to be the most potent independent predictor.

The predictive usefulness of serum albumin reduction was further substantiated by Receiver Operating Characteristic (ROC) curve analysis, with a cut-off value of >0.9 g/dL providing good sensitivity and specificity. According to this research, tracking postoperative serum albumin levels may prove to be a useful clinical tool in identifying patients who are more likely to have delirium early on.

In summary, the research emphasises the need of preserving sufficient blood albumin levels in senior patients undergoing major surgery and proposes that therapies targeted at averting a notable decline in albumin levels could potentially lower the rate of postoperative delirium.

In older patients undergoing total joint arthroplasty (TJA), a study evaluated the predictive usefulness of postoperative serum albumin decline (Δ Alb) for postoperative delirium (POD). Twenty-seven percent of the 328 elderly individuals in the research had POD. With an area under the curve

(AUC) of 0.821, the data showed that Δ Alb was a reliable predictor of POD. With an odds ratio (OR) of 2.43, the study concluded that Δ Alb was an independent risk factor for POD, underscoring its significance in the early detection of individuals at risk of delirium [6].

One study examined the preoperative C-reactive protein/albumin ratio (CAR) in older TJA patients as a potential risk factor for POD. The study discovered that, with an AUC of 0.804, CAR was substantially correlated with POD. With an OR of 3.04, preoperative CAR was found to be an independent risk factor for POD. The importance of inflammatory and nutritional indicators in predicting POD is highlighted by this study [7].

A study looked into the prognosis nutritional index (PNI) after primary total joint arthroplasty (TJA) and its relationship to POD. With an OR of 0.908, patients out of 994 who had lower preoperative PNI were more likely to have POD. According to the study, PNI's assessment of preoperative nutritional status is a strong indicator of postoperative disease (POD) in senior patients [8].

A study assessed the CAR (c-reactive protein/albumin ratio) in individuals older than 60 who were having total knee replacement surgery. With an AUC of 0.782, it was discovered that greater CAR was independently correlated with POD. According to the study, CAR is an effective marker for predicting POD, especially in the elderly [9].

Neutrophil-to-albumin ratio (NAR), CAR, and PNI are among the albumin-associated inflammatory and nutritional markers that have been studied to predict postoperative pain and swelling (POD) in older patients who have had total hip arthroplasty (THA). Age above 75 years and these indicators were found to be significant predictors of POD in the trial, and a nomogram model was created to help with clinical risk classification [10].

Conclusion

In conclusion, a postoperative decrease in serum albumin was a strong independent predictor of delirium in elderly patients following total joint arthroplasty. These findings suggest that monitoring serum albumin levels may be valuable in identifying patients at higher risk for postoperative delirium, enabling timely interventions to mitigate this complication.

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