

# Intra-hospital complications in acute traumatic spinal cord injury

## Complicações intra-hospitalares em pacientes com lesão medular traumática aguda

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### ABSTRACT

There is scarce data about intra-hospital complications in acute traumatic spinal cord injury (TSCI). **Objective:** To report characteristics of complications in patients with TSCI in a major trauma center. **Method:** This is a cross-sectional study with 434 patients with acute TSCI from 2004 to 2014. Outcomes were frequency and description of complications, length of hospital stay (LOS), and causes of increased LOS. **Results:** Patients presented at least 1 complication in 82.2% of the cases: urinary tract infection (UTI) = 64.4%, pressure ulcers (PU) = 50.6%, and pneumonia = 23.7%. Pneumonia, intubation and cases of surgical corrections for PU were independently associated with increased LOS. **Conclusion:** UTIs and PUs were the most frequent complications. Investigating its causes and consequences is paramount in the care of patients with SCI. Possible reasons for such complications could comprise time, and frequency of repositioning in bed. Investigating intra-hospital complications is paramount in SCI centers.

**Keywords:** Spinal Cord Injuries/Complications, Length of Stay, Brazil, Cross-Sectional Studies

### RESUMO

Há poucos dados sobre complicações hospitalares em pacientes com LMT aguda. **Objetivo:** Reportar as características de complicações em pacientes com LMT em um grande centro de trauma. **Método:** Estudo transversal com 434 pacientes com LMT aguda de 2004 a 2014. Os desfechos foram a frequência e característica das complicações, o tempo de internação (TDI), e fatores associados com seu aumento. **Resultados:** Incidência de complicações foi 82,2%, sendo as mais frequentes: infecção do trato urinário (ITU)=64,4%, úlcera de pressão (UP)=50,6% e pneumonia= 23,7%. Pneumonia, intubação, e ser submetido a qualquer cirurgia para UP foram independentemente associados com aumento do TDI. **Conclusão:** ITUs e UP foram as complicações mais prevalentes, e devem ser melhor estudadas para melhor atenção a LMT. As investigações sobre as complicações na lesão medular traumática devem ser mandatórias nos centros e unidades dedicadas ao tratamento da Lesão Medular.

**Palavras-chave:** Traumatismos da Medula Espinal/Complicações, Tempo de Internação, Brasil, Estudos Transversais

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## INTRODUCTION

Global incidence of spinal cord injury (SCI) is estimated between 40-80 cases per million population.<sup>1-3</sup> Traumatic spinal cord injury (TSCI) accounts for at least 75% of total cases of SCI.<sup>2,4,5</sup> Acute TSCI implies in longer length of hospitalization and costs than non-traumatic injuries, which can be partially explained by higher rates of intra-hospital complications.<sup>6</sup>

In Brazil, epidemiological data of TSCI is scarce,<sup>7</sup> and international data is heterogeneous. Prevalence of intra-hospital complications in acute TSCI can range from 38% in Australia<sup>6</sup> to 50% in South Africa.<sup>8</sup> Previous preliminary data published by our group indicate that at least 60% of the patients hospitalized in our Spinal Injuries Unit had complications.<sup>9</sup> Intra-hospital complications can increase costs of hospitalization, with some studies showing a fourfold augment for a single complication.<sup>6</sup>

Insights into the incidence of complications, as well as its causes could provide means for its prevention, which could reduce costs for the government.

## OBJECTIVE

The aim of this study is to report incidence rates of complications, its impact on length of hospital stay (LOS), as well as the characteristics of patients with traumatic spinal cord injury in a major trauma center in São Paulo, Brazil.

## METHODS

Study design: cross-sectional study, Population: patients with acute traumatic spinal cord injury discharged alive from 2004 to 2014.

Setting: Spinal Injuries Unit, Institute of Orthopedics & Traumatology of the Hospital das Clínicas at the University of São Paulo's Medical School, São Paulo, Brazil. Patients in this unit receive medical care until they are clinically stable for discharge. This facility does not have inpatient rehabilitation beds.

Outcomes: Primary: frequency and characteristics of complications. Secondary: Length of stay (LOS) in days (from admission in the hospital to discharge home) analyzed by multivariate linear regression. This study was approved by the Ethics Committee of the hospital.

Data was analyzed using Stata Statistical Software: Release 13 (StataCorp, 2013. College

Station, TX). Comparison of continuous data across 2 groups was done using Student's t-test. Chi-square was used for categorical variables. Multivariable linear regression model for predicting LOS was conducted by a step-down stepwise method based in variables established a priori: age, level of injury, complete spinal cord injury, pneumonia, deep vein thrombosis, pressure ulcer, pressure ulcer surgery, heterotopic ossification orotracheal intubation and urinary tract infection. Level of significance was  $p \leq 0.05$  and power=80% for all analysis.

## RESULTS

### Demographics

Health records of 454 patients were assessed, and 20 were excluded for incompleteness of data or non-traumatic lesions. Mean (SD) and median (range) for age was 36.1(16) and 33.8(0-77). Males were 84.6% of the cohort.

### Etiology

Data for etiology is presented in Table 1. The most frequent cause of TSCI were falls (42.1%), followed by traffic injuries (36.3%) and assault (10.7%). Patients with traffic injuries were on a motorcycle (43.2%), car (36.1%) or were run over by a vehicle (20.6%). Sports-related injuries were predominantly due to diving in shallow waters (95.8%). Most assault cases were due to gunshot wounds (89.4%).

### Characteristics of the Injury

Level and severity of the lesion are presented in Table 2. There was only 1 patient with American Spinal Injury Association Impairment Scale (AIS) E. Spinal surgery was done in 83.5% of patients. Median time until spinal surgery was 7 days (interquartile range [IQR] of 4-12 days). There was no difference in time-to-surgery of paraplegic and tetraplegic patients ( $t = -0.93$ ,  $p = 0.35$ ).

**Table 1.** Etiology of TSCI

	Tetraplegia (n=202)	Paraplegia (n=232)	Total (n= 434)
Falls	38.6% (78)	45.3% (105)	42.1% (183)
Traffic injuries	38.1% (77)	34.5% (80)	36.3% (157)
Assault	8.9% (18)	12.5% (29)	10.7% (47)
Sports / Leisure	12.4% (24)	0.4% (1)	6.0% (25)
Fall of object	2.4% (5)	6.0% (14)	4.4% (19)
Others	0% (0)	1.3% (3)	0.5% (3)

### Hospitalization Data

Information regarding LOS and intensive care unit (ICU) stay, as well as orotracheal intubation is presented in Table 3. Univariate analysis showed that patients with tetraplegia had a longer LOS than paraplegics ( $p < 0.001$ ). Multivariable linear regression showed that pneumonia ( $\beta = 13.6$ , 95%CI 4.1-23.2,  $p = 0.005$ ), pressure ulcer surgery ( $\beta = 51.3$ , 95%CI 43.1-59.6,  $p < 0.000$ ) and intubation ( $\beta = 36.5$ , 95%CI 26.5-46.7,  $p < 0.000$ ) were the only factors that independently influenced LOS.

### Intra-hospital Complication

Eighty-two percent of the patients had at least 1 complication. There was no difference in complication rates comparing tetraplegic and paraplegic patients ( $t = 0.26$ ,  $p = 0.79$ ) or time to admission in our hospital ( $\leq 1$ day vs  $> 1$ day:  $t = 0.41$ ,  $p = 0.68$ ;  $\leq 7$ days vs  $> 7$ days:  $t = -0.87$ ,  $p = 0.38$ ). There was no difference in the incidence of any individual complication (e.g.: pressure ulcer, pneumonia) when comparing patients with different time-to-admission ( $\leq 1$ day vs  $> 1$ day; and  $\leq 7$ days vs  $> 7$ days).

Urinary tract infection (UTI) was the most frequent complication (64%). The median (range) number of UTIs was 1 (1-6). Pressure ulcers were present in 50% of patients, with 30.6% of those cases required surgical. There was no difference in the prevalence of surgical correction for pressure ulcers considering time to admission in our hospital ( $\leq 1$ day vs  $> 1$ day,  $\chi^2 = 0.06$ ,  $p = 0.79$ ;  $\leq 7$ days vs  $> 7$ days,  $\chi^2 = 0.67$ ,  $p = 0.41$ ). Other complications were pneumonia (23.4%), orotracheal intubation (22.7%), heterotopic ossification (11.7%), deep vein thrombosis/pulmonary embolism (8.5%)

Heterotopic ossification (HO) incidence was 11.3%. Hip was the most common site of HO (89.5%). Single-dose radiation therapy alone was the most common treatment (60%).

## DISCUSSION

Intra-hospital complication rates were high in our population. While research conducted in South Africa<sup>8</sup> and United States<sup>10</sup> showed an

**Table 2.** Injury information

Neurologic Level	%	Frequency
C1-C4	14.4%	59
AIS A	61.0%	36
AIS B	17.0%	10
AIS C	11.9%	7
C5-C8	28.3%	114
AIS A	41.2%	47
AIS B	27.2%	31
AIS C	16.7%	19
T1-S5	57.3%	228
AIS A	65.8%	150
AIS B	14.5%	33
AIS C	12.3%	28

**Table 3.** Hospitalization data

Time from injury to admission in our hospital, in days	
median (range)	1.0 (0-129)
mean (SD)	4.7 (10.5)
≤1 day	50.1% (221)
>1 day	48.9% (213)
≤7 days	82.3% (357)
>7 days	17.7% (77)
Length of hospital stay, in days	
median (range)	43 (0-459)
mean (SD)	59.4 (52.4)
ICU	
Admittance	37.4% (162)
Length of stay, median (range)	8.0 (1-95)
Intubation	
Incidence	22.7% (97)
Days of intubation, median (range)	12 (1-70)
Tracheostomy at discharge	
	4.7% (20)
Mechanical ventilation at discharge	
	1.7% (7)

incidence of complications of 50% and 58%, respectively, our study showed 82%. Despite variability in the definition of complications across those studies, when comparing only the incidence of urinary tract infection (UTI) and pressure ulcer (PU), our cohort persisted with higher complication rates.

UTI incidence was 64%, compared to 17-20% in the abovementioned studies. Data from other countries range from 9 to 57%.<sup>11-14</sup> In our study, UTI was defined when there was clinical and laboratory abnormality in the urinary tract that required antibiotic use. As for the reasons for this high incidence, we can only speculate. A possible reason for the high rates could be length of time until changing from indwelling

catheter to intermittent catheterization.<sup>15</sup> Inappropriate catheterization technique is unlikely, since they are conducted using aseptic technique by nurses with large experience in SCI. Investigating causes of UTI incidence in our population could result in its prevention, and reduction of antibiotics usage during admission.

PU incidence was 50% compared to 14-51% in previous studies.<sup>8,11,13,14</sup> Improving the frequency of repositioning could ameliorate this rate.<sup>16</sup> Due to sub-optimal nurse-to-patient ratio, repositioning in our unit is done at every 4-6 hours. Effectively repositioning patients at every 2 hours would require more manpower in a public health system stricken by chronic

budget issues. Use of a prediction score such as the SCI Pressure Ulcer Scale (SCIPUS) could be beneficial for identifying patients with higher risk of PUs<sup>17,18</sup> and could result in better resource allocation. Pneumonia rates in our population were similar to other studies.<sup>8,10</sup>

Presence of orotracheal intubation resulted in longer LOS. That is expected, since it is associated with severity of trauma. Median duration of intubation was 12 days. Early tracheostomy could be considered in those patients in order to reduce complications.<sup>19,20</sup>

Median LOS was 43 days, compared to other studies that ranged from 7-24 days.<sup>3,6,8</sup> We hypothesize this is secondary to both high complication rates and social issues in our population. In the past, we have experienced high complication rates following early discharge, particularly with UTIs and PUs. Our population has small support for managing SCI in the primary care setting. There are scarce educational programs, and difficulty obtaining material for bladder catheterization. We believe that by training and caregivers on bladder and ulcer management in our unit we have decreased rate of post-discharge complications in those patients. Adequate support on primary care setting would probably reduce LOS in our unit.

Results of this research should improve care of SCI patients in our center. Our findings were already presented to the healthcare teams involved with those patients, and current protocols will be reviewed, particularly aiming at the improvement of UTI and PU rates.

### Study Limitation

We did not include patients that deceased during hospitalization. Therefore, we could have underestimated incidence of complications. Also, we did not assess timing of the onset of complications, which could provide better insight on its causes.

### CONCLUSION

Our patients with acute TSCI treated in our unit have high complication rates during hospital admission, particularly UTIs and PUs. Our study will benefit our TSCI patients as current protocols will be revised. We expect that this study stimulates other SCI centers in Brazil to evaluate intra-hospital complication rates for patients with TSCI, and to revise current protocols for preventing the most frequent complications.

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