Is Surgical Intervention Still Beneficial for Femoral Neck Fractures in Super-Old Patients?

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INTRODUCTION:

Japan is the most aged society globally, with nearly 30% of the population aged 65 years or older, and more than 2.6 million people aged 90 or above. Approximately 30% of men and 50% of women born after 2020 are expected to reach 90 years or older. The Japan Geriatrics Society categorizes older adults into three groups: pre-old (65–74 years), old (75–89 years), and super-old (90 years and above). Previous studies reported cognitive and physical decline in the super-old. As the aging population grows, femoral neck fractures due to osteoporosis are increasing. The one-year mortality rate after femoral neck fractures in individuals aged 65 or older is reported as 28%. However, mortality rates in super-old elderly specifically remain under-researched.

Femoral neck fractures significantly contribute to long-term care needs, comprising around 15% of those requiring nursing care in Japan. Surgical intervention within 48 hours is recommended to prevent complications from prolonged immobility. However, super-old patients often have comorbidities that complicate surgical intervention. Although surgery itself as a mortality risk factor is not well studied, identifying mortality predictors could aid orthopedic surgeons in decision-making.

This study aimed to 1) evaluate the six-month mortality rate after femoral neck fractures in super-old elderly and 2) identify mortality-associated factors within six months of injury.

METHODS:

This retrospective study, approved by the ethics committee of Fukui University, included 76 patients aged 90 years or older with femoral neck fractures between April 2010 and March 2021. Data collection included demographics, fracture type, pre-injury ambulatory function, treatment type, and laboratory data. Patients were grouped based on six-month survival, and factors were analyzed.

Treatment Protocol:

Surgery was recommended for all, but non-surgical management was chosen if surgery posed high risk or was refused. Non-surgical patients were mobilized to wheelchairs within one week. Surgery included internal fixation for stable fractures and bipolar hemiarthroplasty for unstable fractures.

Data Collection and Analysis:

Collected data included demographic characteristics, ASA-PS classification, fracture classification, ambulatory function, and laboratory results. Statistical analysis included univariate and multivariate analyses, with significance set at $p<0.05$.

RESULTS:

Of the 76 patients, 14 were men and 62 women, with a mean age of 91.9 years. The six-month mortality rate was 21%, with 40.5% in the non-surgical group and 2.5% in the surgical group. Significant mortality predictors were poor pre-injury ambulatory function and low serum albumin levels. Surgical intervention did not independently increase mortality.

DISCUSSION AND CONCLUSION:

The six-month mortality rate in super-old elderly with femoral neck fractures was approximately 20%. The non-surgical group showed a significantly higher mortality rate. Pre-injury ambulatory function and albumin levels were more predictive of mortality than surgery itself. AST levels were higher in the non-survival group, likely due to muscle injury rather than liver dysfunction. Improving nutritional status perioperatively could reduce mortality.

Limitations:

Selection bias may have affected results due to differences in nutritional status between groups. Additionally, as a single-center study, results may not generalize to all settings. Further studies are needed to validate findings.

Conclusion:

In super-old elderly patients, mortality within six months for femoral neck fractures was 20%. Although the mortality rate was 40.5% in the non-surgical group, mortality was significantly associated with ambulatory function and albumin levels rather than surgical intervention. In this patient population, surgical intervention should be considered to preserve ambulatory function and potentially reduce mortality. However, preoperative assessment and perioperative optimization of nutritional status are essential.

Table1 Demographics and characteristics of the study participants and comparison between survival group and non-survival group

Factor	Total (76cases)	Survival group (60cases)	Non-Survival group (16cases)	p value
Age (yrs)	91.9	92.4	91.9	0.83
Sex (case)				
Men	14	9	5	0.16
Women	62	51	11	
Body mass index (kg/m²)	19.5(14.7-29.4)	19.6(14.7-26.5)	19.4(15.3-29.4)	0.33
Treatment (case)				
Surgical treatment	39	38	1	<0.001*
non-surgical treatment	37	22	15	
Ambulatory function (case)				
Independent ambulation	28	24	4	<0.001*
Assisted ambulation	41	35	6	
Wheelchair mobility	7	1	6	
American Society of Anesthesiologists-Physical Status (case)				
I	0	0	0	0.20
II	24	20	4	
III	32	27	5	
IV	20	13	7	
Garden Classification (case)				
1	4	3	1	0.88
2	10	8	1	
3	22	22	10	
4	40	18	22	

Values in the table express number for categorical variables and median (range) for continuous variables.

Wilcoxon's rank-sum test was used for continuous variables, and the *chi-square* test was used for categorical variables.

* Significant differences between survival group and non- survival group.

Table2: Laboratory data at hospitalization and comparison between Survival group and non-survival group

Factor	Total	Survival group	Non-Survival group	p value
White blood cell count (×10⁹/μL)	8.4 (2.7-17.9)	8.2 (2.7-15.7)	8.9 (4.8-17.9)	0.33
Hemoglobin (g/dL)	11.2 (7.3-15.1)	11.2 (7.3-15.1)	11.3(8.2-14.3)	0.65
Platelet count (×10⁹/μL)	213.4 (90.0-438.0)	214.8 (90.0-438.0)	208.0 (110.0-327.0)	0.78
C-reactive protein (mg/dL)	2.4 (0.01-17.4)	2.1 (0.01-16.2)	5.3 (0.03-17.4)	0.85
Serum Sodium (mEq/L)	139.2(129-151)	139.1 (128-165)	139.6 (130-151)	0.30
Serum Potassium (mEq/L)	4.0 (2.3-6.2)	4.1 (2.5-6.2)	3.9 (2.6-5.6)	0.29
Serum chloride (mEq/L)	102.9 (88-115)	102.6 (88-112)	104.4 (95-115)	0.30
Serum calcium (mEq/L)	8.69 (7.7-8.7)	8.71 (7.7-8.7)	8.6 (7.9-9.2)	0.47
Blood urea nitrogen (mg/dL)	22.6 (9-93)	23.1 (9-93)	27.3 (15-53)	0.28
Creatinine (mg/dL)	0.8 (0.3-2.6)	0.8 (0.4-2.6)	1.1 (0.3-2.4)	0.20
Total protein (g/dL)	6.3 (4.8-8.5)	6.6 (4.8-8.5)	6.2 (4.9-7.7)	0.05
Albumin (g/dL)	3.3 (1.9-5.8)	3.4 (2.1-4.5)	2.8 (1.9-3.8)	0.005*
Aspartate aminotransferase (U/L)	29.8 (14-263)	32.0 (14-263)	21.2 (14-32)	0.03*
Alanine transaminase (U/L)	20.2 (4-236)	21.9 (6-236)	13.2 (7-23)	0.10
Lactate dehydrogenase (U/L)	256.3 (99-479)	256.8 (172-479)	253.9 (99-384)	0.80
Creatinine kinase (U/L)	176.6 (99-479)	188.6 (28-1811)	124.1 (77-227)	0.80

Values in the table express median (range) for continuous variables.

Wilcoxon's rank-sum test was used for continuous variables, and the *chi-square* test was used for categorical variables.

* Significant differences between survival group and non- survival group.

Table 3 Results of multivariate analysis: Logistic regression analysis

Parameter	Standard error	p-value	OR (95%CI)
Treatment	0.6	0.07	9.2(0.8-104.5)
Surgical treatment	-	-	1
non-surgical treatment	0.6	0.07	9.2 (0.8-104.5)
Ambulatory function		Trend p=0.10	
Independent ambulation	-	-	1
Assisted ambulation	0.948	0.21	0.30(0.04-1.9)
Wheelchair mobility	1.689	0.04	28.7(1.04-787.70)
Albumin	0.989	0.04	0.14(0.02-0.99)
Aspartate aminotransferase	0.081	0.10	0.89(0.76-1.04)

Abbreviations: OR; odds ratio, CI; confidence interval