

Original Article

The effect of NRS2002-guided nutrition interventions on health knowledge, nutrition, and fracture union in senior patients with hip fractures after surgery

Yuqing Lan¹, Ying Huang², Jianguo Zhou¹, Fang Yu¹

Departments of ¹Joint Surgery, ²Nutrition, People's Hospital of Ganzhou, Jiangxi, China

Received September 7, 2019; Accepted October 10, 2019; Epub December 15, 2019; Published December 30, 2019

Abstract: Objective: This study was designed to analyze the clinical effects of nutrition interventions subject to the guidance of Nutritional Risk Screening 2002 (NRS2002) in senior patients with hip fractures after surgery. Methods: 105 senior patients with hip fractures admitted to our hospital from January 2017 to January 2019 were included as the objects for this retrospective analysis. They were randomly divided into an observation group and a control group using the random number table method. While the controls (n=53) received routine nutrition guidance, NRS2002-guided nutrition interventions were conducted in the patients from the observation group (n=52). The two groups were compared in terms of their mastery of health knowledge, nutrition, and fracture union. Results: 8 weeks after the intervention, both groups demonstrated significant intragroup elevations in their total NRS2002 scores, calf circumferences, arm muscle circumferences, and BMI ($P<0.05$), and the observation group exceeded the control group ($P<0.05$); the observation group reported a mean healing time of (2.21 ± 0.47) months and a mastery of health knowledge of 92.31%, while the mean healing time and mastery of health knowledge in the control group was (3.38 ± 0.52) months and 75.47% respectively ($P<0.05$). After interventions, the levels the nutritional status, including albumin, prealbumin, hemoglobin, transferrin and fibronectin, in the observation group were significantly higher than they were in the control group ($P<0.05$). Conclusion: NRS2002-guided nutrition interventions can enable senior patients with hip fractures to acquire more health-related knowledge, improve patients' nutritional levels, and promote fracture healing, which has a good application value.

Keywords: Hip fractures in the elderly, nutritional risk screening, nutrition interventions, health knowledge, nutritional status

Introduction

Hip fractures are defined as and include transcervical fractures, intertrochanteric fractures, and subtrochanteric fractures, of which, the first two types share an approaching incidence while the last one is seldom reported [1]. "Hip fractures in the elderly" means the elderly aged above 60. Transcervical fractures are generally found in patients at a more advanced age as compared with general transcervical fractures, showing a prominent aging feature [2].

Though surgery is an important means for the clinical treatment of hip fractures in the elderly, numerous factor result in a longer process of postoperative recovery, and nutrition problems occur in most senior patients to various de-

grees due to hypofunctions in digestion and chewing [3, 4]. The consequence of nutrition problems is insufficient minerals, vitamins, and proteins, which impairs patients' resistance and postoperative tissue healing ability and may increase the risks of poor wound healing or infection, and can even lead to a rising postoperative mortality [5, 6]. Moreover, in a study by Martin et al. [7], nutrition problems were proved to be a key factor resulting in hip fractures by highlighting the incidence of osteoporosis, a direct cause of this disease. In addition to the severe impact on patients' QOL, the high incidence, high disability, and high mortality of hip fractures in the elderly also puts a heavy burden on the society [8, 9]. Therefore, on the basis of active clinical surgical treatment, attention shall be additionally paid to postopera-

tive nutrition interventions in senior patients with hip fractures to maintain a satisfactory nutritional level and ensure postoperative recovery quality. However, most of the current studies on the implementation of nutritional interventions are in accordance with clinical experience and medical staff nursing experience, studies which lack a sufficient scientific basis. In this study, nutrition intervention was carried out based on the nutritional risk screening 2002 (NRS2002) scale, which can ensure the pertinence and effectiveness of the intervention.

NRS2002 is non-invasive, simple and fast, and it is designed to identify groups at high risk for malnutrition in the early stages with outstanding guidance values in its diagnosis and treatment [10]. The present study analyzed the effects of NRS2002-guided nutrition interventions on senior patients with hip fractures after surgery, with the expectation of providing effective methodological guidance for promoting postoperative recovery.

Materials and methods

Materials

105 senior patients with hip fractures admitted to our hospital from January 2017 to January 2019 were retrospectively analyzed for clinical data and randomly divided into an observation group and a control group using the random number table method. The control group (n=53) had an age range of 61 to 78, and the range in the observation group (n=52) was 60-80. The inclusion criteria consisted of meeting the diagnosis standards for hip fractures [11], the implementation of image examinations, LOS no longer than 3 d, an identified necessity for surgical treatment, normal communication skills, no nutritional treatment after surgeries, the provision of an informed consent by the patient himself or his guardians, and approval from the ethics committee of the Hospital. Some patients were excluded as they withdrew from the study while it was in process, or they were associated with wasting disease, including malignant tumors, hyperthyroidism and tuberculosis, digestive, hepatic or renal dysfunction, or because they received supported nutritional treatment after their surgeries.

Methods

The controls were routinely guided in their nutrition by means of verbal education and the distribution of health propaganda and education cards, and their questions were answered in detail. No additional systematical nutrition interventions were provided.

The patients in the observation group received NRS2002-guided nutrition interventions, and they were assessed using NRS2002 after their surgeries to help them understand factors affecting their nutrition, such as their psychological status, diet structure, their understanding of nutrition, compliance and capacity for movement, etc. Based on those factors and the results of NRS2002, the nurses formulated plans for nutrition interventions, and they conducted health education in various forms such as oral delivery, questionnaire, texts, pictures and videos and covering different knowledge fields, which included specifically psychological counseling, the adjustment of their diet structure, an understanding of nutrition, the recovery of limb functions, the improvement of their ability to care for themselves, and the mastery of nutritional knowledge by the patients and their family members. The preliminary plans were presented to the hospital's experts in orthopedics, nutrition, and psychology for review and finalized based on their suggestions, and was implemented according to following steps:

(1) Intervention in the understanding of nutrition: malnutrition items and their adverse impact on disease were introduced to patients and explained in details in words, making sure they can accept nutrition interventions voluntarily and compliantly with a correct understanding of their nutritive value.

(2) Adjustment of their diet structure: daily categories of food necessary and addable at each stage were presented in color pictures, and the patients were judged for compliance with the doctor's suggestions on dieting twice every week. Nutritional elements to be supplemented included: 1. Calcium: patients deficient in calcium were required to eat egg yolk, cheese, mustard, and cereal for manganese, evaporated milk, animal liver, wheat, eggs, lean meat, flour, and beans for iron, animal liver, soybeans,

sea fish, mushrooms, sunflower seeds for zinc, and bananas, kiwifruits and apples for B group vitamins, vitamins C and D, along with drinking plenty of water. 2. Proteins: patients were advised to consume milk and meat at 1.0-1.5 g/kg (per capita · d) at least once a day, and eggs twice a week.

(3) Recovery of self-care ability and limb functions: the content of functional exercises was introduced to patients via videos to help them with their self-care ability training. From the 1st to the 3rd week after surgery, patients practiced relaxing and contracting their muscles, especially the quadriceps brachii which should be contracted for a long time, while the patella was passively moved. The exercise progressed to the bending and stretching of the unfixed joints from the 3rd to the 6th weeks to slowly practice and move the joints where the fracture took place, and the frequency, strength and range of limb movements were increased from the 6th to the 8th weeks. 8 weeks after surgery, the patients were encouraged to walk on flat ground until the 12th week.

(4) Improvement of the caretakers' knowledge of nutrition: the caretakers received comprehensive health information, education and guidance to ensure a rational proportion of various nutrients and a balance in the color, flavor, taste, amount and type. The recipes were based on patients' ability to take food. For patients who were not able to chew, small-particle food, which can easily be chewed and digested, was prepared to ensure the patients' sufficient intake of coarse fiber. Furthermore, caretakers were required to encourage the patients to maintain a pleasant mood during intake, forbid them from excessive movement half an hour before and after taking food, and advise them to eat some fruit 1 h after meals.

Observation indices

(1) Nutritional risk: the patients were evaluated using NRS2002 [12] before and after their intervention (when discharged), which covered 4 aspects: BMI, changes in dietary intake in the past 1 week, changes in body weight in the past 3 months, and the severity of the primary diseases' impact on their nutritional status. For patients over 70, the degree of nutritional risk was 1; a score of 3 was selected as the cut-off point, above or at which, the patients had a

nutritional risk, and under which the patients were risk free.

Anthropometry: the measurements included calf circumference, which will be equivalent to or greater than 31 cm, arm muscle circumference which will be greater than 22 cm, and BMI, which will be between 18.5-23 to indicate a healthy condition. Patients with a calf circumference under 31 cm, an arm muscle circumference under 21 cm, and a BMI under 18 were malnourished, and patients with an arm muscle circumference between 21-22 cm had nutritional risks or who had a BMI over 24 were challenged with overnutrition.

(2) Fracture union time: defined as the interval from the day on which a surgery was performed to the date on which the fracture was completely united according to imaging examinations.

(3) Mastery of health knowledge: questionnaires were distributed before and after the intervention, which contained 16 questions to learn about the patients' physical conditions, basic nutritional knowledge, knowledges on osteoporosis, behavioral factors, and food frequency. For each correct answer, 1 mark was given and a nil was given for incorrectly answered or missed questions. With the highest mark of 24, the patients were given a failing grade at mastering the required knowledge in the case of a mark under 13, partial mastery if between 14 and 20, and complete mastery from 21 to 24.

(4) Nutritional status: the levels of albumin, prealbumin, hemoglobin, transferrin, and fibronectin were determined before and after the intervention.

Statistical analysis

The statistical analysis was performed using SPSS 22.0. In the case of numerical data expressed as the mean \pm standard deviation, comparison studies were carried out through independent-samples *t*-tests for the data which were normally distributed, and a Mann-Whitney U test for the data which were not normally distributed, a paired test for pre-and-pro comparisons in the group; in the case of nominal data expressed as [n (%)], comparison studies were carried out using χ^2 tests for inter-group comparisons. For all statistical comparisons, significance was defined as $P < 0.05$.

Table 1. Comparison of the clinical data between the observation group and the control group ($\bar{x} \pm s$)/[n (%)]

Materials		Observation Group (n=52)	Control Group (n=53)	t/X ²	P
Gender	M	29 (55.77)	30 (56.60)	0.007	0.931
	F	23 (44.23)	23 (43.40)		
Age (y)		70.56±5.48	71.95±6.34	1.201	0.233
Height (cm)		165.89±8.59	168.43±9.42	1.443	0.152
Weight (kg)		65.39±4.25	66.83±4.51	1.683	0.095
Age	Under 65	16 (30.77)	18 (33.96)	0.122	0.727
	At or above 65	36 (69.23)	35 (66.04)		

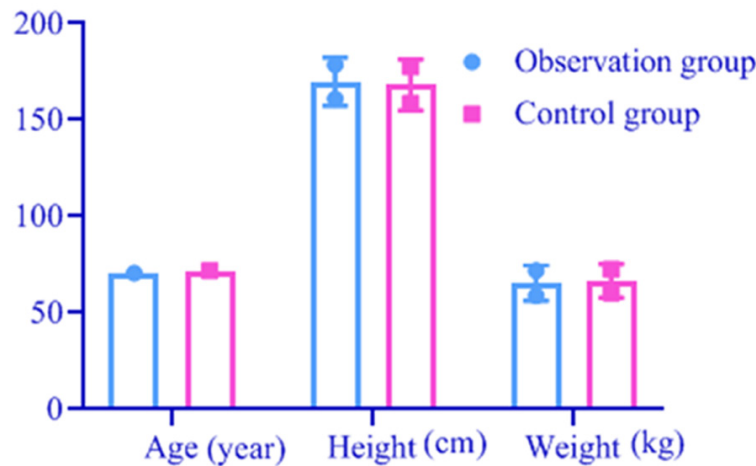


Figure 1. Comparison between the observation group and the control group in age, height and weight. The observation group had no significant statistical differences with the control group in terms of mean age, mean height, and mean weight ($P>0.05$).

Results

Comparison of clinical data

No significant differences were revealed between the observation group and the control group in terms of proportions of males and females ($P>0.05$), mean age ($P>0.05$), mean height ($P>0.05$), mean weight ($P>0.05$), or the proportions of age groups with 65 as the cut-off point (Table 1 and Figure 1).

Comparison in NRS2002 results

Before the intervention, the observation group reported 90.38% of its patients with nutritional risk, while the control group was 84.91% ($P>0.05$), but after the intervention, both values were reduced to 19.23% and 33.96%, respectively ($P<0.05$, Table 2 and Figure 2).

Comparison in anthropometry

In terms of calf circumference, arm muscle circumference, and BMI, the observation group and the control group had no statistical difference ($P>0.05$) before the intervention, and the achieved an intragroup elevation ($P<0.05$) 8 weeks after the intervention, which was more significant in the observation group ($P<0.05$, Table 3 and Figures 3, 4).

Comparison of the fracture union time and the mastery of health knowledge

The minimum and maximum fracture union times of the observation group were 1 month and 3 months respectively, with a mean value of (2.21 ± 0.47) months, and those of the control group were 2 months, 5 months and (3.38 ± 0.52) months, respectively ($P<0.05$). The observation group (n=52) and the control group (n=53) respectively reported 21 (40.38%) and 17 cases (32.08%) of complete mastery of health knowledge, 27 (51.92%) and 23 (43.40%)

cases of partial mastery, and 4 (7.69%) and 13 (24.53%) cases of failure. The mastery of the health knowledge of the observation group was 92.31%, which was significantly higher than it was the control group of 75.47% ($P<0.05$) (Table 4 and Figure 5).

Comparison of nutritional status levels in the observation and control groups

There was no statistically significant difference in the nutritional status levels of albumin, prealbumin, hemoglobin, transferrin, and fibronectin between the observation group and the control group before the intervention ($P>0.05$). The level of each index in the observation group was significantly different from the level before the intervention ($P<0.05$), but after the intervention in the control group, the level of each index was not much different than it was before

The effect of nutritional intervention

Table 2. Comparison in the NRS2002 results between the observation group and the control group [n (%)]

Group	Before Intervention		After Intervention	
	With nutritional risk	Without nutritional risk	With nutritional risk	Without nutritional risk
Observation Group (n=52)	47 (90.38)	5 (9.62)	10 (19.23)*	42 (80.77)
Control Group (n=53)	45 (84.91)	8 (15.09)	18 (33.96)	35 (66.04)
χ^2	0.726		4.404	
P	0.394		0.036	

Note: The statistical value of P after 8 weeks of intervention in the two groups was compared with that before intervention in the group (*: $P < 0.05$).

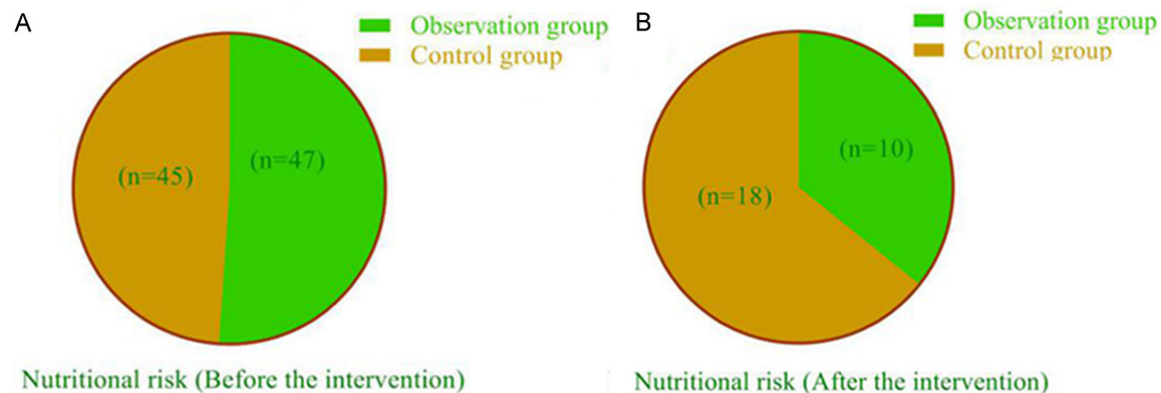


Figure 2. A Comparison between the observation group and the control group in their NRS2002 results. While no statistical difference was found between the two groups before the intervention ($P > 0.05$), the observation group reported a decreased proportion of patients with a nutritional risk after the intervention as compared with the control group ($P < 0.05$).

Table 3. Comparison in anthropometry between the observation group and the control group ($\bar{x} \pm s$)

Group	Observation Group (n=52)		Control Group (n=53)		t	P
	Before intervention	8 weeks after intervention	Before intervention	8 weeks after intervention		
Calf circumference (cm)	25.63±0.89	34.56±0.92*	25.24±0.79	30.28±0.89*	24.230	0.000
Arm muscle circumference (cm)	19.58±2.63	29.95±1.35*	19.82±2.75	25.31±1.83*	14.762	0.000
BMI (kg/m ²)	18.86±1.35	21.34±1.56*	18.95±1.42	19.68±1.37*	5.797	0.000

Note: The statistical values of t and P after 8 weeks of intervention in the two groups were compared with those before intervention in the group (*: $P < 0.05$).

the intervention ($P > 0.05$). After the intervention, the levels of the nutritional status indexes, including albumin, prealbumin, hemoglobin, transferrin and fibronectin in the observation group, were significantly higher than they were in the control group ($P < 0.05$) (Table 5).

Discussion

Hip fractures, mostly found among seniors, have been experiencing a progressively increased incidence in recent years as a result of aging [13]. Senior patients with hip fractures

are affected in their nutrition by a reduced range of movement, changes in their diets and stress arising from surgeries, so that they are less resistant and more vulnerable to postoperative infection, leading to increased disability and mortality, extended LOS and an accessorial medical burden [14, 15].

Nutrition is closely related to the postoperative recovery of senior patients with hip fractures and affected by their arm muscle circumference, calf circumference, mastery of health knowledge, psychological status and capacity for

The effect of nutritional intervention

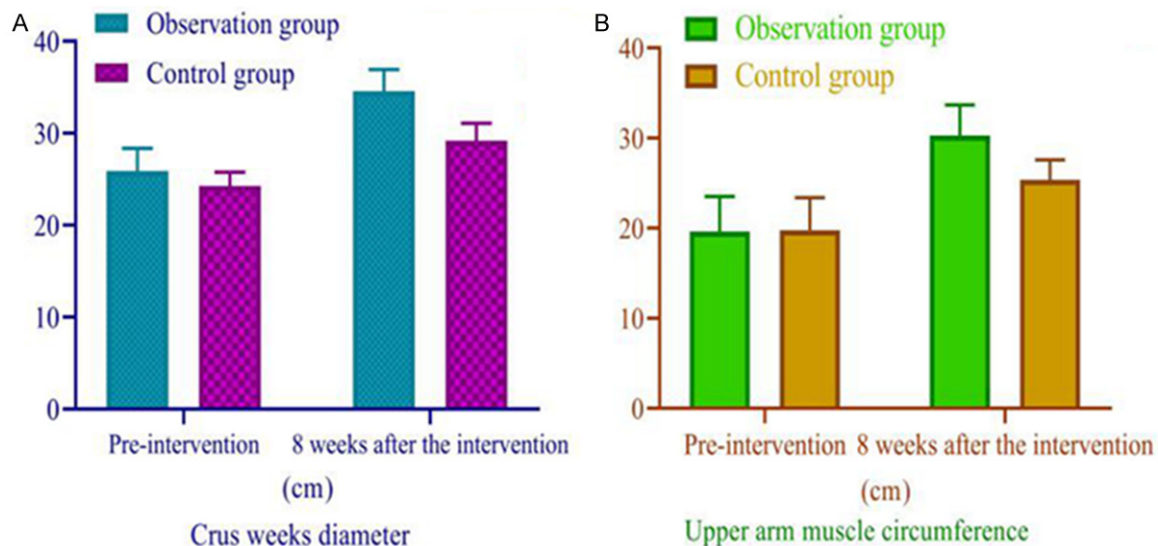


Figure 3. Comparison between the observation group and the control group in calf circumference and arm muscle circumference. In terms of calf circumference and arm muscle circumference, no statistical differences were observed between the control group and the observation group before the intervention ($P>0.05$), but the observation group exceeded the control group 8 weeks after the intervention ($P<0.05$), and reached a level ($P<0.05$) which was not observed in the control group ($P>0.05$) compared with the conditions before the intervention.

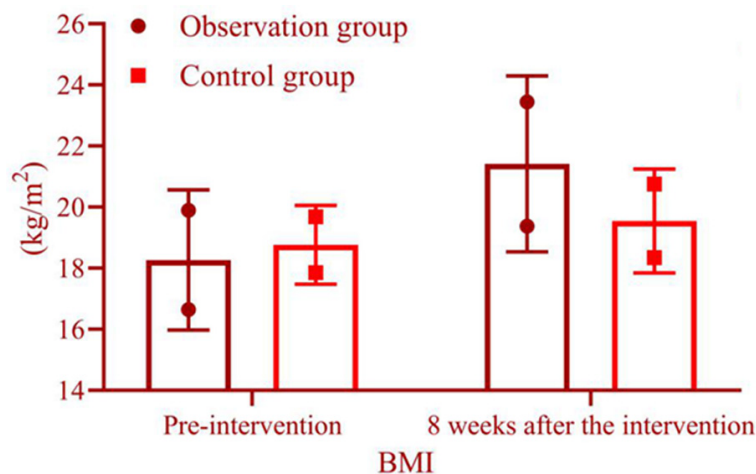


Figure 4. Comparison between the observation group and the control group in BMI. In terms of BMI, no statistical difference was observed between the control group and the observation group before the intervention ($P>0.05$), but the observation group exceeded the control group 8 weeks after intervention ($P<0.05$), and reached a level ($P<0.05$) which was not observed in the control group ($P>0.05$) compared with the conditions before intervention.

function. Patients with a smaller calf circumference, arm muscle circumference and mastery of health knowledge had more obvious nutritional problems. Poor nutrition in senior patients with hip fractures are attributed to the obvious decline in body development, metabolism and internal secretions, the large-scale aging of muscles and bones, and problems in the digestive system, cardio-cerebral vascular system, respiratory system, and their metabolic system [4, 18]. Furthermore, physiological changes in bone tissues, the metabolism of vitamin D and parathyrin may also contribute to osteoporosis and affect the patients' nutrition [19].

movement [16, 17]. The present study showed that postoperative nutrition interventions in senior patients with hip fractures on the basis of NRS2002 were advantageous as the patients' mastery of health knowledge, calf circumference, and arm muscle circumference were positively associated with the risk of mal-

In the present study, the observation group received nutrition interventions on the basis of NRS2002, and the results revealed that 8 weeks after intervention, the observation group achieved a NRS2002 score, calf circumference, arm muscle circumference, and BMI higher than the controls who were routinely guided

Table 4. Comparison in the mastery of health knowledge before and after the intervention between the observation group and the control group [n (%)]

Group	Completely Master	Partially Master	Fail to Master	Mastery
Observation Group (n=52)	21 (40.38)	27 (51.92)	4 (7.69)	48 (92.31)
Control Group (n=53)	17 (32.08)	23 (43.40)	13 (24.53)	40 (75.47)
χ^2				5.483
P				0.019

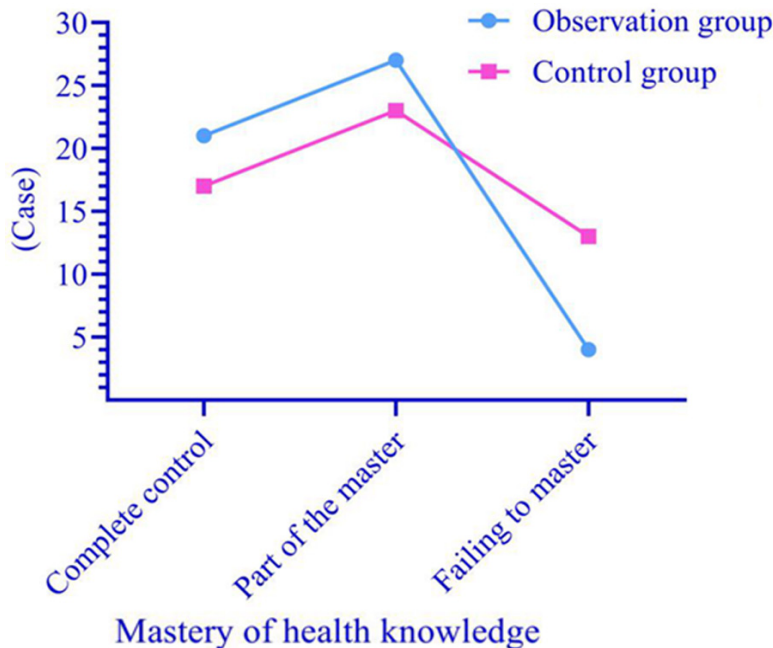


Figure 5. Comparison between the observation group and the control group in mastery of health knowledge. The observation group outnumbered the control group in terms of patients who completely or partially mastered the health knowledge, and in total mastery which was 92.31% in the observation group and 75.47% in the control group, and reported fewer cases of failure ($P<0.05$).

for nutrition only ($P<0.05$). After the intervention, the levels of nutritional status indexes including albumin, prealbumin, hemoglobin, transferrin, and fibronectin in the observation group were significantly higher than they were in the control group ($P<0.05$). The underlying reasons are that nutritional interventions on the basis of NRS2002 can provide a guarantee for the clear and correct understanding of patients' nutrition before intervention, and the instructions for the formulation of intervention schemes which were presented to experts from various fields for review and finalization to improve their scientific soundness, targeted implementation, and application effects. Gur et

al. [20] studied hundreds of hospitalized senior patients using NRS2002 for their nutrition assessment, and the results revealed that patients at an advanced age were more vulnerable to malfunction as compared with the controls who were directly intervened by nursing, and the nursing intervention on the basis of assessment resulted in a more obvious improvement in nutrition. In the present study, the observation group reported a mastery of health knowledge at 92.31% and a mean healing time of (2.21 ± 0.47) months, while the control group was 75.47% and (3.38 ± 0.52) months, indicating that the improved mastery of health knowledge contributed to the fracture union as patients were more compliant with nutrition interventions after learning the roles of nutrition in postoperative recovery and after the schemes were implemented successfully and effectively.

NRS2002 is characterized by simple procedures which can be mastered by medical staff rapidly and done in 10 min, with an extensive coverage and the feasibility of bedside implementation [21]. It groups

patients into "with malnutrition risk" and "without malnutrition risk" and contributes to the correct understanding of patients' degree of nutritional risk to provide guidance for medical staff when they are formulating targeted nutrition intervention schemes. Arslan et al. [22] found through their study that for patients who had no abnormal appearance of serum proteins, NRS2002 can be relied on to correctly judge the existence of any nutritional risks in them, while Karateke et al. [20] revealed a specificity of 98%, a positive predictive value of 97% and a sensitivity of 96% when NRS2002 was adopted for the assessment of malnutrition. In addition, Canales et al. [23] re-

Table 5. Comparison of the levels of nutritional status indexes in the observation and control groups ($\bar{x} \pm s$)

Group	Observation Group (n=52)		Control Group (n=53)		t	P
	Before intervention	After intervention	Before intervention	After intervention		
Albumin (g/L)	27.39±2.64	31.75±2.19*	27.35±2.59	28.46±2.61	6.990	0.000
Prealbumin (mg/dL)	25.94±2.16	28.94±1.53*	25.98±2.16	26.28±1.64	8.590	0.000
Hemoglobin (g/L)	120.16±3.59	123.31±3.64*	119.92±4.53	120.53±3.86	3.795	0.000
Transferrin (g/L)	3.09±0.20	3.59±0.35*	3.07±0.16	3.18±0.23	7.107	0.000
Fibronectin (g/L)	2.25±0.13	3.10±0.35*	2.31±0.16	2.62±0.28	7.767	0.000

Note: the statistical values of *t* and *P* after the intervention in the two groups were compared with those before the intervention in the group (*: *P*<0.05).

ported through a comparative analysis that NRS2002 had an increased accuracy in patients above 65 and with severe malnutrition, while the results of Masopust et al. [24] after nutrition interventions on the basis of NRS2002 showed that no patients experienced malnutrition 3 months later, and 70% of the patients had improved NRS2002 scores as compared with their scores before the intervention.

In conclusion, NRS2002-guided nutrition interventions have shown satisfactory application values by assisting senior patients with hip fractures in mastering more health-related knowledge, improving nutritional levels, and fracture union in this study. However, the present study focused on a retrospective analysis with a short follow-up, fewer study indices, and less sufficiently representative results. In the future, perspective studies based on a large sample size and a longer follow-up will be stressed to further investigate the role of NRS2002-guided nutrition interventions and to provide senior patients with hip fractures more feasible options for postoperative recovery.

Disclosure of conflict of interest

None.

Address correspondence to: Fang Yu, Department of Joint Surgery, People's Hospital of Ganzhou, No. 16 Meiguan Road, Ganzhou 341000, Jiangxi Province, China. Tel: +86-0797-5889771; E-mail: yiyuy123@163.com

References

- [1] Anagnostis P, Paschou SA and Goulis DG. Management of acute hip fracture. *N Engl J Med* 2018; 378: 971-972.
- [2] Roberts KC, Brox WT, Jevsevar DS and Sevarino K. Management of hip fractures in the elderly. *J Am Acad Orthop Surg* 2015; 23: 131-137.
- [3] Peeters CM, Visser E, Van de Ree CL, Gosens T, Den Ouden BL and De Vries J. Quality of life after hip fracture in the elderly: a systematic literature review. *Injury* 2016; 47: 1369-1382.
- [4] Malafarina V, Reginster JY, Cabrerizo S, Bruyère O, Kanis JA, Martinez JA and Zulet MA. Nutritional status and nutritional treatment are related to outcomes and mortality in older adults with hip fracture. *Nutrients* 2018; 10.
- [5] Hammad A, Kaido T, Aliyev V, Mandato C and Uemoto S. Nutritional therapy in liver transplantation. *Nutrients* 2017; 9.
- [6] Dellièvre S and Cynober L. Is transthyretin a good marker of nutritional status? *Clin Nutr* 2017; 36: 364-370.
- [7] Malafarina V, Uriz-Otano F, Malafarina C, Martinez JA and Zulet MA. Effectiveness of nutritional supplementation on sarcopenia and recovery in hip fracture patients. A multi-centre randomized trial. *Maturitas* 2017; 101: 42-50.
- [8] Parker MJ. Sliding hip screw versus intramedullary nail for trochanteric hip fractures; a randomised trial of 1000 patients with presentation of results related to fracture stability. *Injury* 2017; 48: 2762-2767.
- [9] Manoli A 3rd, Driesman A, Marwin RA, Konda S, Leucht P and Egol KA. Short-term outcomes following hip fractures in patients at least 100 years old. *J Bone Joint Surg Am* 2017; 99: e68.
- [10] Priegnitz C, Galetke W, Tremel M and Randerath WJ. "Nutritional risk screening 2002"-in clinical pneumology. *Pneumologie* 2014; 68: 478-482.
- [11] Kim JW, Lee JI and Park KC. Pseudoaneurysm of the deep femoral artery caused by a guide wire following femur intertrochanteric fracture with a hip nail: a case report. *Acta Orthop Traumatol Turc* 2017; 51: 266-269.

- [12] Priegnitz C, Kietzmann I, Richter K, Galetke W and Randerath W. Nutritional risk screening 2002 - Application in pneumology. *Pneumologie* 2012; 22: 167-177.
- [13] Koso RE, Sheets C, Richardson WJ and Galanos AN. Hip fracture in the elderly patients: a sentinel event. *Am J Hosp Palliat Care* 2018; 35: 612-619.
- [14] Stephens JR, Williams C, Edwards E, Ossman P and DeWalt DA. Getting hip to vitamin D: a hospitalist project for improving the assessment and treatment of vitamin D deficiency in elderly patients with hip fracture. *J Hosp Med* 2014; 9: 714-719.
- [15] Nijmeijer WS, Folbert EC, Vermeer M, Slaets JP and Hegeman JH. Prediction of early mortality following hip fracture surgery in frail elderly: The Almelo Hip Fracture Score (AHFS). *Injury* 2016; 47: 2138-2143.
- [16] Karakatsani A, Katsoulis M, Klinaki E and Trichopoulou A. Corticosteroids and hip fracture risk in elderly respiratory patients: EPIC-Greece cohort. *Adv Respir Med* 2017; 85: 124-125.
- [17] Vosoughi AR, Emami MJ, Pourabbas B and Mahdaviazad H. Factors increasing mortality of the elderly following hip fracture surgery: role of body mass index, age, and smoking. *Musculoskelet Surg* 2017; 101: 25-29.
- [18] Inoue T, Misu S, Tanaka T, Sakamoto H, Iwata K, Chuman Y and Ono R. Pre-fracture nutritional status is predictive of functional status at discharge during the acute phase with hip fracture patients: a multicenter prospective cohort study. *Clin Nutr* 2017; 36: 1320-1325.
- [19] Wang HP, Liang J, Kuo LM, Chen CY and Shyu YI. Trajectories of nutritional status and cognitive impairment among older taiwanese with hip fracture. *J Nutr Health Aging* 2017; 21: 38-45.
- [20] Gur AS, Atahan K, Aladag I, Durak E, Cokmez A, Tarcan E and Tavusbay C. The efficacy of Nutrition Risk Screening-2002 (NRS-2002) to decide on the nutritional support in general surgery patients. *Bratisl Lek Listy* 2009; 110: 290-292.
- [21] Gökcan H, Selçuk H, Töre E, Gülseren P, Cambaz H, Sarıtaş Ş, Öcal R, Başaran Ö, Yılmaz U and Akın E. The nutritional risk screening 2002 tool for detecting malnutrition risk in hospitalised patients: perspective from a developing country. *Turk J Gastroenterol* 2014; 25: 718-723.
- [22] Arslan M, Soylu M, Kaner G, Inanc N and Basmisirli E. Evaluation of malnutrition detected with the Nutritional Risk Screening 2002 (NRS-2002) and the quality of life in hospitalized patients with chronic obstructive pulmonary disease. *Hippokratia* 2016; 20: 147-152.
- [23] Canales C, Mccarthy C, Yeh D, Chokengarnwong N, Belcher D, Nakayama A and Quraishi S. 553: nutric vs. nutritional risk screening 2002 as predictors of outcomes in critically ill patients. *Critical Care Medicine* 2015; 43 Suppl 1: 140.
- [24] Masopust J, Kratochvil J, Martinkova V and Charvat J. The relation between nutritional risk category identified by the modified Nutritional Screening 2002 and mortality in metabolic intensive care unit. *Vnitr Lek* 2008; 54: 817-820.