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Nutrición Hospitalaria

Trabajo Original

Valoración nutricional

Influence of nutritional risk assessment on the prognosis of trauma patients

Influencia de la evaluación del riesgo nutricional en el pronóstico de pacientes con traumatismos

Fei Li, Haiyang Guan, Liu Ying

Emergency Intensive Care Department. Nantong First People's Hospital. Nantong, Jiangsu Province. People's Republic of China

Abstract

Background: malnutrition negatively impacts trauma prognosis, and this study aimed to evaluate the Nutrition Risk Index (NRI) as a prognostic factor alongside other variables such as comorbidities and the Barthel Index (BI).

Objective: to evaluate the NRI as a prognostic factor while considering other variables, including nutritional parameters, comorbidities, and the Barthel Index. Although mortality was the primary outcome, we will clarify this to avoid any confusion.

Methods: a cohort of 80 Chinese trauma patients, aged 30-69 years, was analyzed through prospective data collection at admission and post-discharge, covering mortality, nutritional factors, and prognostic indicators. The average observation period was 5.83 months, with an average admission age of 45.6 years.

Results: this study examined the relationship between nutritional parameters, trauma, and their effects on mortality and survival. The 6-month survival rate was 93 %, and a correlation was noted between mortality risk and patients with Nutritional Risk Index (NRI) scores greater than 96. However, those with severe risk (NRI < 83.5) did not show a significant association with mortality, possibly due to a small sample size (*n* = 4), suggesting the need for larger studies to further explore this relationship. The Cox proportional hazard analysis identified older age, lower NRI scores, and specific comorbidities like ischemic heart disease, chronic kidney disease, and hypertension as significant mortality risk factors. Additionally, types of fractures, particularly radius and ulna and vertebral fractures, were linked to higher mortality. Lower Barthel Index scores at admission and discharge were significant predictors of mortality; however, deceased patients often had higher BI scores, indicating that a low BI cannot be universally regarded as a risk factor.

Conclusion: overall, the findings emphasize that older age, lower NRI scores, and comorbidities are critical predictors of mortality in trauma patients, while the relationship between the Barthel Index and outcomes requires further clarification.

Keywords:

Fracture. Nutritional risk index. Mortality. Barthel's index. Body mass index.

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Ethical statement: ethical approval was deemed not necessary for this observational study, as it did not involve the disclosure of any personal data of patients. The tests conducted were routine clinical assessments used solely for the purpose of this observational study. Additionally, oral approval was obtained from the relevant authorities and participants, ensuring adherence to ethical standards and respect for participant autonomy.

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Correspondence:

Liu Ying. Emergency Intensive Care Department. Nantong First People's Hospital. No 6 Hai'erxiang North Road, Chongchuan district. Nantong 226001, Jiangsu Province. People's Republic of China
e-mail: 19952457201@163.com

Resumen

Antecedentes: la desnutrición impacta negativamente en el pronóstico del traumatismo y este estudio buscó evaluar el Índice de Riesgo Nutricional (NRI) como un factor pronóstico junto a otras variables como las comorbilidades y el índice de Barthel (IB).

Objetivo: evaluar el NRI como factor pronóstico, considerando otros parámetros nutricionales, las comorbilidades y el IB. Aunque la mortalidad fue el resultado principal, se aclarará para evitar confusiones.

Métodos: se analizó una cohorte de 80 pacientes politraumatizados chinos, de 30 a 69 años, mediante recolección de datos prospectivos en el momento del ingreso y después del alta, abarcando mortalidad, factores nutricionales e indicadores pronósticos. El período promedio de observación fue de 5,83 meses, con una edad media al ingreso de 45,6 años.

Resultados: este estudio examinó la relación entre parámetros nutricionales, traumatismo y sus efectos en la mortalidad y la supervivencia. La tasa de supervivencia a 6 meses fue del 93 % y se observó una correlación entre el riesgo de mortalidad y los pacientes con puntuaciones de índice de riesgo nutricional (NRI) superiores a 96. Sin embargo, aquellos con riesgo severo (NRI < 83,5) no mostraron una asociación significativa con la mortalidad, posiblemente debido a un tamaño de muestra pequeño ($n = 4$), lo que sugiere la necesidad de estudios más grandes para explorar esta relación. El análisis de riesgos proporcionales de Cox identificó la edad avanzada, las puntuaciones bajas en el NRI y comorbilidades específicas como la enfermedad cardíaca isquémica, la enfermedad renal crónica y la hipertensión como factores de riesgo significativos para la mortalidad. Además, ciertos tipos de fracturas, especialmente las de radio, cúbito y vertebrales, se asociaron con mayor mortalidad. Las puntuaciones más bajas del índice de Barthel al ingreso y al alta fueron predictores significativos de mortalidad; sin embargo, los pacientes fallecidos a menudo tenían puntuaciones más altas de IB, indicando que un bajo IB no puede considerarse universalmente como factor de riesgo.

Conclusión: en general, los hallazgos enfatizan que la edad avanzada, las puntuaciones bajas en el NRI y las comorbilidades son predictores críticos de mortalidad en los pacientes traumatizados, mientras que la relación entre el índice de Barthel y los resultados requiere una mayor aclaración.

Palabras clave:

Fractura. Índice de riesgo nutricional. Mortalidad. Índice de Barthel. Índice de masa corporal.

INTRODUCTION

Trauma patients frequently navigate a multifaceted path to recovery, and the state of their nutritional well-being significantly influences the course of their healing journey. The intricate interconnection between trauma and nutritional status has become a focal point of heightened interest within the medical community. Malnutrition has been correlated with unfavorable consequences, including prolonged hospital stays, heightened complications, increased in-hospital mortality rates, and escalated healthcare costs (1).

The study analyzed by Iwuchukwu et al. (2) included a subset of 771 subjects from around the world from the Improving Nutrition Practices in the Critically Ill International Nutrition Surveys (INS) (3), conducted in the years 2013-2015; it highlights a discernment of trauma patients who face an elevated risk of unfavorable outcomes because of their nutritional status and additionally, the research aims to identify individuals within this patient population who could potentially derive benefits from increased caloric and protein intake (2). Despite the prevailing belief in the significance of nutrition for severely injured patients, the existing body of evidence is surprisingly limited in both quantity and quality. Often, the available evidence is characterized by a lack of robustness, frequently being of low quality and outdated (1). The levels of serum albumin during the perioperative period exhibit a significant association with adverse outcomes in trauma patients (4). Nutritional interventions targeting inflammation control during the initial healing stage after trauma may be contraindicated, given the essential role of the inflammatory response in optimal healing. However, the judicious use of dietary supplements to minimize prolonged or excessive inflammation can potentially enhance the healing process and facilitate a safe return to recovery (5). Considering the adverse outcomes associated with malnutrition, it is advisable to routinely and attentively monitor the nutritional status of trauma patients (6).

This study delves into the profound influence of nutritional risk assessment on the outlook of trauma patients, emphasizing the pivotal role that effective nutritional management can play in maximizing outcomes. A comprehensive understanding of the intricate interplay between nutritional risk assessment and the prognosis of trauma patients is poised to strengthen ongoing endeavors to refine and optimize trauma care practices. The overarching objective is to provide invaluable insights that can guide clinical decision-making and healthcare policy, ultimately paving the way for enhanced outcomes and improved quality of life for trauma patients.

METHODS

DATA

This study was conducted as a single-center prospective observational study in the First People's Hospital of Nantong City, Jiangsu Province, China. From January 2021 to January 2023, we enrolled patients aged 30 or older who underwent trauma treatment and provided informed consent. Upon admission, physicians collected comprehensive demographic and clinical information, including age, gender, height, weight, BMI, fracture type, serum albumin level, comorbidities, smoking status, alcohol consumption, Barthel index (BI), and history of fragility fracture. The BI was assessed using ten surveys evaluating activities of daily living, with scores ranging from 0 to 15. Higher BI scores indicated better daily functioning (7). BI at admission was based on the patient's pre-injury status, while BI in patients with cognitive impairment was obtained from their caregivers' information. Clinical data were collected post-admission, including surgery status, postoperative complications, BI at discharge, hospital stay duration, and discharge destination. Follow-up questionnaires were sent every month for up to six months after discharge to assess survival, new fracture incidence, walking ability, and living arrangements.

NRI ESTIMATION

The NRI was calculated using the baseline serum albumin level and body weight following the formula (8): NRI = 15.19 × serum albumin (g/dL) + 41.7 × (body weight / ideal body weight). In this study, the ideal body weight was determined using the Robinson formula which is an equations for ideal body weight denoted as IBW = 51.65 kg + 1.85 kg/inch of height greater than 5 feet for men and IBW = 48.67 kg + 1.65 kg/inch of height greater than 5 feet for women (9). Four risk groups were established based on the NRI cutoff values: > 100 for no nutritional risk, 97.5-100 for mild risk, 83.5-97.5 for moderate risk, and < 83.5 for severe risk.

PATIENT INCLUSION CRITERIA

In this registry, 592 patients were registered between January 2021 and January 2023. This study excluded the following patients: 1) patients under the age of 30 years, 2) those with heavy trauma, 3) those with pathological fracture, 4) those who provided incorrect information, 5) death during hospitalization, 6) those with a history of contralateral hip fracture, and 7) withdrawal of consent. Following exclusion, total number of patients analyzed in this study are 80.

OUTCOME

All patients' clinical information was obtained from follow-up questionnaires. The primary goals were to use the Kaplan-Meier method and the log-rank test to examine overall survival. Secondary outcomes included a multivariate Cox regression analysis of each risk factor for overall survival and secondary fracture. Overall survival was defined as the time elapsed between the date of discharge and the date of death, withdrawal from the study, or the time of the last follow-up.

STATISTICAL ANALYSIS

We used the Mann-Whitney U test for continuous variables and Pearson's chi-square test or Fisher's exact test for categorical variables to analyze the differences between the two groups (deceased and survivors). We used the Cox proportional hazards model with potentially confounding variables to assess the independent effects of each factor on mortality and secondary fractures, and we calculated the HR and 95 % CI. The Kaplan-Meier method which estimates survival functions from lifetime data by plotting survival probabilities over time, accounting for censored data, was used to calculate overall survival after hospital discharge.

RESULTS

BASELINE CHARACTERISTICS AND OVERALL SURVIVAL

In this study, 80 Chinese trauma patients, including 50 % women, were analyzed, and their baseline characteristics and clinical information are presented in table I. The average observation period was 6 months (median 6, range 0-6). Upon admission, the average age was 45.6 years (median 45, range 30-69), with a BMI of 20.81 (median 20.70, range 15.80-26.90) (Table I). The distribution of fractures (femoral fractures, tibial and fibular fractures, humeral fractures, radius and ulna fractures, spinal fractures, ankle fractures and wrist and hand fractures) are detailed in table I, with femur fractures being the most prevalent (51.25 %).

The Barthel index (BI) at discharge significantly decreased to 65.58 (median 66, range 39-90) compared to admission (70.80, median 70.50, range 45-95). On admission, the average Nutrition Risk Index (NRI) was 98.81 (median 97.78, range 62.80-112.50) (Table I). The Kaplan-Meier survival curve analysis indicated a 6-month overall survival rate of 93 % (Fig. 1).

In terms of mortality analysis, the deceased group (n = 5) differed significantly from the survival group (n = 75) in several key factors. The average age of deceased patients was notably higher than that of survivors, and although the body mass index (BMI) was similar between both groups (p = 0.728), the Barthel index (BI) was significantly lower in patients who died, both at the time of admission and discharge. Additionally, mortality rates between men and women were not significantly different. Furthermore, vitamin D3 supplementation was not significantly associated with mortality (p = 0.441). While vitamin D3 supplementation is essential in managing bone health, it must be paired with osteoformers or antiresorptives for osteoporosis treatment, as recommended by scientific societies. Vitamin D3 supplementation on its own is insufficient as a standalone treatment for trauma affecting bones, which further explains its lack of significant association with mortality in this study. With Vitamin D3 supplementation following fracture more patients survived over deceased patients, however focus on combined therapies was equally given importance (Table I).

Significant factors identified through univariate analyses were utilized in both univariate and multivariate Cox proportional hazards models to delineate mortality factors (Table II). Prognostic factors for overall survival included the type of fracture, reason for admission, and associated comorbidities (such as hypertension, chronic kidney disease, and ischemic heart disease) (Table II). The most frequent fractures observed were radius and ulna fractures (HR = 1.051), spinal fractures (HR = 1.138), and other fracture types (Table II). The comorbidities significantly correlated with mortality included hypertension (HR = 1.035), chronic kidney disease (HR = 2.224), and ischemic heart disease (HR = 2.565).

Table I. Baseline characteristics

	Total (*n* = 80)	Deceased (*n* = 5)	Survivor (*n* = 75)	*p*-value
Age (years)	45.60 (45, 30-69)	60.60 (66, 44-69)	44.60 (45, 30-60)	0.003
Male	40 (50)	0 (0)	40 (53.33)	0.021
Female	40 (50)	5 (100)	35 (46.66)	0.021
Height (cm)	167.78 (167, 154-182)	165 (163, 157-175)	167.97 (167, 154-182)	0.382
BW (kg)	59.02 (60, 40-79)	56 (55, 48-63)	59.22 (60, 40-79)	0.036
BMI (kg/m^2)	20.81 (20.70, 15.80-26.90)	20.60 (19.60, 18.70-23.70)	20.87 (20.70, 15.80-26.90)	0.728
Ideal BW (kg) (Robinson)	61.67 (61, 47-77)	56.80 (55, 50-66)	62 (61, 47-77)	0.203
Serum albumin (g/dL)	3.74 (3.80, 1.30-4.20)	2.24 (2.20, 1.30-3.20)	3.84 (3.80, 3.50-4.20)	< 0.001
NRI	98.81 (97.78, 62.80-112.50)	75.63 (74.26, 62.80-96.29)	98.23 (98.46, 87.86-112.50)	0.032
Fracture type				
Femoral fractures	41 (51.25)	0 (0)	41 (54.66)	0.018
Tibial and fibular fractures	34 (42.50)	0 (0)	34 (45.33)	0.047
Humeral fractures	9 (11.25)	2 (40)	7 (9.33)	0.036
Radius and ulna fractures	3 (3.75)	1 (20)	2 (2.66)	0.048
Spinal fractures	6 (7.50)	2 (40)	4 (5.33)	0.004
Ankle fractures	11 (13.75)	3 (60)	8 (10.66)	0.002
Wrist and hand fractures	21 (26.25)	4 (80)	17 (22.66)	0.005
Comorbidities on admission				
Diabetes	24 (30)	0 (0)	24 (32)	0.131
Stroke	31 (38.75)	0 (0)	31 (41.33)	0.066
Hypertension	24 (30)	4 (80)	20 (26.66)	0.012
Hyperlipidemia	29 (36.25)	0 (0)	29 (38.66)	0.082
Chronic kidney disease	9 (11.25)	4 (80)	5 (6.66)	< 0.001
Ischemic heart disease	4 (5)	2 (40)	2 (2.66)	< 0.001
Liver cirrhosis	3 (3.75)	1 (20)	2 (2.66)	0.048
Hepatitis	3 (3.75)	2 (40)	1 (1.33)	< 0.001
Chronic respiratory disease	36 (45)	0 (0)	36 (48)	0.037
Malignancy	8 (10)	3 (60)	5 (6.66)	< 0.001
Rheumatoid arthritis	5 (6.25)	2 (40)	3 (4)	0.001
D3 supplementation	8 (10)	0 (0)	8 (10.66)	0.441
Smoker	17 (21.25)	5 (100)	12 (16)	< 0.001
Alcoholic	13 (16.25)	3 (60)	10 (13.33)	0.006
Barthel index on admission	70.80 (70.50, 45-95)	86 (85, 80-95)	69.78 (70, 45-90)	< 0.001
Surgical treatment	80 (100)	5 (100)	75 (100)	
Complication after operation				
Bed sores	3 (3.75)	1 (20)	2 (2.66)	0.048
Peroneal nerve palsy	3 (3.75)	2 (40)	1 (1.33)	< 0.001
DVT	4 (5)	4 (80)	0 (0)	< 0.001
Pneumonia	4 (5)	0 (0)	4 (5.33)	0.596
Others	6 (7.50)	1 (20)	5 (6.66)	0.273
Barthel index at discharge	65.58 (66, 39-90)	81 (80, 75-95)	64.56 (65, 39-84)	< 0.001
Hospitalization period (days)	28.87(27, 5-85)	55.60 (50, 28-85)	27.09 (26, 5-60)	0.002
Observation period (months)	5.8 (6, 0-6)	3.4 (4, 0-5)	6 (6, 6-6)	< 0.001

Units: height, cm (centimeters); body weight (BW), kg (kilograms); body mass index (BMI), kg/m^2 (kilograms per square meter); ideal body weight (ideal BW), kg (kilograms); serum albumin, g/dL (grams per deciliter).

Table II. Prognostic factors through univariate and multivariate analysis

	Univariate				Multivariate			
	HR	95 % CI (lower)	95 % CI (upper)	*p*-value	HR	95 % CI (lower)	95 % CI (upper)	*p*-value
Age	1.035	1.007	1.063	0.012	1.040	1.007	1.075	0.018
NRI (continuous variable)	1.046	1.006	1.087	0.024	1.237	1.004	1.525	0.046
Comorbidities on admission								
Radius and ulna fractures	1.051	1.001	1.105	0.046	1.040	1.007	1.075	0.018
Spinal fractures	1.138	1.053	1.230	0.001	1.673	1.105	2.533	0.015
Comorbidities on admission								
Hypertension	1.035	1.007	1.063	0.012	1.940	1.174	3.205	0.010
Chronic kidney disease	2.224	1.161	4.262	0.016	2.228	1.191	4.170	0.012
Ischemic heart disease	2.565	1.257	5.236	0.010	3.440	1.372	8.625	0.008
Barthel index on admission	1.122	1.004	1.254	0.042	1.137	1.013	1.127	0.033
Barthel index at discharge	1.141	1.015	1.282	0.027	1.151	1.017	1.302	0.026

HR: hazards ratio; CI: confidence interval; p*-value < 0.05 is significant.*

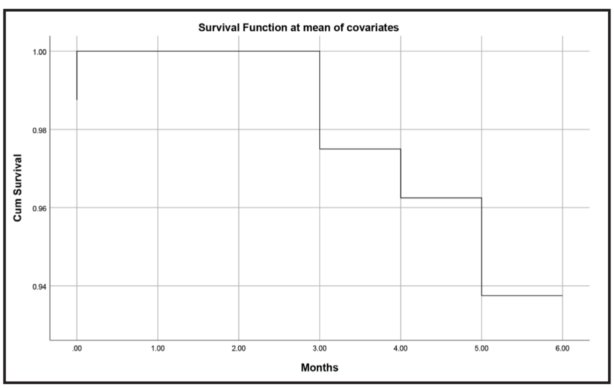

Figure 1.

Overall Survival of patients; $p < 0.05$.

NRI INTERPRETATION

Our multivariate analysis identified the Nutrition Risk Index (NRI) as a significant prognostic factor for long-term mortality (HR = 1.046 [$p = 0.046$]). To assess mortality risk, NRI values were categorized into different risk groups: > 100 (no risk), 97.5-100 (mild risk), 83.5-97.5 (moderate risk), and < 83.5 (severe risk). Upon admission, serum albumin levels were measured in a standard laboratory setting, revealing 4 patients in the severe risk category, 33 in the moderate risk category, 17 in the mild risk category, and 26 in the no risk category. Lowest serum albumin levels (2 g/dL) were observed in severe risk patients group (Table III).

Kaplan-Meier survival curve analysis demonstrated a 6-month overall survival rate after trauma (Fig. 1). Furthermore, there are no significant differences in mortality based on sex; only comparisons between the risk groups within each sex were made. Additionally, no significant differences were observed between the groups in terms of vitamin D3 intake, and the relationship with the Barthel index (BI) showed that patients with the highest nutritional risk tend to be more independent (with higher BI scores) (Table III).

The percentages reported reflect the distribution of patients in each risk group and do not represent mortality outcomes based on risk group. Furthermore, there is no evidence from the data to suggest any significant differences in mortality between men and women at six months.

Although sarcopenia has been linked to lower Barthel Index scores in previous studies (10-12), in this cohort, patients with high-moderate nutritional risk did not exhibit significantly lower Barthel index scores. Therefore, the association between sarcopenia and nutritional risk could not be supported in this study.

DISCUSSION

We utilized data from a single-center perspective registry in Nantong, Jiangsu, China, focusing on evaluating short-term overall survival. The study involved 80 patients aged over 30 years with trauma-induced fractures, revealing an overall survival rate of 93 % (Fig. 1). Additionally, our analysis confirmed that NRI, older age, taking vitamin D3 supplementation, and Barthel index was related to survival, with more dependent patients (those with lower Barthel scores) seemingly surviving longer in this cohort.

The 6-month overall survival post-discharge remained at 93 %. Our univariate and multivariate analyses identified several prognostic factors for trauma-induced fracture patients, including NRI (continuous variable), radius and ulna fractures, spinal fractures, comorbidities on admission, hypertension, chronic kidney disease, ischemic heart disease, Barthel index on admission, and Barthel index at discharge (Table II).

Table III. Baseline characteristics on the basis of nutritional risk assessment

Baseline characteristics	Severe risk	Moderate risk	Mild risk	No risk	*p*-value
Number	4 (5)	33 (41.25)	17 (21.25)	26 (32.5)	
Age (years)	58.75 (61, 44-69)	45.42 (47, 30-68)	41.88 (40, 31-60)	46.23 (47, 31-60)	0.063
Male	0 (0)	17 (51.51)	13 (76.47)	10 (38.45)	0.017
Female	4 (100)	16 (48.48)	4 (23.52)	16 (61.53)	0.017
Height (cm)	165.50 (165, 157-175)	166.87 (167, 154-178)	172.05 (175, 155-181)	166.50 (163.50, 156-182)	0.076
BW (kg)	54.25 (54.50, 48-60)	55.57 (53, 40-69)	65 (70, 42-77)	60.23 (59, 44-79)	0.006
BMI (kg/m^2)	19.82 (19.55, 18.70-21.50)	19.88 (20.10, 15.80-23.70)	21.79 (22.30, 17.50-23.80)	21.54 (21, 17.90-26.90)	0.005
Ideal BW (kg) (Robinson)	56.75 (56.50, 49-65)	60.92 (60.50, 46.95-73.18)	66.74 (70.46, 47.85-75.90)	59.99 (57.36, 48.76-76.80)	0.044
Serum albumin (g/dL)	2 (1.90, 1.30-2.90)	3.69 (3.70, 3.20-4.00)	3.84 (3.80, 3.70-4.10)	4.03 (4, 3.70-4.20)	< 0.001
NRI	70.47 (69.05, 62.80-80.97)	94.09 (94.58, 87.86-97.42)	98.77 (98.87, 97.63-99.74)	103.05 (102.18, 100.10-112.50)	< 0.001
Fracture type					
Femoral fractures	0 (0)	16 (48.48)	9 (52.94)	16 (61.53)	0.143
Tibial and fibular fractures	0 (0)	13 (39.39)	9 (52.94)	12 (46.15)	0.263
Humeral fractures	2 (50)	3 (9.09)	2 (11.76)	2 (7.69)	0.090
Radius and ulna fractures	1 (25)	1 (3.03)	1 (5.88)	0 (0)	0.099
Spinal fractures	2 (50)	0 (0)	0 (0)	4 (15.38)	0.001
Ankle fractures	3 (75)	4 (12.12)	1 (5.88)	3 (11.53)	0.003
Wrist and hand fractures	2 (75)	9 (27.27)	4 (23.52)	5 (19.23)	0.130
Comorbidities on admission					
Diabetes	0 (0)	11 (33.33)	3 (17.64)	10 (38.45)	0.260
Stroke	0 (0)	13 (39.39)	8 (47.05)	10 (38.45)	0.387
Hypertension	3 (75)	12 (36.36)	2 (11.76)	7 (26.92)	0.063
Hyperlipidemia	0 (0)	11 (33.33)	8 (47.05)	10 (38.45)	0.346
Chronic kidney disease	3 (75)	4 (12.12)	0 (0)	2 (7.69)	< 0.001
Ischemic heart disease	1 (25)	3 (9.09)	0 (0)	0 (0)	0.079
Liver cirrhosis	1 (25)	1 (3.03)	0 (0)	1 (3.84)	0.126
Hepatitis	1 (25)	2 (6.06)	0 (0)	0 (0)	0.067
Chronic respiratory disease	0 (0)	14 (42.42)	10 (58.82)	12 (46.15)	0.196
Malignancy	2 (50)	4 (12.12)	0 (0)	2 (7.69)	0.025
Rheumatoid arthritis	1 (25)	2 (6.06)	0 (0)	2 (7.69)	0.305
D3 supplementation	0 (0)	5 (15.15)	1 (5.88)	2 (7.69)	0.595
Smoker	4 (100)	5 (15.15)	4 (23.52)	4 (15.38)	0.001
Alcoholic	2 (50)	4 (12.12)	3 (17.64)	4 (15.38)	0.284
Barthel index on admission	86.25 (85, 80-95)	70.12 (72, 45-85)	71.17 (69, 58-85)	69.03 (68, 50-90)	0.025
Surgical treatment	4 (100)	33 (100)	17 (100)	26 (100)	
Complication after operation					
Bed sore	1 (25)	1 (3.03)	1 (5.88)	0 (0)	0.099
Peroneal nerve palsy	1 (25)	1 (3.03)	0 (0)	1 (3.84)	0.126
DVT	3 (75)	1 (3.03)	0 (0)	0 (0)	< 0.001
Pneumonia	0 (0)	2 (6.06)	0 (0)	2 (7.69)	0.664
Others	1 (25)	2 (6.06)	0 (0)	3 (11.53)	0.278
Barthel index at discharge	81.25 (80, 75-90)	64.69 (67, 39-80)	66.35 (63, 54-81)	63.80 (64, 46-84)	0.023
Hospitalization period (days)	59.50 (62.50, 28-85)	24.42 (24, 5-52)	26.88 (26, 10-52)	31.11 (28, 10-60)	0.010
Observation period (months)	3.25 (4, 0-5)	5.93 (6, 4-6)	6 (6, 6-6)	6 (6, 6-6)	< 0.001

In the study by Yeh et al. (13), a significant association was found between low Geriatric Nutritional Risk Index (GNRI) scores and higher mortality in adult patients with polytrauma. Additionally, comparing the GNRI with the NRI should be approached cautiously, as they are two distinct indices measuring different aspects of nutritional risk. We have now ensured that these indices are not directly compared and have provided the proper bibliographical reference for Yeh et al.'s study. Our study corroborated these findings, demonstrating a similar trend where the NRI in the deceased group (n = 5) was markedly lower at 75.63 (p = 0.032) compared to the survived group (n = 75) with an NRI score of 98.23 (p = 0.032). This observation suggests that elderly patients are more prone to a poor prognosis following trauma (14), which aligns with our study findings, as all the deceased patients in our research were in the age group of > 60 years (Table I).

Wang CY et al. (15) conducted a study on n = 4997 patients admitted at Chang-Gung Memorial Hospital, Keelung branch, a single level I trauma center in Northern Taiwan between January 1, 2011, and December 31, 2015 to assess how comorbidities influence the prognosis of trauma patients. The findings indicated that conditions like hypertension, chronic kidney disease, and ischemic heart disease were linked to increased mortality among trauma patients (15).

In our study, we observed similar outcomes where comorbidities, including hypertension (HR = 1.035, p = 0.033), chronic kidney disease (HR = 2.224, p = 0.012), and ischemic heart disease (HR = 2.565, p = 0.008), were correlated with higher mortality among patients (n = 5). Notably, Barthel's index at admission (HR = 1.122, p = 0.033) and Barthel index at discharge (HR = 1.141, p = 0.026) showed significant differences (Table II). The results underscore that while the Barthel Index at discharge is lower than at admission for both groups, functional losses (baseline BI vs. BI at discharge) were not directly compared between the deceased and survivor groups, although they appear similar based on table I.

Nevertheless, in our examination, Barthel's index exhibited a nominal decrease from 70.80 (admission) (Fig. 2) to 65.58 (discharge) (Fig. 3). The robustness of our study lies in its longitudinal prospective design with a 0 % attrition rate. While our study did not find a significant association between treatment with vitamin D3 and prognosis, we observed that patients with a higher Barthel Index (more independent) had a higher risk of mortality, which contrasts with most studies where dependent patients tend to have worse outcomes. This surprising finding may be related to the younger age of the sample and the possibility that more independent patients suffered additional damage associated with the fracture.

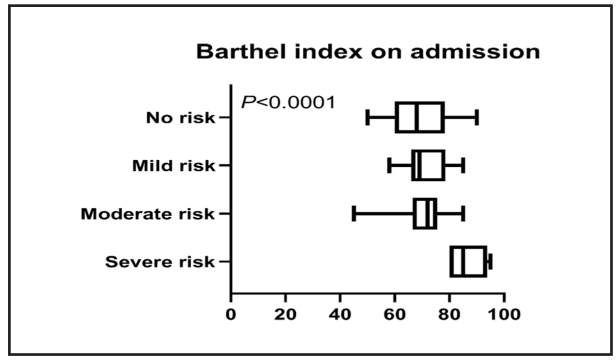

Figure 2.

Barthel's index (BI) at the time of admission, $p < 0.05$. Score (0-100). BI = Ability of a person to do daily life activities.

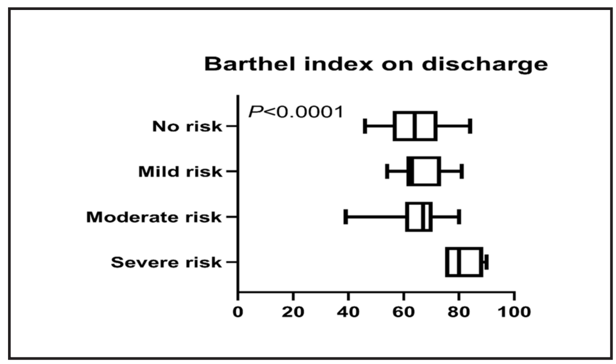

Figure 3.

Barthel's index (BI) at the time of discharge, $p < 0.05$. Score (0-100). BI = Ability of a person to do daily life activities.

CONCLUSION

Evaluation of long-term overall survival following various types of fractures, with a particular focus on the fractures most associated with mortality, including those of the radius, ulna, and vertebrae, based on our univariate and multivariate analyses was performed. The predictors of mortality identified in our study include older age, lower NRI, vertebral or radius and ulna fractures, hypertension, and ischemic heart disease. While the Barthel index was significant, our data showed that patients with a higher Barthel Index had a higher risk of mortality. Additionally, we evaluated the overall survival following trauma-induced fractures, with no specific analysis of secondary femoral neck fractures or BMI-related risk factors for re-fracture.

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