Original Article

Nutritional risk, malnutrition and nutritional support among hospitalized patients in orthopedics/spinal surgery of a Hohhot teaching hospital

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The evolution of nutritional status (the prevalence of nutritional risk, malnutrition, overweight and obesity) and the nutritional support of the hospitalized patients from admission to discharge or over a two-week period in orthopedics/spinal surgery of a teaching hospital in Hohhot were investigated. 432 patients from two wards of the orthopedics/spinal surgery from Jan to Dec 2013, the traditional spinal surgery and the minimally invasive spinal surgery, were selected and detected in this study. The Nutritional Risk Score 2002 (NRS 2002) was used to determine the patients' nutritional status within 48h after admission and during their hospitalization. The overall prevalence of nutritional risk, malnutrition, overweight and obesity at admission was 11.6%, 12.7%, 35.9% and 7.41%, respectively. Overall, there were 88.0% of the patients who were at nutritional risk received nutritional support, while 14.1% of non-risk patients received a redundant nutritional support. The overall prevalence of nutritional risk changed from 11.6% at admission to 19.4% upon discharge ($p<0.05$), and the prevalence of malnutrition changed from 12.7% to 20.6% ($p<0.05$). The prevalence of overweight and obesity, which changed from 35.9% to 31.0% and from 7.41% to 5.79% respectively, didn't experience statistically significant evolution. NRS 2002 was a feasible nutritional risk screening tool for patients in spinal surgery of orthopedics department. Patients' prevalence of nutritional risk and malnutrition increased significantly in spinal surgery of this hospital. Some inappropriate uses of nutritional support were observed in orthopedics/spinal surgery, and nutritional support guidelines or protocols should be promoted by a professional committee.

Key Words: Nutritional Risk Screening 2002, nutritional risk, nutritional support, spinal surgery, orthopedics

INTRODUCTION

The prevalence of malnutrition and nutritional risk has been estimated as high as 20%-50% among hospitalized adults, depending on the definition employed and the population assessed.[1-4] Large cohort of studies showed a close association between malnutrition and increased complication rate, length of hospital stay and costs.[1,5-7] To address this problem, identification of malnourished individuals and those at nutritional risk is the essential first step of a comprehensive nutrition care program.[8,9] Several methods[10-12] were considered to identify patients at risk of malnutrition, and the Nutritional Risk Screening 2002 (NRS 2002) was chosen by the European Society for Parenteral and Enteral Nutrition (ESPEN)[12] and the Chinese Society of Parenteral and Enteral Nutrition (CSPEN)[13] to assess malnutrition risk in populations.

Nutritional care can contribute to improve or maintain nutritional status and to avoid complications throughout patients' hospitalization and illness period,[14] while lack of nutritional support or appropriate nutritional support may worsen the nutritional status.[6] Some reports indicated that nutritional support of patients undergoing spinal surgery could improve patients' nutritional status and minimize their complications.[15-17]

The purpose of this study was to evaluate the nutritional status upon patients' admission, and to investigate their evolution in nutritional status and the nutritional support

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of the patients in orthopedics/spinal surgery of a Hohhot teaching hospital from admission to discharge or over a two-week period of hospitalization. The findings of this study should provide some evidence on the evolution of nutritional status of orthopedics/spinal surgery patients and on the provision of nutritional support in spinal surgery. This study is the first investigation on the evolution of the nutritional status among orthopedics/spinal surgery patients using the NRS 2002 tool.

MATERIALS AND METHODS

Study population

Figure 1 presents the number of patients eligible for screening actually been involved in this study. Among 527 patients newly admitted in the spinal surgery from Jan to Dec 2013, 441 patients could meet the inclusion criteria and eligible for this investigation. Within the 441 patients, 9 of them could not be completely screened, therefore, 432 (82.0%) patients were enrolled in this study and categorized into traditional spinal surgery group (250 patients) and minimally invasive spinal surgery group (182 patients). After that, each group was then divided into at nutritional risk group and not at risk group.

Subjects and methods

This study was a prospective descriptive designed investigation. Patients from two spinal surgery wards in orthopedics department, the traditional spinal surgery and the minimally invasive spinal surgery, were chosen and assessed for their prevalence of nutritional risk, the application of nutritional support and changes in nutritional status during their hospitalization from Jan to Dec 2013.

Patients admitted consecutively to these wards were eligible for this study if they met the following inclusion criteria. The patients' age should be older than 18 years; scheduled to stay more than 24 h in hospital; well oriented to height and weight; not a emergency patient and provided informed consent to participate in the study.

Nutritional risk screening and malnutrition

Patients' nutritional status and the NRS 2002 were evaluated following the operation based on NRS 2002 screening tool. The first step to determine the NRS 2002 score was primary screening, which was consisted of four key components, Body Mass Index (BMI), weight loss, food intake reduction, and severity of disease. The second step was final screening, which evaluated the nutritional status. In the second step, the nutritional damage score, disease severity and age score contributed to the nutritional risk score.[12] Nutritional damage score was based on BMI score, recent weight loss score, and food intake reduction score. Disease severity score was graded 1-3 based on metabolic needs and nutritional requirements, and an age adjustment for patients aged ≥70 years (+1). Patients whose nutritional risk score ≥3 were considered to be at nutritional risks and requiring nutritional support.

BMI was used in this study to classify patients' malnutrition, normal, overweight, and obesity. For Chinese, the normal range defined by BMI was 18.5<BMI<24.0, the malnutrition range was BMI≤18.5, while the overweight and obesity range was 24.0≤BMI<28.0 and BMI≥28.0, respectively.[18] This classification was also used in other

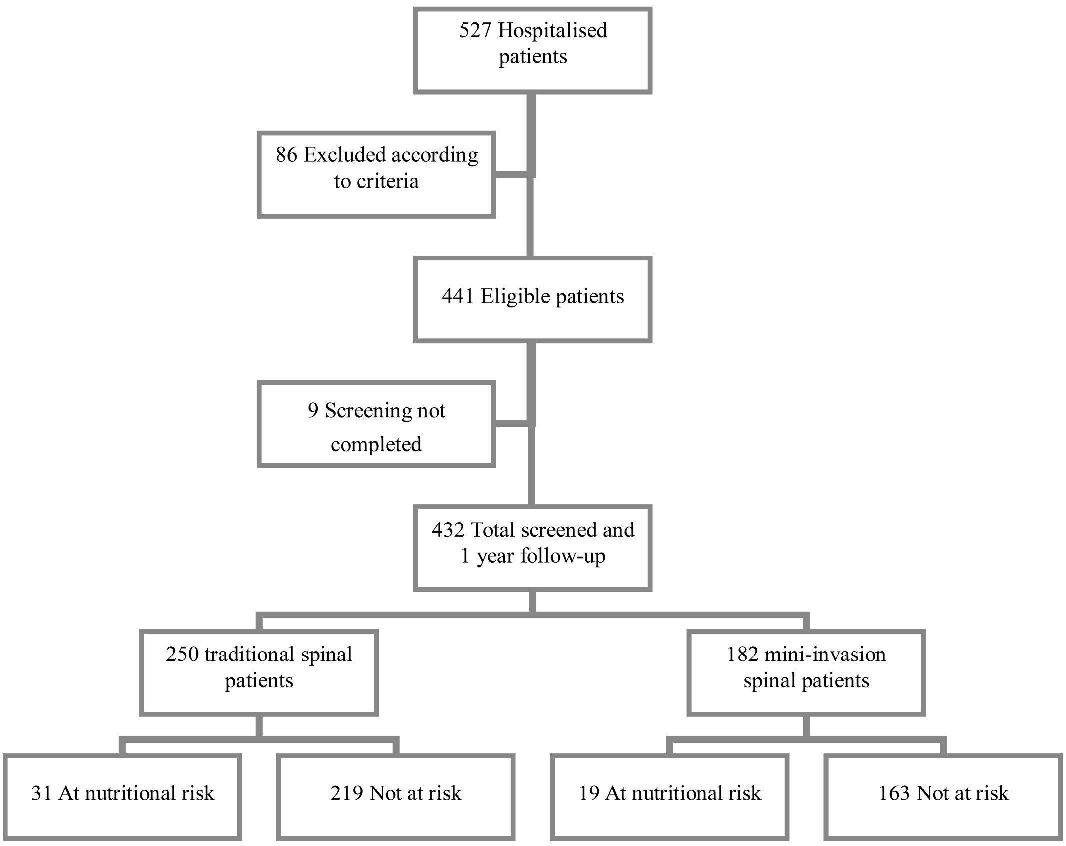

Figure 1. The flow-chart of the investigation

investigation and on Chinese nutritional status.[4,13]

In this study, patients' nutritional support during their hospitalization was assessed using a self-developed check list, which included the types (oral diet, enteral nutrition (EN), parenteral nutrition (PN)), prescribes (carbohydrates, amino acids, lipids) and the dosages.

Data collection

Patients newly admitted were asked whether they would like to participate in this investigation. After their agreement, the patients' recent nutritional conditions, weight loss and food intake reduction were interviewed by the clinical pharmacists. Patients' weight and height from admission to discharge were measured also by the clinical pharmacists with the same standard scale: before meals in the morning, with shoes off and wearing a hospital gown. The height of the patient was measured to the nearest 0.5 cm, and body weight to the nearest 0.5 kg. The patients' nutritional supports being delivered were also collected from their medical records. The data-collection should be performed until two weeks after admission or until the time of patients' discharge.

This study protocol was approved by the Ethics Committee of Inner Mongolia Medical University. The clinical trials registration number is 2013057.

Statistical analysis

SPSS (Statistical Package for Social Sciences, Chicago, IL, USA), version 16.0, was used for the statistical analyses in this study. The situation that $p<0.05$ was considered statistically significant. Descriptive statistics were used to describe the frequency and percentage of patients' nutritional status (nutritional risk, malnutrition, normal, overweight and obesity) and the percentage of nutritional support. The Chi-square test was performed to compare the percentage of nutritional risks in different gender and age groups and the difference of nutritional risk and malnutrition from admission to discharge. Paired t-test or Student's t-test was used to compare the difference of the continuous variables from admission to two weeks after admission or until discharge, such as weight loss, length of stay etc. A linear regression model was constructed to determine the contribution of each component of the NRS 2002 to patients' nutritional risk evolution.

RESULTS

Demographic data

Of 432 consecutive patients who met the inclusion criteria upon their admission, 228 (52.8%) were male and 204 (47.2%) were female.

Overall, the age range of the enrolled patients was 22 to 84 years, and the average age was 54.6 years (SD 12.5 years). The percentage of the patients younger than 60 years was significantly higher than that older than 60 years (χ^2=5.93, $p<0.05$). The average length of hospital stay from admission to discharge was 18.0 days (SD 7.4 days). The patients' mean length of hospital stay in traditional spinal surgery was 19.8 days (SD 8.3 days), which was significantly longer than that in the minimally invasive spinal surgery (15.2 days, SD 5.1 days) (t=7.17, $p<0.001$). Detailed information was shown in Table 1.

On the diagnoses of the patients in orthopedics/spinal surgery, 33.8% of the entire sample suffered the Fracture and its complication, and 3.47% suffered Tumors. The patients' diagnoses and the range of disease scores were shown in Table 2.

Prevalence of nutritional risk

The prevalence of nutritional risk at admission among the patients of the entire sample, traditional spinal surgery and minimally invasive spinal surgery was 11.6%, 12.4% and 10.4%, respectively. The prevalence of nutritional risk at admission and upon discharge was shown in Table 3. Among the patients involved, traditional spinal surgery (12.4%) provided a higher prevalence of nutritional risk at admission than that of minimally invasive spinal surgery (10.4%), but not a statistically significant difference (p=0.547). Within the four key components of the nutri-

Table 1. Detail information of the demographic data

	Total	Traditional spinal	Mini-invasion spinal	*p* value
Total, n (%)	432	250	182	
Gender, n (%)				
Women	204 (47.2)	100 (40.0)	104 (57.1)	0.010†
Men	228 (52.8)	150 (60.0)	78 (42.9)	
Age groups, n (%)				
18-59	289 (66.9)	179 (71.6)	110 (60.4)	0.015†
≥60	143 (33.1)	71 (28.4)	72 (39.6)	
Hospitalization days, mean±SEM	18.0±7.4	19.8±8.3	15.2±5.1	<0.001‡

†Chi-squared test.
‡Student's t-test.

Table 2. Diagnoses and the range of disease severity score of each spinal surgery at admission

Diagnoses	Total		Traditional spinal		Mini-invasion spinal	
	n (%)	Score	n (%)	Score	n (%)	Score
Fracture and complication	146 (33.8)	0-1	87 (34.8)	0-1	59 (32.4)	0-1
Lumbar disc herniation	130 (30.1)	0-1	70 (28.0)	0-1	60 (33.0)	0-1
Lumbar spondylolisthesis	28 (6.48)	0-1	18 (7.20)	0-1	10 (5.49)	0
Tumours	15 (3.47)	1	15 (6.00)	1	0 (0)	0
Other spinal surgery diseases	113 (26.2)	0	60 (24.0)	0	53 (29.1)	0

tional risk score, significant difference was observed only in the severity of disease score (p<0.05) between traditional spinal surgery and minimally invasive spinal surgery (Table 4). The study also found that the prevalence of nutritional risk increased with patients' age increasing. Figure 2 showed the prevalence of nutritional risk among different age groups at admission, from which the highest prevalence of nutritional risk (40.3%) was observed in the 70 years or more age group.

Prevalence of malnutrition, overweight and obesity

The classifications of malnutrition, normal, overweight and obesity were based on the standard of BMI for the Chinese population. Overall, 12.7% of patients were in the category of malnutrition upon admission; however, nearly half of the patients were categorized as overweight (35.9%) and obesity (7.41%) upon admission. (Table 5)

Nutritional support application

In this study, patients who received the combinations of carbohydrates, amino acids and lipids were considered as receiving nutritional support, while only one or two kinds of them were considered as not.

Of all the samples, there were 88.0% (44/50) patients who were at nutritional risk received nutritional support during hospitalization. In traditional spinal surgery and minimally invasive spinal surgery, this number was 87.1% (27/31) and 89.5% (17/19), separately. Meanwhile, there were still 14.1% (54/382) patients who were not at nutritional risk received redundant nutritional support. The details were reported in Table 6.

The nutritional support prescription of the 44 patients who were at nutritional risk received nutritional support were then studied in this investigation. The average energy and protein consumption and the duration of nutritional support for patients among the entire patients, traditional spinal surgery and minimally invasive spinal sur-

Table 3. The prevalence of nutritional risk at admission or upon discharge (two-weeks after admission)

Surgery	Nutritional station	Admission, n (%)	Discharge, n (%)	χ^2	p value
All patients (n=432)	At risk	50 (11.6)	84 (19.4)	10.2	0.001
	Not at risk	382 (88.4)	348 (80.6)		
Traditional cervical spinal (n=250)	At risk	31 (12.4)	59 (23.6)	10.6	0.001
	Not at risk	219 (87.6)	191 (76.4)		
Mini-invasion spinal (n=182)	At risk	19 (10.4)	25 (13.7)	0.931	0.335
	Not at risk	163 (89.6)	157 (86.3)		

Table 4. Nutritional risk status of each spinal surgery at admission

	Traditional cervical spinal	Mini-invasion spinal	p value
Prevalence of nutritional risk (%)	12.4	10.4	0.547†
Body measure score (mean±SD)	0.37±0.99	0.31±0.92	0.531‡
Weight loss score (mean±SD)	0.16±0.45	0.13±0.41	0.448‡
Food intake score(mean±SD)	0.12±0.38	0.15±0.40	0.456‡
Severity of disease score (mean±SD)	0.16±0.36	0.08±0.28	0.017‡
Age score (mean±SD)	0.16±0.37	0.16±0.37	0.893‡
Nutritional risk score (mean±SD)	0.82±1.22	0.69±1.16	0.269‡

†Chi-squared test.
‡Student's t-test.

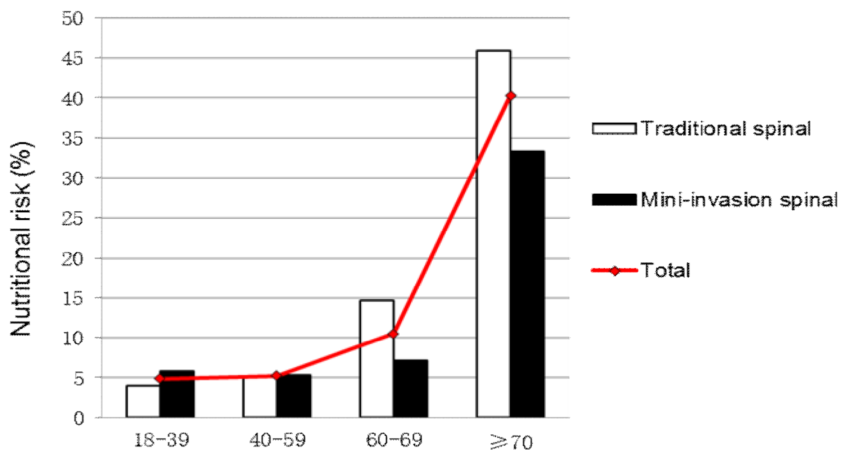

Figure 2. The prevalence of nutritional risk at admission of different age groups in a Huhhot teaching hospital. White bars showed the prevalence of nutritional risk in traditional spinal surgery, black bars showed the prevalence of nutritional risk in mini-invasion spinal surgery, and the line showed the prevalence of nutritional risk of the entire sample.

Table 5. The prevalence of malnutrition, overweight and obesity

	All patients (n=432)		Cervical spinal (n=250)		Mini-invasion spinal (n=182)	
	Admission	Discharge	Admission	Discharge	Admission	Discharge
Malnutrition	55 (12.7)†	89 (20.6)*	31 (12.4)	59 (23.6)*	24 (13.2)	30 (16.5)
Normal	190 (44.0)	184 (42.6)	117 (46.8)	109 (43.6)	73 (40.1)	75 (41.2)
Overweight	155 (35.9)	134 (31.0)	88 (35.2)	72 (28.8)	67 (36.8)	62 (34.1)
Obesity	32 (7.41)	25 (5.79)	14 (5.60)	10 (4.00)	18 (9.89)	15 (8.24)

†Data were presented as n (%).
*p<0.05.

Table 6. The situation of the nutritional support in cervical spinal survey of a Huhhhot teaching hospital

Nutritional risk	Nutrition support	All patients (n=432)	Cervical spinal (n=250)	Mini-invasion spinal (n=182)
NRS ≥3 (at risk)	Use	44 (88.0)†	27 (87.1)	17 (89.5)
	No use	6 (12.0)	4 (12.9)	2 (10.5)
	Total	50 (100)	31 (100)	19 (100)
NRS <3 (not at risk)	Use	54 (14.1)	41 (18.7)	13 (7.98)
	No use	328 (85.9)	178 (81.3)	150 (92.0)
	Total	382 (100)	219 (100)	163 (100)

†Data were presented as n (%).

Table 7. Nutritional support prescription of patients at nutritional risk (n=44)

	All patients	Traditional cervical spinal	Mini-invasion spinal
Energy consumption (kJ/(kg.d))	9.84±8.10†	10.8±6.10	8.13±8.87
Lipids consumption (g/(kg.d))	1.00±9.78	1.11±7.48	0.89±10.1
Protein consumption (g/(kg.d))	0.94±1.93	1.00±1.77	0.87±2.12
Duration	7.5±5.8	8.6±6.0	4.2±3.6

†Data were presented as mean±SD.

gery were summarized in Table 7. For the duration of nutritional support, there was 28.6% (28/98) patients received nutritional support more than 7 days, and this number was 36.8% (25/68) and 10.0% (3/30) in traditional spinal surgery and minimally invasive spinal surgery. In this investigation, there was 19.4% (19/98) of patients received nutritional support for less than 5 days, and 14.7% (10/68) in traditional spinal surgery and 30.0% (9/30) in minimally invasive spinal surgery.

In this investigation, PN was applied to all of the patients who received nutritional support, while no EN was used.

Evolution in nutritional status during hospitalization

Table 3 revealed a significant difference in the prevalence of nutritional risk from admission to discharge or two weeks after admission among all patients (χ^2=10.2, p<0.05). When it was divided into traditional spinal surgery and minimally invasive spinal surgery, only patients in traditional spinal surgery demonstrated the same significant change (χ^2=10.6, p<0.05).

In this study, there were 22 (5.09%) patients, including 10 patients from traditional spinal surgery and 12 from minimally invasive spinal surgery, whose nutritional status changed from at nutritional risk on admission to non-risk upon discharge or two weeks after admission. Meanwhile, 56 (13.0%) patients who were not at nutritional risk, including 38 from traditional spinal surgery and 18 from minimally invasive spinal surgery, developed a state of at nutritional risk during hospitalization.

As well as the changes among the overall patients' nutritional status, the detail components of patients' nutritional status were also investigated in this study (Table 8).

During patients' hospitalization, the BMI revealed a significant evolution, which changed from 23.0 kg/m^2 (SD 3.39) at admission to 22.3 kg/m^2 (SD 3.60) at discharge or two-weeks after admission (p<0.05). In this study, the mean body measure score of the entire sample changed from 0.35 (SD 0.96) at admission to 0.59 (SD 1.19) at discharge (p<0.05). This evolution was also found in traditional spinal surgery and minimally invasive spinal surgery.

On the prevalence of weight loss, some significant differences from admission to discharge were also observed. On admission, there was 12.0%, 13.2% and 10.4% out of the entire group, the traditional spinal surgery patients and the minimally invasive spinal surgery patients respectively experienced weight loss. At discharge or two weeks after admission, the prevalence of weight loss changed into 26.9%, 32.0% and 19.8% respectively, all of which experienced statistically significant changes. The mean weight loss score defined by the NRS 2002 of the entire patients changed from 0.15 (SD 0.43) at admission to 0.42 (SD 0.75) at discharge (p<0.05). The same significant changes were also found in traditional spinal surgery and minimally invasive spinal surgery.

When patients admitted to hospital, 11.3% of the entire group, 10.0% of traditional spinal surgery patients and 13.2% of minimally invasive spinal surgery patients ex perienced a food intake reduction. Upon discharge, the

Table 8. Nutritional risk status at admission and upon discharge (two-weeks after admission)

	All patients (n=432)		Cervical spinal (n=250)		Mini-invasion spinal (n=182)	
	Admission	Discharge	Admission	Discharge	Admission	Discharge
BMI (kg/m^2)†	23.0±3.39	22.3±3.60*	23.0±3.22	22.1±3.54*	22.8±3.55	22.5±3.64*
Body measure score†	0.35±0.96	0.59±1.19*	0.37±0.99	0.72±1.28*	0.31±0.92	0.41±1.04*
Weight loss, n (%)	52 (12.0)	116 (26.9)*	33 (13.2)	80 (32.0)*	19 (10.4)	36 (19.8)*
Weight loss score†	0.15±0.43	0.42±0.75*	0.16±0.45	0.50±0.79*	0.13±0.41	0.32±0.70*
Food intake, n (%)	49 (11.3)	125 (28.9)*	25 (10.0)	78 (31.2)*	24 (13.2)	47 (25.8)*
Food intake score†	0.13±0.39	0.38±0.65*	0.12±0.38	0.44±0.72*	0.15±0.40	0.30±0.55*
Nutritional damage score†	0.48±0.99	0.74±1.18*	0.51±1.01	0.88±1.26*	0.44±0.96	0.55±1.04
Severity of disease score†	0.12±0.33	0.11±0.31*	0.16±0.36	0.14±0.36*	0.08±0.28	0.07±0.26
Nutritional risk score†	0.76±1.20	1.00±1.39*	0.82±1.22	1.16±0.09*	0.69±1.16	0.79±1.25

†Mean±SD.
*p<0.05.
Chi-square test was used for comparation of the percentage, and t-test for continuous variables.

reduction of food intake was experienced by 28.9% of the entire patients, 31.2% of traditional spinal surgery patients and 25.8% of minimally invasive spinal surgery patients. Significant difference was found in the entire sample as well as in the spinal surgery and minimally invasive spinal surgery group ($p<0.05$). The food intake score defined by the NRS 2002 of the entire patients changed from 0.13 (SD 0.39) at admission to 0.38 (SD 0.65) at discharge ($p<0.05$). This change was also be found in spinal surgery and minimally invasive spinal surgery.

In this study, significant differences were found in the mean nutritional damage score of the entire patients and traditional spinal surgery patients, which changed from 0.48 (SD 0.99) at admission to 0.74 (SD 1.18) at discharge ($p<0.05$) of the entire sample and from 0.51 (SD 1.01) at admission to 0.88 (SD 1.26) at discharge ($p<0.05$) of the traditional spinal surgery. While among patients in the minimally invasive spinal surgery, no significant difference was found.

Upon admission, the mean severity of disease score defined by the NRS 2002 was 0.12 (SD 0.33) in the entire group, 0.16 (SD 0.36) in the traditional spinal surgery patients and 0.08 (SD 0.28) in the minimally invasive spinal surgery patients. Subsequently, this number changed to 0.11 (SD 0.31), 0.14 (SD 0.36) and 0.07 (SD 0.26) at discharge or two weeks after admission respectively. In conclusion, significant differences were observed among the entire group and traditional spinal surgery group ($p<0.05$), but not in the minimally invasive spinal surgery group.

During patients' hospitalization, the nutritional risk score in the entire sample and traditional spinal surgery changed significantly. For the total patients, the mean nutritional risk score changed from 0.76 (SD 1.20) to 1.00 (SD 1.39) ($p<0.05$), and for patients in the spinal surgery, this score changed from 0.82 (SD 1.22) to 1.16 (SD 0.09) ($p<0.05$). While in the minimally invasive spinal surgery, no significantly difference was found ($p=0.269$).

Furthermore, a significant difference in the prevalence of malnutrition between admission and discharge or two-weeks after admission among the total patients and patients of spinal surgery was observed in the study ($p<0.05$) (Table 5).

DISCUSSION

In this investigation, patients in two spinal surgery wards of orthopedics department, the traditional spinal surgery and minimally invasive spinal surgery, were chosen to study their prevalence of nutritional risk, the application of nutritional support, and changes in nutritional status in a Huhhot teaching hospital from Jan to Dec 2013.

Since there were some differences in the treatment prescriptions of hospitalized patients between traditional spinal surgery and minimally invasive spinal surgery, patients in these two wards were studied and discussed separately. This study is the first investigation on the evolution of nutritional status and support of hospitalized patients in orthopedics/spinal surgery.

Nutritional status

For orthopedics patients in spinal wards, both in the traditional spinal surgery and minimally invasive spinal surgery, nutritional risk or malnutrition could be found occasionally. This may be because some of these patients suffered grave pain before hospitalization which could cause food intake and body weight reducing.

In this study, the prevalence of nutritional risk in hospitalized orthopedics/spinal patients was 11.6%. Li's[18] study reported the prevalence of nutritional risk in hospitalized orthopedics patients was 16%, which was higher than that in this study. One research on the nutritional risk in a Norway university hospital population[19] reported that the percentage of nutritional risk based on NRS 2002 of the whole sample was 29.0%, and in orthopedics /traumatology department, this percentage was 21.6%, which was higher than that of this study. The possible reason might be that the patients in orthopedics department[20] ororthopedics/traumatology[21] suffered more serious illness or nutritional status than that in orthopedics/spinal surgery. Moreover, the differences in races, areas and dietary might be another possible reason.

For the hospitalized patients (both medical and surgery department), the prevalence of nutritional risk based on NRS 2002 were within the range of 21.0%-39.4%[4, 14, 22-23] in the previous reports, which were higher than that of the hospitalized in orthopedics/spinal reported by this paper. The reason might be that patients from some medical and surgery departments of the previous studies may suffer more serious diseases or nutritional status. Thus, the severity of disease score and NRS score might be higher than orthopedics/spinal surgery patients.

In this study, smaller sample size, 432 patients, might be the other possible reason why the prevalence of nutritional risk and malnutrition in this study lower than other studies. In the follow-up study, the quantity of samples would be increased to obtain a more realistic conclusion.

In this study, the prevalence of nutritional risk increased with age, which was also be certified in previous studies.[24-26] NRS 2002 gives one extra point for age 70 years or older, because older people might have lower tolerance for reduced nutritional status. Compared to younger patients, older patients in hospitals generally suffer more comorbidity and polypharmacy that affect appetite, food intake and absorption of nutrients.

Nutritional support application

Being consistent with studies conducted in other reports, this investigation found that only a small proportion of patients received nutritional support, including the patients who were at nutritional risk. In a Brazil hospital, only 4% of the hospitalized patients who were at nutritional risk received some sort of nutritional therapy, of which 2% received enteral nutrition and 2% parenteral nutritional.[27] An investigation on nutritional care in 12 Cuban hospitals indicated that 10.9% of the patients fulfilled an indication for nutritional intervention, and nutritional support was provided to less than 15.0% of them.[28] Another study carried out in Beijing reported that 26.3% of the surgical patients were at nutritional risk, and 46.8% of them received an adequate amount of energy and protein, while within the other 73.7% surgical patients who were not at risk, there were still 12.7% of them received extra nutritional support.[4]

The advised energy consumption for a hospitalized adult subject is 105-126 kJ/(kg.d), which should contain 25-40% lipids, and 10-15% proteins.[12-13] In our study for the patients at nutritional risk, energy and nutrient consumption levels were low or very low for all the groups, which was found in other reports.[28-30]

In this study, investigators also found that more than half of the nutritional support did not be carried out in an adequate amount of time or route of administration. This was also be found in a Brazil hospital, the average duration time of the nutritional therapy for both routes of administration was 6.8 days.[26] In a hospital in Beijing China, 36% patients received nutritional support for less than 5 days.[4] Furthermore, the over-use of nutritional support for non-risk patients and inadequate duration of nutrients were also common problems.[4,28] The reason might be that not enough attention was paid to patients' nutritional status and nutritional support, and it also could be that the assignment of responsibility for nutritional support is unclear or the institutions lack clinical procedures and guidelines regarding nutritional support.[1]

In this investigation, no EN was used for patients in orthopedics/spinal surgery. This may be because not enough attention was paid to the administration route of tnutritional support for orthopedics/spinal patients in this hospital. In the follow-up studies, more detailed investigation and analysis for the administration route of tnutritional support would be conducted.

Although the clinical guidelines on the nutritional risk screening, the NRS 2002, was recommended by ESPEN[12] and guidelines on the nutritional support was recommended by CSPEN,[13] the majority cities in China still did not pay enough attention to the nutritional risk screening and nutritional support.[21,29-31] Thus, some clinical guidelines or protocols of nutritional support on patients of different wards should be conducted by some professional committee, and the individual physician and registered dietitians should be responsible for nutritional problems according to their clinical experience.

Evolution in nutritional risk during hospitalization

From this investigation, significant evolution in the prevalence of nutritional risk during patients' hospitalization was found among the orthopedics/spinal patients. The prevalence of nutritional risk increased significantly in the entire sample and the traditional spinal surgical patients, while no statistically significant evolution was found in mini-invasion spinal patients. A study conducted by Li[18] in Tianjin China, using the same screening tool, reported that 8 out of 592 orthopedics patients developed a state of nutritional risk during their hospitalization.

In order to study the contributing factors for the change in nutritional risk, the linear regression model was constructed, in which the categories of the severity of disease, BMI, age, weight loss and food intake reduction were considered as the independent continuous variables and nutritional risk score as the dependent continuous variable. The coefficients for each independent variable in descending order were: BMI 0.726; weight loss 0.307; age 0.306; severity of disease 0.270; food intake reduction 0.027. Thus, the BMI was the contributing factor for the change in nutritional risk in orthopedics/spinal patients. All components were correlated with nutritional risk change (p<0.05).

Conclusion

The NRS 2002 tool could be completed by most of the orthopedics/spinal patients and was a feasible nutritional risk screening tool for the patients in spinal surgery in orthopedics department of a Huhhot teaching hospital. Thus, NRS 2002 could be used as a clinical reference to define inpatients' nutritional status and formulate the nutritional support dosing regimen in orthopedics/spinal surgery.

A significant change was found in the prevalence of nutritional risk among the entire sample and the traditional spinal surgery patients. Some inappropriate uses of nutritional supports were also be found in the orthopedics /spinal surgery. Therefore, some nutritional support guidelines or protocols should be conducted by some professional committee, and the individual physician and registered dietitians should be responsible for nutritional problems according to their clinical experience.

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AUTHOR DISCLOSURES

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Original Article

Nutritional risk, malnutrition and nutritional support among hospitalized patients in orthopedics/spinal surgery of a Hohhot teaching hospital

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呼和浩特教学医院脊柱骨科住院患者营养风险、营养不良及营养支持情况调查

调查呼和浩特教学医院脊柱骨科患者入、出院（或入院 2 周后）时营养状况（营养风险、营养不良、超重及肥胖的发生率）的变化及其住院期间营养支持的应用情况。采用定点连续抽样的方法，对该院两个脊柱骨科病房（传统脊柱骨科及微创脊柱骨科）2013 年 1 月至 12 月的 432 例符合入组条件的住院患者进行调查分析。于入院 48 小时内采用营养风险筛查工具 2002（NRS 2002）进行营养风险筛查，记录患者住院期间的营养支持情况。该院脊柱骨科营养风险、营养不良、超重及肥胖的总体发生率分别为 11.6%, 12.7%, 35.9% 及 7.41%。88%有营养风险的患者住院期间接受了营养支持治疗；但该院仍有 14.1%的无营养风险患者接受了额外的营养支持。调研的脊柱骨科患者中，营养风险发生率由入院时的 11.6%变化为出院时的 19.4%（$p<0.05$）；营养不良发生率由 12.7%变化为 20.6%（$p<0.05$）；超重及肥胖分别由入院时的 35.9%和 7.41%变化为出院时的 31.0%和 5.79%，变化无统计学意义。NRS 2002 是脊柱骨科患者有用的营养风险筛查工具。该院脊柱骨科患者住院期间的营养风险及营养不良的发生率均显著增高，同时该院营养支持药物的使用存在较多不合理现象，营养支持的指南或方案应由专业委员会提出。

关键词：营养风险筛查 2002、营养风险、营养支持、脊柱外科、骨科