

## ASSESSMENT OF RISK AND INCIDENCE OF FALLS IN NEUROSURGICAL INPATIENTS

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*Neurosurgical patients may present motor, sensitive and balance impairment and increased risk of falling. The aim of this study was to evaluate the fall-related risk factors and the incidence of falls in the pre and post-operative period of neurosurgical patients. A prospective cohort study with a research population of patients undergoing elective neurosurgical procedures. Ninety-seven patients took part in the study. Eight (8.2%) have presented falls with a total of 12 falls (12.4%). In two falls (16.7%), bed side rails were down, whereas in six falls (50%), beds had no rails at all. There was no difference among fall-related risk factors during pre and the post-operative periods. We have concluded that most falls could have been prevented through an improvement in the hospital internal structure and with the introduction of a falls prevention program.*

**DESCRIPTORS:** accidental falls; nursing; epidemiology; neurosurgery

## EVALUACIÓN DE RIESGO E INCIDENCIA DE CAÍDAS EN PACIENTES DE NEUROCI RUGÍA

*Los pacientes en neurocirugía pueden presentar deficiencias motoras, sensitivas y del equilibrio, lo cual aumenta el riesgo de caídas. El objetivo de este estudio fue evaluar los factores de riesgo y la incidencia por caídas en pacientes de neurocirugía durante el pre-operatorio y post-operatorio. Estudio de cohorte prospectivo, en donde se incluyeron pacientes sometidos a cirugías intra-craneanas y raquídeo-medulares. Participaron del estudio noventa y siete pacientes, de los cuales ocho (8,2%) tuvieron caídas, totalizando 12 (12,4%) caídas. En 2 (16,7%) de las caídas, ocurridas durante el estudio, las barandas no estaban colocadas en la cama y en 6 (50%) de ellas, la cama no tenía barandas. No se evidenció diferencia entre los factores de riesgo para las caídas en los pacientes durante el pre-operatorio y post-operatorio. Concluimos que la mayoría de las caídas podrían haber sido prevenidas, a través de una mejor estructura hospitalaria, así como con la implementación de programas de prevención para caídas.*

**DESCRIPTORES:** accidentes por caídas; enfermería; epidemiología; neurocirugía

## AVALI AÇÃO DE RISCO E INCIDÊNCIA DE QUEDA EM PACIENTES NEUROCI RÚRGICOS

*O paciente neurocirúrgico pode apresentar déficits motores, sensitivos e de equilíbrio, aumentando o risco de queda. O objetivo deste estudo foi avaliar os fatores de risco e a incidência de queda em pacientes neurocirúrgicos durante o pré e pós-operatório. Estudo de coorte prospectivo, onde foram incluídos pacientes submetidos a cirurgias intracranianas e raquimedulares eletivas. Noventa e sete pacientes participaram do estudo, sendo que oito (8,2%) apresentaram queda, totalizando 12 (12,4%) quedas. Em 2 (16,7%) quedas ocorridas, neste estudo, as camas apresentavam as grades abaixadas e em 6 (50%) delas a cama não possuía grades. Não houve diferença entre os fatores de risco para queda no paciente no pré e no pós-operatório. Conclui-se que a maioria das quedas poderiam ter sido prevenidas com a melhoria da estrutura hospitalar e com a implementação de programa de prevenção de quedas.*

**DESCRIPTORES:** acidentes por quedas; enfermagem; epidemiologia; neurocirurgia

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## INTRODUCTION

A fall is defined as a sudden and unexplainable change in position, in which patients come to the floor unintentionally<sup>(1)</sup>. Over 70% of inpatients falls occur inside the rooms, during the change to bed, chair or wheelchair, and 19% occur in deambulation when going and coming back from the toilet<sup>(1-2)</sup>.

Risk factors for falls are: being over 65<sup>(3-4)</sup>, changes in level of awareness<sup>(3-4)</sup>, use of medication (antidepressants, benzodiazepines, antihypertensive medication)<sup>(5-6)</sup>, syncope, and postural hypotension<sup>(2,4)</sup>, bladder or bowel incontinence<sup>(3-4)</sup>, balance disturbances<sup>(2,4)</sup>, motor impairment<sup>(2-4)</sup>, sensory impairment<sup>(2-4)</sup>, lack of confidence in the environment<sup>(2-4)</sup>, and previous occurrence of falls<sup>(2-4)</sup>.

Among the diseases most commonly associated with falls, musculoskeletal lesions have been observed as directly related to it, and neurological and cardiac diseases are indirectly related to it<sup>(7)</sup>.

Around 23% of falls in hospitalized patients result in lesions, and 83% of these lesions are bruises, sprains and lacerations, and 9% are fractures<sup>(1)</sup>. Among fractures, 4% occur in the bones of the hips, and 3.5% in the bones of the skull<sup>(2)</sup>. Falls can lead to an increase in admission length and in the cost of treatment, as well as causing discomfort to patients, and skepticism regarding nursing services<sup>(8)</sup>.

The implementation of many falls prevention programs have been successful and they are made of three elements: identifying the risk for falls, introducing techniques for prevention and reassessment of patients to keep or include new risk factors<sup>(4)</sup>. With these measures is expected to decrease fall rates and complications in hospitalized patients.

Fall is considered as an indicator of quality in nursing care and it is also one of the indicators monitored by Quality of Care in Hospital program that aims at improving quality of care, with the purpose of reaching excellence in hospital care<sup>(9)</sup>.

The objective of this study was to compare risk factors for fall in pre and postoperative periods, and assess the incidence of falls in neurological patients during pre and postoperative periods.

## METHOD

A cohort prospective study, performed in the neurosurgical unit and neurointensive care unit of

Hospital São Paulo, from February to August 2006. Patients included were those admitted to intracranial and spinal cord surgeries that were over 18 years old. Patients with neurological diseases have been excluded. Data collection started after approval of the Ethical Research Committee of the Federal University of São Paulo, and patients were included after giving their written consent.

The following data have been collected: age, gender, days of hospital stay, medical diagnoses, risk factors for falls, occurrence, and number of falls during hospitalization, place of fall, type and site of lesion after falling. Risk factors for fall were related to patients, environment and to nursing.

Risk factors related to patients were: being over 65<sup>(3-4)</sup>, changes in level of awareness<sup>(3-4)</sup>, use of medications (antidepressants, benzodiazepines, anti-hypertensive medication, and others)<sup>(5-6)</sup>, balance<sup>(2,4)</sup>, motor<sup>(2-4)</sup>, and sensitive impairment (decreased visual and/or auditory accuracy)<sup>(2-4)</sup>, musculoskeletal diseases<sup>(7)</sup>, and previous history of falls<sup>(2-4)</sup>.

The assessment of motor function was performed with classification of level 0 to 5<sup>(10)</sup>. In the item history of previous fall before admission, the reason, place and number of falls have been collected together with presence and type of lesions.

Risk factors related with environment included: beds with side rail, beds without side rails, high beds, and call bells out of reach for patients. According to patients, side rails were either up or down most of the times. Beds were considered high when patients needed a ladder to climb up or down the beds.

In risk factors related to nursing we have collected: patients requesting or not the help of the nursing staff.

Risk factors for falls were assessed in the pre and postoperative periods. Daily data collection was performed regarding the occurrence of fall and number of patients/day. Fall rate was calculated by dividing the number of falls by the number of patients/day and multiplying it by 1000<sup>(9)</sup>.

Statistical analysis of risk factors in the pre and postoperative period was performed by Chi-square test or Fischer's exact test, considering p values <0.05 as statistically significant.

## RESULTS

During hospital admission 97 patients were included. Table 1 presents features regarding age, gender, days of hospital stay and medical diagnosis.

Table 1 – Distribution according to age, gender, days of hospital stay, and medical diagnoses

Features	Total (n = 97)	
Age (years; $\bar{x} \pm SD$ )	48.9	14.8
Gender (n, %)		
Male	49	50.5
Female	48	49.5
Hospital stay (days; $\bar{x} \pm SD$ )	16	12.8
Medical diagnoses (n, %)		
Intracranial tumor	39	40.2
Stroke	18	18.5
Spinal cord diseases	16	16.5
Spinal tumors	9	9.3
TBI	2	2.1
Lesions on the peripheral nervous system	3	3.1
Neurocysticercosis	3	3.1
Hydrocephalus	2	2.1
SCI	1	1.0
Other brain diseases	4	4.1

$\bar{x}$ , mean; SD, Standard deviation; TBI, traumatic brain injury; SCT, spinal cord injury

Table 2 presents risk factors related with neurosurgical patients in pre and postoperative period.

Table 2 – Distribution of risk factors related with neurosurgical patients in the pre and postoperative periods

Risk factors related with patients	Pre -Operative		Post -Operative		p
	n	%	n	%	
Being over 65	16	16.5	16	16.5	1.00
Change in the level of awareness	9	9.3	10	10.3	0.81
Change in visual accuracy	43	44.4	43	44.4	1.00
Motor change	45	46.4	41	42.2	0.66
Change in gait and or/balance	18	18.5	18	18.5	1.00
Use of antihypertensive medication	46	47.4	45	46.4	0.88
Use of psychotropic drugs	63	65.0	61	62.9	0.88
Musculoskeletal diseases	5	5.2	5	5.2	1.00
History of previous fall	21	21.6	21	21.6	1.00

Among patients who presented change in the level of awareness, seven (77.8%) were disoriented in the preoperative period, and eight (80.0%) in the postoperative period; two (22.2%) were with lethargy in the preoperative period, and two (20.0%) in the postoperative period.

Regarding change in visual accuracy, 6 (14.0%) patients presented unilateral amaurosis; two (4.6%) had bilateral amaurosis; five patients (11.6%) presented diplopia, three (7.0%) cataract; one patient (2.3%) had strabismus ; 17 (39.5%) used corrective lens for short-sightedness or farsightedness, and 9 patients (21.0%) had visual accuracy decreased due to neurological diseases in the pre and postoperative periods.

In the assessment of motor function, 45 patients (46.4%) in the preoperative period, and 41 patients (42.2%) in the postoperative presented decrease in motor strength. Hemiparesis from grade 1 to grade 4 was seen in 10 patients (22.2%) in the preoperative period, and in 9 (22.0%) in the postoperative period; paraparesis grade 1 to grade 4 in 11 patients (24.5%) in the preoperative and 11 (26.8%) in the postoperative period; paresis of inferior limb grade 2 to grade 4 in nine patients (20.0%) in the preoperative period, and 7 (17.0%) in the postoperative period; quadriparesis in 11 patients (24.5%) in the preoperative period and 9 (22.0%) in the postoperative period; hemiparalysis in one patient (2.2%) in the preoperative period and in 1 in the postoperative period (2.4%); paresis in superior limbs in 3 patients (6.6%) in the preoperative period, and in 4 patients (9.8%) in the postoperative period.

The presence of change in gait and/or balance was assessed in 18 patients (18.5%), in the pre and postoperative period. During the preoperative period, 8 patients (44.4%) presented dizziness, 5 (27.9%) had ataxic gait, 2 (11.1%) had vertigo, 2 (11.1%) had paretic gait, and 1 (5.5%) presented antalgic gait. In the postoperative period, 10 patients (55.6%) presented dizziness, 4 (22.2%) ataxic gait, 2 (11.1%) vertigo, and 2 (11.1%) paretic gait.

Of the 63 patients (65.0%) using psychotropic drugs in the preoperative period, 49 (77.8%) used anticonvulsants, 8 (12.7%) antidepressants, and 6 (9.5%) benzodiazepines. In the postoperative period, 61 (62.9%) used psychotropic, and 48 patients (78.7%) used anticonvulsants, 6 (9.8%) used antidepressants, and 7 (11.5%) benzodiazepines.

Musculoskeletal diseases were present in 5 patients (5.2%) in the pre and postoperative period, and 2 patients (40%) had osteoarthritis, 1 (20%) had amputation of inferior limb, 1 (20%) had pelvic muscles hypertrophy, and of inferior limbs, and 1 patient (20.0%) was put on a cast due to fracture of left inferior limb.

Twenty-one patients (21.6%) reported previous fall before admission, the causes were: 11 (52.3%) decrease in motor strength, 4 (19.0%) balance impairment, 3 (14.3%) due to seizure, 1 (9.6%) due to syncope and 2 (9.5%) did not report the reason. Places of fall were: 13 (62.0%) patients' household; 4 (19.0%) on the streets, 1 (4.7%) in hospital before this admission, 1 (4.7%) at work and 2 (9.5%) did not report the place. Among patients

presenting falls, 12 (57.0%) presented the following lesions: 7 (33.3%) had skin abrasions, 3 (14.3%) bruises, 1 (4.7%) abrasions and bruise, 1 (4.7%) bruise and fracture of superior right limb. Regarding the number of falls, 17 patients (81.0%) had fallen once, 1 patient (4.7%) had fallen twice, 1 (4.7%) three times, and 2 (9.6%) had fallen 4 times or over. Of the 21 patients (21.6%) that presented falls previous to hospital stay, 3 (14.3%) had falls during the current hospital stay.

Table 3 present risk factors related to the environment and nursing in the pre and postoperative period. All patients reported the nursing team answered to their requests when they required.

Table 3 - Distribution of risk factors related to the environment and to nursing during pre and postoperative period

Risk factors related to the environment and nursing	Pre-Operative		Post-Operative		P
	n	%	n	%	
Side rails on the beds					
No side rails	54	55.7	56	57.8	
Side rails were up	28	28.9	31	32.0	0.55
Side rails were down	15	15.4	10	10.2	
Height of Beds					
High	71	73.2	72	74.2	0.87
Low	26	26.8	25	25.8	
Call Bells					
At patients' reach	83	85.6	89	91.8	0.26
Out of patients' reach	14	14.4	8	8.2	
Requested nursing assistance and was answered	81	83.5	89	91.8	0.14
Did not ask for nursing assistance	16	16.5	8	8.2	0.13

During hospital stay, 8 patients (8.2%) fell, of a total of 12 falls (12.4%). Two patients (25%) were over 65. In the preoperative period, 5 patients (62.5%) fell, and 2 patients (25.0%) presented two falls, on a total of 7 falls in the preoperative period (58.3%). In the postoperative period, 3 patients fell (37.5%), however, 1 patient (12.5%) presented 3 falls, in a total of 5 falls in the postoperative period (41.7%). There was no statistical difference between patients who fell in the pre and in the postoperative period ( $p < 0.72$ ). Places of fall were: 7 (58.3%) in the preoperative room; 4 (33.3%) in the postoperative room and 1 (8.4%) the fall occurred in the toilet in the postoperative period. Distribution of the ways patients fell was the following: 5 falls (41.7%) when stepping down the bed; 3 (25.0%) in deambulation in the bedroom; 3 (25.0%) when changing position on

the bed, and in the 3 cases, the bed did not have side rails, and in 2 cases beds were high; and 1 (8.3%) fall occurred when patient was leaving the toilet bowl. One patient (8.3%) evolved with subcutaneous bruise in the frontal region after the fall.

Table 4 presents reasons referred by patients and by nursing that led to fall during hospital stay. There was predominance of motor impairment in the pre and postoperative period as the main reason for fall.

Table 4 – Reasons for fall referred by patients and by nursing of the unit during hospital stay

Reason for Fall	Pre-Operative		Post-Operative	
	n	%	n	%
Motor impairment	4	33.3	2	16.7
Balance and/or gait disturbance	2	16.7	-	-
Mental Confusion (associated with motor deficit)	1	8.3	-	-
Visual Impairment (associated with balance and/or gait disturbance)	-	-	3	25.0

Figure 1 assesses the rate of fall per month. Fall rate of a patient was higher in February with 10.2 falls/1000 patients day.

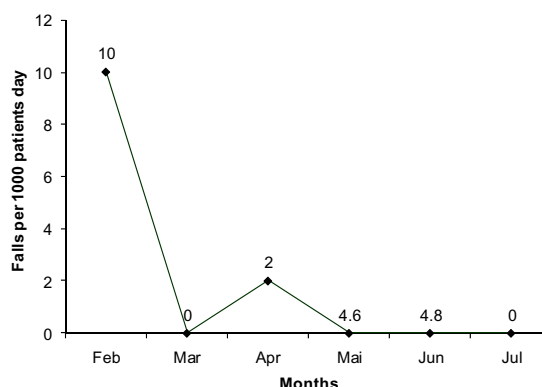


Figure 1 – Rate of Patients' fall / 1000 patients day

## DISCUSSION

Fall is the most common side effect in hospitalized patients, and 70% of the accidents occur inside the hospital<sup>(11)</sup>. Among patients, 2% fall during hospital stay<sup>(1)</sup>.

Elderly patients are at risk for fall, and 53% of falls occur in patients over 65<sup>(5)</sup>. In neurological and neurosurgical wards, the risk of fall is regardless of age<sup>(1)</sup>. In this study, we have assessed that 25% of falls occur in patients who were over 65 years old.

Among the most common risk factor in neurological patients is muscular weakness, strongly

associated with this type of fall and to fall generally speaking. A survey conducted with inpatients showed that muscular weakness was present in 80.9% of patients who fell<sup>(5)</sup>. Motor impairment was found in 4 patients (33.3%) who fell in the pre-operative period, and 2 (16.7%) in the postoperative; visual impairment associated with balance and/or gait disturbance was found in 3 patients (25%) who fell in the postoperative period.

Risk factors for fall are present in hospital patients in neurological and surgical units. However, the risk of fall is greater in psychiatric, neurological and/or neurosurgical wards<sup>(1)</sup>. In these wards, patients present several risk factors, such as level of awareness, hindered mobility, orthostatic hypotension, vesical or intestinal disturbances, sensory deficits, and previous history of falls. Falls among neurology patients occur twice as much as in other units<sup>(1)</sup>.

In risk factors associated with hospital environment, both problems of structure and process were assessed. High beds and those without side rails are related to problems with the structure of the hospital. Beds with side rails that remained lowered and not requesting nurse's assistance are related to failure in the process.

A survey assessing risk factors related to the presence of fall demonstrated that 56.1% of patients that fell had the side rails of their beds lowered. Additionally, 44 (44.9%) of them referred they requested nurses' assistance sometimes, whereas only 11 (11.2%) said they always asked for nurses' assistance<sup>(11)</sup>. In this study, the number of patients that referred not requesting nurses' assistance was 16 (16.5%) in the preoperative period, and 8 (8.2%) in the postoperative period. In 2 falls (16.7%), the beds had their side rails lowered, and in 6 of them (50%), beds did not have side rails at all.

Among patients admitted to a neurological/neurosurgical ward, 5.8% fell during hospital stay<sup>(1)</sup>. In this study, 8.2% of patients fell, which shows that in addition to risk factors related to patients, the

difficulties found regarding structure and process may have contributed to the occurrence of falls.

Falls have been divided according to the period they occurred, pre or postoperative. Seven of the falls (58.3%) occurred in the preoperative period, and 5 (33.3%) in the postoperative. When risk factors were assessed, 4 patients (4.2%) who presented motor impairment in the pre-operative period did not present it in the postoperative.

The rate of lesions caused by falls was 28% in neurological/neurosurgical wards<sup>(1)</sup>, whereas in other wards, this rate was 33.6 %<sup>(12)</sup>. We have observed in this study that 8.3% of falls caused lesions but no fracture. In another study 2% of patients had fracture<sup>(1)</sup>.

The rate of fall was 6.12 falls per 1000 patients day in a neurology ward<sup>(5)</sup>, while in this study, rates ranged from zero to 10.2 falls per 1000 patients day. Factors related to structure and process contribute to these rates.

For these preventable falls, current beds have to be replaced by beds with side rails and height adjustment. In addition to these measures, at hospital admission, there should be an assessment of the risk of falls, to determine prevention action during hospital stay. This assessment should also be periodical, since risk factors change. It is also important to involve Continuous Education of the hospital to educate the nursing team.

## CONCLUSIONS

There was no difference between risk factors for fall found in the pre and post operative period of neurosurgery. Rate of fall was 12.4%, and 6 falls (50%) could have been prevented with the improvement of hospital structure, 2 (16.7%) with the introduction of a program to prevent fall, and 4 (33.3%) if there was adherence of patients to request help for the nursing staff before performing any activity.

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