

NON NEUROLOGICAL OUTCOME COMPARISON OF EARLY AND DELAYED SURGICAL STABILIZATION IN C-SPINE FRACTURES

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Background: Non neurological outcome postsurgical stabilization in C-spine injury has not been reported. Non neurological outcome i.e. the risk of lung infection (pneumonia), systemic inflammation response syndrome (SIRS), length of postoperative care (LOPOC) which can compromise the recovery process and treatment period. This study aims to investigate non neurological outcome comparison after early surgical stabilization (ESS) and delayed surgical stabilization (DSS) in patients with C-spine fractures. **Methods:** The author retrospectively reviews 59 of 108 consecutive patients who met the inclusion criteria with C-spine fractures who underwent surgical stabilization at the Sanglah General Hospital, between 2007 and 2010. Consisting of 25 patients underwent ESS and 34 patients were treated by DSS. The last follow up period range was 3-36 months. Non neurological outcome were evaluated and compared; the risk of pneumonia, SIRS and LOPOC. **Results:** Significant statistically between ESS and DSS in; the risk of pneumonia (ESS: DSS= 1:9) by Chi-square-test ($p=0.023$); the risk of SIRS (ESS: DSS= 1:11) by Chi-square-test ($p=0.008$); and the LOPOC (ESS: DSS= 6.84:9.97) by independent t-test ($p=0.000$). Application of ESS for C-spine fractures could provide early mobilization, prompt treatment and facilitate early rehabilitation thus significantly reduces complications due to prolong immobilization and reduces LOPOC. **Conclusion:** It can be concluded that the ESS strategy is effective and efficient thus may propose an option of surgical timing in C-spine fractures.

Keywords: injury, recovery, inclusion, criteria, effective.

INTRODUCTION

There is still being debated among surgeons in determining the optimal time for surgery in cases of spinal trauma.^{1,2} Some researchers believe that early surgical stabilization may improve the neurological outcome. Levi et al (1991) showed an improvement by early (<24 hours) spine fixation. Mirza et al (1999) examined 43 patients and stated that early surgical (<72 h) may improve neurological recovery. However, early surgical stabilization (<3 days) in patients with spinal trauma has non-neurological benefits such as early patient mobilization, decrease pulmonary complications, reduction in lengths of stay and intensive care unit (ICU) treatment and decrease the medical costs.^{1,2}

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The incidence of complications in spinal surgery is still not clear. The researchers assume that between 10 and 20% of patients who underwent surgical stabilization procedure will experience complication.³ Kerwin et al (2005), showed a lower incidence of pneumonia in early fixation (6.5% versus 33.3%).⁴ Complication of surgery is one of the causes of SIRS (Anonymous, 2011). Major surgery or trauma affecting SIRS.⁵ This is due to cytokine release which reached the maximum number (cytokine storm) into the circulation resulting in excessive inflammatory responses.⁶ Boakye et al (2008) showed that 1 patient who experienced postoperative cervical complications will increase 4 days length of stay (LOS), twenty-fold increase in mortality, and require more than \$ 10,000 additional hospital costs.⁷

Researchers suspect that by the early surgical stabilization (<3 days) will reduce the non-neurologic complications in patients with cervical fractures, such as decreased lung infection; decrease the occurrence of SIRS, and reduction of postoperative care length.

PATIENTS AND METHODS

This was an observational study using analytic retrospective study cohort design. Cervical fracture patient's data that obtained from the registration, who underwent surgery (surgical stabilization) from years 2007 to 2010 in the neurosurgical ICU and Central Operating Theatre Sanglah Hospital in Denpasar. From the registrar recorded the identity of the patient such as name, sex, age, number of Medical Records (MR), diagnosis and the date of surgeries. Through the MR we recorded the date of admission, date of discharged, the mechanism of injury, American Spinal Cord Injury Association (ASIA) scale, fracture's level, and records of patient progress during treatment.

Selection of sample is based on inclusion and exclusion criteria. Inclusion criteria: cervical fracture patients with age between 16-65 years. Exclusion criteria: patients with multiple trauma, patients with pulmonary infection prior to surgery, patients with SIRS prior to surgery and patients treated in ICU before the surgery was done. Drop out: when a patient died during treatment.

The numbers of patients from 2007 to 2010, with cervical surgical stabilization in Sanglah Hospital were 108 patients. The data were collected, further processed descriptively to characterize the data for age, sex, level of fracture, mechanism of injury and degree of motor (ASIA). Analysis using SPSS 16.0 for Windows XP to find out early surgical stabilization factors, delayed surgical stabilization, lung infection, SIRS and hospital length of stay. The data obtained were statistically analyzed using Chi-square (cross tabulation 2x2) and independent t-test. Statistical test performed with significance level based on the value of $p < 0.05$.

RESULTS

Basic Characteristics Based on Time Management

Table 1 shows the average age group of patients treated by Early Surgical Stabilization (ESS) was 40.76 ± 11.05 and the mean age group of patients treated with Delayed Surgical Stabilization (DSS) is 47.50 ± 13.75 . In the ESS group, consist of 18 male and 7 female. While in the DSS, consist of 29 men and 5 women.

Base on the level of fracture, patients with low level in the ESS group were 24 and 34 in the DSS group. Patient with high level in the ESS group was 1 and none in the DSS group. Patients with a falls mechanism in the ESS group were 13 and in the DSS group were 20. Patients with a mechanism for traffic accidents in the ESS group were 11 and in the DSS group were 14, and patient injury due to diving only 1 patient in the ESS group.

From the degree of motor (ASIA) cervical fracture patients, patients with ASIA A in the ESS group were 11 and in the DSS group were 21.

ASIA B in the ESS group was 1 and in the DSS group were 7. ASIA C was 1 in each group, ASIA D in the ESS group were 6 and in the DSS group were 5. ASIA E in the ESS group were 6 and none in the DSS group.

Occurrence of Lung Infection Risk Based on Time Management

To determine the role of handling time on the risk of lung infections used Chi-Square (2x2 cross tabulation). Table 2 shows that time management is a risk factor for pulmonary infections ($X^2 = 5.17$, $p = 0.023$). Early surgical stabilization reduce the incidence of pulmonary infection by 1.306 times (RR = 1.306) compared to delayed surgical stabilization.

The risk of occurrence of SIRS Based on Time Management

To determine the role of handling time on the risk of SIRS used Chi-Square (2x2 cross tabulation). Table 3 shows that time management is a risk factor for SIRS ($X^2 = 7.15$, $p = 0.008$). Early surgical stabilization can reduce the incidence of SIRS by 1.419 times (RR = 1.419) compared to delayed surgical stabilization.

Difference Score Mean Length of Post Operation Care (LOPOC)

Lengths of post-operation care (LOPOC) data were analyzed using independent t-test. Table 4 shows that the average score of length of post-operation care (LOPOC) ESS group was 6.84 ± 1.25 days, mean of the DSS group was 9.97 ± 2.61 days. Analysis of significance with independent t-test showed that p value = 0.000. It means that the LOPOC differ significantly ($p < 0.05$) between 2 groups.

DISCUSSION

Among 108 cervical fracture patients who underwent surgery (surgical stabilization), only 59 patients met the criteria for inclusion as research subjects. Based on 59 medical records were obtained the basic characteristics as in table 1, mean age of patients treated by ESS was 40.76 ± 11.05 and DSS was 47.50 ± 13.75 . Egmond (2009) found that population age were between 20-40 years with mean age was 36.75 year.⁹

Men were more often than women with ratio of 7.35: 1, incidence of trauma in males were 5 times greater than women, especially at the decades 3.7 of age, while in this study, the incidence of men were 4 times greater than women.^{8,9} This is consistent with the data in the United States with the ratio of men:women was 4:1.⁸

Many factors can cause cervical fracture include traffic accidents (47%), falls from height (23.7%), approximately 13.7% of physical violence, as well as sports injuries around 8.7%.¹⁰

Table 1
Basic Characteristics Based on Time Management

Characteristics	ESS n=25 (42.4%)	DSS n=34 (57.6%)	Total
Age (year)	40.76±11.05	47.50±13.75	
Sex			
Male	18 (30.5%)	29 (49.1%)	47 (79.7%)
Female	7 (11.9%)	5 (8.5%)	12 (20.3%)
Level of Fracture			
Low	24 (40.7%)	34 (57.6%)	58 (98.3%)
High	1 (1.7%)	0	1 (1.7%)
Mechanism of injury			
Falling	13 (22.1%)	20 (33.9%)	33 (55.9%)
Traffic accident	11 (18.6%)	14 (23.7%)	25 (42.4%)
Diving	1 (1.7%)	0	1 (1.7%)
Motor function (ASIA scale)			
A	11 (18.6%)	21 (35.6%)	32 (54.2%)
B	1 (1.7%)	7 (11.8%)	8 (13.5%)
C	1 (1.7%)	1 (1.7%)	2 (3.4%)
D	6 (10.2%)	5 (8.5%)	11 (18.7%)
E	6 (10.2%)	0	6 (10.2%)

Table 2.
Risk of Lung Infections

		Lung Infection		χ^2	p	RR
		Positive	Negative			
Time Management	ESS	1	24	5.17	0.023	1.306
	DSS	9	25			

Table 3.
Risk of Systemic Inflammatory Response Syndrome

		Systemic Inflammatory Response Syndrome		χ^2	p	RR
		Positive	Negative			
Time Management	ESS	1	24	7.15	0.008	1.419
	DSS	11	23			

Table 4.
The mean examination score LOPOC between ESS and DSS Groups

Groups	n	Mean	SD	t	p
ESS	25	6.84	1.25	5.54	0.0001
DSS	34	9.97	2.61		

While Martin et al (2001) reported the injury mechanisms were as follows; 78% traffic accidents, falls 14%, 5% of diving accidents and others 3%.

Ducker and Perrot reported 40% of spinal cord injuries were caused by traffic accidents, falls 20%, 40% consist of gunshot wounds, sports and working accidents.¹⁰ Sapkas (2007) reported the

cause of injury: road traffic accidents (73%), falls from height (18 %), diving (7.5%) and sports (1.5%).¹¹

In this study, the injury mechanisms as follows: falls from height (55.9%), traffic accidents (42.4%), as well as a result of diving accidents (1.7%).

From the table 1, the basic characteristics of fracture level, approximately 98.3% in low-level fractures (C3-C7), while high-level fracture were about 1.7%. Trauma to subaxis (C3-C7) were more common than the C1-2.¹²

Meanwhile, there is no absolute consensus among the spine surgeons regarding the timing for surgical intervention in spinal trauma.^{1,2} Some authors believe that early surgical stabilization may improve the neurological outcome. There is an increasing function with early (<24 hours) surgical spine fixation.⁶ Surgery before 72 hours was said, increase neurologic recovery in patients with spinal cord injury and reduce the treatment time at the hospital.¹³ Other said that the timing of surgery does not affect the neurological outcome.¹¹ On the otherhand, the incidence of pneumonia was lower in the early fixation (6.5% versus 33.3%).⁴ Early mobilization can reduce the incidence of pneumonia through enhanced cough reflex activation due cilia on airway mucosa through active movement and the effects of gravity as the patient learns to sit up on his side. With a good cough reflex returns naturally cleansing the lungs so that secretions do not accumulate to the media of germs multiply.

Earlier definitive surgical prevent us from excessive inflammation because inflammatory peak reached after the third till the fifth day and then slowly decreases inflammation. So we can avoid the occurrence of inflammatory storm if surgery is done early because the operation itself also adds to the inflammatory process. If the patient can be mobilized quickly and easily in the room will allow ordinary care, immediate rehabilitation programs, provision of exercise nutrition, hygiene patient's body, immediate trained the family to care at home so that the patient can immediately be treated outpatient and overall length of stay and costs can be suppressed.

Early surgical stabilization has non-neurological benefits such as more rapid patient mobilization, reduction in pulmonary complications, reduced treatment time in the intensive care unit and overall treatment time in hospital, and decrease the medical cost.^{1,2} The hospital length of stay (HLOS) were significantly shorter (14.3 versus 21.1) in patients with early fixation.⁴ In our study, the length of post-operation care was significantly shorter in the early surgical group compared with delayed surgical stabilization (6.84± 1.25 days vs. 9.97 ±2.61 days).

CONCLUSIONS

From this study, early surgical stabilization (<3 days) improved non-neurologic outcome significantly. Early surgical stabilization reduced the incidence of pulmonary infection (RR = 1.306), reduced the incidence of SIRS (RR = 1.419) and shortened the LOPOC compared to delayed surgical stabilization.

Some weaknesses in this study include: This study was using a retrospective cohort study so the data were secondary. There was no randomization in this study. No control available for groups of cervical fracture location, fracture type, implant type, neurological disorders and type of surgery. No observational data available of neurological development in patients who undergone surgery because longer time is required.

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