

## Impact of right ventricular systolic pressure in elderly admitted to ICU after femur repair

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**Background/Aims:** The number of femoral fractures is expected to continue to increase as the size of the older population rapidly grows. However, old age is accompanied by various comorbidities and is an important postoperative risk factor in itself, meaning that patients who undergo surgery for a femur fracture may require admission to an ICU. We investigated pulmonary complications in patients over the age of 65 admitted to the ICU after femur fracture surgery.

**Methods:** This study is based on 289 patients over a period of 8 years who have been admitted to ICU after femur fracture surgery. Pulmonary complications have been observed in 97 of total patients (33.6%) after surgery.

**Results:** Mean hospitalization days ( $34.1 \pm 25.7$  vs.  $23.1 \pm 15.7$ ,  $P < 0.001$ ) and mean length of stay in ICU ( $8.4 \pm 16.1$  vs.  $2.5 \pm 1.1$ ,  $P = 0.001$ ) were significantly longer for patients with pulmonary complications than for patients without pulmonary complications after femur fracture surgery. Patients with pulmonary complications also presents higher proportion of pulmonary disease (19.6% vs. 8.9%,  $P = 0.009$ ) and exhibit sequelae on preoperative chest X-rays (9.3% vs. 3.6%,  $P = 0.048$ ) than patients without pulmonary complications. In addition, significant differences were observed in the right ventricular systolic pressure (RVSP) measured during preoperative echocardiography ( $40.7 \pm 9.3$  mmHg vs.  $37.4 \pm 10.9$  mmHg,  $P = 0.010$ ) and in the proportion of each group that had RVSP of  $> 35$  mmHg, which is a marker for pulmonary hypertension (76.3% vs. 55.2%,  $P < 0.001$ ). In multivariate analysis, RVSP of  $> 35$  mmHg during preoperative echocardiography was associated with pulmonary complications after femur fracture surgery (OR, 2.6; 95% CI, 1.45–4.53).

**Conclusions:** Pulmonary complications were associated with longer hospitalization and ICU stays for older patients admitted to ICU after femur fracture surgery. Preoperative RVSP could be a predictable factor that higher probability of pulmonary complications exists for elderly patients following their transfer to ICU after femur fracture surgery.

Table 1. Demographic and clinical characteristics of the total study population

Characteristics	N = 289
Age, years	$82.0 \pm 7.4$
Sex	
Men	65 (22.5)
Women	224 (77.5)
BMI, kg/m <sup>2</sup>	$21.9 \pm 3.6$
Interval between fracture and operation, days	$5.8 \pm 9.7$
Hypertension	194 (67.1)
Diabetic mellitus	78 (27.0)
Old cerebrovascular accident	84 (29.1)
Dementia	63 (21.8)
CCI	$1.81 \pm 1.7$
General anesthesia	288 (99.7)
ASA classification	$2.51 \pm 0.04$
Operation time, min	$92.8 \pm 57.0$
Anesthesia time, min	$150.4 \pm 60.7$
Cause of fracture	
Slipping	258 (89.3)
Fall from bed	15 (5.2)
Traffic accident	8 (2.8)
Assault	1 (0.3)
Unknown vector	7 (2.4)
Site of femur fracture	
Proximal femur fracture*	263 (91.0)
Distal and shaft fracture	26 (9.0)
Right	149 (51.6)
Left	139 (48.1)
Both	1 (0.3)
Surgery procedure	
CR/IF	166 (57.4)
OR/IF	33 (11.4)
Hemiarthroplasty	90 (31.1)
Development of pulmonary complications after surgery	97 (33.6)
Hospitalization, days	$26.8 \pm 20.3$
Mortality	9 (3.1)

Figures are presented as counts with the percentage in parentheses or the mean  $\pm$  standard deviation, unless otherwise indicated. BMI, body mass index; CCI, Charlson comorbidity index; ASA, American Society of Anesthesiologists; CR/IF, closed reduction internal fixation; OR/IF, open reduction internal fixation. \*Proximal femur fracture included the femoral neck.

Table 2. Comparison of prognosis between subjects with or without pulmonary complications

Variable	Without pulmonary complication (n=192)	With pulmonary complication (n=97)	P-value
Hospitalization, days	$23.1 \pm 15.7$	$34.1 \pm 25.7$	$< 0.001$
ICU stay, days	$2.5 \pm 1.1$	$8.4 \pm 16.1$	0.001
Pulmonary complication			
Pneumonia		46 (29.7)	
Atelectasis		9 (5.8)	
Pulmonary edema		39 (25.2)	
Pulmonary embolism		8 (5.2)	
Pleural effusion		20 (12.9)	
Respiratory failure requiring mechanical ventilation		33 (21.3)	
$\geq 2$ pulmonary complications		46 (47.4)	
Mortality	1 (0.5)	8 (8.2)	0.001
Immediate cause of death			
Pan peritonitis		1	
Cerebrovascular accident	1		
Myocardial infarction		1	
Pneumonia		5	
Asphyxia		1	

Figures are presented as counts with the percentage in parentheses or the mean  $\pm$  standard deviation, unless otherwise indicated. ICU, intensive care unit