Article Title: Effectiveness of surgical fixation for rib fractures in relation to its timing: A retrospective Japanese nationwide study

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Online Resource 1 Characteristics of patients according to surgical rib fixation status within 6 days after admission adjusted using overlap weights

Variables	Patients who did not undergo surgical rib fixation ≤ 6 days after admission (n=6,025)	Patients who underwent surgical rib fixation ≤ 6 days after admission (n=113)	Standardized difference (%)
Age: years, mean	67.5	68.3	
Age groups: years, (%)			
<60	(20.3)	(20.3)	0.0
60–69	(24.9)	(24.9)	0.0
70–79	(31.4)	(31.4)	0.0
80≤	(23.4)	(23.4)	0.0
Sex (male), (%)	(64.7)	(64.7)	0.0
Body mass index: kg/m^2, mean	22.3	22.3	
Body mass index groups: kg/m^2, (%)			
<18.5	(17.0)	(17.0)	0.0
18.5–24.9	(58.0)	(58.0)	0.0
25–29.9	(20.4)	(20.4)	0.0
30≤	(4.6)	(4.6)	0.0
Japan Coma Scale, (%)			
0 (alert)	(43.7)	(43.7)	0.0
1–3 (dizziness)	(20.0)	(20.0)	0.0
10–30 (somnolence)	(15.0)	(15.0)	0.0
100–300 (coma)	(21.3)	(21.3)	0.0
Comorbidities, (%)			
Clinically important traumatic brain injury	(14.9)	(14.9)	0.0
Cervical fracture	(2.8)	(2.8)	0.0
Vertebral fracture	(8.4)	(8.4)	0.0

Clavicular fracture	(12.2)	(12.2)	0.0
Sternal fracture	(9.0)	(9.0)	0.0
Scapular fracture	(7.5)	(7.5)	0.0
Flail chest	(19.2)	(19.2)	0.0
Pelvic fracture	(6.2)	(6.2)	0.0
Procedures on admission, (%)			
Catecholamine use	(58.0)	(58.0)	0.0
Chest drainage	(55.7)	(55.7)	0.0
Transfusion	(69.9)	(69.9)	0.0
Transarterial embolization	(7.7)	(7.7)	0.0
Interventions for other organs, (%)			
Craniotomy	(2.0)	(2.0)	0.0
Thoracotomy	(18.3)	(18.3)	0.0
Laparotomy	(5.8)	(5.8)	0.0
Pelvic ORIF, (%)	(6.2)	(6.2)	0.0
Surgery to limbs, (%)	(15.2)	(15.2)	0.0
Charlson comorbidity index, (%)			
0	(87.4)	(87.4)	0.0
1	(5.8)	(5.8)	0.0
2	(4.0)	(4.0)	0.0
3≤	(2.9)	(2.9)	0.0
ICD-10 based severity score for trauma, mean (SD)	8.9	8.9	0.0
ICU admission, (%)	(91.3)	(91.3)	0.0

ICD, International Classification of Diseases; ICU, intensive care unit; ORIF, open reduction and internal fixation; SD, standard deviation

Online Resource 2 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 6 days after admission adjusted using overlap weights

Variables	Percent difference (%)	95% confidence interval			*P*-value
Duration of mechanical ventilation	-13.6	-30.7	to	7.6	0.19
Length of hospital stay	-8.4	-18.7	to	3.2	0.15

Online Resource 3 Proportion with tracheostomy, post-admission pneumonia, and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 6 days after admission adjusted using overlap weights

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.29	0.28	0.01	-0.08 to 0.10	0.80
Pneumonia after admission	0.16	0.18	-0.02	-0.09 to 0.05	0.57
All-cause 28-day in-hospital mortality	0.03	0.05	-0.02	-0.05 to 0.01	0.23

Online Resource 4 Characteristics of patients according to surgical rib fixation status within 10 days after admission after overlap weighting

Variables	Patients who did not undergo surgical rib fixation ≤ 10 days after admission (n=5,829)	Patients who underwent surgical rib fixation ≤ 10 days after admission (n=162)	Standardized difference (%)
Age: years, mean	68.3	68.5	
Age groups: years, (%)			
<60	(19.9)	(19.9)	0.0
60–69	(23.3)	(23.3)	0.0
70–79	(29.7)	(29.7)	0.0
80≤	(27.1)	(27.1)	0.0
Sex (male), (%)	(61.3)	(61.3)	0.0
Body mass index: kg/m^2, mean	22.6	22.7	
Body mass index groups: kg/m^2, (%)			
<18.5	(14.1)	(14.1)	0.0
18.5–24.9	(59.7)	(59.7)	0.0
25–29.9	(21.5)	(21.5)	0.0
30≤	(4.6)	(4.6)	0.0
Japan Coma Scale, (%)			
0 (alert)	(38.9)	(38.9)	0.0
1–3 (dizziness)	(21.6)	(21.6)	0.0
10–30 (somnolence)	(18.4)	(18.4)	0.0
100–300 (coma)	(21.1)	(21.1)	0.0
Comorbidities, (%)			
Clinically important traumatic brain injury	(14.9)	(14.9)	0.0
Cervical fracture	(2.7)	(2.7)	0.0
Vertebral fracture	(8.7)	(8.7)	0.0

Clavicular fracture	(13.6)	(13.6)	0.0
Sternal fracture	(7.9)	(7.9)	0.0
Scapular fracture	(6.7)	(6.7)	0.0
Flail chest	(16.9)	(16.9)	0.0
Pelvic fracture	(14.9)	(14.9)	0.0
Procedures on admission, (%)			
Catecholamine use	(54.2)	(54.2)	0.0
Chest drainage	(58.6)	(58.6)	0.0
Transfusion	(72.0)	(72.0)	0.0
Transarterial embolization,	(8.9)	(8.9)	0.0
Interventions for other organs, (%)			
Craniotomy	(2.1)	(2.1)	0.0
Thoracotomy	(15.9)	(15.9)	0.0
Laparotomy	(6.9)	(6.9)	0.0
Pelvic ORIF	(5.0)	(5.0)	0.0
Surgery to limbs	(13.4)	(13.4)	0.0
Charlson comorbidity index, (%)			
0	(80.5)	(80.5)	0.0
1	(10.8)	(10.8)	0.0
2	(6.7)	(6.7)	0.0
3≤	(2.1)	(2.1)	0.0
ICD-10 based severity score for trauma, mean	9.2	9.2	0.0
ICU admission, (%)	(92.4)	(92.4)	0.0

ICD, International Classification of Diseases; ICU, intensive care unit; ORIF, open reduction and internal fixation; SD, standard deviation

Online Resource 5 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 10 days after admission adjusted using overlap weights

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	13.3	-5.6 to 35.9	0.18
Length of hospital stay	0.3	-9.2 to 10.7	0.96

Online Resource 6 Proportion with tracheostomy, post-admission pneumonia, and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 10 days after admission adjusted using overlap weights

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.34	0.28	0.06	-0.02 to 0.14	0.15
Pneumonia after admission	0.19	0.18	0.01	-0.06 to 0.07	0.81
All-cause 28-day in-hospital mortality	0.02	0.05	-0.01	-0.04 to 0.01	0.26

Online Resource 7 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 3 days after admission adjusted using overlap weights (without transforming these values into natural logarithms)

Variables	Treated group	Untreated group	Difference	95% confidence interval			*P*-value
Duration of mechanical ventilation (days)	7.5	14.1	-6.6	-9.2	to	-4.0	<0.001
Length of hospital stay (days)	38.0	52.7	-14.7	-27.9	to	-1.5	0.03

Online Resource 8 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 6 days after admission adjusted using overlap weights (without transforming these values into natural logarithms)

Variables	Treated group	Untreated group	Difference	95% confidence interval			*P*-value
Duration of mechanical ventilation (days)	11.8	15.0	-3.2	-5.8	to	-0.7	0.01
Length of hospital stay (days)	42.3	52.4	-10.1	-19.1	to	-1.1	0.03

Online Resource 9 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 10 days after admission adjusted using overlap weights (without transforming these values into natural logarithms)

Variables	Treated group	Untreated group	Difference	95% confidence interval			*P*-value
Duration of mechanical ventilation (days)	15.1	14.9	0.3	-2.4	to	2.9	0.85
Length of hospital stay (days)	47.2	53.4	-6.2	-16.5	to	4.1	0.24

Online Resource 10 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 3 days after admission adjusted using overlap weights (excluding patients with clinically important traumatic brain injury, cervical fracture, craniotomy on admission, and spinal fusion on admission)

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	-42.3	-58.8 to -19.1	0.001
Length of hospital stay	-23.0	-35.6 to -7.9	0.004

Online Resource 11 Proportion of tracheostomy, post-admission pneumonia and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 3 days after admission adjusted using overlap weights (excluding patients with clinically important traumatic brain injury, cervical fracture, craniotomy on admission, and spinal fusion on admission)

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.16	0.21	-0.06	-0.17 to 0.55	0.32
Pneumonia after admission	0.11	0.15	-0.04	-0.14 to 0.05	0.39
All-cause 28-day in-hospital mortality	0.04	0.04	0.00	-0.06 to 0.06	0.97

Online Resource 12 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 6 days after admission adjusted using overlap weights (excluding patients with clinically important traumatic brain injury, cervical fracture, craniotomy on admission, and spinal fusion on admission)

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	-11.1	-30.7 to 14.2	0.36
Length of hospital stay	-9.1	-20.8 to 4.3	0.17

Online Resource 13 Proportion of tracheostomy, post-admission pneumonia and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 6 days after admission adjusted using overlap weights (excluding patients with clinically important traumatic brain injury, cervical fracture, craniotomy on admission, and spinal fusion on admission)

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.27	0.25	0.02	-0.08 to 0.12	0.64
Pneumonia after admission	0.15	0.17	-0.16	-0.09 to 0.06	0.68
All-cause 28-day in-hospital mortality	0.04	0.04	0.00	-0.05 to 0.04	0.84

Online Resource 14 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 10 days after admission adjusted using overlap weights (excluding patients with clinically important traumatic brain injury, cervical fracture, craniotomy on admission, and spinal fusion on admission)

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	16.7	-5.0 to 43.3	0.14
Length of hospital stay	0.8	-10.1 to 13.1	0.89

Online Resource 15 Proportion of tracheostomy, post-admission pneumonia and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 10 days after admission adjusted using overlap weights (excluding patients with clinically important traumatic brain injury, cervical fracture, craniotomy on admission, and spinal fusion on admission)

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.34	0.25	0.09	0.00 to 0.17	0.05
Pneumonia after admission	0.18	0.16	0.01	-0.06 to 0.08	0.70
All-cause 28-day in-hospital mortality	0.02	0.03	-0.01	-0.04 to 0.01	0.40

Online Resource 16 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 3 days after admission adjusted using overlap weights (patients without frail chest)

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	-47.0	-60.7 to -28.6	<0.001
Length of hospital stay	-21.1	-34.0 to -5.7	0.009

Online Resource 17 Proportion of tracheostomy, post-admission pneumonia and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 3 days after admission adjusted using overlap weights (patients without frail chest)

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.19	0.23	-0.05	-0.16 to 0.07	0.44
Pneumonia after admission	0.10	0.17	-0.06	-0.15 to 0.03	0.17
All-cause 28-day in-hospital mortality	0.04	0.06	-0.02	-0.08 to 0.04	0.50

Online Resource 18 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 6 days after admission adjusted using overlap weights (patients without frail chest)

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	-19.0	-36.4 to 3.2	0.09
Length of hospital stay	-12.7	-23.5 to -0.4	0.04

Online Resource 19 Proportion of tracheostomy, post-admission pneumonia and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 6 days after admission adjusted using overlap weights (patients without frail chest)

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.24	0.26	-0.02	-0.11 to 0.07	0.68
Pneumonia after admission	0.13	0.17	-0.04	-0.12 to 0.03	0.26
All-cause 28-day in-hospital mortality	0.04	0.05	-0.02	-0.06 to 0.03	0.46

Online Resource 20 Duration of mechanical ventilation and length of hospital stay according to surgical rib fixation status within 10 days after admission adjusted using overlap weights (patients without frail chest)

Variables	Percent difference (%)	95% confidence interval	*P*-value
Duration of mechanical ventilation	12.0	-8.6 to 37.3	0.27
Length of hospital stay	-2.7	-12.7 to 8.5	0.63

Online Resource 21 Proportion of tracheostomy, post-admission pneumonia and all-cause 28-day in-hospital mortality according to surgical rib fixation status within 10 days after admission adjusted using overlap weights (patients without frail chest)

Variables	Treated group	Untreated group	Risk difference	95% confidence interval	*P*-value
Tracheostomy	0.32	0.27	0.05	-0.04 to 0.13	0.28
Pneumonia after admission	0.17	0.18	0.00	-0.07 to 0.06	0.91
All-cause 28-day in-hospital mortality	0.02	0.03	-0.01	-0.03 to 0.02	0.64