

ORIGINAL RESEARCH

Impact of nutritional status on major orthopedic surgery outcome

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ABSTRACT

Surgery is a medical procedure involving physical as well as mental stress of an individual. It results in various inflammatory and catabolic pathways in the humans. Proper nutritional status of the individual will be helpful in early recovery of the patient from the stress of surgery and also results in good prognosis of the procedures. Though malnutrition and orthopedic surgery complications are known to be significantly related in about 50% of hospitalized patients, proper knowledge is not available. Previous nutritional assessment studies could not be validated as these studies included few screening study parameters. So, the present study is aimed to determine the impact of nutritional status on major orthopedic surgery of the patients as an attempt to obtain more valid related information.

The patients attending the Orthopedics department, Maheshwara Medical College, Chitkul between March 2022 and February 2023 were included in study. The study is done in 200 patients after obtaining ethical committee clearance as per the inclusion and exclusion criteria. The 200 patients were categorized into two groups, one group with good nutritional status and another group with under nutritional status. The outcome of the patient, post-operative complications, duration of the discharge were compared and analyzed between the two groups. Malnourished patients were confirmed by CONUT score.

Out of 100 patients in group with good nutritional status 20 patients and 63 patients in malnutritional group experienced at least one postoperative complication. The average duration from admission for surgery till discharge was more i.e., 42 days in the malnourished group while it was about 23 days in the nourished group. Similarly, the values of serum albumin, total lymphocyte and total cholesterol levels were found to be lowered in the malnourished group as shown in table. Upon analysis, it was found that the albumin score, lymphocyte score, cholesterol score and CONUT score were significantly lowered in the malnourished group when compared to the control well-nourished group as in table.

In our study, albumin lymphocyte and cholesterol levels were found to be lowered significantly in the malnourished group and it resulted in delayed recovery of the patients with increased risk of post-operative complications in the patients who have undergone major orthopedic surgery.

The present prospective research confirms the association of major orthopedic surgery with outcome and the nutritional status of the patients. It can be concluded from our study that when compared to well-nourished patients, the malnourished patients are having higher risk of post-operative recovery, mortality and hospitalization stay.

Keywords: major orthopedic surgery, malnutrition, CONUT, albumin, cholesterol, total leucocyte count.

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INTRODUCTION

Surgery is a medical procedure involving physical as well as mental stress of an individual. It results in various inflammatory and catabolic pathways in the humans [1]. Proper nutritional status of the individual will be helpful in early recovery of the patient from the stress of surgery and also results in good prognosis of the procedures [1]. Contrarily, lowered nutritional status may result in poor post-op recovery including comorbidity and mortality. Malnutrition has significant threat to the population worldwide [2]. Though malnutrition and orthopedic surgery complications are known to be significantly related in about 50% of hospitalized patients [3].

Serological markers such as serum albumin, total lymphocyte count; anthropometric studies of calf muscle circumference, triceps skin fold; Assessment and screening tools such as Rainey-MacDonald nutritional index, Mini nutrition assessment short form, Malnutrition universal screening tool, Nutrition risk screening 2002 are used for assessing the nutritional status in orthopedic patients. But, proper confirmative and acceptable guidelines for nutritional status assessment have not yet been confirmed [3]. Latest implementation of Perioperative nutrition screen (PONS) was easy and efficient in identifying patients and risk stratify patients of malnutrition [4].

Even though there are advanced techniques in anesthesia and surgical procedures, the occurrence of post-operative infections affecting outcome may range from 3.1 to 45%. Surgical site infections (SSI) alone occur in about 5 lakh patients in a year in US [5]. When records of 217 patients of primary total hip or total knee arthroplasty were analyzed, it was observed that complications of major wounds were seven times more in patients having serum albumin levels more than 3.5 g/dL and five times more in patients with total lymphocyte count more than 1,500 cells/mm³ [6]. In another study of 6,489 total knee arthroplasties, it was observed that prosthetic joint infections (PJIs) was related to nutrition, obesity and DM [7].

Protein-energy malnutrition (PEM) is a chronic or acute condition associated with specific nutrient deficiency leading a measurable change in body function [8]. PEM is a clinical condition characterized by lowered muscle or body fat and visceral proteins. PEM has significance because of its delayed recovery and increased mortality

[9,10]. Poor nutritional status is one of the significant factors affecting post-operative outcome after major surgeries [11,12]. Controlling Nutritional Status (CONUT) is an assessment requiring regular laboratory investigations routinely during presurgical assessments. It is examiner non-biased and useful in retrospective nutritional status evaluation [13]. Trauma along with surgery result in major physiological alterations which are known as acute phase reaction (APR). APR may be due to numerous reasons such as nociceptive stimulations, tissue damage, tissue ischemia and certain hemodynamic alterations commonly seen in patients. APR is due to compensatory mechanisms such as release of counter-regulatory hormones, metabolic alterations and release of hepatic acute phase factors (C-reactive protein, haptoglobin, complement protein, etc). Previous nutritional assessment studies could not be validated as these studies included few screening study parameters. So, the present study is aimed to determine the impact of major orthopedic surgery on nutritional status of the patients as an attempt to obtain more valid related information.

MATERIALS & METHODS

The present study is a prospective descriptive study done to study the impact of major orthopedic surgery on the nutritional status of the patients. The patients included in the study were those who have attended the Maheshwara Medical College Orthopedics department between March 2022 and February 2023. The study is done in 200 patients after obtaining ethical committee clearance as per the inclusion and exclusion criteria.

Inclusion criteria: All patients who underwent major orthopedic surgery including spine instrumentation surgeries and joint replacement surgeries.

Exclusion criteria: Trauma patients, Patients admitted for tumor surgeries with abnormal hemodynamic parameters and critically ill patients.

Nutritional assessment: It is done by anthropometry – height, weight, BMI and biochemical markers - prealbumin, transferrin as these are better predictors of the nutritional status. Blood samples were collected before surgery on the day of admission. The CONUT scores were calculated using the obtained investigative results of three laboratory tests; serum albumin concentration, lymphocyte count, and total cholesterol concentration as in Table-1.

Table-1: CONUT scores

Parameter	None	Light	Moderate	Severe
Serum albumin (g/dL)	≥3.5	3.0 – 3.49	2.5 – 2.49	<2.5
Albumin score	0	2	4	6
Total lymphocyte count (/mm ³)	≥1600	1200–1599	800–1199	<800
Lymphocyte score	0	1	2	3
Total cholesterol (mg/dl)	≥180	140–179	100–139	<100
Cholesterol score	0	1	2	3
Total score	0-1	2-4	5-8	9-12

The patients were evaluated pre-op, post op and after three months follow up. The data containing demographic details, diagnosis, surgery done, comorbidities and the nutritional parameters were obtained for each patient.

All the patients were divided into two groups –lower nutritional status and optimum nutritional status. The data obtained was recorded in the tabular forms under relevant columns. Statistical analysis was done using IBM SPSS software version 20. A *p*-value of less than 0.05 was considered to be significant and above 0.05 was considered to be non-significant.

RESULTS

Totally 200 patients were identified as per the inclusion and exclusion criteria for the study. The 200 patients

were categorized into two groups, one group with good nutritional status and another group with under nutritional status. The outcome of the patient, post-operative complications, duration of the discharge were compared and analyzed between the two groups.

Malnourished patients were confirmed by CONUT score [14]. Out of 100 patients in group with good nutritional status, 20 patients experienced at least one postoperative complication (3 urinary tract infections, 1 surgical site infections, 11 cases of enteritis, and 5 others) while in the group with under nutritional status, 63 patients were found at least one postoperative complication (13 urinary tract infections, 4 heart failures, 11 surgical site infections, 2 re-fractures, 1 pneumonias, 2 arrhythmias, 20 cases of enteritis, and 10 others) shown in Table-2.

Table-2: Post-operative complications

Post-operative complications	group with good nutritional status	group with under nutritional status
urinary tract infections	03	13
heart failures	00	04
surgical site infections	01	11
re-fractures	00	02
Pneumonias	00	01
Arrhythmias	00	02
Enteritis	11	20
Others	05	10
Total	20	63

Observations made for the deviations from normal post-operative care are analyzed as per Clavien-Dindo classification grade.

Table-3: Clavien-Dindo classification grade

Clavien-Dindo classification grade	group with good nutritional status	group with under nutritional status
I	00	02
II	14	32
III	06	23
IV	00	06
V	00	00
Total	20	63

Grade I is defined by deviation from the normal postoperative course;

Grade II is defined by conditions requiring medical therapy without surgical treatment;

Grade III is defined by surgical, endoscopic or radiological intervention;

Grade IV is defined by life-threatening complications requiring intensive care;

Grade V is defined by death due to complications.

Table-4: Comparison of data between two groups

	group with good nutritional status	group with under nutritional status
Age (years)	46 (30-70)	42 (30-70)
Average hospital stays (days)	23 (20-45)	42 (25-55)
Serum albumin (g/dL)	5.8 (4.1-8.9)	2.7 (2.1-3.3)
Total lymphocyte count (/mm ³)	6500 (5200-9800)	1350 (1000-1400)
Total cholesterol (mg/dl)	221 (192-271)	119 (94-168)

In the nutritional group, the average age was 46 years out of which 52% of the patients were females, where as in the malnourished group the average age was found to be 42 years with 56% females. The average duration from admission for surgery till discharge was more i.e., 42 days in the malnourished group while it was about 23 days in the nourished group. Similarly, the values of serum albumin, total lymphocyte and total cholesterol levels were found to be lowered in the malnourished group as shown in table-4.

Table-5: Analysis between two groups

Parameters	OR	95% CI	p-value
Albumin score	1.08	0.962-1.230	0.031
Lymphocyte score	1.96	0.812-3.184	0.002
Cholesterol score	1.14	0.946-1.653	0.049
CONUT score	1.22	1.02-1.55	0.038

Upon analysis, it was found that the albumin score, lymphocyte score, cholesterol score and CONUT score were significantly lowered in the malnourished group when compared to the control well-nourished group as in table-5.

DISCUSSION

The present prospective study was performed to study the consequence of major orthopedic surgery with consideration of the nutritional status of the patients. The results of the present study confirm the significant lowering of post-op status, CONUT score and levels of albumin, lymphocyte and cholesterol in malnutrition group. It is known that trauma, surgery and anesthesia is related with the nutritional status of the patient [15-19]. CONUT developed by Ignacio de Uli'Barri et al. in 2005 was found to be related to increased surgical complications, mortality risk, gastrointestinal and hepato-pancreato-biliary cancers and also mortality in hospitalized patients with heart failure [20,21].

Several studies showing relation between malnutrition and clinical outcome in ortho surgery by the levels of serum albumin and malnutrition which found that hypoalbuminemia was related to more postoperative complications [22-24]. The patients with lower albumin and lymphocyte levels during hospital stay had increased risk of mortality compared to group of normal albumin levels [25]. The undernutrition in the orthopedic patients was reported to be around 40% [26-30]. This may be due to the patient selection criteria. We included only those patients who were undergoing planned elective major orthopedic surgery in our present study. Most of the literature on malnutrition in orthopedics are on trauma, especially hip trauma in the elderly [31]. These might be reasons for the gross difference in the incidence of malnutrition in our study.

It has been further observed that the biochemical parameters were found to be nearer to the normal range in the malnourished group at the time of discharge were once again found to be lowered in most of the patients. It may be because of the individual's food habits or some other factors which has to be studied further. Thus, such patients have to be followed further to confirm the actual cause of their malnutrition and can be corrected accordingly for further benefit of the patients throughout their life time which may lead to better quality life of the patients. The age is also another factor affecting the nutritional recovery of the patients after major orthopedic surgery. The association of age and nutritional status in orthopedic patients was studied stating the lowered recovery of the malnutrition in the elder age patients when compared to younger aged patients [31,32]. The post-op surgical site infections were found to be positively correlated with their nutritional status [33-35].

In our study, albumin lymphocyte and cholesterol levels were found to be lowered significantly in the malnourished group and it resulted in delayed recovery of the patients with increased risk of post-operative complications in the patients who have undergone major orthopedic surgery.

CONCLUSION

The present prospective research confirms the association of major orthopedic surgery with outcome

and the nutritional status of the patients. It can be concluded from our study that

1. when compared to well-nourished patients, the malnourished patients are having higher risk of post-operative recovery, mortality and hospitalization stay.

2. before any surgery, the levels of albumin, cholesterol and total leucocytes shall be considered for proper post-operative management.

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