


RESEARCH NOTE

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Nutritional status significantly affects hospital length of stay among surgical patients in public hospitals of Northern Ethiopia: single cohort study

Mulugeta Woldu Abrha^{1*} , Oumer Seid², Kidanu Gebremariam², Amha Kahsay² and Haftom Gebrehiwot Weldearegay³

Abstract

Objective: This study aimed to assess the effect of nutritional status on length of hospital stay in Northern Ethiopia.

Result: Institutional based prospective cohort study was conducted among 324 admitted surgical patients. Length of hospital stay were significantly associated with duration of disease (Adjusted Hazard Ratio (AHR) = 3.7, 95% Confidence interval (CI): 2.35–5.82), history of surgery (AHR = 1.4, 95% CI 1.40, 95% CI 1.17–1.86), nutritional status (Body Mass Index (AHR = 1.38, 95% CI 1.28–1.51), Mid Upper Arm Circumference (AHR = 1.29, 95% CI 1.04–1.62)) and individual diet diversity score (AHR = 2.64, 95% CI 1.14–6.14). Screening of patients for malnutrition at admission and provision of dietary supplements based on their nutritional status is recommended.

Keywords: Nutritional status, Length of hospital stay, Duration, Surgical patients, Northern Ethiopia

Introduction

Length of hospital stay (LOS) is one of the key performance indicators for hospital management and efficiency of the health system. Reducing hospital stay has the potential to decrease health care cost, risk of infections, other hospital acquired diseases and improves patients' quality of life [1–3]. Under nutrition increases length of hospital stay due to reduced wound healing, increased complication rates, mortality, and healthcare costs. Previous studies found that up to 40% of patients are malnourished at the time of admission and majority of these patients continued to be nutritionally depleted throughout their hospital course [4, 5].

Malnourished surgical patients have complication and mortality rates 3 to 4 times higher than normally nourished patients with longer hospital admissions, incurring up to 50% greater costs. It is often difficult to separate the

deleterious effects of malnutrition from the underlying disease process itself, especially because each can be a cause or consequence of the other [5–9].

The cost–benefit associated with nutritional intervention in patients at risk of malnutrition found to be estimated saving to the health care facility of USD1.064 per patient [10]. Despite numerous advances in medicine and clinical care, the simple correction of a patient's nutritional status are not considered as a sufficient medical priority [11].

Even though there are studies from developed countries, there are limited studies concerning nutritional status and hospital length of stay among surgical patients in Ethiopia. Therefore this study examined nutritional status and factors associated with length of hospital stay among admitted surgical patients and might have an input to the health care professionals and policy makers.

*Correspondence: mulugetawoldu425@gmail.com

¹ Tigray Health Research Institute, Mekelle, Ethiopia

Full list of author information is available at the end of the article



Main text

Methods

Study setting, design and sample size

Institutional based prospective cohort study design was conducted in Tigray Region, Northern Ethiopia from January–March 2016. The source population was all admitted surgical patients older than 18 years of age in hospitals. Surgical patients were patients admitted to the surgical ward for surgical intervention. The sample size was calculated using double proportion formula taking malnutrition as exposure variable [6]. The desired level of precision was set at 0.05 and considering the effect of multi-stage sampling; a design effect of 1.5 was used. Adding 10% of possible non-responses, total sample size was 324 patients. Tigray Region has seven zones and out of these two zones was selected randomly. There were five general hospitals in the selected two zones. Then after, three hospitals were selected by lottery method. Likewise, study participants were proportionally allocated to the selected hospitals based on their amount of bed. Finally the participants were consecutively included to the study during admission to surgical ward.

Data collection procedure and quality improvement

Data were collected using standardized, structured and face to face interviewer questionnaire and direct measurement. Questionnaire had socio-demographic information, clinical variables, and dietary assessment and biochemical tests sections. Data quality was managed by trained three Bachelors of Science holders fluent in the local language (Tigrigna). A modification was made after a pre-test. Daily supervision, spot checking and reviewing completed questionnaire was conducted. Duplicate measurements of weight, height, mid upper arm circumference and waist circumference was taken at the same time from each study subject during admission using calibrated and standardized equipment and average value of the measurement was recorded.

Anthropometric measurements

Weight determined by a scale with a maximum capacity of 150 kg and accuracy of 0.1 kg and was calibrated after each measurement.

Height measured in standing position in stadiometer but for those confounded to bed were used demi-span and arm span based on the patient's condition.

Body mass index calculated dividing weight by height square and classified as underweight (BMI < 18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²), Obese (BMI ≥ 30 kg/m²).

Waist circumference (WC) was measured on the median line of costal border and the iliac crest at the end of exhalation. Dichotomize into higher than 94 cm for

men and 80 cm for women which were considered at risk according to IDF [12].

MUAC measured using a non-stretchable MUAC tape and was dichotomize for male < 20 cm and male < 26 cm considered as under nutrition and ≥ 20 cm (female), ≥ 26 cm (male) considered as well nourished.

Hemoglobin status was collected from the medical records and cut-off point was 11 g/dl [12]. *Dietary assessment* assessed to patients what they eat with in the past 24 h and were categorized ≤ 3 as low IDDS, 4–5 as medium IDDS and ≥ 6 as high IDDS.

Statistical analysis

Data was entered in to Epi Data 3.1 statistical software and analyzed using SPSS version 20.0 package. Descriptive statistics were computed after normality checked. Patient outcomes other than discharge (died, defaulter, patients self-discharge and patients referred to other hospital) were considered as censored. Finally, the outcome of each subject was dichotomized into censored or discharged. The relationship between length of hospital stay and the covariates was analyzed using Cox bi-variable proportional regression model and before fitting the covariate into the model proportional hazard assumption was checked by examining Log (-Log) S (t) plots. In order to identify independent predictors a multivariable Cox-proportional adjusted model was fitted with those variables p-value ≤ 0.25 in bi-variate Cox proportional regression analysis. Crude and adjusted hazard ratios with their 95% Confidence interval (CI) were estimated and P-value less than 0.05 were used to declare the presence of significant association.

Result

Socio-economic and demographic characteristics of study participants

The study involved 324 patients above 18 years old. The mean (SD) age of the participant were 39 (± 15) and three fifth 210 (62%) of them were in the age range of 18–40 years. Slightly above half 171 (52.8%) of them were rural residents. Male accounts two third 210 (64.8%) of the study subject. Six out of ten 211 (65.1%) of the respondents had 3–5 family members. Two fifth 137 (42.3%) of the participants had no formal education. Six out of ten (n = 212) of the patients were married. Half of the participants used public car 175 (54%) when they are transported to Hospitals. One third of participants 119 (36.7%) were farmers (Table 1).

Clinical/surgical features of the patients

Majority of the patients 267 (82.4%) carried out emergency surgery. Majority 303 (93.5%) and 239 (73.8%) of patients have no co-morbidity and history of surgery

Table 1 Socio-economic and demographic characteristics of surgical patients Northern Ethiopia, 2016 (N = 324)

Characteristics	Frequency	Percent
Age in year		
18–40	201	62.0
41–64	97	29.9
> 64	26	8.0
Sex		
Female	114	35.2
Male	210	64.8
Religion		
Orthodox	282	87.0
Muslim	42	13.0
Residence		
Rural	171	52.8
Urban	153	47.2
Educational status		
No formal education	137	42.3
Grade 1–4	22	6.8
Grade 5–8	35	10.8
Grade 9–10	49	15.1
Grade 11–12	29	9.0
College and above	52	16.0
Marital status		
Married	212	65.4
Divorced	26	8.0
Widowed	20	6.2
Single	66	20.4
Family members		
1–2	42	13.0
3–5	211	65.1
6–7	63	19.4
>7	8	2.5
Transportation type to hospital		
Foot	31	9.6
Private care	5	1.5
Public care	175	54.0
Government car	12	3.7
Ambulance	101	31.2
Occupational status		
Farmer	119	36.7
House wife	39	12.0
Employed	57	17.6
Merchant	32	9.9
Daily laborer	32	9.9
Other	45	13.9
Characteristics		Mean (± SD)
Median Age		39 (± 15) year

Table 2 Clinical feature of admitted surgical patients Northern Ethiopia, 2016 (N = 324)

Characteristics	Frequency	Percentage
Duration of disease (week)		
≤ 2	289	89.2
> 2	35	10.8
History of surgery		
Yes	85	26.2
No	239	73.8
Type of surgery		
Elective	178	54.9
Acute/emergency	146	45.1
Co morbidity		
No	303	93.5
Yes	21	6.5
Type of disease		
Gastro intestinal system	121	37.3
Cardio vascular system	14	4.3
Urinary system	31	9.60
Muscular system	74	22.8
Skeletal system	73	22.5
Nervous system	11	3.4

respectively. Nine out of ten (n=289) had less than 2 weeks duration of disease. More than one third of the participants 121 (37.3%) had disease of gastro intestinal system (Table 2).

Nutritional status of admitted surgical patients

Thirty one percent (n=102) of patients were underweight and mean MUAC was 21.5 cm (± 2.7). Three out of 100 females 10 (3.1%) were at risk of under nutrition measured using waist circumference. About 71 (21.9%) were at risk of under nutrition estimated using waist hip ratio and 30 (9.3%) respondents had abnormal level of hemoglobin during admission. Sixty nine percent (n= 224) of the admitted patients had low diet diversity score 224 (69%) (Table 3).

Predictors of hospital length of stay among admitted surgical patients

In bi-variable Cox proportional regression analysis age, educational status, marital status, family members, type of transportation, occupational status, duration of current disease, history of surgery, type of surgery, co morbidity, body mass index, hemoglobin, Mid Upper Arm Circumference, IDDS, dark green leafy vegetables were significant.

Table 3 Nutritional status of admitted surgical patients, Northern Ethiopia, 2016 (N = 324)

Characteristics	Frequency	Percent
BMI		
Under weight	102	31.5
Normal weight	221	68.2
Over weight	1	0.3
Waist circumference		
Male (cm)		
< 94	208	64.2
≥ 94	2	0.6
Female (cm)		
< 80	104	32.1
≥ 80	10	3.1
Waist hip ratio		
High risk	71	21.9
Moderate risk	83	25.6
Low risk	170	52.4
Hemoglobin		
Abnormal (< 11 g/dl)	30	9.3
Normal (≥ 11 g/dl)	294	90.7
IDDS		
High DDS	11	3.4
Medium DDS	89	27.4
Low DDS	224	69.2
Characteristics	Frequency	Mean (± SD)
MUAC	324	21.5 (± 2.7)cm
Hip circumference	324	52 (± 23)cm
Waist circumference	324	46 (± 21) cm

After adjustment, the independent significant predictors of length of hospital stay were: the hazard of hospital stay were 3.7 times lower among patients who had less than two weeks duration of disease than those greater than two weeks duration [AHR=3.7, 95% CI (2.35–5.82)]. Hospital length of stay in admitted surgical patients who did not have history of surgery had 1.4 times less hazard of hospital stay than those who had previous surgery (AHR=1.41, 95% CI 1.17–1.86). Patients admitted with normal weight were 1.3 times more likely to reside shorter in hospital than underweight patients (AHR=1.38, 95% CI 1.28–1.51). Additionally based on MUAC measurement admitted surgical patients with normal nutrition had 1.3 times lower probability of hospital stay than the counterpart (AHR=1.29, 95% CI 1.04–1.62). Patients feeding high DDS were 2.6 times more likely to stay lower in hospital than patients feeding

lower DDS (AHR=2.64, 95% CI 1.14–6.14) (Additional file 1: Table S1).

Discussion

A shorter hospital stay will reduce the cost per discharge and shift care from inpatient to less expensive post-acute settings and effective reduction of a hospital’s average length of stay is not a question of simply discharging patients earlier. Instead, it is ensuring that patients recover more quickly and reach the point at which they are ready to leave the hospital sooner [1, 8, 13-16].

As the finding of this study, patients with normal BMI had a shorter length of Hospital stay than underweight patients. Similar Studies from Switzerland, Korea, Portugal, Israel, Brazil, and Egypt supports this study [13, 15, 17-20]. A study found that, one day difference in stay between the normal weight and underweight of BMI. Such a delay may have financial and psychological implications, and may expose patients to additional risk of acquiring nosocomial conditions [21]. And also treatment decisions for patients such as laparoscopic versus open surgery or conservative versus immediate operative management may differ depending on their weight. Furthermore, obesity is known to increase the risk of other conditions such as cardiovascular diseases or thromboembolic disease that may prolong hospitalization. But this study was in contrast to study done in United States [22] which observed that patients with higher BMI had shorter hospital stays compared with patients with normal BMI. This result was observed even after adjusting for number of co-morbidities. This suggests that when differences in co-morbid conditions are accounted for patients with higher BMI they are tended to be discharged sooner.

This study revealed that nutritional status of the patients during admission measured using MUAC showed that patients with normal nourished had higher hazard of discharge. MUAC has been proposed as an alternative index of nutritional status when the collection of height and weight measurements is difficult, including in emergencies such as famines or refugee crises. This result is in line with studies done in Brazil, Portugal, India, and Vietnam which found an increase in length of stay in malnourished patients [12, 18, 23, 24].

Other predictor of length of stay was duration of the disease; patients with greater than two weeks of disease duration had higher length of hospital stay. This result is consistent with study done in India [25]. This indicates that duration of disease increases loss of appetite, complication, lower immunity and all this might lead to an increased hospital stay.

This study revealed that length of hospital stay was higher in those patients who had history of surgery. This result was in line with studies done in Tabriz Shahid Madani Cardiovascular Hospital [26], Iran [27]. This could be due to history of surgery might affect the current disease recovery rate and could lead to low immunity.

Another predictor of hospital length of stay was the IDDS revealed that patients with high DDS had lower hospital stay than patients feeding low DDS. Similar study done in Israel supports this [15]. Dietary diversity is remarkably associated with nutrient adequacy and represents diet quality. Diets with low diversity could increase the risk of nutrient deficiencies especially in vulnerable populations such as diseased individuals, elderly and women [28]. Individuals with high diet diversity might develop immunity and can reduce infection, complications.

Conclusion

Independent predictors of hospital length of stay in admitted surgical patients were found to be duration of disease, history of surgery, nutritional status (BMI, MUAC). Therefore it is recommended that patients at the time of hospital admission need to be screened for malnutrition, dietary supplementations in hospitals should be based on their nutritional status and specific deficiencies should be evaluated in patients found to be malnourished at the time of hospital admission. Researchers are needed to examine or give attention the occurrence of malnutrition upon hospital-admission and hospital-acquired malnutrition among all patients admitted to Hospital.

Limitation of the study

This study doesn't consider the effect of hospital acquired malnutrition during stay; there might be social acceptability bias and early discharge due to shortage of bed in the hospital. The sample size is small in contrast to the variables so needs careful interpretation of the key findings.

Additional file

Additional file 1: Table S1. Bi and multivariable analysis predictors of length of hospital stay, Northern Ethiopia 2016 (N = 324).

Abbreviations

BMI: body mass index; IDDS: individual diet diversity score; IDF: international diabetic foundation; LOS: length of stay; MUAC: mid upper arm circumference; WC: waist circumference; WHO: World Health Organization; WHR: waist hip ratio.

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Authors' contributions

MWA: Conceptualization, Methodology, analysis, writing original draft of the manuscript. OS: Methodology, review and editing of the manuscript. KG: Methodology, review & editing of the manuscript. AK: Methodology, review & editing of the manuscript. HGW: Methodology, review & editing of the manuscript. All authors read and approved the final manuscript.

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Availability data and materials

The datasets used and/or analyzed during the current study is available from the corresponding author on request.

Ethics approval and consent to participate

Participation was voluntary for all the selected surgical patients. Before the interview, the interviewer explained in detail the content of the questionnaire, informed the participants on confidentiality of their responses and of their free choice to withdraw from the study during the interview or later. A written consent was obtained from all participants. The study was approved by the Institutional Review Board of the College of Health Sciences of the University of Mekelle (No: ERC 06113/2016).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹ Tigray Health Research Institute, Mekelle, Ethiopia. ² School of Public Health, College of Health Sciences, Mekelle University, Mekelle, Ethiopia. ³ Department of Midwifery, College of Health Sciences, Mekelle University, Mekelle, Ethiopia.

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