Original Research Article

Pre-operative hypoalbuminemia: overlooked prior knee arthroplasty?

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ABSTRACT

Background: Role of preoperative serum albumin on primary total knee arthroplasty.
Methods: A total of 1022 patients who underwent primary knee arthroplasty were collected. All patients were divided into the control group (preoperative serum albumin ≥3.5 g/dl) and case group (preoperative serum albumin <3.5 g/dl). The risk factors of preoperative hypoalbuminemia and the postoperative complications were analyzed.
Results: Compared to controls, hypoalbuminemia patients were older (p<0.05), had higher risk for any complication such as delayed wound healing, pleural effusion, and pneumonia, lower BMI and longer hospital stay (p<0.001).
Conclusions: Preoperative hypoalbuminemia is more frequent in patients who are older, have poor nutritional condition, and have more than two concurrent disorders. Hypoalbuminemia before surgery is linked to a higher risk of postoperative problems.

Keywords: Hypoalbuminemia, Total knee arthroplasty, Risk factors, Postoperative complications

INTRODUCTION

The most abundant protein in human plasma is the albumin which plays a vital role in maintaining the physiological function of the body in normal condition.[1] Serum albumin <3.5 g/dl is defined as hypoalbuminemia.[2] This is routinely noticed in clinical practice commonly seen in elderly patients with chronic diseases such as diabetes mellitus, systemic hypertension and malnutrition. With advancement in our medical system in the recent decades, the percentage of elderly population is higher in our society and hence more of knee arthroplasty is now seen due to degenerative knee joints. However, the older population is found to have multiple co-morbid conditions, low compensatory ability and insufficient ability to tolerate hypoalbuminemia. Hence the role of this study is to assess if preoperative hypoalbuminemia can serve as one of the indicators for post operative complications such as wound infection, pneumonia, and limb swelling, increased Length of hospital stay which indirectly affects the patients and

their family financially and emotionally. All the patients undergoing primary total knee arthroplasty (TKA) were divided into the control group (preoperative serum albumin ≥3.5 g/dl) and case group (preoperative serum albumin <3.5 mg/dl) and postoperative complications of the two groups were observed and analyzed retrospectively. The results of the study could provide a basis for improving the prognosis of patients after knee arthroplasty.

METHODS

Retrospective analysis of all patients who underwent unilateral total knee arthroplasty in the last 7 years between 2012 and 2019 in our institution was taken into consideration for the study. All patients aged above 30 years who consented for primary TKA in our institution were included in the study. Patient who underwent multi-staged or revision TKA, insufficient data available in the hospital electronic database were excluded from the study. The data collected from the database included age,

sex, preoperative and postoperative haemoglobin levels, pre-operative serum albumin levels, indication for undergoing TKA, ASA grading, smoking and alcohol consumption status, comorbids calculated with Charles comorbid index and all these variables were equated to their length of hospital stay.

All TKAs were performed by our institution's most senior arthroplasty surgeons. A tourniquet was used for virtually all patients, and general or spinal anaesthesia was employed depending on the patient's cooperation and the anaesthetist's preference. All patients were given prophylactic cephalosporin treatment 30 minutes to 1 hour before surgery as a standard procedure. The medial parapatellar approach was used for all TKAs. The use of the implant and drain was by the choice of the surgeon. Multimodal pain treatment in the form of 50 mg tramadol or 75 mg diclofenac (if not contraindicated) as well as antibiotics were given twice day after surgery.

To avoid deep vein thrombosis, all patients are given chemical prophylaxis (enoxaparin or LMWH) and mechanical prophylaxis (pneumatic compression) for two days. Starting on postoperative day 1, the physiotherapy and rehabilitation team began mobilisation with full weight-bearing as tolerated, as well as quadriceps and hamstring strengthening exercises for at least one hour each day was done.

The wound assessment and dressing were carried out in a sterile environment. Patients were discharged if they met the following criteria: no wound-related or systemic complications, good knee flexion with an angle equivalent to or greater than preoperative status, VAS score less than 3, liberated walking without assistance, and training given to manage bed to chair mobilisation, stair climbing, and personal care.

If the foregoing requirements are satisfied, the operating team determines the discharge date. The primary outcome of this study to analyse the role of pre operative serum albumin levels and post operative complications and if it affects the length of stay (LOS), which is defined as the total number of days spent in the hospital from admission to discharge.

RESULTS

The study comprised a total of 1022 patients, 706 of whom were female and 316 of whom were male. The following are the indications for TKA in patients: 917 individuals had TKA for primary osteoarthritis of the knee joint, 96 patients had TKA for arthritis of the knee joint related to rheumatoid arthritis, and 9 patients had TKA for proximal tibia fractures and stress fractures.

At the time of admission, a variety of factors were considered, including age, sex, preoperative and postoperative haemoglobin levels, preoperative serum albumin levels, indication for TKA, ASA grading,

smoking and alcohol consumption status, and comorbids calculated using the Charles comorbid index.

Table 1: Age wise distribution of hypoalbunemia.

Age (years)	Hypoalbunemia	N	%
<50	9	111	8.1
51-60	39	334	11.6
61-70	51	356	14.3
>70	41	221	18.5

The admitted patients were then divided into the control group (preoperative serum albumin ≥3.5 g/dl) and case group (preoperative serum albumin <3.5 g/dl). A total of 140 patients with pre operative serum albumin levels below 3.5mg/dl were segregated into case group (14%) and the rest belonged to control group (86%). Patients were then categorised according to age with age <50 years, 51-60 years, 61-70 years and >70 years in the respective groups. Hypoalbuminemia was found to be significantly higher with increasing age group.

Table 2: Case and control in hypoalbunemia.

Groups	Fever	N	%
Case	63	140	45
Control	47	882	5.3
Total	110	1022	-

Table 3: Hypoalbunemia in RA and OA.

| Parameters	Hypoalbune MIA	N	%
RA	42	96	43.75
OA	98	917	10.6
Others	0	9	0
Total	140	1022	

A total of 110 patients (11%) had fever in the post operative period before suture removal out of which 63 of them belonged to the case group. This accounts to nearly half of the patients in our case group which was statistically significant (p<0.001). Nearly one third (n=42) of the patients with hypoalbuminemia belonged to RA patients. Therefore 42 out of the 96 RA patients (amounting to 43.75%) had pre operative serum albumin levels below 3.5g/dl which was statistically significant (p<0.001). Routine suture removal was done on POD 14, but a total of 185 patients had delayed suture removal due to delay in wound healing and 55 of them belonging to case group. 10 patients found to have surgical site infection within 30 days of post operative period, 7 of them belonging to case group. 8 patients in the cases showed clinical evidence of pneumonia, and none was reported in the control group. Other complications like deep vein thrombosis, electrolyte imbalance, constipation, dyspepsia were found to be statistically insignificant. No death was reported in our case study.

Table 4: Demographic details.

| Variable	N (%)	Mean ±SD	Mean LOS	P value
Age (years)				
<50	111	5.95±3.201	5.95	
51-60	334	6.03±2.407	6.03	
61-70	356	6.68±3.818	6.68	0.001
> 70	221	7.84±3.855	7.84	
Sex				
Male	316 (30.9)	6.48±3.376	6.48	
Female	706 (69.1)	6.71±3.451	6.71	0.32
Diagnosis				
OA	917 (89.7)	6.55±3.395	6.55	
RA	96 (9.4)	6.90±2.278	6.90	0.001
Fracture	9 (0.9)	13.33±8.139	13.33	
Albumin				
< 3.0	39 (3.9)	7.69±4.420	7.69	
3.0 - 3.4	101 (9.9)	7.46±3.732	7.46	
3.5 - 4.0	447 (43.7)	6.58±3.289	6.58	0.001
>4.0	435 (42.5)	6.06±3.074	6.06	
BMI				
<18.5	17 (1.7)	3.71±1.572	3.71	
18.5 - 24.9	281 (27.5)	6.04±3.605	6.04	
25 - 29	389 (38.1)	6.65±3.218	6.65	0.001
> 30	335 (32.8)	7.28±3.424	7.28	
Smoking /alcohol				
Yes	143 (14.0)	8.54±3.455	8.54	
No	879 (86)	6.33±3.324	6.33	0.001
Charles comorbidity index				
0	298 (29.2)	3.41±1.572	3.41	
1	378 (37.0)	6.12±3.605	6.12	
2	263 (25.7)	6.43±3.208	6.43	0.001
3	79 (7.7)	7.23±3.104	7.23	
6	4 (0.4)	9.32±3.623	9.32	
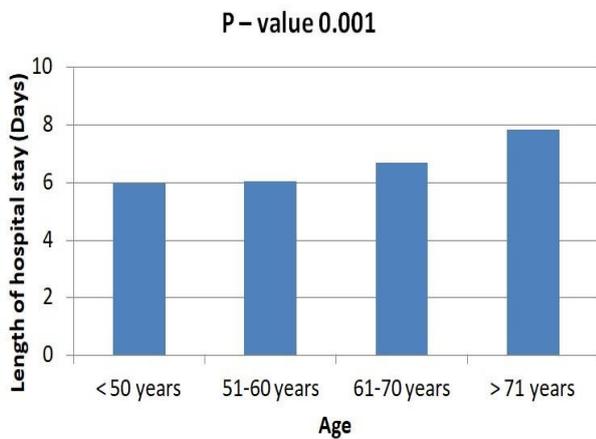
**Figure 1: Age and length of stay.**
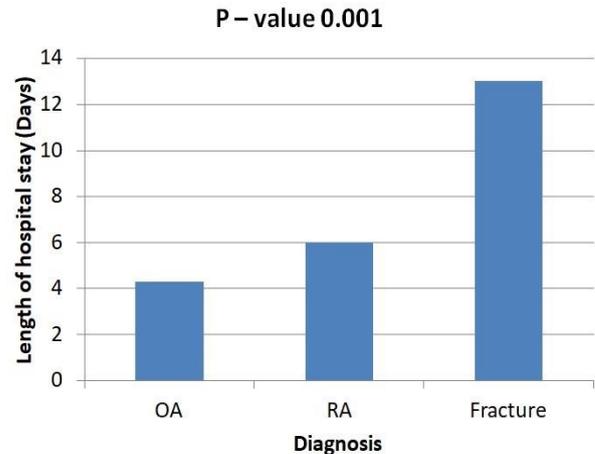
Figure 2: Diagnosis and length of stay.

All of the above characteristics, together with the Charles co morbid index, culminated in the patients in the case group staying longer than those in the control group. The length of time spent in the hospital increases with age. Patients under the age of 50 had a mean hospital stay of 5.9 days, whereas those over the age of 71 have a mean hospital stay of 7.84 days, with a significant p value of 0.001.
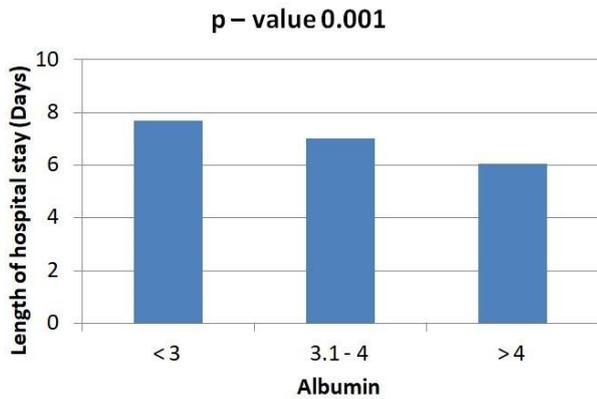
Figure 3: Effect of albumin and LOS.

The average length of stay in the hospital was 6.48 days for males and 6.71 days for females, which was judged to be insignificant with a p value of 0.32. When compared to patients who had TKA for osteoarthritis (OA) or arthritis of the knee secondary to rheumatoid arthritis (RA), the duration of stay and cost of rehabilitation were substantially higher for patients who had TKA for proximal tibia fracture. The mean duration of stay in case of fracture was 13 days in comparison to OA and RA, with a mean duration of stay of 6.5 days and 6.55 days with a significant p value of 0.001.
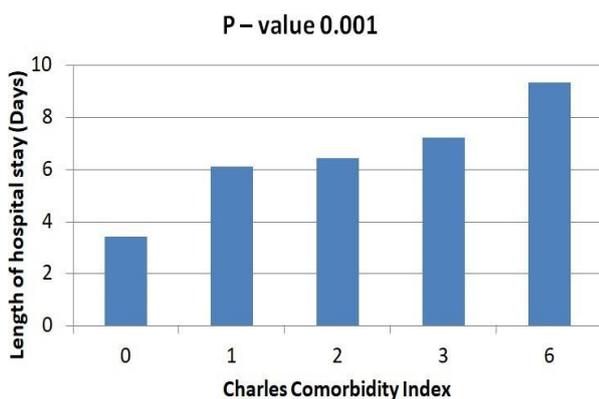
Figure 4: Effect of comorbids in length of stay.

The patient's BMI was also calculated, and only 281 of the 1022 patients had a normal BMI. High BMI causes difficult rehabilitation and a greater risk of DVT, necessitating DVT prophylaxis, both mechanical and

chemical, as well as a longer stay in the hospital, with an average stay of 7 days (p<0.001).

In the case of length of stay, the Charles comorbidity Index is also essential. When compared to patients with fewer comorbids, patients with more comorbids stay in hospitals longer and require more ICU care. Larger portion of higher Charles comorbity index was seen in case group when compared to thr control group. Patients with a Charles comorbidity Index of 0 spend an average of 3.4 days in the hospital, whereas those with a Charles comorbidity Index of 6 spend an average of 9.3 days with a significant p value of 0.001.

DISCUSSION

According to the established inclusion and exclusion criteria, 882 people were in the control group and 140 in the case group in this study. Despite the fact that the control group has significantly more individuals than the case group, the scenario is more realistic and closer to the actual world than if both groups had the same number of people. Hypoalbuminemia has been shown to be associated with increased mortality and morbidity rates in hospitalized patients; intra-operatively a low albumin can produce adverse outcomes. Patients with more preoperative concurrent disorders were more likely to develop hypoalbuminemia, according to this study. The proportion of patients with cardiovascular disease, diabetes mellitus, bedsores, impaired liver and renal function, or more than two concurrent disorders before the surgery was greater in the case group (p<0.001), according to the findings of this study. One of the most frequent cardiovascular illnesses in the world is hypertension. The impairment to vascular endothelial function has been revealed to be linked to the aetiology of hypertension.[3] In hypertensive individuals, microvascular permeability is enhanced. When trauma or surgery are combined, a huge number of inflammatory cytokines are generated, aggravating the damage of capillary endothelial cells and leading to vascular leakage resulting in hypoalbunemia.[4] Under stress, the insulin receptor in diabetic patients is blocked, glucose oxidative metabolism is abnormal, and the negative nitrogen balance is more stubborn and apparent.[5] Cirrhosis-related hypoproteinemia reduces the ability of the liver and kidneys to synthesize proteins and to synthesize plasma proteins. Patients who do have hypoalbuminemia prior to surgery have a higher risk of postoperative problems, according to previous studies.[6,7]

In our study, patients in case group exhibited a greater rate of surgical complications than the control group, including delayed wound healing, pleural effusion, and pneumonia. Deep venous thrombosis, dyspepsia, constipation, and electrolyte disruption in the lower extremities did not vary significantly. This is found to be similar with other previous studies. Kamath et al studied TKA patients and discovered that those with hypoalbuminemia had greater rates of deep surgical site

infection, pneumonia, urinary tract infection, and sepsis than those with normal albumin levels.[8] As many as 50% of pre-existing malnutrition goes unnoticed during the hospital stay, becomes evident on extreme low levels.[9] Theoretically there lies a potential relationship between the level of albumin and the healing process, an increased level of nutrition lowers the complication rate and a rapid wound healing for a better rehabilitation protocol, all this will reduce the length of hospital stay for the patient. Carlos et al evaluated the standard preoperative laboratory tests of 119 patients and demonstrated that preoperative nutritional status was an excellent predictor as SSI, as well as controllable factors for postoperative complications in patients undergoing joint replacement surgery.[10] Also, nutritional status in the form of albumin can not be a sole indicator dependable to produce SSI, but by the pre-operative comorbids that the patient possesses that can alter the outcome of an arthroplasty surgery. Increased comorbidity will always lead to an increased delay for a patient to go into physiotherapy to get his desired knee movements. Although serum albumin level may also be affected by acute factors such as trauma and surgical stress, it is predictive of operative outcome because it is a marker of disease and malnutrition as well as possibly conferring a direct protective effect through several biological mechanisms.[11] It is a better prognostic indicator than anthropomorphic markers of nutritional status because it can detect protein-energy malnutrition, which is not necessarily accompanied by lower body weight and may not be clinically recognizable, but is associated with significantly increased risk of morbidity and mortality following a major elective case like a replacement all these unfavorable outcomes will burden the patient.[12] For a better outcome the idea to increase the albumin levels pre-operatively can be put together as dietary forms or as albumin infusions, but invariably increase the cost expenditure of the surgery. However, albumin infusion usually does not promise an effective therapy if surgery is not planned quickly because the albumin will degrade quickly and infusion does not address the underlying causes of adverse operative outcome.

Malnourished people had much higher complication rates, which have been shown to be more than doubled in several studies. Other studies have found that postoperative problems might last anywhere from 30 days to 12 months.[1,3,18,20] Joint infection, renal problems, hematoma formation, pneumonia, unexpected readmission, pulmonary complications, anaemia, extended duration of stay, and even mortality were previously found to be elevated.[13,17] Increased duration of stay, as well as death following surgery, can result in a slew of legal and financial problems for which the hospital is responsible.[15]

In addition to its value as a prognostic tool, serum albumin level is a cue in accurate nutritional assessment and it has been shown that nutritional therapy is more effective in reducing surgical mortality and morbidity when the diagnosis of malnutrition is based on objective nutritional indices that include serum albumin rather than on subjective assessment. Particularly in patient populations with high rates of comorbidities, it would seem that the test should be used more frequently as a prognostic tool and for detecting malnutrition for better outcome for which the surgery is done

CONCLUSION

Hypoalbuminemia patients who needed primary knee replacement were more likely to be elderly, have poor nutritional status, have cardiovascular disease, diabetes, bedsores, liver and kidney dysfunction, and other concurrent disorders, which affects the post operative recovery and duration of the stay according to this study. Hypoalbuminemia leads to a lengthier stay in the hospital and a higher risk of surgical complications such delayed wound healing and pneumonia.

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