

Perioperative Complications, Urinary Retention and Aspiration Pneumonia in Patients with Femoral Neck and Trochanter Fractures Under the Multidisciplinary Program: A Study at Bone Femoral Neck and Trochanter Fracture Center, Toyama Municipal Hospital

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Abstract

Objective: The objective of the present study was to evaluate risk factors for postoperative complications of Urinary Retention (UR) and Aspiration Pneumonia (AP) in patients with femoral neck fractures.

Methods: We recruited 276 patients (age 84.9 ± 7.1 years, 55 males and 221 females) with a history of hip surgery carried out at Toyama City Hospital. We evaluated the risk factors for UR and AP, including age, sex, Body Mass Index (BMI), serum albumin, cognitive impairment and Activities of Daily Living (ADL), using a multiple logistic regression analysis.

Results: In the present study, UR occurred in 44 out of 276 cases (15.9%) and AP occurred in 11 out of 276 cases (4.0%). The multivariate logistic regression analysis under adjustment with age, sex and BMI showed that cognitive impairment ($p = 0.001$, OR 4.50, 95% CI 1.84–10.99), and ADL ($p = 0.014$, OR 2.62, 95% CI 1.22–5.64) correlated with the occurrence of UR, whereas serum albumin ($p = 0.047$, OR 4.83, 95% CI 1.02–22.88) correlated with the occurrence of AP.

Conclusions: The present study suggested that the cognitive impairment as well as ADL are risk factors for UR, and the serum albumin concentration is a risk factor for AP in patients receiving post-operative surgery of femoral neck and trochanter fractures.

Keywords: Activities of daily living; Albumin; Aspiration pneumonia; Elderly; Femoral Bone Fracture; Urinary retention

Introduction

Toyama city locates in the middle district in Toyama Prefecture which has an area of approximately 1,200 square

kilometers and has about four hundred thousand residents. Residents. The proportion of elderly people aged 65 and over to all the residents in Toyama city is over 30% [1]. Toyama Municipal Hospital is a core hospital in Toyama Prefecture which has approximately 600 beds. In the hospital, an Elderly Bone Femoral Neck and Trochanter Fracture Center has been installed with

advanced technology and dedicated staffs to conduct surgery in patients with acute phase femoral neck and trochanteric fracture.

The old people (over 65-year-old) which occupies the most part of femoral neck and trochanteric fracture also have concurrent medical diseases, thus not only the fracture but also whole-body control has been required. Among various diseases, femoral neck as well as trochanteric fracture are the major diseases which the nursing was required [2]. Waiting time is also known to be a risk factor of post-operative complications and mortality of patients [3,4]. It is also known that the waiting time affects not only on the delay in the operation standby hour but also on the delay of the rehabilitation [5]. The average waiting time in Japan is approximately 4.2 days [6], but in Toyama Municipal Hospital the time is approximately 1.2 days. Co-management of hip fracture patients by orthopedic surgeons and geriatricians is suggested to be effective to reduce length of hospital stay without negatively affecting major patient outcomes [6,7], which suggests that multidisciplinary cooperation could be effective in Toyama Municipal Hospital. On the other hand, not only the operative delay but also post-operative morbidity has been crucial for prognosis of patients with orthopedic trauma [8]. Regarding the post-operative complications, urinary retention and aspiration pneumonia are the major complications especially in the elderly [9-12]. The risk factors of these complication have been under investigation. Several reports have suggested that malnutrition [13], ADL [14], and cognitive function [15] are suggested to be risk factors relevant to these complications [16-20]. Our previous study showed the same results [21-22].

However, analyses for the risk factors were conducted separately. In the present study, risk factors for aspiration pneumonia and urinary retention were evaluated simultaneously [23-25]. It is significant to create an easy diagnostic prediction tool of perioperative complications after femoral bone surgery. Serum albumin is produced in liver and plays an important role such as transporter protein and index of malnutrition in human body [26]. In addition, low albumin predicts 1-year mortality after discharge in the elderly people receiving femoral bone surgery.

The present study was undertaken to investigate risk factors associated with major post-operative complications, urinary retention and aspiration pneumonia, in elderly patients with post-operative surgery of femoral neck and trochanter fractures.

Method

Study Population

Of 321 patients admitted to the Toyama Municipal Hospital from January 1, 2016, to December 31, 2017, 276 patients (male/ratio: 55/221, age: 85.33±6.95/83.09±7.44 years) were included, excluding 16 patients younger than 65 years, 8 patients with conservative treatment, 8 patients with multiple trauma, 2 patients with pathologic fracture, 2 patients with falls, 2 patients with in-hospital falls, and 7 patients with no measurement of Alb (male/ratio: 55.33±6.95/83.09±7.44 years).

Data Collection and Classification

Data were collected by physicians, specialist nurses, pharmacists, and medical affairs. The existence of the urinary retention was also examined in the same division. Serum albumin concentration was measured and the value itself was used for the following statistical analysis as continuous variables. In addition, the data were divided into high albumin (≥ 3.5 g/dL) and low albumin (< 3.5 g/dL) groups that were used for the following analysis as dichotomous variables. ADL is classified by the four groups (J, A, B, C), which were divided into two groups, nursing unnecessary group J A (ambulatory), and nursing required B C (non ambulatory) group.

Statistical Analysis

The present study consists of continuous data, such as age, BMI, serum albumin concentration, which were statistically evaluated by mean, standard deviation and Student's t-test. The present study also consists of dichotomous data, such as gender, cognitive disorder and ADL, which were statistically evaluated by chi-square test. Logistic regression analyses were performed using dichotomous UR(+) and UR(-) as well as AP(+) and AP(-) as dependent variables, and age, gender, BMI, serum albumin, cognitive disorder and ADL as independent variables. All statistical analyses, including t-test, chi-square test and logistic regression analyses were performed using EZR [16].

Results

Figure 1 shows the recruitment status of patients for this retrospective study. Initially we recruited 321 patients, in which the age less than 65 (N=16) were excluded. Then, patients who did not meet inclusion criteria (noninvasive therapy: N=3, multiple bone fracture: N=8, pathological bone fracture: N=2, changing hospital: N=2, and nosocomial fall: N=2) were excluded. Then, patient with loss of albumin data (N=3) were excluded. Finally, 276 patients were included as an analysis set.

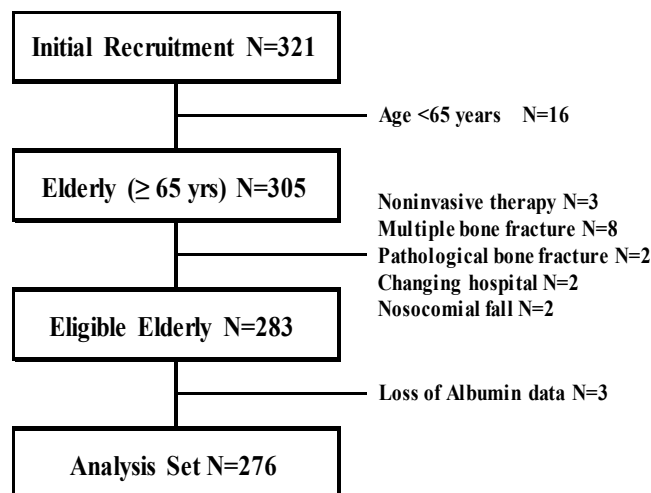


Figure 1: Flow chart of the study recruitment.

Table 1 shows patient characteristics at the enrollment in this study. The patient population (N=276) were divided into UR negative (N=232) and UR positive (N=44) groups. Age, categorized albumin, cognitive impairment and ADL showed significant differences between the groups (p=0.012, 0.009, <0.001 and <0.001, respectively). The patient population were also divided into AP negative (N=265) and AP positive (N=11) groups. Age, gender, serum albumin (both continuous and categorized) and cognitive impairment showed significant differences between the groups (p<0.001, 0.031, 0.033, 0.004 and 0.009, respectively).

Variable	UR(-) N=232	UR(+) N=44	*p-value	AP(-) N=265	AP(+) N=11	*p-value
Age (Mean±S.D.)	84.4±7.2	87.3±6.3	0.012	84.6±7.0	91.8±4.8	<0.001
Gender, female: N (%)	187 (80.6)	34 (77.3)	0.612	215 (81.1)	6 (54.5)	0.031
BMI (Mean±S.D.)	21.6±9.1	21.6±3.8	0.989	21.7±8.5	19.5±4.4	0.425
Albumin (Mean±S.D.)	3.6±0.5	3.6±0.9	0.399	3.6±0.6	3.2±0.5	0.033
Albumin, ≥ 3.5g/Dl: N(%)	163 (70.3)	22 (50.5)	0.009	182 (68.7)	3 (27.3)	0.004
Cognitive Impairment: N (%)	107 (46.1)	37 (84.1)	<0.001	134 (50.6)	10 (90.9)	0.009
ADL, Assistance Required: N (%)	31 (13.4)	17 (38.6)	<0.001	44 (16.6)	4 (36.4)	0.090
*t-test (Age, BMI, Albumi), chi-square test (others)						

Table 1: Patient Characteristics at Baseline.

Table 2 shows the multiple logistic regression analysis indicating that cognitive impairment (p = 0.001, OR 4.50 95% CI 1.84–10.99) as well as ADL (p = 0.014, OR 2.61 95% CI 1.21–5.62) were associated with the occurrence of UR under adjustment of age, sex and BMI as covariates. Serum albumin (p = 0.968) did not significantly correlate with the occurrence of UR.

	Coefficients	S.E.	p-Value	Adjusted Odds Ratio	95%CI
Age	0.045	0.030	0.124	1.047	0.988-1.109
Sex	-0.335	0.430	0.435	0.715	0.308-1.661
BMI	0.016	0.018	0.362	1.017	0.981-1.053
Albumin	-0.032	0.291	0.912	0.968	0.547-1.713
Cognitive	1.504	0.456	0.001	4.500	1.842-10.99
ADL	0.960	0.391	0.014	2.611	1.213-5.619

Table 2: Results of Logistics Regression Analysis (UR).

Table 3 shows the multiple logistic regression analysis indicating that serum albumin (p = 0.047, OR 4.83 95% CI 1.02–22.73) was associated with the occurrence of AP under adjustment of age, sex and BMI as covariates. Cognitive impairment (p = 0.094) and ADL (p = 0.920) did not significantly associate with the occurrence of AP.

	Coefficients	S.E.	p-Value	Adjusted Odds Ratio	95%CI
Age	0.209	0.081	0.009	1.233	1.053-1.444
Sex	-1.832	0.770	0.017	0.160	0.035-0.725
BMI	-0.108	0.115	0.348	0.897	0.716-1.125
Albumin	-1.574	0.794	0.047	4.827	1.018-22.73
Cognitive	1.887	1.125	0.094	6.600	0.728-59.88
ADL	0.082	0.823	0.920	1.086	0.216-5.446

Table 3: Results of Logistics Regression Analysis (AP).

Figure 2 Shows the ROC curves of the two logistic models, one is the UR(+) and UR(-) as dichotomous dependent variables, and the other is the AP (+) and AP(-) as dichotomous dependent variables, and age, sex, BMI, albumin, cognitive disorder and ADL as independent variables. The area under the curve and its 95% confidence intervals are as follows: Urinary Retention: 0.765 (0.692-0.838), Aspiration Pneumonia: 0.885 (0.792-0.977).

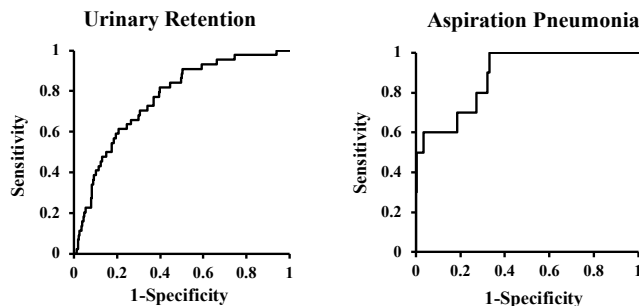


Figure 2: ROC curves of the two logistic regression models.

Discussion

In parallel with the advances in orthopedics, the number of elderly people who undergo surgery increase. In such situation, management of postoperative complications lead to better post-operative prognosis, and investigation of risk factors underlying such complications are important in this viewpoint. The present retrospective study has suggested that the cognitive impairment as well as ADL could be risk factors for UR, and the serum albumin concentration could be a risk factor for AP in patients receiving post-operative surgery of femoral neck and trochanter fractures.

Regarding the patients background, as shown in Table 1, age, categorized albumin, cognitive impairment and ADL showed significant differences between the UR(+) and UR(-) groups ($p=0.012$, 0.009 , <0.001 and <0.001 , respectively). The results suggested that categorized albumin, cognitive impairment and ADL could be candidates associate with UR(+) and UR(-), but age also significantly different between the groups which could be an underlying confounding factor. Table 1 also shows that age, gender, serum albumin (both continuous and categorized) and cognitive impairment showed significant differences between the AP(+) and AP(-) ($p<0.001$, 0.031 , 0.033 , 0.004 and 0.009 , respectively). The results suggested that serum albumin and cognitive impairment could be candidates associate with AP(+) and AP(-), but age and gender also shows significant difference between the groups which could be an underlying confounding factor.

The results of the multiple logistic regression analyses were shown in Tables 2 and 3.

Table 2 suggested that cognitive impairment ($p = 0.001$, OR 4.50 95% CI 1.84–10.99) as well as ADL ($p = 0.014$, OR 2.61 95% CI 1.21–5.62) were associated with the occurrence of UR under adjustment of age, sex and BMI as covariates, indicating that

cognitive impairment as well as ADL are variables independently associated with occurrence of UR.

Table 3 suggested that serum albumin ($p = 0.047$, OR 4.83 95% CI 1.02–22.73) was associated with the occurrence of AP under adjustment of age, sex and BMI as covariates, indicating that serum albumin is variable independently associated with occurrence of AP.

Regarding association of UR with ADL, catheter drainage after acute urinary retention is known to have an impact on ADL and morbidity [17]. Permanent indwelling urethral catheters can also induce deterioration of activities of daily living and stone formation [18]. In Japan, Tobu et al., suggested that early removal of the urethral catheter has significant correlations with post-operative UR [9]. These results have suggested that catheterization could be a strong risk factor in deterioration of ADL. Tobe, et al., suggested that preoperative cognitive disorder has significant correlations with post-operative UR [9]. It is also suggested that cognitive impairment is associated with ADL in elderly patients with hip fracture [19]. The results have suggested that managing of ADL as well as cognitive disorder could be important for better prognosis of post-operative hip fracture in elderly patients.

Regarding association of AP with serum albumin, Metani, et al. suggested that elderly patients with AP showed significantly lower level of serum albumin than non-AP patients [10] Reilly, et al, also suggested that serum albumin was the strongest clinical predictor of cost and the complications, including pneumonia, in patients with malnutrition [13].

Regarding association of these variables with waiting time, it is suggested that early surgery was not associated with improved function or mortality, but it was associated with reduced pain and length of stay and probably major complications among patients medically stable at admission [20].

It has also been reported that the pneumonia in the preoperative was 0.8% with shorter waiting time compared to other facilities [10]. In our hospital, the waiting time to surgery is approximately 1.2 days and surgery was conducted under the multidisciplinary program. The present results have no control group (conventional orthopedic program) in which the waiting time to the surgery is longer. This should be taken into consideration on the interpretation of the present results. This study has several limitations. Research was conducted in a single center. Regardless of gender urinary retention is a critical perioperative complication. However, the difference of urological anatomy exists between male and female. Taking account of gender differences, multivariate analyses including sex were performed. Multidisciplinary project will be expected to be installed into all facilities in order to reduce perioperative complications and mortality after discharge [23–25].

Conclusion

In the present article, we retrospectively evaluated the risk factors for UR and AP in patients with femoral neck and trochanter fractures. Further investigation would be required continuously to

elucidate key factors relevant to the prognosis of post-operative femoral fracture.

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