Faculdade de Medicina de São José do Rio Preto

Programa de Pós-Graduação em Ciências da Saúde

João Simão de Melo Neto

Caracterização e Fatores Preditivos no Traumatismo Raquimedular

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Tese apresentada à Faculdade de Medicina de São José do Rio Preto para obtenção do Título de Doutor no curso de Pós-graduação em Ciências da Saúde, Eixo Temático: Medicina e Áreas Correlatas.

Orientador: Prof. Dr. Waldir Antônio Tognola

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João Simão de Melo Neto

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SUMÁRIO

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Epígrafe

"Que os vossos esforços desafiem as impossibilidades, lembrai-vos de que as grandes coisas do homem foram conquistadas do que parecia impossível".

Charles Chaplin

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Lista de Abreviaturas e Símbolos

TRM	Trauma Raquimedular
EUA	*United States of American* (Estados Unidos da América)
ATLS	*Advanced Trauma Life Support*
ASIA	*American Spinal Injury Association*
SCI	*Spinal Cord Injury*
SUS	Sistema Único de Saúde
FAMERP	Faculdade de Medicina de São José do Rio Preto
OR	*Odds Ratio*
CI	*Confidence interval*
TBI	*Traumatic Brain Injury*
TCE	Traumatismo cranioencefálico
TV	Traumatismos vertebrales
TE	Traumatismos encefálicos
GCS	*Glasgow coma scale*
RR	Risco relativo

RESUMO

Introdução: O traumatismo raquimedular (TRM) ocasiona prejuízos na qualidade de vida e gastos aos sistemas de saúde. Nos últimos anos, com a inversão da pirâmide etária, há alta prevalência de TRM em idosos. Além disso, a lesão associada ao TRM mais apresentada é o Traumatismo Cranioencefálico (TCE). O direcionamento do tratamento depende de inúmeros fatores, sendo determinante para a presença de morbimortalidade. Neste contexto, estes fatores precisam ser explorados para haver investimentos na prevenção e terapêutica destes pacientes.

Objetivos: Identificar as características e aspectos clínicos de pacientes com traumatismo raquimedular, especificamente: idosos; indivíduos com TRM associado ao TCE; e sujeitos submetidos à cirurgia.

Métodos: Estudo retrospectivo, sendo previamente selecionados 321 pacientes com TRM. As variáveis clínicas e sócio-demográficas foram coletadas e analisadas. Os pacientes foram caracterizados e analisados os fatores preditores de morbimortalidade em idosos (≥60 anos) (n=62), sujeitos que sofreram TCE associado ao TRM (n=52), e em pacientes submetidos a tratamento cirúrgico (n=211).

Resultados: Durante a análise entre os diferentes sexos, observou-se que mulheres apresentam fratura compressão associada à região de transição toracolombar; homens apresentam listese mais relacionada com lesões na cervical e aumento no número de complicações; a necessidade de intervenção cirúrgica é maior em homens. Durante a comparação entre idosos e indivíduos jovens (<60 anos; n=259), observou-se que os diagnósticos morfológicos, fratura compressão e fratura luxação, são mais associados com idade ≥60 e <60, respectivamente; idosos após TRM tiveram maior associação com instabilidade hemodinâmica tardia. Com relação aos pacientes que sofreram TRM associado à TCE, o sexo masculino (85%), a faixa etária entre 21-30 anos (25%), o estado civil de união estável (56%), o baixo nível de escolaridade (69%). O acidente automobilístico (58%) foi a principal etiologia. O segmento cervical teve maior risco de lesão (RR=3,48, IC: 1,856-6,526; p<0,0001). O estado neurológico ASIA-E (52%), o quadro sindrômico de cervicalgia (35%) e o índice de TCE leve (65%) foram os mais

frequentes. As complicações atingiram 13 pacientes, sendo pneumonia a de maior frequência (62%). O tempo de internação foi significativamente maior nos pacientes com TCE (20±28 dias), e 17% dos pacientes foram a óbito. Os homens (RR=2,513, IC: 1,777-3,554; p=0,028) e indivíduos expostos a acidentes com veículo automotor (RR=1,91, IC: 1,00-1,579; p=0,022) apresentaram maior risco de sofrer essas lesões concomitantemente. Além disso, esses pacientes apresentaram 2,48 (IC: 1,372-4,477; p<0,01) mais risco de morte que vítimas de TRM isolado. Por fim, com relação à escolha do tratamento, a queda e lesões nas regiões cervical superior e lombosacral foram associadas com tratamento conservador. Pacientes com lesões nas regiões cervical inferior, pior status neurológico e lesões instáveis foram associados com cirurgia. Complicações no pós-operatório ocorreram principalmente em pacientes que realizaram cirurgia, sendo pneumonia a mais frequente, visto que os pacientes que são submetidos a este tipo de intervenção é porque apresentam um pior quadro clínico na admissão. Posteriormente, durante a análise para verificar se a idade influenciava as características dos pacientes submetidos à cirurgia, observou-se que sujeitos com <60 anos foram associados com acidente motociclístico e com o diagnóstico morfológico de lesão: lístese. Subsequentemente, nós analisamos a influência do sexo sobre as características destes pacientes. Mulheres que sofreram acidente automobilístico foram associadas à cirurgia. Mulheres foram associadas com paraparesia e diagnóstico morfológico: fratura explosão, principalmente nas regiões de transição tóraco-lombar e lombo-sacral. Homens que apresentaram TCE e trauma torácico foram relacionados à cirurgia. Estes indivíduos tiveram um pior status neurológico e foram associados à complicação. Homens e a região cervical foram mais afetados, assim, estes pacientes foram analisados isoladamente (n=92). A presença de complicações aumenta a permanência hospitalar. Pacientes com diagnósticos morfológicos em multiníveis vertebrais e com pior status neurológico apresentaram mais complicações. A mortalidade foi maior nos casos clínicos com Pneumonia e traumatismo torácico.

Conclusão: Existem fatores clínicos e demográficos específicos em idosos; assim como em pacientes que sofreram TRM associado ao TCE; e em indivíduos submetidos ao tratamento cirúrgico. O conhecimento destes fatores possibilitam investimentos em

prevenção, reabilitação e tratamento, visando reduzir a morbimortalidade, prejuízos na qualidade de vida e gastos com os serviços hospitalares.

Descritores: 1. Traumatismo da coluna vertebral, 2. Epidemiologia, 3. Idoso, 4. Fusão vertebral, 5. Traumatismo craniocerebrais.

ABSTRACT

Introduction: Spinal cord injury (SCI) has a negative impact on quality of life and healthcare costs. In recent years, with the age pyramid inversion, there is a high prevalence of SCI in the elderly. In addition, the most common SCI-related lesion is Traumatic brain injury (TBI). Treatment planning depends on many factors, and is determining for the presence of morbidity and mortality. These factors must be explored so that we can have investments for the prevention and treatment of these patients.

Objectives: To identify the characteristics and clinical features of patients with SCI, specifically: the elderly; individuals with TBI-related SCI and individuals undergoing surgery.

Methods: Prospective study, including 321 previously selected patients with SCI. Clinical and socio-demographic variables were collected and analyzed. Patients were characterized and morbidity and mortality predictors in the elderly (≥60 years) (n=62) were analyzed, as well as individuals who had TBI-related SCI (n=52), and patients undergoing surgical treatment (n=211).

Results: The comparison between the two genders showed that women have compression fracture associated to the thoracolumbar transition region; men presented listhesis more related to cervical lesions and increase in the number of complications; the need for surgical intervention is higher in men; among other factors. When we compared older and younger patients (<60 years; n = 259), we found that the morphological diagnosis, compression fracture and dislocation fracture are more associated with age ≥60 to <60, respectively; elderly after SCI had a greater association with late hemodynamic instability. With regards to patients who had TBI-related SCI, male gender (85%), age group between 21-30 years (25%), individuals who have a common-law marriage status (56%), low level of education (69%) and the Roman Catholic religion (77%) had a higher number of patients. The cervical segment had higher risk of injury (RR=3.48, CI: 1.856 to 6.526; p <0.0001). The neurological status ASIA-E (52%), syndromic presentation of neck pain (35%) and mild TBI (65%) were the most frequent. Complications were observed in 13 patients, and pneumonia was the

most prevalent (62%). Hospital stay was significantly higher (20±28 days), and 17% of patients died. Men (RR=2.513, CI: 1.777 to 3.554; p=0.028) and individuals exposed to car accidents (RR=1.91, CI: 1.00 to 1.579; p=0.022) showed a greater risk to suffer these lesions concomitantly. Furthermore, these patients had a 2.48 (CI: 1.372 to 4.477; p<0.01) higher risk of death than patients with SCI alone. Finally, regarding the choice of treatment, fall and upper cervical and lumbosacral injuries were associated with conservative treatment. Patients with lesions in the lower cervical area, worse neurological status and unstable lesions were associated with surgery. Complications in the postoperative period occurred mainly in patients undergoing surgery. Afterwards, we assessed whether age influenced the characteristics of patients undergoing surgery. Subjects <60 years of age were associated with motorcycle accidents and the morphologic diagnosis of injury was listhesis. Subsequently, we analyzed the influence of gender on the characteristics of these patients. Women who had car accidents were associated with surgery. Women were associated with paraparesis and morphologic diagnosis of burst fracture, especially in the thoracolumbar and lumbosacral transition. Men who had TBI and thoracic trauma were related to surgery. These individuals had a worse neurological status and were associated with complications. Men and cervical region were the most affected and therefore, these patients were analyzed separately (n = 92). The presence of complications increases hospital stay. Patients with simultaneous morphological diagnosis, worse neurological status, quadriplegia and sensorimotor changes had more complications. Mortality was higher in cases with clinical pneumonia and thoracic trauma.

Conclusion: There are clinical and demographic factors that are specific to the elderly, as well as to patients who have had TBI-related SCI and individuals undergoing surgical treatment. The understanding of these factors enables investments in prevention, rehabilitation and treatment aiming at reducing morbidity and mortality, losses in quality of life and hospital service expenditures.

Descriptors: 1. Traumatic spinal, 2. Epidemiology, 3. Elderly, 4. Spinal fusion, 5. Craniocerebral trauma.

1. INTRODUÇÃO

1. Introdução

Traumatismo raquimedular (TRM) refere-se a lesões nos componentes ósseos, elementos neurais e tecidos moles adjacentes à coluna vertebral, ocasionados de forma traumática. Estas lesões podem resultar em sequelas transitórias ou irreversíveis, envolvendo as funções motoras, sensitivas e autônomas.[1]

A prevalência mundial do TRM é de 236 a 4187 casos / milhão de indivíduos. A incidência global corresponde a 23 casos / milhão de indivíduos, na América do sul a 25 casos / milhão de indivíduos, e no Brasil a 21 casos / milhão de indivíduos por ano, com custos elevados ao sistema de saúde.[2,3] No Brasil, as principais causas observadas são queda (39%), acidentes com veículo automotor (31%), esportes / lazer (14%), violência e suicídios (16%). Cerca de 21% destes pacientes morrem até um ano após o traumatismo.[2]

Na população idosa estima-se que mundialmente o TRM corresponde a aproximadamente 20% de todos os casos.[4] Entretanto, no Brasil a incidência nestes indivíduos é desconhecida, devido a falhas de notificações e escassez de estudos epidemiológicos.[5] Atualmente, está com a inversão da pirâmide etária, um envelhecimento saudável e bem sucedido é desejável.[6] Segundo o estatuto do idoso, esta categoria corresponde a indivíduos com ≥60 anos de idade, apresentando diretos garantidos no Brasil.[7]

Idosos apresentam alterações provenientes dos processos de senescência e / ou senilidade.[8] Estas alterações associadas a comorbidades pré-existente tornam os idosos mais susceptíveis a lesões traumáticas, como o TRM.[9] Com base nestes fatores, idosos tem características que os distinguem de indivíduos mais jovens, requerendo serviços

diferenciados.[10] No Brasil, pesquisas[11,12] abordando a temática são escassas, além de possuírem caráter descritivo, local e com pouca análise inferencial.

Em relação aos indivíduos que sofrem TRM em qualquer idade, a lesão associada mais frequentemente apresentada é traumatismo cranioencefálico (TCE). O TCE resulta em alterações cognitivas, psicológicas e físicas. Estes traumatismos estão entre as principais causas de morbimortalidade global, porém, quando associados, podem estar relacionadas com um pior prognóstico.[13-15] Existem poucos estudos[16-18] abordando a temática, assim, fica evidente a necessidade de conhecer melhor esta população para que diretrizes nacionais voltadas a estes pacientes possam ser formuladas.

O diagnóstico correto, preciso e rápido contribuem para o sucesso terapêutico. A literatura[19] aponta que o TRM não diagnósticado no primeiro atendimento está principalmente relacionado à coluna cervical e as falhas ocorrem em qualquer etapa do atendimento e frequentemente em serviços terciários.[20]

Durante admissão destes pacientes, as normas do *Advanced Trauma Life Support* (ATLS) devem ser seguidas, sendo necessária anamnese, exame físico geral e da coluna vertebral, análise da gravidade da lesão neurológica por meio da escala ASIA (*American Spinal Injury Association*)[21], avaliação de reflexo e da função autonômica.[22] Pacientes admitidos com ausência de déficit neurológico, dor, intoxicação, alteração do estado mental e amplitude de movimento preservada, não necessitam de exames radiológicos e podem ser liberados.[23,24]

Existem diversas formas de classificar morfologicamente as fraturas da coluna vertebral. Denis[25] divide a coluna em três porções (anterior, média e posterior), visando

determinar o nível de instabilidade mecânica e/ou neurológica, dividindo as fraturas em achatamento, explosão, tipo cinto de segurança e luxação.

As lesões medulares podem ser classificadas em completas ou incompletas. A escala de ASIA, utilizada para avaliação do status neurológico, é graduada em cinco níveis, distribuída entre "A e E". O ASIA-A representa lesão medular completa e pode apresentar status sindrômico de tetraplegia e paraplegia. Logo, ASIA entre "B à D" representam lesões incompletas, enquanto ASIA-E demonstra status neurológicos normal, podendo apresentar quadros álgicos devido as lesões nos demais tecidos adjacentes.[21]

O TRM na região cervical pode ser relacionado a lesões cerebrovasculares, tais como a dissecção da artéria carótida interna, relacionada à hiperextensão cervical com rotação lateral durante o acidente automobilístico. Ainda, danos nas artérias vertebrais podem ser ocasionados por lesões que envolvam o processo transverso das vértebras cervicais. A formação de pseudoaneurisma também pode ser observada.[21,26,27]

A aplicabilidade de angiotomografia e angiorressonância são fundamentais para o diagnóstico diferencial, visto que os sintomas podem demorar até 24 horas para aparecerem.[21,26,27] A neuroimagem é utilizada para o diagnóstico diferencial e compressão dos mecanismos fisiopatológicos associados ao TRM. Os exames mais aplicados são radiografia simples, tomografia computadorizada e ressonância magnética.[28,29]

O tratamento cirúrgico é adotado para lesões instáveis. Existem numerosas técnicas de instrumentação cirúrgica ou fixação usada em pacientes com TRM, porém, a escolha da técnica a ser aplicada dependerá do quadro clinico do paciente, características da lesão e da experiência do cirurgião. De forma geral, a presença de

instabilidade posterior será tratada com fusão vertebral posterior, enquanto instabilidade anterior será com fusão anterior. Quando existir lesão discoligamentar completa, a aplicação de fixação circular ou combinada deverá ser aplicada.[30,31] A intervenção cirúrgica promove dissecção e retração de diversas estruturas, visando expor a coluna para correção da lesão instalada. Desta forma, como consequência, pode ocorrer aumento de complicações e mortalidade,[32] por esta razão é fundamental conhecer quais são os fatores associados à necessidade cirúrgica e quais aspectos clínicos estão associados com a morbimortalidade.

O objetivo deste estudo foi identificar as características e aspectos clínicos de pacientes com traumatismo raquimedular, sendo analisados: idosos; pacientes com TRM associado ao traumatismo cranioencefálico; sujeitos submetidos à cirurgia.

2. ARTIGOS CIENTÍFICOS

Artigos Científicos

ARTIGO 1

Título: *Spinal cord injury in elderly admitted at a tertiary hospital.*

Autores: João Simão de Melo Neto, Fabiana de Campos Gomes, Dionei Freitas de Morais, Waldir Antonio Tognola.

Periódico: *Journal of Back and Musculoskeletal Rehabilitation*, submetido em 27/07/2016.

ARTIGO 2

Título: *Analysis of patients with spinal cord trauma associated with traumatic brain injury.*

Autores: João Simão de Melo Neto, Waldir Antonio Tognola, Antonio Ronaldo Spotti, Dionei Freitas de Morais.

Periódico: Coluna/ Columna, publicado 2014;13(4):302-5.

ARTIGO 3

Título: C*haracteristics and clinical aspects of patients with spinal cord injury undergoing surgery*

Autores: João Simão de Melo Neto, Lara Eduarda Leite Vidotto, Fabiana de Campos Gomes, Dionei Freitas de Morais, Waldir Antonio Tognola.

Periódico: Revista Brasileira de Ortopedia, aceito para publicação em 28/07/2016.

ARTIGO 1

Título: *Spinal cord injury in elderly admitted at a tertiary hospital.*

Autores: João Simão de Melo Neto, Fabiana de Campos Gomes, Dionei Freitas de Morais, Waldir Antonio Tognola.

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SPINAL CORD INJURY IN ELDERLY ADMITTED AT A TERTIARY HOSPITAL

Traumatismo raquimedular em idosos admitidos em hospital terciário

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ABSTACT

OBJECTIVE: To identify the characteristics and clinical aspects of the spinal cord injury (SCI) in elderly.

METHODS: Retrospective study in elderly (≥60 years) with a clinical diagnosis of SCI. The clinical and socio-demographic variables were collected from medical records.

RESULTS: Sixty-two elderly were studied (56% men). The elderly were analyzed according to gender, being observed: women present the compression fracture more associated with thoracolumbar transition; men present the listhesis more associated with lesions in the cervical and increase in the number of complications; the need for surgical intervention are higher in men. Among many characteristics that differ elderly and younger people (<60 years; n=259), we observe: the morphological diagnosis, compression fracture and dislocation fracture, were more associated with aged ≥60 and <60, respectively; elderly after SCI have a higher association with late hemodynamic instability.

CONCLUSION: Elderly with SCI have characteristics and clinical factors distinct in related to the genders and when compared with individuals more young.

Key words: Aging; Spinal Injuries; Spinal Fractures; Epidemiology.

RESUMO

Objetivo: Identificar as características de idosos com traumatismo raquimedular (TRM).

Métodos: Estudo prospectivo em idosos (≥60 anos) com histórico médico de TRM. As variáveis clínicas e sócio-demográficas foram coletadas dos prontuários médicos.

Resultados: Sessenta e dois idosos foram estudados (56% homens). Os idosos foram analisados de acordo com o sexo. Observou-se que mulheres apresentam fratura compressão associada à região de transição toracolombar; homens apresentam listese mais associada com lesões na cervical e aumento no número de complicações; a necessidade de intervenção cirúrgica é maior em homens; entre outros fatores. Entre inúmeras características distintas dos idosos em relação a indivíduos mais jovens (<60 anos; n=259), observou-se que os diagnósticos morfológicos, fratura compressão e fratura luxação, são mais associados com idade ≥60 e <60, respectivamente; idosos após TRM tiveram maior associação com instabilidade hemodinâmica tardia.

Conclusão: Idosos com TRM têm fatores clínicos e demográficos específicos.

Palavras-chave: Idoso; Traumatismos da coluna vertebral; Fraturas da Coluna Vertebral; Epidemiologia.

INTRODUCTION

Aging has grown significantly in recent years, and an important lifestyle goal is successful aging and quality of life. However, problems associated with age and decreased functional capacity affect this population, and require improving treatments and a better understanding about these individuals.[1]

In Brazil, according to the By-laws of the Elderly, individuals ≥60 years of age are considered as elderly and have guaranteed rights.[2] Physical and psychological changes related to aging and pre-existing diseases result in increased morbidity and mortality in this population.[3] Because of these changes, the elderly is more susceptible to traumatic injuries, such as spinal cord injury (SCI).[3] Due to the presence of comorbidity, older people with SCI have limited physiological capacity.[4] In this context, medical and rehabilitation services are significantly different and require special attention.[5]

There are few studies that characterize and analyze separately elderly patients with SCI and researches show different aspects, such as, demographic data and clinical services,[4-6] being scarce studies in Brazil[7,8]. In addition, these researches[7,8] are descriptive and in different regions of the country.

Regional and cultural factors may influence the clinical characteristics of these individuals,[9] therefore it is extremely important to investigate them. Moreover, the characterization of a given population and the diagnosis of the major risk factors are important because they support the national guidelines, which are defined and re-evaluated to meet the specific needs of each population.[10]

SCI is defined as spinal injury and/or neuronal elements and may be caused with or without fractures and/or vertebral dislocation, may result in motor, sensory and autonomic functional changes, which may be persistent or transient.[11]

It is estimated that SCI in elderly worldwide corresponds to approximately 20% of the overall cases.[12] In 2004, the Brazilian Public Healthcare System, the so-called Unified Health System (SUS) identified 15,700 hospitalizations, and 505 patients died

due to SCI,[13] resulting in high costs to the public healthcare system. However, the incidence of SCI rates in Brazil are unknown, due to lack of notifications and the scarcity of epidemiological studies in this population.[14]

In this context, demographic studies are required to obtain a more specific understanding of risk groups and the main causes. As a result, prevention programs for these individuals may be created,[14] helping program the use of resources required for medical treatment and rehabilitation, contributing to a better prognosis for the patient.[13]

Therefore, the objective of this study is to identify the characteristics and clinical aspects of the spinal cord injury in elderly.

METHODS

Retrospective study conducted at Hospital de Base, São José do Rio Preto Medical School (FAMERP), a tertiary referral center in the northwest region of São Paulo, Brazil. The study was approved by the Institutional Ethics Committee, protocol no. 806.452.

Previously, three hundred and twenty-one patients with SCI were selected in the period 2008-2012. Patients with incomplete medical records were excluded. The medical diagnosis of SCI was used as inclusion criterion. To confirm the diagnosis of SCI, patients underwent clinical and radiological evaluation by computed tomography and/or magnetic resonance imaging.

The elderly (n=62) were analyzed according to gender (♀ n=27; ♂ n=35) and to variables more closely associated with mortality (n=13). In addition, individuals with SCI and <60 years of age (n=259) were used to verify which factors were most associated with the elderly.

The following variables were collected from medical records of patients included in the research: socio-demographic data, cause of injury, syndromic presentation, topography and morphologic diagnosis of injury, neurological status, associated lesions and clinical complications during hospitalization.

Elderly individuals with injury in the upper cervical region (C1-C2), lower cervical (C3-C7), thoracic (T1-T10), thoracolumbar transition (T11-L2) and lumbosacral (L3-S1) were included in the study.[15] Morphological classification of the lesions was performed as suggested by Denis[16]. The neurological status of patients was obtained through the ASIA scale (American Spinal Injury Association)[17].

Data analysis was performed using descriptive and inferential statistics. The results were expressed as mean (standard deviation) or median (minimum – maximum), absolute and relative frequencies. The Kolmogorov-Smirnov test was used to verify the normality. For comparison among the different groups the unpaired test-t (parametric) and Mann Whitney (non-parametric) were used. The level of association among the variables was analyzed using the odds ratio (OR), confidence interval (CI) and confirmed by Fisher's exact test. A $p \leq 0.05$ value was considered statistically significant. Statistical analysis was performed by the Instat program. (version 3.0; GraphPad, Inc., San Diego, CA, USA).

RESULTS

Characteristics of elderly individuals with SCI

Sixty-two elderly patients were evaluated (56% male; Mean: 72±08 years of age). As to individual characteristics, 95% were caucasian, 71% had primary education; 76% were catholic; 58% were married; and 64% are employers (Table 1). Patients from 19 different cities were included in the study. Approximately 69% patients were treated by national public healthcare service.

The most frequent etiology of injuries were fall (58%) and motor vehicle accidents (26%) (Table 2). Mean hospital stay after the SCI was 10±11 days. Patients were submitted to conservative treatment (53%) and surgical (47%) treatment. The mean time of surgery was 5.2±9.1 hours, including the post-anesthetic recuperation.

The most affected vertebrae were C6 (27%), C5 (19%) and T12 (15%). One hundred and eight fractured vertebrae were diagnosed. Twenty-two individuals had two injured vertebrae, seven had three injured vertebrae; two had four injured vertebrae and

one had five associated spinal injuries. The other individuals had only one vertebra affected. Regarding the topography of the lesion, the lower cervical region was the most affected (37%), followed by the thoracolumbar transition (35%).

Table 1. Socio-demographic characteristics of the individuals with spinal cord injury.

	<60 years n=259 (%)	**≥60 years n=62 (%)**
Race		
Caucasian	222 (86)	59 (95)
Black	10 (04)	02 (03)
Mulatto	27 (10)	01 (02)
Educational level		
Illiterate	17 (07)	04 (06)
Primary education	146 (56)	44 (71)
Secondary school	70 (27)	11 (18)
Higher education	26 (10)	03 (05)
Religion		
Agnostic	13 (05)	07 (11)
Roman Catholic	201 (78)	47 (76)
Orthodox Catholic	10 (04)	-
Spiritualism	02 (01)	01 (02)
Evangelical	22 (08)	03 (05)
Pentecostal	09 (03)	02 (03)
Others*	02 (01)	02 (03)
Marital status		
Divorced	11 (04)	04 (06)
Single	130 (50)	07 (11)
Married	101 (39)	36 (58)
Widower	17 (07)	15 (25)
Occupations		
Agriculture	05 (02)	-
Housewife	17 (6.5)	17 (28)
Farmer	19 (07)	04 (06)
Mason	06 (2.5)	05 (08)
Merchant	13 (05)	05 (08)
Retired	01 (0.5)	05 (08)
Student	17 (6.5)	-
Teacher	04 (1.5)	-
Security person	-	03 (05)
Wall painter	04 (1.5)	-
Others *	173 (67)	23 (37)

* Variables that have less than three events per category.

Four patients had trauma in different topographical regions. The most common morphological diagnose was compression fracture (37%). Sixty-seven diagnoses were evaluated and five individuals had two simultaneous morphological lesions (Table 2).

The main neurological status according to the ASIA scale during the admission was "E" (61%) (Table 3). Moreover, it was observed that the most frequent syndromic presentation was dorsal pain (30%) (Table 2).

The most common associated injury was traumatic brain injury (11%). Seven, two and one patients had two, three and four associated injuries, respectively. The other individuals had only one associated injuries affected. Clinical complications were observed in 16 individuals, of who five had two complications and two had three complications. The other individuals had only one complication. Pneumonia (10%) was the most prevalent complication. Thirteen patients died (Table 3).

Variables associated with gender in the elderly

The elderly were also analyzed according to gender [Median age - ♀: 72 (61-93), ♂: 72 (60-91) years; $p>0.05$, Mann-Whitney test], as shown to tables 2 and 3. We observed that during trauma, the morphological diagnosis was compression fracture (more frequently associated with women) and listhesis (more frequently associated with men). The lower cervical was more affected in men and the thoracolumbar transition was more affected in women. Consequently, cervicalgia was more associated with males, whereas low back pain was more associated with females. Men are three times more associated with complications than women during hospitalization.

We investigate the relationship between the factors associated with elderly according to different genders. Regarding women, we found that the compression fracture is more associated with thoracolumbar transition region. (OR: 7,000, IC: 2,19-22,43; p =0.0008, Fisher test).

In men, we observed that listhesis was more associated with lesions in the cervical region (OR: 53.57, CI: 3.00-957.97, p<0.0001, Fisher test) and the increase in the number of complications (OR: 27.00, CI: 1.30-562.82, p=0.008, Fisher test). The need for surgical intervention was three times higher in men (p=0.039, Fisher's test).

Variables associated with mortality in the elderly

Variables associated with mortality were analyzed. The presence of complications (OR: 5.19, CI: 1.40-19.19, p=0.015, Fisher test), associated lesions (OR: 7.00, CI: 1.81-27.08, p=0.006, Fisher test), syndromic presentation of tetraplegia (OR: 6.82, CI: 1.30-35.81; p=0.030, Fisher test), sensorimotor alteration (OR: 6.23, CI: 1.64-23.75, p=0.006, Fisher test) and neurological status ASIA-A (OR: 7.03, CI: 1.55-31.99, p=0.015, Fisher test) are associated with higher mortality. However, neurological status ASIA-E (OR: 0.132, CI: 0.03-0.55; p=0.003, Fisher test) demonstrated to be a protective factor for death after the SCI.

Variables associated to SCI in different ages (<60 and ≥60 years)

The variables were analyzed and compared to individuals <60 years of age (mean age: 36±13 years; 76% male) as shown in table 4 and 5. Socio-demographic characteristics are shown in Table 1. Elderly women were more associated with SCI (OR: 2.40, IC= 1.35-4.27; p=0.004, Fisher test).

Table 2. Etiology, morphological diagnosis, topography of the lesion and syndromic presentation of elderly with spinal cord injury, and level of association between genders.

	♀	♂	**Total**		
	n=27 (%)	**n=35 (%)**	**n=62 (%)**	**OR (CI)**	**p**
Etiology					
Car accident	05 (18)	11 (31)	16 (26)	2.017 (0.60-6.73)	0.196
Electric shock	-	01 (03)	01 (02)	2.390 (0.09-61.08)	0.564
Fall	17 (63)	19 (54)	36 (58)	1.432 (0.51-3.99)	0.319
Motorcycle accident	02 (7.5)	01 (03)	03 (05)	2.880 (0.25-33.53)	0.402
Trampling	02 (7.5)	02 (06)	04 (06)	0.758 (0.10-5.76)	0.589
Sport	01 (04)	01 (03)	02 (03)	0.765 (0.05-12.82)	0.685
Morphological diagnosis					
Burst fracture	07 (26)	07 (20)	14 (23)	1.400 (0.42-4.62)	0.400
Compression fracture	15 (55.5)	08 (23)	23 (37)	4.219 (1.41-12.61)[#]	0.009*
Dislocation fracture	02 (7.5)	03 (09)	05 (08)	0.853 (0.132-5.51)	0.624
Listhesis	01 (04)	11 (31)	12 (19)	11.92 (1.43-99.43)[#]	0.006*
Others	03 (11)	10 (29)	13 (21)	-	-
Number of events	28	39	67	-	-
Topography					
Upper cervical (C1-C2)	01 (04)	05 (14)	06 (10)	4.330 (0.48-39.54)	0.169
Lower cervical (C3-C7)	05 (19)	18 (51)	23 (37)	4.659 (1.44-15.10)[#]	0.008*
Lumbosacral (L3-S1)	03 (11)	03 (09)	06 (10)	0.840 (0.16-4.53)	0.532
Thoracic (T1-T10)	06 (22)	03 (09)	09 (14)	3.048 (0.69-13.54)	0.126
Thoracolumbar transition (T11-L2)	13 (48)	09 (26)	22 (35)	2.683 (0.92-7.82)	0.059*
Number of events	28	38	56	-	-
Syndromic presentation					
Coma	01 (04)	01 (03)	02 (03)	1.310 (0.08-21.92)	0.685
Dorsal pain	10 (37)	09 (25)	19 (30)	1.699 (0.57-5.05)	0.247

Hemiparesis	-	01 (03)	01 (02)	0.418 (0.02-10.68)	0.564
Low back pain	05 (18)	01 (03)	06 (10)	7.727 (0.85-70.69)	0.051*
Cervicalgia	02 (7.5)	12 (34)	14 (23)	5.000 (0.99-25.18)	0.012*
Paraparesis	04 (14.5)	01 (03)	05 (08)	5.913 (0.62-56.37)	0.107
Paraplegia	02 (7.5)	02 (06)	04 (06)	1.320 (0.17-10.03)	0.589
Tetraparesis	02 (7.5)	03 (09)	05 (08)	0.853 (0.13-5.51)	0.624
Tetraplegia	01 (04)	05 (14)	06 (10)	4.33 (0.47-39.54)	0.169

OR – Odds Ratio. CI – Confidence interval. *$p<0.05$, Fisher test. [#]Significant CI.

Table 3. Syndromic status, associated injuries, complications and mortality of elderly with spinal cord injury, and level of association between genders.

	♀ n=27 (%)	♂ n=35 (%)	Totaln=62 (%)	OR (CI)	p
Syndromic status					
ASIA-A	03 (11)	06 (17)	09 (15)	1.655 (0.37-7.33)	0.385
ASIA-B	01 (04)	01 (03)	02 (03)	0.765 (0.05-12.82)	0.685
ASIA-C	05 (18)	04 (11)	09 (14)	1.761 (0.42-7.32)	0.334
ASIA-D	-	03 (09)	03 (05)	5.920 (0.62-3.98)	0.173
ASIA-E	17 (63)	20 (57)	37 (61)	1.569 (0.62-3.98)	0.421
Coma	01 (04)	01 (03)	02 (03)	0.765 (0.05-12.82)	0.685
Associated injuries					
Lower appendicular limb	02 (07)	04 (11)	06 (10)	1.613 (0.28-9.54)	0.468
Upper appendicular limb	01 (04)	02 (06)	03 (05)	1.529 (0.13-17.81)	0.598
Thoracic trauma	02 (07)	04 (11)	06 (10)	1.613 (0.28-9.54)	0.468
Traumatic brain injury	02 (07)	05 (14)	07 (11)	2.803 (0.37-11.68)	0.335
Others	01 (04)	01 (03)	02 (03)	-	-
Number of events	08	16	24	2.000 (0.69-5.78)	0.152
Complications					
Late hemodynamic instability	-	03 (09)	03 (05)	5.923 (0.29-119.82)	0.173
Pneumonia	01 (04)	05 (14)	06 (10)	4.333 (0.48-39.54)	0.169
Respiratory failure	-	02 (06)	02 (03)	4.104 (0.19-89.19)	0.315
Sepsis	01 (04)	01 (03)	02 (03)	0.765 (0.05-12.82)	0.685
Urinary tract infection	02 (07)	02 (06)	04 (06)	0.758 (0.01-5.76)	0.589
Others	03 (11)	05 (14)	08 (13)	-	-
Number of events	07	18	25	3.025 (1.02-8.97)[#]	0.038*
Mortality	06 (22)	07 (20)	13 (21)	1.114 (0.33-3.91)	0.537

OR – Odds Ratio. CI – Confidence interval. *$p<0.05$, Fisher test. [#]Significant CI.

Table 4. Etiology, morphological diagnosis, topography of the lesion and syndromic presentation of elderly and people with <60 years.

	< 60 years	**≥ 60 years**		
	n=259 (%)	**n=62 (%)**	**OR (CI)**	**p**
Etiology				
Car accident	109 (42)	16 (26)	2.089 (1.12-3.88)[#]	0.012*
Fall	52 (20)	36 (58)	5.512 (3.06-9.94)[#]	< 0.0001*
Motorcycle accident	46 (18)	03 (05)	4.247 (1.28-14.15)[#]	0.006*
Trampling	03 (01)	04 (06)	8.862 (1.58-49.57)[#]	0.014*
Sport	19 (07)	02 (03)	0.421 (0.10-1.86)	0.190
Others	30 (12)	01 (02)	-	-
Morphological diagnosis				
Burst fracture	62 (24)	14 (23)	0.927 (0.48-1.79)	0.484
Compression fracture	33 (13)	23 (37)	4.039 (2.16-7.60)[#]	< 0.0001*
Dislocation fracture	67 (26)	05 (08)	3.978 (1.53-10.35)[#]	0.001*
Listhesis	38 (15)	12 (19)	0.716 (0.35-1.47)	0.232
Others	59 (22)	08 (13)	-	-
Topography				
Lower cervical (C3-C7)	111 (43)	23 (37)	1.272 (0.72-2.25)	0.248
Lumbosacral (L3-S1)	20 (08)	06 (10)	0.781 (0.30-2.04)	0.386
Thoracic (T1-T10)	51 (20)	09 (14)	0.693 (0.32-1.50)	0.228
Thoracolumbar transition (T11-L2)	76 (29)	22 (35)	1.324 (0.74-2.38)	0.214
Upper cervical (C1-C2)	32 (12)	06 (10)	1.316 (0.52-3.30)	0.369
Number of events	290	66	-	-
Syndromic presentation				
Coma	04 (02)	02 (03)	2.125 (0.38-11.88)	0.328
Dorsal pain	62 (24)	19 (31)	1.404 (0.76-2.59)	0.176
Low back pain	11 (04)	06 (10)	2.416 (0.86-6.81)	0.087
Cervicalgia	68 (26)	14 (23)	1.221 (0.63-2.35)	0.337

Paraparesis	27 (10)	05 (08)	1.327 (0.49-3.60)	0.388
Paraplegia	25 (10)	03 (05)	2.101 (0.61-7.20)	0.170
Tetraparesis	24 (09)	05 (08)	1.164 (0.43-3.19)	0.497
Tetraplegia	37 (14)	06 (10)	1.556 (0.63-3.87)	0.231
Others	01 (01)	02 (02)	-	-

OR – Odds Ratio. CI – Confidence interval. *$p<0.05$, Fisher test. [#]Significant CI.

Table 5. Syndromic status, associated injuries, complications and mortality of elderly and people with <60 years.

	< 60 years	**≥ 60 years**	**OR (CI)**	**p**
	n=259 (%)	**n=62 (%)**		
Syndromic status				
ASIA-A	59 (23)	09 (14)	0.576 (0.27-1.24)	0.102
ASIA-B	10 (04)	02 (04)	0.830 (0.18-3.89)	0.582
ASIA-C	31 (12)	09 (14)	1.249 (0.56-2.78)	0.359
ASIA-D	20 (08)	03 (05)	1.646 (0.47-5.73)	0.317
ASIA-E	135 (52)	37 (60)	0.736 (0.42-1.29)	0.176
Coma	04 (01)	02 (03)	2.125 (0.38-11.89)	0.328
Associated injuries				
Lower appendicular limb	25 (10)	06 (10)	1.003 (0.39-2.56)	0.577
Upper appendicular limb	19 (07)	03 (05)	0.642 (0.18-2.24)	0.354
Thoracic trauma	17 (07)	06 (10)	0.656 (0.25-1.74)	0.271
Traumatic brain injury	45 (17)	07 (11)	1.652 (0.71-3.87)	0.165
Others	57 (22)	02 (03)	-	-
Number of events	163	24	3.184 (1.83-5.55)[#]	<0.0001*
Complications				
Late hemodynamic instability	01 (01)	03 (05)	13.119 (1.34-128.43)[#]	0.024*
Pneumonia	24 (09)	06 (10)	1.049 (0.41-2.69)	0.541
Respiratory failure	02 (01)	02 (03)	4.283 (0.59-31.04)	0.169
Sepsis	03 (01)	02 (03)	0.352 (0.06-2.15)	0.248
Urinary tract infection	14 (05)	04 (06)	1.207 (0.38-3.80)	0.471
Others	48 (19)	08 (13)	-	-
Number of events	92	25	1.226 (0.70- 2.16)	0.286
Mortality	12 (05)	13 (21)	5.461 (2.35-12.68)[#]	0.0001*

OR – Odds Ratio. CI – Confidence interval. *p<0.05, Fisher test. [#]Significant CI.

We observed that the causes most common for elderly individuals were fall and trampling, whereas car and motorcycle accidents were more associated with individuals aged <60 years. The morphological diagnosis, compression fracture and dislocation fracture, were more associated with individuals aged ≥60 and <60, respectively (Table 4).

In this context, motor vehicle accidents (car and motorcycle) were more associated with dislocation fracture (OR: 2.01, IC: 1.10-3.67; p=0.015, Fisher test). The fall was significantly resulting in fracture compression (p=0.046, Fisher test). Individuals aged <60 years showed more injuries associated with SCI. Elderly individuals after SCI have a higher association with late hemodynamic instability and mortality than patients with <60 years of age (Table 5).

There were no differences for hospitalization time and surgical intervention between the two age groups (p>0.05, Mann-Whitney test). Surgical treatment was more associated with individuals <60 years of age (OR: 2.690, IC= 1.53-4.74; p=0.0005, Fisher test).

DISCUSSION

Age is a major risk factor for mortality after SCI,[18] and therefore, further studies are required to increase the possibility of investments in specific prevention, rehabilitation and treatment programs. Thus, our aim was to identify the clinical characteristics of these patients.

Regarding gender, the SCI in elderly has been shown discordant. Turkey[4] and Canada[19] has been described as being more prevalent in men, while in Taiwan[20], in women. We found no difference of prevalence among the genders during analysis in elderly. However, there was a high prevalence in older women, compared to the younger group, probably due to cultural and regional factors,[9] demonstrating the importance of characterization of this population. According to Güzelkücük et al.[4], SCI in the elderly is related to degenerative conditions of the spine resulting from the natural aging process and can be a determining factor for the occurrence of injuries.

Fall was the main cause of injuries in the evaluated population. This etiology has been observed in national studies[15,21] involving populations of different ages. However, other studies[9,22] have shown that age is related to cause injury, as in young people, auto motor vehicle accidents are frequently described, results found in this study, because they are more frequently exposed to risk activities.[23]

The increased risk of fall in the elderly may be due to musculoskeletal weakness, decreased proprioception and balance, cognitive impairment and visual, polypharmacy and associated diseases.[4] Moreover, regarding the primary cause of SCI in the elderly, cultural factors and regional differences must not be neglected.[23] Still, the high rate of SCI after trampling should be taken into consideration.

There are differences in the literature about the most affected segment. According to some studies[6,11], falls are directly related to injuries in the upper cervical region in the elderly. However, in this study we observed prevalence in the lower cervical region, as in other studies[4,24]. Furthermore, the upper cervical region was significantly associated with higher mortality. Thus, variations in the affected region are observed, but the cervical segment is usually the most affected.

The lower cervical and thoracolumbar transitions were more affected in men and women, respectively. Consequently, cervicalgia was more associated with male gender, whereas low back pain was more associated to women. The thoracolumbar transition is often injured because it is an area of transition from one fixed segment, by the ribcage, to a segment with greater mobility.[9] Other anatomic factors can influence, such as thoracic stabilization by intercostal muscles and ribs; and difference in positioning of facets in the different regions.[25] The need for surgical intervention was greater in men. This may be possibly explained by the variation of the spinal anatomy observed in different regions.[26]

The morphologic diagnosis of compression fracture was four times more associated the elderly. Limited studies[25,27] show that this type of fracture is common in individuals with decreased bone mineral density. This could justify the significant association in the elderly. We observed that morphologic diagnostic is related the most

cause prevalent and gender, being more common in older women. Both genders show balance between bone formation and resorption, but men develop less osteoporosis than women, by gaining more bone mass during puberty, and lose less bone mass during aging, because not abruptly lose the estrogenic hormones.[28] Within this context, men were more associated with listhesis. Estrogens provide greater mobility to ligaments, responsible for stabilizing the spine, justifying the results found. Listhesis in men was more associated with the cervical region; complications and consequently an increase in the number of surgery in males, possibly due to anatomical particularities of this region.[26]

However, dislocation fracture was more associated to individuals <60 years of age. Patients with this type of injury require surgical treatment,[29] and are related to injuries after automobile accident, explaining the occurrence of this type of intervention in individuals in this age group.

The associated lesions were present in most subjects with <60 years, probably due to the primary cause of SCI in the individuals of this age group. There was no difference in the number of complications between ages distinct. However, the elderly showed greater association with late hemodynamic instability and death. This can be explained by the higher prevalence of comorbidities in elderly.[27] Still, according to Grant et al.[30], this clinical complication is due to loss of sympathetic vascular tone, then, showed worse in these patients.

The presence of complications, associated injuries, syndromic presentation of quadriplegia, sensorimotor alteration and neurological status ASIA-A were significantly associated with increased mortality. In patients of different ages it was observed that the greater severity of the lesion and the cervical segment, makes patients more vulnerable to respiratory complications, thereby, promoting increased risk of morbimortality in the elderly,[9] which was also observed in this study. Furthermore, the absence of neurological impairment proved to be a protective factor for death after SCI in the study population.

CONCLUSION

Elderly with SCI have characteristics and clinical factors distinct in related to the genders and when compared with individuals more young. Older women suffer more SCI than those <60 years old, mainly associated with trauma in the thoraco-lumbar transition with compression fracture, presenting a better prognosis that male. However, the elderly men present unstable lesions, mainly in the lower cervical and they evolve with greater gravity. Still, the elderly present more complications post-SCI, associated lesions, neurological deficit and mortality, evolving with a worse prognosis than younger individuals. In this context, the information presented in this research provides new insights for the prevention and treatment.

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ARTIGO 2

Título: *Analysis of patients with spinal cord trauma associated with traumatic brain injury.*

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Analysis of patients with spinal cord trauma associated with traumatic brain injury

Análise de pacientes com trauma raquimedular associado a traumatismo cranioencefálico

Análisis de los pacientes con traumatismos vertebrales asociados con traumatismos encefálicos

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ANALYSIS OF PATIENTS WITH SPINAL CORD TRAUMA ASSOCIATED WITH TRAUMATIC BRAIN INJURY

ANÁLISE DE PACIENTES COM TRAUMA RAQUIMEDULAR ASSOCIADO A TRAUMATISMO CRANIOENCEFÁLICO

ANÁLISIS DE LOS PACIENTES CON TRAUMATISMOS VERTEBRALES ASOCIADOS CON TRAUMATISMOS ENCEFÁLICOS

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ABSTRACT

Objective: Characterize victims of spinal cord injury (SCI) associated with traumatic brain injury (TBI) and risk factors. **Methods**: Study conducted with 52 victims of SCI associated with TBI. The variables studied were: gender; age; marital status; occupation; educational level; religion; etiology and the lesion area; neurological condition by the ASIA scale; associated injuries and potential risk factors. **Results**: The male (85%), aged between 21-30 years (25%), civil status stable union (56%), low level of education (69%) and the Roman Catholic religion (77%) presented the greater number of victims. Motor vehicle accidents (58%) were the main etiology. The cervical segment had higher injury risk (RR=3.48, IC: 1.856-6.526; p<0.0001). The neurological status ASIA-E (52%), the syndromic cervicalgia (35%) and the rate of mild TBI (65%) were the most frequent. Complications occurred in 13 patients with increased frequency of pneumonia (62%). The length of hospital stay was significantly higher (20±28 days) and 17% of patients died. Men (RR=2.513, IC: 1.777-3.554; p=0.028) and individuals exposed to motor vehicle accidents (RR=1.91, IC: 1.00-1.579; p=0.022) showed a higher risk of these lesions concurrently. Moreover, these patients had 2.48 (IC: 1.372-4.477; p<0.01) higher risk of death than victims of SCI alone. **Conclusion**: The SCI associated with TBI was more frequent in men, young adults, and individuals exposed to motor vehicle accidents. The cervical spine is more likely to be affected. Furthermore, the length of hospitalization is significantly higher and the subjects analyzed have higher risk of death.

Keywords: Spinal Injuries; Craniocerebral trauma; Epidemiology.

RESUMO

Objetivo: Caracterizar vítimas de traumatismo raquimedular (TRM) associado a traumatismo cranioencefálico (TCE) e fatores de risco. **Métodos**: Estudo realizado com 52 vítimas de TRM associado a TCE. Foram estudadas as variáveis: sexo; idade; estado civil; profissão; escolaridade; religião; etiologia e região do TRM; condição neurológica pela escala da ASIA; lesões associadas e fatores de risco em potencial. **Resultados**: O sexo masculino (85%), a faixa etária entre 21-30 anos (25%), o estado civil de união estável (56%), o baixo nível de escolaridade (69%) e a religião Católica Apostólica Romana (77%) apresentaram um maior número de vítimas. O acidente automobilístico (58%) foi a principal etiologia. O segmento cervical teve maior risco de lesão (RR=3,48, IC: 1,856-6,526; p<0,0001). O estado neurológico ASIA-E (52%), o quadro sindrômico de cervicalgia (35%) e o índice de TCE leve (65%) foram os mais frequentes. As complicações atingiram 13 pacientes, sendo pneumonia a de maior frequência (62%). O tempo de internação foi significativamente maior (20 ± 28 dias), e 17% dos pacientes foram a óbito. Os homens (RR=2,513, IC: 1,777-3,554; p=0,028) e indivíduos expostos a acidentes com veículo automotor (RR=1,91, IC: 1,00-1,579; p=0,022) apresentaram maior risco de sofrer essas lesões concomitantemente. Além disso, esses pacientes apresentaram 2,48 (IC: 1,372-4,477; p<0,01) mais risco de morte que vítimas de TRM isolado. **Conclusões**: O TRM associado ao TCE foi mais frequente em homens, adultos jovens, além de indivíduos expostos a acidentes com veículo automotor. A coluna cervical tem mais risco de ser afetada. Além disso, o tempo de internação é significativamente maior e os indivíduos analisados apresentaram mais risco de óbito.

Descritores: Traumatismos da coluna vertebral; Traumatismos craniocerebrais; Epidemiologia.

RESUMEN

Objetivo: Caracterizar las víctimas de traumatismos vertebrales (TV) asociados con traumatismos encefálicos (TE) y los factores de riesgo. **Métodos**: Estudio realizado con 52 víctimas de TV asociados con TE. Se estudiaron las siguientes variables: sexo; edad; estado civil; profesión; educación; religión; etiología y el área de la lesión; condición neurológica por la escala ASIA; lesiones asociadas y factores de riesgo potenciales. **Resultados**: El varón (85%), con edades comprendidas entre 21-30 años (25%), estado civil de relación estable (56%), bajo nivel de educación (69%) y la religión católica (77%) presentaron un mayor número de víctimas. Los accidentes de tráfico (58%) fueron la principal etiología. El segmento cervical presentó mayor riesgo de lesión (RR=3.48, IC: 1.856-6.526; p<0.0001). El estado neurológico ASIA-E (52%), cuadro sindrómico de dolor del cuello (35%) y la tasa de TE leve (65%) fueron las más frecuentes. Las complicaciones ocurrieron en 13 pacientes, con una mayor frecuencia de la neumonía (62%). La estancia hospitalaria fue significativamente mayor (20 ± 28 días) y el 17% de los pacientes murió. Los hombres (RR=2.513, IC: 1.777-3.554; p=0.028) y los individuos expuestos a accidentes de tráfico (RR=1.91, IC: 1.00-1.579; p=0.022) mostraron un mayor riesgo de estas lesiones en forma concomitante. Además, estos pacientes tenían 2,48 (IC: 1.372-4.477; p<0.01) mayor riesgo de muerte que las víctimas del TV aislado. **Conclusión**: El TV asociado con el TE fue más frecuente en los hombres, los adultos jóvenes y las personas expuestas a los accidentes de vehículos automotores. La columna cervical es más propensa a ser afectada. Además, la estancia en el hospital es significativamente más larga y los individuos analizados presentaron un mayor riesgo de muerte.

Descriptores: Traumatismos vertebrales; Traumatismos craneocerebrales; Epidemiología.

INTRODUCTION

Spinal cord injury (SCI) is an injury to the soft and bone tissues of the vertebral column and spinal cord that results in permanent or temporary sequelae in the sensory, autonomic and motor functions.[1] Traumatic brain injury (TBI) results in psychological, social and physical deficits, such as sensorimotor, emotional, language and cognitive impairment, and consequently, deterioration of functional capacity and quality of life.[2] SCI and TBI are among the primary causes of global morbimortality,[3,4] but if these injuries occur in association, the victim is expected to have a worse prognosis. At the present time, failures have been observed in the diagnosis of these associated injuries during admission to post-traumatic rehabilitation.[5]

There are few studies[6-8] involving victims of TBI associated with SCI, and those that exist have varied methodologies. Moreover, the precise risk factors have not been described in detail.[7] Health professionals expect the literature to offer evidence-based practice; however, when dealing with these associated diagnoses, there is no solid scientific basis, which hinders the practice of these professionals.[9] Therefore, new surveys are necessary to achieve better characterization, diagnosis, advances in evaluation techniques and adequate treatment.

Accordingly, this study aims to characterize patients who are victims of spinal cord injury associated with traumatic brain injury, as well as the possible risk factors.

METHOD

A descriptive and prospective study realized in tertiary reference center, Hospital de Base de São José do Rio Preto, SP, Brazil.

Three hundred and twenty-one patients were preselected with a diagnosis of SCI in the period from January 2008 to June 2012. The criterion for inclusion was TBI as an injury associated with SCI. Both diagnoses were confirmed by means of initial clinical and radiological evaluation.

During the clinical evaluation, the following observations were made: altered levels of consciousness; reports of accentuated pain or symptoms of spinal cord injury with accentuation of these conditions in orthostatism; autonomic dysfunctions, such as priapism, alterations in fecal and urinary continence; and multiple lesions.

The patients were submitted to radiological confirmation using computed tomography and/or magnetic resonance. The characterization of the patients was based on the following variables: gender; age;

marital status; level of education; religion; occupation; etiology, morphology and SCI region; neurological status of the patients using the ASIA scale;[1] set of symptoms; level of TBI; associated injuries; complications; treatment; length of hospitalization and deaths.

The TBI level was rated using the Glasgow coma scale (GCS), according to the score obtained in the clinical evaluation, as mild (GCS: 13-15), moderate (GCS: 9-12), or severe (GCS: 3-8).

The regions of the injury in the patients with SCI were: upper cervical (C0-C2), lower cervical (C3-C7), thoracic (T1-T10), thoracolumbar transition (T11-L2), and lumbosacral (L3-S1).[9]

Descriptive and inferential statistics were used for the data analysis. The descriptive results were expressed in mean, standard deviation (±), absolute and relative frequencies. The following tests were used: Mann-Whitney to compare average length of hospitalization; and the relative risk (RR) between the variables with Fisher's exact test. A significance level of $p \leq 0.05$ was considered. The statistical analysis was performed in the Instat program (version 3.0; Graph-Pad, Inc., San Diego, CA, USA).

This study was approved by the Research Ethics Committee of the Faculdade de Medicina de Rio Preto, SP, Brazil. FAMERP, protocol No. 4823/2009.

RESULTS

Of the 321 individuals with SCI, 52 patients (85% male) who presented with associated TBI were studied. The average age was 38.6 (± 19.2) years. In the evaluation of age distribution, it was noted that the most predominant age group was 21-30 years in 25% of the patients. (Table 1)

Table 1. Frequency distribution of age group, marital status, level of education and religion of the 52 patients with spinal cord injury associated with traumatic brain injury.

	Frequency	(%)
Age group		
0 – 20 years	08	15,5
21 – 30 years	13	25
31 – 40 years	08	15,5
41 – 50 years	08	15,5
51 – 60 years	08	15,5
> 61 years	07	13
Marital status		
Divorced	01	02
Single	29	56
Married or Common-law marriage	21	40
Widow/widower	01	02
Level of education		
Incomplete primary education	36	69
Complete primary education	06	11
Incomplete high school education	05	10
Complete high school education	01	02
Higher education	04	08
Religion		
Protestant	06	11
Roman Catholic	40	77
Other or not stated	06	12

The most frequent marital status was common-law marriage in 56% of the sample, the most predominant level of education was incomplete primary education (69%), and Roman Catholicism (77%) was the religion of the highest number of victims. (Table 1) Occupations were general helper/housekeeper (12%), student (12%), bricklayer (10%), driver (8%), cattle rancher (6%), painter (6%), and other occupations (46%).

Car accident (58%) was the most frequent etiology of SCI associated with TBI. The main morphologies of SCI were dislocation fracture (23%) and fracture of posterior elements (23%), while eight patients presented two associated injuries, totaling 60 morphologies. The lower cervical spine (C3-C7) was the segment most often affected in 58% of the patients, and four patients suffered injury in two segments, totaling 56 regions affected. (Table 2)

Table 2. Frequency distribution of etiology, morphology and segment affected of the 52 patients with spinal cord injury associated with traumatic brain injury.

	Frequency	(%)
Etiology		
Car accident	30	58
Dive into shallow water	05	10
Fall	06	11
Firearm wound	01	02
Motorcycle accident	07	13
Sport	03	06
Morphology		
Burst fracture	04	08
Compression fracture	09	17
Dislocation fracture	12	23
Listhesis	10	19
Odontoid fracture	04	08
Posterior element fracture	12	23
Spinal cord contusion	04	08
Others	05	10
Segment		
Lower cervical (C3-C7)	30	54
Upper cervical (C1-C2)	11	20
Thoracic (T1-T10)	10	18
Thoracolumbar transition (T11-L2)	05	09

The neurological status assessed by the ASIA[1] scale was “A” in 15%, “B/C/D” in 21%, and “E” in 52%, while six patients were in a prolonged coma (GCS < 8), preventing the evaluation of this parameter.

The set of syndromes consisted of cervicalgia (35%), tetraparesis (15%), back pain (13%), tetraplegia (10%), paraplegia (6%), cervicalgia with paresthesia (6%), paraparesis (4%), and 11% were in coma. As regards the TBI level, about 65% of the patients presented with mild trauma, while 27% had severe and 8% moderate trauma.

Only 27 patients suffered a total of 39 injuries associated with the trauma, the most frequent was facial trauma in 33% of these patients, while 41% of the patients presented with two, and 4% with three associated injuries (Table 3). Complications affected 13 patients, of which about 62% evolved to pneumonia, and eleven patients presented with two or more, totaling 24 complications. (Table 3)

The patients were submitted to conservative (50%) and surgical treatment (50%); the mean hospitalization time was 20 ± 28 days, and 17% of the patients died.

We noted that men (RR=2.513, IC: 1.777-3.554; p=0.028) have a higher risk of suffering these associated injuries than women. The cervical segment (RR=3.48, IC: 1.856-6.526; p<0.0001) had a greater

risk of being the affected region. Moreover, car accident victims are 1.43 times more likely to suffer SCI associated with TBI (IC: 1.05-1.935; p=0.043), and this rate is accentuated when it comes to any accident involving a motor vehicle (RR=1.91, IC: 1.00-1.579; p=0.022). The individuals who suffered SCI associated with TBI had significantly longer (p=0.011) hospitalization times than those who suffered SCI alone (9±12 days). In addition, these patients presented a 2.48 (IC: 1.372-4.477; p<0.01) times high risk of death than victims of SCI alone.

Table 3. Frequency distribution of associated injuries and complications of the 52 patients with spinal cord injury associated with traumatic brain injury.

	Frequency	(%)
Associated injury		
Facial trauma	09	24
Fractures of lower limbs	05	13
Hip fracture	03	08
Injuries to upper limbs	07	18
Rib fractures	03	08
Thoracic trauma	06	15
Other	06	14
Complications		
Pneumonia	08	33
Respiratory failure	02	08
Sepsis	02	08
Urinary tract infection	04	17
Other	08	33

DISCUSSION

When SCI occurs concomitantly with TBI, it may result in increased morbidity, impair quality of life, and hinder the rehabilitation process.[6] In this context, the purpose of this study was to characterize these individuals and analyze the potential risk factors.

In this survey, we observed that men had a greater risk than women of suffering these associated injuries, especially young adults (21-30 years of age). According to Morais et al.[3], the SCI in this population may be prevalent at a global level. Vasconcelos and Ribeiro[10] add that SCI victims have a greater prevalence due to their challenging behavior, with more involvement in high-risk activities. Moreover, common-law marriage was the most common marital status, and studies[3,11] relate it to age and higher exposure to accidents. The level of education and religion found can be attributed to socioeconomic and political differences.[11]

Our study enabled us to ascertain that traffic accidents increase the risk of suffering TBI in victims of SCI, as observed in other studies.[10,12] The researches[3,13] relate this cause of SCI to the more developed and

urbanized geographical regions. Furthermore, other factors that can influence these results are reckless driving and poor road signs. Investments in raising awareness of the importance of traffic laws and the use of safety equipment are vitally important.[12]

Mild TBI and ASIA-E were the most frequent neurological statuses on admission. The ASIA scale associated with diagnostic imaging tests collaborate for better monitoring, treatment, and follow-up, besides playing a crucial role during admission, as they contribute towards a better prognosis of victims of isolated SCI.[14-16]

In the individuals with SCI associated with TBI, we noted that the cervical segment was the region with the greatest risk of injury; that pneumonia was the main complication; and that these patients had an increased risk of death. TBI is the most common severe associated injury in victims of SCI with injuries in the cervical segment.[17] Other surveys[8,17] found the same association. This segment is crucial for the innervation of the respiratory muscles from the peripheral nerves.[9] Thus, following injury to the cervical spine, the victim becomes more susceptible to respiratory complications such as pneumonia, increasing the risk of mortality.[9,18] These results were also found in this study.

The individuals studied had significantly greater hospitalization times. This fact can be explained by the cognitive, neurobehavioral and motor alterations resulting from TBI, which hinder rehabilitation. The motor alterations that can be found include coordination and postural control deficits. Therefore, the value of investments in the rehabilitation process should be stressed for these patients.[19]

CONCLUSION

Spinal cord injury associated with traumatic brain injury was more common in young adults in a common-law marriage and with a low educational level. Pneumonia was the main clinical complication. Men and individuals exposed to accidents involving a motor vehicle were at a greater risk of suffering these injuries concomitantly. The cervical spine is more likely to be affected. Furthermore, the hospitalization time is significantly longer, and these individuals have a higher risk of death.

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ARTIGO 3

Título: *Characteristics and clinical aspects of patients with spinal cord injury undergoing surgery.*

Autores: João Simão de Melo Neto, Lara Eduarda Leite Vidotto, Fabiana de Campos Gomes, Dionei Freitas de Morais, Waldir Antonio Tognola.

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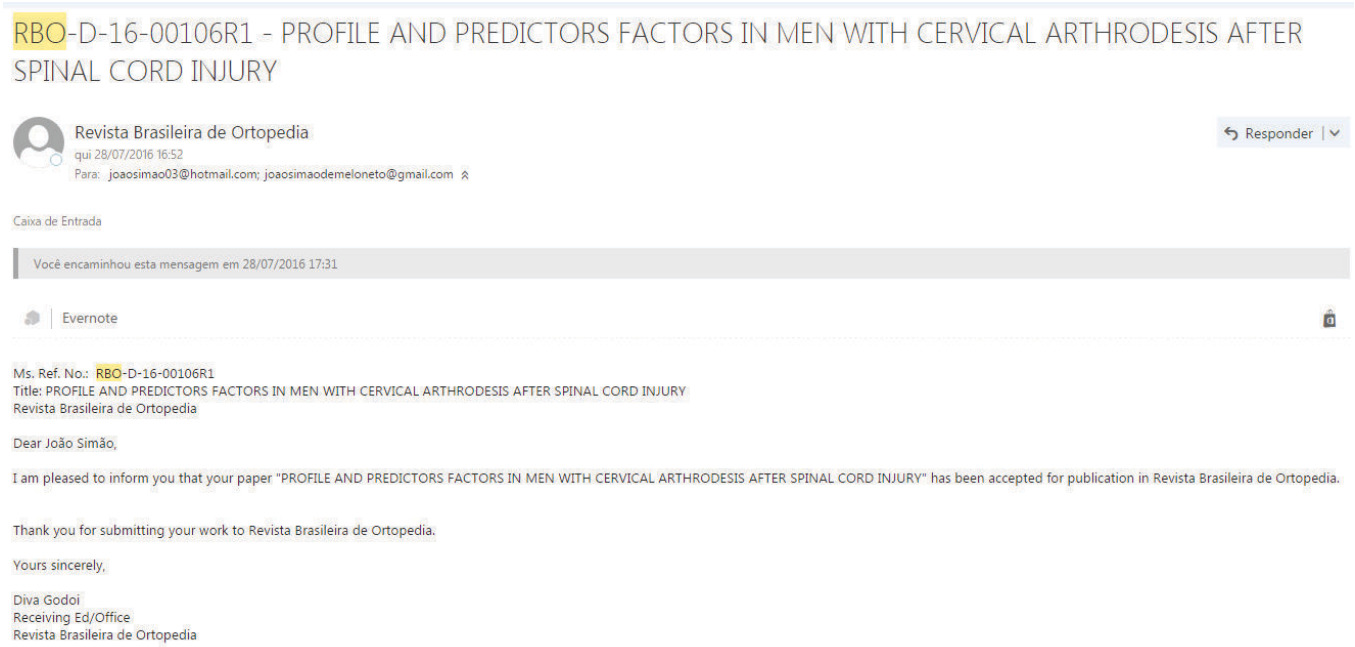

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CHARACTERISTICS AND CLINICAL ASPECTS OF PATIENTS WITH SPINAL CORD INJURY UNDERGOING SURGERY

CARACTERIZAÇÃO E ASPECTOS CLÍNICOS DE PACIENTES COM TRAUMATISMO RAQUIMEDULAR SUBMETIDOS À CIRURGIA

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ABSTRACT

Objective: To identify the characteristics of patients with spinal cord injury (SCI) undergoing surgery.

Methods: Previously, 321 patients with SCI were selected. Clinical and socio-demographic variables were collected.

Results: two hundred and eleven patients were submitted to surgery. Fall and injuries in the upper cervical and lumbosacral regions were associated with conservative treatment. Patients with lesions in the lower cervical spine, worse neurological status and unstable injuries were associated with surgery. Individuals undergoing surgery were associated with complications after treatment. We assessed if age influences the characteristics of patients submitted to surgery. Subjects with <60 years of age were associated with motorcycle accidents and the morphologies of injury were dislocation fracture. Elderly individuals were associated to fall, SCI in the lower cervical spine and the morphology of injury was listhesis. Subsequently, we analyzed the characteristics of genders in these patients. Women who suffered car accidents were associated to surgery. Women were associated with paraparesis and the morphologic diagnosis was explosion fracture, especially in the thoracolumbar transition and lumbosacral regions. Men that presented traumatic brain injury and thoracic trauma were related to surgery. These individuals have a worse neurological status and were associated to complications. Men and cervical region were most affected, thereby, these subjects were analyzed separately (n=92). The presence of complications increases the length of hospital stay. The simultaneous presence of morphological diagnosis, worst neurological status, tetraplegia, sensory and motor alterations were associated with complications. Pneumonia and chest trauma were associated with mortality.

Conclusion: These factors enable investments in prevention, rehabilitation and treatment.

Keywords: Epidemiology; Spinal cord injuries; Spinal fusion; Spinal fractures; Mortality; Traumatology.

RESUMO

Objetivo: Identificar as características de pacientes com traumatismo raquimedular (TRM) submetidos à cirurgia.

Métodos: Previamente, 321 pacientes com TRM foram selecionados. As variáveis clínicas e sócio-demográficas foram coletadas e analisadas.

Resultados: Duzentos e onze pacientes foram submetidos à cirurgia. A queda e lesões nas regiões cervical superior e lombosacral foram associadas com tratamento conservador. Pacientes com lesões nas regiões cervical inferior, pior status neurológico e lesões instáveis foram associados com cirurgia. Indivíduos que operaram foram associados com complicações após tratamento. Posteriormente, nós avaliamos se idade influenciava as características dos pacientes submetidos à cirurgia. Sujeitos com <60 anos foram associados com acidente motociclístico e o diagnóstico de lesão: lístese. Subsequentemente, nós analisamos as características dos sexos nestes pacientes. Mulheres que sofreram acidente automobilístico foram associadas a cirurgia. Mulheres foram associadas com paraparesia e diagnóstico morfológico: fratura explosão, principalmente nas regiões de transição tóraco-lombar e lombo-sacral. Homens que apresentaram traumatismo cranioencefálico e torácico foram relacionados a cirurgia. Estes indivíduos tiveram um pior status neurológico e foram associados à complicação. Homens e região cervical foram mais afetas, então, estes pacientes foram analisados isoladamente (n=92). A presença de complicações aumenta a permanência hospitalar. A presença de diagnósticos morfológicos simultaneamente, pior status neurológico, tetraplegia, alteração sensório-motora foram associados com complicações. Pneumonia e traumatismo torácico foram associados com mortalidade.

Conclusão: Estes fatores possibilitam investimentos em prevenção, reabilitação e tratamento.

Palavras-chave: Epidemiologia; Traumatismos da medula espinal; Fraturas da coluna vertebral; Fusão espinhal; Mortalidade; Traumatologia.

Introduction

The spinal cord injury (SCI) refers to vertebral column lesions that may result in transient or irreversible consequences, depending on the affected tissues during trauma.[1-3] The clinical complications after SCI are being evaluated[3-5] to improve interventions and achieve better prognosis for these patients, reducing socioeconomic costs and mortality. However, there are few studies addressing the characteristics and clinical aspects of patients undergoing surgery. Only one descriptive study[6] was found in Brazil, demonstrating the need to better understand this population and determine where investments should be made for prevention and treatment. Moreover, cultural factors and regional differences must not be neglected.[7]

There are numerous technical instrumentation and fixation methods used in patients with traumatic cord spinal injury. However, the technique used depends of the patient, characteristics of the lesion and on the surgeon's experience. In general, posterior instability should be treated by posterior fusion and anterior instability by anterior fusion. However, when there is complete discoligamentous injury, circular or combined fixation is recommended to give adequate stabilization.[8]

Surgical intervention promotes dissection and retraction of the several structures to exposure of spine to correct the injury installed,[9] possibly resulting in other tissue lesions, and, as a consequence, increasing the clinical complications and mortality.

Therefore, the objective of this study is to identify the characteristics and clinical aspects of patients with spinal cord injury submitted to surgery.

Methodology

Prospective study conducted at Hospital de Base of São José do Rio Preto - SP, Brazil, a tertiary referral center. Study approved by the Research Ethics Committee, São José do Rio Preto Medical School (FAMERP), protocol 806.452.

Three hundred and twenty-one patients with SCI were selected from 2008 to 2012. An initial evaluation was made to confirm the diagnosis of SCI. Patients were submitted to radiological analysis using computed tomography and/or magnetic resonance imaging.[2]

The following variables were analyzed: gender; age; etiology, morphology and topography of the SCI; neurological status; syndromic status; associated injuries; complications; length of hospitalization and deaths.

Patients with injury in the upper cervical region (C1-C2), lower cervical (C3-C7), thoracic (T1-T10), thoracolumbar transition (T11-L2) and lumbosacral (L3-S1) were included in the study.[3] Morphological classification of lesions was performed as suggested by Denis[10]. The neurological status of patients was obtained by the ASIA scale (American Spinal Injury Association).[11] Clinical complications presented within 30 days of hospitalization were collected.[3]

Initially, the variables frequently presented by patients undergoing surgery were reported. We then evaluated the factors most associated with surgery when compared to conservative treatment, age, gender and morbidity/mortality in men submitted to surgical treatment in the cervical spine.

Data analysis was performed using descriptive and inferential statistics. Descriptive results were expressed as mean ± standard deviation (parametric distribution), median with minimum, maximum (non-parametric distribution), and absolute and relative frequencies. The analysis of the normality of the data was performed using the Kolmogorov-Smirnov test. Data with parametric distribution were analyzed by unpaired t test, and the nonparametric for Mann-Whitney test. The association between variables was assessed for Odds Ratio (OR) with a confidence interval (CI), being confirmed by the Fisher exact test. A $p \leq 0.05$ value was considered statistically significant. Statistical analysis was performed using Instat software (version 3.0, GraphPad, Inc., San Diego, CA, USA).

Results

Individuals with SCI who were submitted to surgery (n=211) were from the private healthcare service (18%) and from the public healthcare system (82%). Patients from 65 different cities were examined. With regard to ethnicity: 85% were Caucasian, 8% mulatto, 4% Black, 3% unidentified. The level of education was classified as illiterate (4%), primary education (59%), secondary education (26%) and higher education (11%). The most frequent marital status was single (47%), followed by married (38%), widowed (8%) and divorced (4%), and seven individuals not reported. The occupation of patients was distributed to employees (83%), home worker (7%), unemployed (5%), students (4%) and retired (1%). Religion was distributed as Roman Catholic (76%), Evangelical Protestant (10%), Orthodox Catholic (5%), agnostic (5%) and others (4%).

In addition, we observed that these patients are mainly: male (77%); admitted after suffering a car accident (41%); associated lesion: traumatic brain injury (12%); the lower cervical spine is the most affected region (49%); cervicalgia with paresthesia (22%); morphological diagnosis of dislocation fracture (34%); and neurological status ASIA-E (39%). Surgical interventions were distributed as anterior (51%) and

posterior (46%) arthrodesis, decompressive laminectomy (4%) and corpectomy (9%). Of these patients, 10% required more than one surgical procedure simultaneously.

The factors most associated with surgery when compared to conservative treatment such as age, gender and morbidity/mortality in men undergoing surgical treatment in the cervical area are shown in figure 1.

Surgical or conservative treatment

Patients were initially analyzed to verify what were the criteria most associated to treatment options, surgical (n=211) or conservative (n=110). The characterization and predictive factors are shown in Table 1. Mean age of patients undergoing surgery [44.5 (11-93) years] was significantly higher (p=0.0004, Mann-Whitney test) than those without surgery [36 (5-89) years]. Of all SCI etiologies, falling was associated with conservative treatment.

Thirty five individuals had lesions in two regions concomitantly. Individuals who had SCI in the upper cervical and lumbosacral regions were referred mainly to conservative treatment, whereas patients with lesions in the lower cervical region were more associated with surgery. In this context, the syndromic status more associated with conservative treatment was neck and dorsal pain with paresthesia, whereas paraparesis, paraplegia and quadriplegia were more related to surgery. Patients with better neurological status were more associated with conservative treatment, whereas those with worse neurological status were more related with surgery. Patients with sensorimotor alterations were seven times more in operated patients.

Regarding the associated injuries, there were 180 events, and 31 patients had two lesions, and 15 had three lesions simultaneously. Patients admitted with associated lesions in the lower limbs and traumatic brain injury were significantly more referred to conservative treatment.

Morphological diagnosis of lesions obtained by imaging tests showed that patients with linear fracture of the vertebral body and compression fracture were referred to conservative treatment. However, patients with burst fracture, dislocation fracture and listhesis were referred to surgery. Thirty-two individuals had two morphologic diagnoses, whereas three of them had three simultaneous lesions.

Operated individuals were significantly more associated with complications after SCI. There were 86 complication events in 54 patients undergoing surgery, of which 13 had two complications, and seven had three complications. The complications most incidents in individuals submitted to surgery were pneumonia (11%) and urinary tract infection (8%), however, there was no difference among the non-surgical patients.

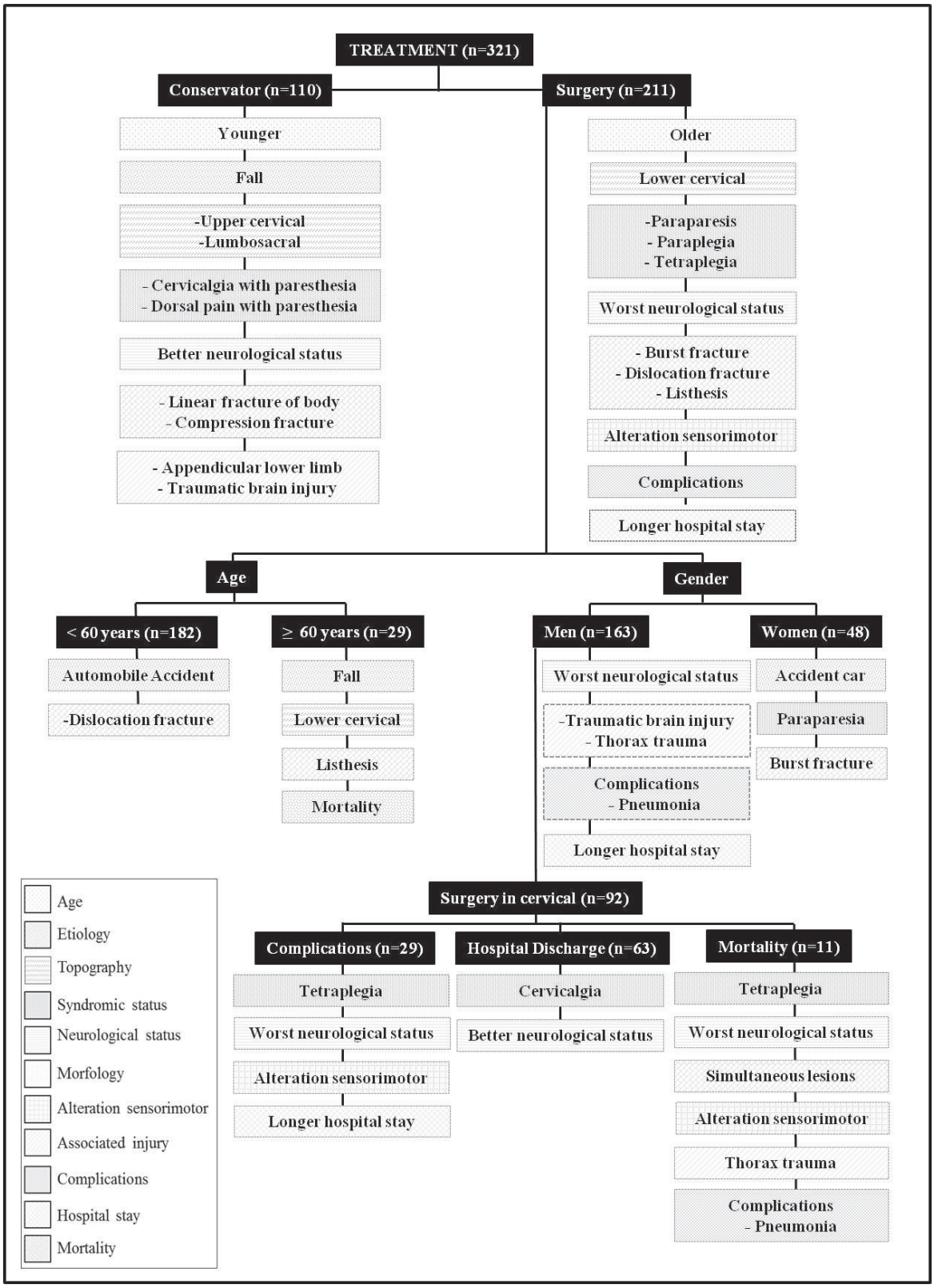

Figure 1 - The factors most associated with surgery when compared to conservative treatment, age, gender and morbidity/mortality in men submitted to surgical treatment in the cervical.

Table 1 - Distribution of individuals (conservator and surgery) according to the etiology, topography, morphology of the lesion, neurological status at admission (ASIA), syndromic status, associated injuries with SCI, complications, mortality and other variables.

	Conservator n=110 (%)	Surgery n=211 (%)	Total n=321(%)	OR	CI	p (Fisher test)
Etiology of injury						
Automobile Accident	39 (35)	86 (41)	125 (29)	1.253	0.777-2.019	0.2109
Diving in shallow water	04 (04)	09 (04)	13 (04)	1.181	0.355-3.925	0.5225
Fall the ground	37 (34)	51 (24)	88 (27)	1.590	0.959-2.637	0.0481*
Gunshot	03 (03)	06 (03)	09 (03)	1.044	0.256-4.258	0.6282
Motorcycle Accident	13 (12)	36 (17)	49 (15)	1.535	0.777-3.033	0.1404
Sports	08 (07)	13 (06)	21 (07)	0.837	0.336-2.085	0.4342
Trampling	03 (03)	05 (02)	08 (02)	0.866	0.203-3.693	0.5561
Other´s	03 (03)	05 (02)	08 (02)			
Morphology						
Burst fracture	08 (07)	68 (32)	76 (24)	6.063	2.792-13.168*	< 0.0001*
Compression fracture	51 (46)	05 (02)	56 (17)	35.614	13.592-93.314*	< 0.0001*
Dislocation fracture	01 (01)	71 (34)	72 (22)	55.279	7.556-404.40*	< 0.0001*
Fracture in the posterior elements	07 (06)	21 (10)	28 (09)	1.626	0.669-3.955	0.1927
Gunshot	03 (03)	06 (03)	09 (03)	1.044	0.256-4.258	0.6282
Linear fracture in the vertebral body	10 (09)	02 (01)	12 (04)	10.450	2.247-48.606*	0.0006*
Listhesis	08 (07)	43 (20)	51 (16)	3.263	1.475-7.219*	0.0013*
Odontoid fracture	07 (06)	07 (03)	14 (04)	1.981	0.676-5.799	0.1630
Posterior ligamentar complex injury	02 (02)	06 (03)	08 (02)	1.580	0.314-7.967	0.4439
Spinal cord contusion	08 (07)	08 (04)	16 (05)	1.990	0.726-5.457	0.1385
Other´s	05 (05)	07 (03)	12 (04)			
Number of events	111	244	355			
Topography						
Lower cervical (C3-C7)	30 (27)	104 (49)	134 (42)	2.592	1.574-4.269*	< 0.0001*
Lumbosacral (L3-S1)	14 (13)	12 (06)	36 (11)	2.418	1.077-5.430*	0.0261*
Thoracic (T1-T10)	20 (18)	40 (19)	60 (19)	1.053	0.581-1.908	0.4967
Thoracolumbar transition (T11-L2)	36 (33)	62 (29)	98 (31)	1.169	0.712-1.921	0.3109
Upper cervical (C1-C2)	25 (23)	13 (06)	38 (12)	4.480	2.187-9.175*	< 0.0001*

Number of events	125	231	351			
Neurological status						
ASIA-A	05 (05)	63 (30)	68 (21)	8.939	3.476-22.989*	< 0.0001*
ASIA-B	02 (02)	10 (05)	12 (04)	2.687	0.578-12.488	0.1589
ASIA-C	05 (05)	35 (17)	40 (12)	4.176	1.586-10.994*	0.0010*
ASIA-D	05 (05)	18 (09)	23 (07)	1.959	0.707-5.427	0.1377
ASIA-E	89 (81)	83 (39)	172 (54)	6.536	3.771-11.329*	< 0.0001*
Coma	04 (04)	02 (01)	06 (02)	3.943	0.711-21.886	0.1075
Syndromic status						
Cervicalgia with paresthesia	35 (32)	47 (22)	82 (26)	1.628	0.972-2.728	0.0432*
Coma	04 (04)	02 (01)	06 (02)	3.943	0.711-21.886	0.1075
Dorsal pain with paresthesia	49 (45)	32 (15)	81 (25)	4.493	2.640-7.649*	< 0.0001*
Low back pain	07 (06)	10 (05)	17 (05)	1.366	0.505-3.694	0.3539
Paraparesis	02 (02)	31 (15)	33 (10)	41.006	9.585-175.43*	< 0.0001*
Paraplegia	01 (01)	27 (13)	28 (09)	15.170	2.032-113.24*	0.0001*
Tetraparesis	06 (05)	23 (11)	29 (09)	2.013	0.795-5.101	0.0948
Tetraplegia	06 (05)	37 (18)	43 (13)	3.686	1.504-9.033*	0.0014*
Other´as	02 (02)	-	02 (01)			
Associated injury						
Abdome Trauma	05 (05)	05 (02)	10 (03)	0.510	0.144-1.801	0.2296
Apendicular lower limb	13 (12)	08 (04)	21 (07)	3.401	1.364-8.479*	0.0070*
Apendicular upper limb	10 (09)	14 (07)	24 (07)	1.407	0.604-3.281	0.2800
Facial trauma	05 (05)	14 (07)	19 (06)	0.670	0.235-1.912	0.3142
Injuries scalp	01 (01)	05 (02)	06 (02)	0.378	0.044-3.278	0.3308
Traumatic brain injury	26 (24)	26 (12)	52 (16)	2.202	1.207-4.020*	0.0079*
Thoracic trauma	10 (09)	24 (11)	34 (11)	1.283	0.590-2.791	0.3350
Other´as	05 (05)	05 (02)	10 (03)			
Individuals who had associated injury	46 (42)	73 (35)	119 (37)			
Complications	18 (16)	54 (26)	72 (22)	1.758	0.972-3.179	0.0391*
Alteration sensorimotor	19 (17)	124 (59)	143 (45)	6.826	3.878-12.016*	< 0.0001*
Mortality	10 (09)	15 (07)	25 (08)	0.765	0.332-1.765	0.3355

OR – Odds Ratio; CI - confidence interval. [a]Less than three individuals in each category. *Statistically significant.

After admission, hospital stay was significantly longer in individuals undergoing surgery [7 (1-127) days] when compared to those with conservative treatment [3 (1-112) days]. Other variables were not significantly different.

Surgical treatment according to age

We then evaluated if the variable age, <60 years (5-59 years, n=182) or ≥60 years (60-89 years, n=29), played a role in the characteristics of patients undergoing surgery, according to table 2. Subjects <60 years of age were more associated with motorcycle accidents (p=0.023, Fisher test), whereas elderly individuals were twice as much associated with fall (OR: 1.622, CI: 1.622-8.248, p=0.002, Fisher test).

Elderly patients were three times more associated with SCI in the lower cervical region than younger individuals (OR: 2.593, IC: 1.120-6.000; p=0.018, Fisher test). In relation to topography and the morphologic diagnosis, 19 patients had two simultaneous lesions. The morphologies of injury, dislocation fracture (OR: 3.641, CI: 1.215-10.916; p=0.010, Fisher test) and listhesis (OR: 2.865, CI: 1.234-6.647, p=0.015, Fisher test) were significantly more associated with age <60 years and ≥60 years, respectively.

Twenty-four patients had two, and four had three concomitant lesions. Twenty-seven patients had two, and seven had three complications at the same time. However, associated injuries and complications did not differ between the different age groups (p>0.05).

Hospital stay was similar between the different age groups (p=0.071, Mann-Whitney test). However, the number of deaths was five times more associated with elderly patients (OR: 5.014, CI: 1.634-15.386; p=0.008, Fisher test). Other variables were not significantly different.

Table 2 - Distribution of individuals (<60 and ≥60 years) with surgical treatment, according to the etiology, topography, morphology of the lesion, neurological status at admission (ASIA), syndromic status, associated injuries with SCI, complications and mortality.

	<60 years n=182 (%)	≥60 years n=29 (%)	Total (n=211)
Etiology of injury			
Automobile Accident	76 (42)	10 (34)	86 (41)
Diving in shallow water	09 (05)	-	09 (04)
Fall the ground	37 (20)	14 (48)	51 (24)
Gunshot	06 (03)	-	06 (03)
Motorcycle Accident	35 (19)	01 (03)	36 (17)
Sports	12 (07)	01 (03)	13 (06)
Other´s[a]	07 (04)	03 (10)	10 (05)
Morphology			
Burst fracture	58 (32)	10 (34)	68 (32)
Compression fracture	05 (03)	01 (03)	06 (03)
Dislocation fracture	67 (37)	04 (14)	71 (34)
Gunshot	06 (03)	-	06 (03)
Listhesis	32 (18)	11 (38)	43 (20)
Odontoid fracture	07 (04)	-	07 (03)
Posterior ligamentar complex injury	05 (03)	01 (03)	06 (03)
Spinal cord contusion	06 (03)	02 (07)	08 (04)
Other´s	14 (08)	01 (03)	15 (07)
Number of events	200	30	230
Topography			
Lower cervical (C3-C7)	84 (46)	20 (69)	104
Lumbosacral (L3-S1)	12 (07)	-	12
Thoracic (T1-T10)	35 (19)	04 (14)	39
Thoracolumbar transition (T11-L2)	56 (31)	06 (21)	62
Upper cervical (C1-C2)	13 (07)	-	13
Number of events	200	30	230
Neurological status			
ASIA-A	56 (31)	07 (24)	63 (30)
ASIA-B	08 (04)	02 (07)	10 (05)
ASIA-C	27 (15)	08 (28)	35 (17)
ASIA-D	17 (09)	01 (03)	18 (09)
ASIA-E	72 (40)	11 (38)	83 (39)
Coma	02 (01)	-	02 (01)
Syndromic status			
Cervicalgia with paresthesia	38 (21)	09 (31)	47 (22)
Dorsal pain with paresthesia	30 (16)	02 (07)	32 (15)
Low back pain	09 (05)	01 (03)	10 (05)
Paraparesis	26 (14)	05 (17)	31 (15)
Paraplegia	25 (14)	02 (07)	27 (13)

Tetraparesis	19 (10)	04 (14)	23 (11)
Tetraplegia	32 (18)	05 (17)	37 (18)
Other´s[a]	03 (02)	01 (03)	04 (02)
Associated injury			
Abdome Trauma	05 (03)	-	05 (02)
Apendicular lower limb	07 (04)	01 (03)	08 (04)
Apendicular upper limb	15 (08)	02 (07)	17 (08)
Facial trauma	14 (08)	-	14 (07)
Injuries scalp	05 (03)	-	05 (02)
Thoracic trauma	19 (10)	03 (10)	22 (10)
Traumatic brain injury	23 (13)	02 (07)	25 (12)
Other´s[a]	04 (02)	01 (03)	05 (02)
Individuals who had associated injury	68	05	73
Complications			
Athelectasis	05 (03)	-	05 (02)
Hypovolemic shock	03 (02)	-	03 (01)
Late hemodynamic instability	02 (01)	02 (07)	04 (02)
Urinary tract infection	12 (07)	04 (14)	16 (08)
Pneumonia	19 (10)	04 (14)	23 (11)
Surgical wound infections	02 (01)	01 (03)	03 (01)
Sepsis	02 (01)	01 (03)	03 (01)
Other´s[a]	29 (16)	02 (07)	31 (15)
Individuals who had complications	44 (24)	10 (34)	54 (26)
Mortality	09 (05)	06 (21)	15 (07)

OR – Odds Ratio; CI - confidence interval. [a]Less than three individuals in each category. *Statistically significant.

Surgical treatment according to gender

Subsequently, we analyzed the characteristics of both genders (♂n = 163; ♀n = 48) in patients undergoing surgery. The characterization and predictive factors are shown in Table 3. Mean age in operated women [37 (6-84) years] was not significantly different (p=0.160, Mann-Whitney test) than in men [36 (5-89) years]. We observed that women who suffered car accidents were three times more subjected to surgical intervention.

Nineteen individuals had two morphological simultaneous diagnoses. Nineteen patients had two, and five had three lesions associated with SCI. Men with traumatic brain injury and thoracic trauma were more related to surgery than women.

Table 3 - Distribution of individuals (men and women) with surgical treatment, according to the etiology, morphology of the lesion, neurological status at admission (ASIA), syndromic status, associated injuries with SCI, complications and mortality.

	Women n=48 (%)	Men n=163 (%)	Total n=211 (%)	OR	CI	p (Fisher test)
Etiology						
Automobile Accident	28 (58)	58 (36)	86 (41)	2.534	1.313-4.891*	0.0042*
Diving in shallow water	-	09 (06)	09 (04)	5.964	0.341-104.44	0.0930
Fall the ground	11 (23)	40 (25)	51 (24)	1.094	0.511-2.344	0.4917
Gunshot	01 (02)	05 (03)	06 (03)	1.487	0.170-13.054	0.5873
Motorcycle Accident	06 (13)	30 (18)	36 (17)	1.579	0.615-4.054	0.2344
Sports	02 (04)	11 (07)	13 (06)	1.664	0.356-7.785	0.3985
Other´as	-	10 (06)	10 (05)			
Morphology						
Burst fracture	21 (44)	47 (29)	68 (32)	1.936	0.997-3.759	0.0380*
Compression fracture	01(02)	05 (03)	06 (03)	0.672	0.077-5.901	0.5873
Dislocation fracture	16 (33)	55 (34)	71 (34)	0.982	0.496-1.943	0.5522
Fracture in the posterior elements	07 (15)	-	07 (03)	4.649	0.261-82.934	0.1593
Gunshot	01 (02)	05 (03)	06 (03)	0.672	0.077-5.901	0.5873
Listhesis	07 (15)	35 (21)	42 (20)	1.602	0.661-3.879	0.2011
Odontoid fracture	-	07 (04)	07 (03)	4.649	0.261-82.934	0.1593
Posterior ligamentar complex injury	01 (02)	05 (03)	06 (03)	1.487	0.170-13.054	0.5873
Spinal cord contusion	02 (04)	06 (04)	08 (04)	1.138	0.222-5.830	0.5782
Other´s	02 (04)	07 (04)	09 (04)			
Number of events	58	172	230			
Neurological status						
ASIA-A	09 (19)	54 (33)	63 (30)	2.147	0.970-4.754	0.0385*
ASIA-B	03 (06)	07 (04)	10 (05)	0.673	0.167-2.710	0.4064
ASIA-C	10 (21)	25 (15)	35 (17)	0.688	0.304-1.558	0.2441
ASIA-D	06 (13)	12 (07)	18 (09)	0.556	0.197-1.571	0.2002
ASIA-E	20 (42)	63 (39)	83 (39)	1.134	0.589-2.182	0.4153
Coma	-	02 (01)	02 (01)	1.502	0.071-31.834	0.5959
Syndromic status						

Cervicalgia with paresthesia	12 (25)	35 (21)	47 (22)	0.820	0.386-1.742	0.3683
Dorsal pain with paresthesia	08 (17)	24 (15)	32 (15)	0.863	0.360-2.069	0.4483
Low back pain	02 (04)	08 (05)	10 (05)	1.187	0.243-5.789	0.5936
Paraparesis	13 (27)	18 (11)	31 (15)	2.992	1.340-6.682*	0.0078*
Paraplegia	03 (06)	24 (15)	27 (13)	2.590	0.745-9.010	0.0918
Tetraparesis	04 (08)	19 (12)	23 (11)	1.451	0.469-4.494	0.3628
Tetraplegia	06 (13)	31 (19)	37 (18)	1.644	0.642-4.212	0.2064
Other´as	04 (08)	02 (01)	06 (03)			
Associated injury						
Abdome Trauma	01 (02)	04 (02)	05 (03)	1.182	0.129-10.842	0.6807
Apendicular lower limb	03 (06)	05 (03)	08 (04)	0.475	0.109-2.064	0.2640
Apendicular upper limb	01 (02)	15 (09)	16 (08)	4.764	0.613-37.046	0.0834
Facial trauma	01 (02)	13 (08)	14 (07)	4.073	0.519-31.981	0.1293
Injuries scalp	01 (02)	04 (02)	05 (03)	1.182	0.129-10.842	0.6807
Thoracic trauma	01 (02)	20 (12)	21 (10)	6.573	0.858-50.338	0.0259*
Traumatic brain injury	02 (04)	24 (15)	26 (12)	3.971	0.903-17.461	0.0356*
Other´as	02 (04)	05 (03)	07 (07)			
Individuals who had associated injury	13	60	73			
Complications						
Hypovolemic shock	-	03 (02)	03 (01)	2.115	0.107-41.698	0.4591
Urinary tract infection	02 (04)	14 (09)	16 (08)	2.161	0.473-9.865	0.2487
Pneumonia	-	23 (14)	23 (11)	16.224	0.966-272.41	0.0018*
Surgical wound infections	01 (02)	02 (01)	03 (01)	1.713	0.152-19.318	0.5409
Sepsis	-	03 (02)	03 (01)	2.115	0.107-41.698	0.4591
Other´as	03 (06)	32 (20)	35 (17)			
Individuals who had complications	05 (10)	49 (30)	54 (26)	3.696	1.380-9.898*	0.0035*
Mortality	02 (04)	13 (08)	15 (07)	1.993	0.434-9.162	0.2931

OR – Odds Ratio; CI - confidence interval. [a]Less than three individuals in each category. *Statistically significant.

Twenty individuals presented lesions in two regions concomitantly. The topography of lesion was divided into upper (6%) and lower cervical (49%) spine, thorax (19%), thoracolumbar transition (29%) and lumbosacral (6%). The affected regions did not differ between genders.

When analyzing the symptoms, it was observed that women are three times more associated with paraparesis. Still, women were more associated with the morphologic diagnosis burst fracture, especially in the thoracolumbar transition and lower back (OR: 18.4, IC: 4.266-79.371; $p<0.0001$, Fisher test).

Men have a worse neurological status and had three times more complications than women, especially the presence of pneumonia after surgery. Twenty patients had two complications, whereas seven patients had three simultaneous complications. The length of hospital stay in men [8 (1-127 days] was significantly higher than in women [5 (1-34) days]. Other variables were not significantly different.

Morbidity / mortality in men undergoing surgical treatment after SCI in the cervical spine

As observed previously, men and cervical region were most affected and are more susceptible to complications, thereby, these subjects were analyzed separately. The characterization and predictive factors are shown in Table 4 and 5.

Ninety-two men were analyzed. They were divided into a group without complications (n=63) and another group of patients who presented complications (n=29). Mean age (without complications = 41±17 years; with complications = 46±20 years) was similar ($p=0.162$, unpaired t-test). Individuals with complications had longer hospital stay ($p<0.0001$, Mann Whitney test). The main cause of SCI in both groups was motor vehicle accident, corresponding to 43% of the individuals (Table 4).

The main morphologies of trauma were: dislocation fracture (37%) and listhesis (34%). Six individuals had two morphological lesions associated to SCI (Table 4). The presence of two simultaneous morphological diagnoses of injury increased the association with postoperative complications. The most prevalent topography of injury was C6 (n=58), followed by C5 (n=45), C7 (n=27), C4 (n=24), C3 (n=12), C2 (n=10) and C1 (n=01). Four patients had four injured vertebrae, 11 had injuries in three

Table 4 - Distribution of individuals (no-complications and complications) with surgical treatment in the cervical region, according to the etiology, morphology of lesion, neurological status at admission (ASIA), syndromic status, associated injuries with SCI, complications and mortality.

	No-complications n=63 (%)	**Complications n=29 (%)**	**Total n=92 (%)**	**OR**	**CI**	**p** (Fisher test)
Etiology of injury						
Automobile Accident	29 (46)	11 (38)	40 (43)	0.716	0.292-1.761	0.505
Diving in shallow water	05 (08)	04 (14)	09 (10)	1.856	0.459-7.498	0.456
Fall the ground	12 (19)	07 (24)	19 (21)	1.352	0.469-3.895	0.588
Motorcycle Accident	07 (11)	03 (10)	10 (11)	0.923	0.221-3.860	1.000
Sports	06 (10)	04 (14)	10 (11)	1.520	0.394-5.863	0.720
Other´s	04 (06)	-	04 (04)	-	-	-
Morphology						
Burst fracture	10 (16)	01(03)	11 (12)	0.189	0.023-1.556	0.163
Dislocation fracture	21 (33)	13 (45)	34 (37)	1.625	0.661-3.998	0.354
Linear fracture in the vertebral body	02 (03)	03 (10)	05 (05)	3.519	0.555-22.328	0.321
Listhesis	23 (37)	08 (28)	31 (34)	0.662	0.523-1.735	0.481
Odontoid fracture	05 (08)	01 (03)	06 (07)	0.661	0.046-3.718	0.661
Spinal cord contusion	02 (03)	04 (14)	06 (07)	4.880	0.839-28.378	0.076
Other´s	-	05 (17)	05 (05)	-	-	-
Number of events	63	35				
Admission neurological status						
ASIA-A	10 (16)	20 (69)	30 (33)	11.778	4.174-33.233*	<0.0001*
ASIA-B	03 (05)	01 (03)	04 (04)	0.714	0.071-7.180	1.000
ASIA-C	13 (21)	02 (07)	15 (16)	0.285	0.060-1.357	0.132
ASIA-D	09 (14)	-	09 (10)	0.097	0.005-1.731	0.053
ASIA-E	26 (41)	06 (21)	32 (35)	0.371	0.133-1.039	0.063
Coma	02 (03)	-	02 (02)	0.417	0.019-8.970	1.000

Syndromic status						
Cervicalgia with paresthesia	29 (46)	06 (21)	35 (38)	3.270	1.172-9.124*	0.016*
Paraparesis	02 (03)	01 (04)	03 (03)	1.089	0.095-12.527	1.000
Tetraparesis	16 (25)	03 (10)	19 (21)	0.339	0.090-1.273	0.164
Tetraplegia	11 (18)	19 (65)	30 (31)	8.982	3.288-24.536*	<0.0001*
Other´as	05 (08)	-	05 (07)	-	-	-
Associated injury						
Apendicular lower limb	01 (02)	02 (07)	03 (03)	4.593	0.399-52.861	0.233
Apendicular upper limb	06 (10)	02 (07)	08 (09)	0.704	0.133-3.719	1.000
Facial trauma	08 (13)	01 (03)	09 (10)	0.245	0.029-2.063	0.264
Injuries scalp	02 (03)	02 (07)	04 (04)	2.259	0.302-16.898	0.588
Thoracic trauma	04 (06)	03 (10)	07 (08)	1.702	0.355-8.155	0.674
Traumatic brain injury	15 (24)	05 (18)	20 (22)	0.667	0.216-2.053	0.592
Other´as	02 (03)	01 (03)	03 (03)	-	-	-
Individuals who had associated injury	27	11	38			
Two morphological diagnoses of injury simultaneously	-	06 (10)	06 (07)	35.128	1.902-648.600*	0.0007*
Alteration sensorimotor	34 (54)	23 (80)	57 (62)	3.270	1.172-9.124*	0.023*
Mortality	02 (03)	09 (31)	11 (12)	13.725	2.733-68.915*	0.0004*

OR – Odds Ratio; CI - confidence interval. [a]Just one individual in each category. *Statistically significant.

Table 5 - Distribution of individuals (mortality and hospital discharge) with surgical treatment in the cervical region, according to the associated injuries with SCI, neurological status at admission (ASIA), syndromic status and other variables.

	Mortality n=11 (%)	**Hospital Discharge n=81 (%)**	**OR**	**CI**	**p** (Fisher test)
Associated injury					
Apendicular upper limb	02 (18)	06 (07)	2.778	0.486-15.885	0.244
Facial trauma	-	08 (10)	0.376	0.020-6.970	0.589
Thoracic trauma	03 (27)	02 (02)	14.813	2.146-102.24*	0.011*
Traumatic brain injury	02 (18)	14 (17)	1.278	0.245-6.658	0.672
Other´s	02 (18)	05 (06)	-	-	-
Individuals who had associated injury	06	32			
Admission neurological status					
ASIA-A	10 (91)	20 (25)	30.500	3.671-253.41*	<0.0001*
ASIA-B	-	04 (05)	0.749	0.038-14.852	1.000
ASIA-C	01 (09)	14 (17)	0.479	0.057-4.049	0.685
ASIA-D	-	09 (11)	0.332	0.018-6.102	0.593
ASIA-E	-	32 (40)	15.101	0.859-265.41	0.007*
Coma	-	02 (02)	1.383	0.062-30.674	1.000
Syndromic status					
Cervicalgia with paresthesia	-	35 (43)	17.559	1.000-308.34	0.003*
Paraparesis	-	03 (04)	1.025	0.050-21.179	1.000
Tetraparesis	02 (18)	17 (21)	1.108	0.218-5.638	1.000
Tetraplegia	08 (73)	22 (27)	7.152	1.738-29.430*	0.005*
Other´s	-	07 (09)	-	-	-
Two morphological diagnoses of injury simultaneously	03 (27)	03 (04)	10.125	1.746-58.726*	0.019*
Alteration sensorimotor	11 (100)	34 (42)	31.667	1.803-556.210*	0.0002

OR – Odds Ratio; CI - confidence interval. [a]Just one or two individual in each category. *Statistically significant.

vertebrae, 61 in two, and 16 had only an injured vertebra. Furthermore, ten patients had a vertebral injury in the thoracic spine simultaneously.

The most common neurologic status according to the ASIA scale were "E" (35%), followed by "A" (33%). However, individuals without complications had predominantly ASIA-E (41%), whereas ASIA-A (69%) was more associated to complications (Table 4).

The most prevalent syndromic state was tetraplegia (33%), followed by cervicalgia (29%). The tetraplegia was more associated with the development of complications after surgery. There were sensorimotor alterations in the groups (no-complication=34; complication=23). Individuals with complications were three times more associated with sensorimotor alterations subsequent to SCI. Thirty-eight men suffered injuries associated with the SCI (without complications=27, with complications=11). Traumatic Brain Injury was the most common in this population (without complications=15, with complication=06), as shown in Table 4. Thoracic trauma was the second most frequent associated injury in patients with complications (14%). However, only thoracic trauma demonstrated an association with mortality (Table 5). Two subjects suffered three injuries, 14 suffered two, and the others (n=32) only one injury associated with the SCI.

The most common complications presented were pneumonia (66%), urinary tract infection (31%), atelectasis (14%), hypovolemic shock (7%), late hemodynamic instability (7%), sepsis (7%) and others complications in only one individual per category (45%). Five subjects had three complications, 12 had two, and the others (n=12) had only one complication after the SCI. There were 11 cases of death, 82% in in the individuals with complications. Complications were 14 times more associated with mortality. Pneumonia was associated with increased mortality (OR: 31.95, CI=6.02-169.64; $p<0.0001$). Neurological status ASIA-A was 30 times more associated with mortality and ASIA-E was more associated with hospital discharge (Table 5). Tetraplegia, sensorimotor alterations and the presence of two morphological injury diagnoses were more associated with mortality. Cervicalgia was more associated with hospital discharge (Table 5).

Discussion

Aiming at identifying the characteristics and clinical aspects of patients with spinal cord injury undergoing surgery, we analyzed the variables most associated with surgery when compared to conservative treatment, age, gender and morbidity/mortality in men submitted to surgical treatment in the cervical.

The most frequent cause of SCI was car accident, but it was not a determining variable in the choice of treatment. Falling was more associated with conservative treatment and with elderly when submitted to surgery. The increased risk of falling in the elderly may be due to musculoskeletal weakness, decreased proprioception and balance, cognitive impairment and visual, polypharmacy and associated diseases.[12] Moreover, cultural factors and regional differences must not be neglected.[7]

Regarding the affected segment, the upper cervical and lumbosacral regions were more associated with conservative treatment. Possibly due to the size of the vertebral canal in the upper cervical spine and high stabilization provided to ligaments of atlanto-occipital articulation, lesions in this region are stable and rare. In relation the lumbar (L3-L5) region, a better prognosis may be explained by the fact that the vertebral body is wider; by the amount of muscles; orientation of articular facets; pelvic stability and ilio-lumbar ligaments.[13] The lower cervical region was the most affected in individuals who required surgery, and age was a determining factor. In this region, the bony and ligamentous elements are totally responsible for the stabilization of segmental vertebrae and the canal is narrower, thereby, the SCI can be more severe.[13] Thus, the affected segment determines the most appropriate treatment.

When subjected to imaging tests, there was an association of linear fracture of the vertebral body and compression fracture to conservative treatment, whereas listhesis, burst fracture and dislocation fracture were more associated with surgery. Surgical intervention may be related the need to stabilize the spine to prevent neurological damage or deformities in the injured region. In this context, the immediate immobilization after any type of trauma is extremely relevant.[13]

Listhesis and dislocation fracture were more frequently observed in the elderly, and individuals with <60 years, respectively. These morphologies promote failures in three columns of Denis[10] being the most unstable injuries[8,14] and can result in poor prognosis for the patient.

Listhesis refers to the anterior or posterior sliding relative to the lower vertebra.[15] In this study it was observed that the fall was the cause more closely associated with the elderly. Thus, this etiology associated with progressive degeneration of articular facets and intervertebral discs during aging,[15] may justify the morphology more associated with elderly.

In younger patients (<60 years), motorcycle accident demonstrated to be a determining factor for the need for surgery. According to Oliveira et al.[16], these patients do not use appropriate safety equipment or are associated with some type of traffic infraction, and are more susceptible to polytrauma. Therefore, the etiology of injury can justify the morphology (dislocation fracture) associated to this population, with the presence of bone lesions and adjacent soft tissues. These results indicate the need of investments in traffic education as a means of prevention.

In addition, older patients were significantly more submitted to surgery, and the elderly had increased mortality. This can be explained by the higher prevalence of comorbidities in these patients.[17]

Women with SCI were more associated with the necessity of surgery and with burst fracture. However, the non-surgical treatment has been recommended due to a satisfactory functional prognosis after this morphologic diagnosis of lesion.[18] Burst fracture involves the axial constriction of vertebral body, more frequent in a high degree of flexion, with comminuted characteristic, involving the upper plateau and the posterior margin of vertebral body with retropulsion of fragment for the vertebral canal.[19] The high rate of surgery in women observed in this study is probably due to the need for decompression of neural elements to preserve or improve neurological function.[13] Therefore, a radiological evaluation could help in the choice of an appropriate therapy.

In men the presence of two morphologic diagnosis of simultaneous injury was associated with higher mortality, regardless of the morphology. This type of injury requires multilevel spinal fusion, is more traumatic to the patient, has longer surgery time and loss of intraoperative blood.[20] Thus, these factors render patients more vulnerable to evolve with death.

During clinical evaluation, women have a greater association with paraparesis. This is a result of the higher incidence of burst fracture in the thoracolumbar transition

and lumbar region.[13] This morphology is frequently displayed when the sample is associated with automobile accidents. These results were demonstrated in this research. Neurological status, clinical status (paresis and plegia) and sensory and motor function were variables associated with the choice of treatment when negative. However, when individuals are analyzed according to gender, a worse status and sensorimotor alterations were significantly more frequent among men, being a determining factor for the presence of complications and mortality when submitted to surgery in the cervical spine. Chen & Chen[21] indicate that these prognostic factors should be analyzed together with imaging tests. The presence of unstable fractures in the spine is determinant in the choice of treatment.

In individuals submitted to conservative treatment the associated lesions in the lower appendicular limb and traumatic brain injury (TBI) are more frequent. Among patients undergoing surgery, men were more related to the presence of polytrauma, being the traumatic brain injury and thoracic trauma the most common ones. The highest incidence of polytrauma in men is related to greater frequency in driving motor vehicles and vulnerability to urban violence.[22] Therefore, the characterization of these patients contributes to social and educational projects and should be implemented to reduce their incidence.

Tetraplegia and thoracic trauma were more associated with complications and mortality in men submitted to surgery in the cervical region. These individuals have more complications after SCI, especially pneumonia, are associated with mortality when submitted to surgery in the cervical region. These variables are related because the thoracic trauma alters the pulmonary mechanics. Furthermore, pneumonia may be due to paralysis of the diaphragm muscle (innervation: phrenic nerve; medullar level: C3-C5) and functional deficiency of the accessory muscles in breathing. Still, an imbalance of autonomic function may result in hypertrophy of mucous glands in the lower airways, leading to pulmonary hypersecretion.[3,23] Immobility may influence other clinical complications,[24] highlighting the importance of early physiotherapy in these patients.

Variables such as surgical treatment, male gender and the presence of complications contributed to longer hospital stay. Intensive physiotherapy has demonstrated to be essential in reducing the length of hospital stay and costs,[25]

operating focused on motor rehabilitation, respiratory intervention and use of electrotherapy resources to stimulate the muscles which are in disuse, secondary to denervation.[26] Therefore preventing clinical complications, promoting greater functional independence and resulting in improved quality of life.[26]

Conclusion

The characteristics observed in this study contribute to the diagnosis of the patient, allowing a faster treatment. Furthermore, age and gender indicate particularity that are taken into account during clinical management. Therefore, the characterization of patients undergoing surgery helps in directing for quality service. Thus, allowing investments in prevention, rehabilitation and appropriate treatment for patients with SCI undergoing surgery.

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3. CONCLUSÕES

Conclusões

Artigo 1

Idosos com TRM tiveram características e fatores clínicos distintos em relação ao sexo e quando comparados com indivíduos mais jovens. Mulheres idosas sofreram mais TRM que aquelas com <60 anos de idade, principalmente associada com trauma na transição tóraco-lombar com fratura compressão, apresentando um melhor prognóstico que homens. Entretanto, homens idosos apresentaram mais lesões instáveis, principalmente na cervical inferior e eles evoluem com pior gravidade. Ainda, os idosos apresentaram mais complicações pós-TRM, lesões associadas, déficit neurológico e mortalidade, evoluindo com um pior prognóstico que indivíduos mais jovens. Neste contexto, as informações apresentadas nesta pesquisa oferecem novos direcionamentos para prevenção e tratamento.

Artigo 2

TRM associado com TCE foram mais comum em adultos jovens, união estável e com baixo nível de escolaridade. Pneumonia foi a principal complicação. Homens expostos acidentes automobilístico tiveram maior risco de sofrerem estas lesões simultaneamente. A coluna cervical é mais afetada nestes indivíduos. Além disso, o período de hospitalização é maior e estes indivíduos têm mais risco de morrerem.

Artigo 3

As características observadas neste estudo contribuem para o diagnóstico do paciente, possibilitando um tratamento mais rápido. Além do mais, a idade e o sexo indicam particularidade que devem ser levadas em consideração durante o manejo clínico. Então, a caracterização de pacientes submetidos à cirurgia contribui no direcionamento para um serviço de atendimento com qualidade. Assim, possibilitando investimentos em prevenção, reabilitação e tratamento adequado para os pacientes com TRM submetidos à cirurgia.

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5. APÊNDICES

Apêndice – Ficha de avaliação do Departamento de Neurocirurgia

FACULDADE DE MEDICINA- HOSPITAL DE BASE-SJRP-SP
PROTOCOLO TRAUMATISMO DE COLUNA VERTEBRAL

I)- Identificação:
Data internação:.....ΔT:.....
Nome:.....Idade:.....Sexo:.....RG:.....
Procedência:.....Profissão:.....Data acidente:.....

II)- Anamnese:
a) Quadro clínico (tempo de lesão):.....
.....
.....
b) Causa do acidente:.....
c) Mecanismo da lesão:.....

III) - Antecedentes pessoais:.....
IV) - Exame físico geral:
PA:..... FC:.....Respiração:.....
Priapismo:.....Choque(neurogênico, medular):.....
ATLS:.....
.
V)- Exame físico(Neuro-ortopédico):
A) Inspeção:.....
B) Palpação:.....
C) Nível sensitivo:
a) Superficial=dor e tato fino (0=ausente, 1=alterado, 2)= normal):
- Ponto de referência=dermátomo:.....
- Toque retal=esfíncter anal externo (sensação: Sim, Não):.....
b) Profunda=indicador/1°dedo Pé: (0=ausente, 1=alterado, 2)=normal):
D) Nível motor:
- (C1-C4, C5, C6,C7,C8,T1):.....
- (T2-L1, L2,L3,L4,L5,S1,S2-S5):.....
- Classificação de força (0,1,2,3,4,5):.....
- Toque retal:=contração voluntária: (Sim, Não):.....

E) Escala de deficiência ASIA:

A) Completa: Não há função motora ou sensitiva preservada nos segmentos sacros S4-S5.
B) Incompleta: Há função sensitiva, porém não motora preservada abaixo do nível neurológico estendendo-se até os segmentos sacros S4-S5.
C) Incompleta: Há função motora preservada abaixo do nível neurológico e a maioria dos músculos-chave abaixo de nível neurológico têm um grau muscular inferior a 3.
D) Incompleta: Há função motora preservada abaixo do nível neurológico e pelo menos a metade dos músculos-chave abaixo do nível neurológico têm grau muscular ≥3.
E) Normal: As funções sensitivas e motoras são normais.

VI) - Lesões Associadas:.....
- Diagnóstico Sindrômico: a) Brown-Sèquard b) Centro medular c) Anterior d) Posterior
e) Cone d) Cauda eqüina:.....

VII) - Radiodiagnóstico:
- Data: RX:.....TC:.....RM:.....
1)-RX simples(AP/P):.....
- Nadador:.....Transoral:.....
- Dinâmico:.....
2-TC:.....
3)-RM (seqüências):.....
.....
.....
- Lesão (localização): única:.....Múltiplas:.....

- Conclusão diagnóstica:.....
.....

VIII - Tratamento:

a) Classificação:

1) a: AO: C3-C7

A: Compressão:	**B: Distração:**	**C: Rotação:**
A1:- impactadas	B1:- lesão ligamentar posterior pura (corpo =nl)	C1:- fratura-luxação facet. unilateral
A2:- Split (separação)	B2:- lesão posterior + fratura tipo A	C2:- luxação facetaria unilateral
A3:- explosão	B3:- Distração anterior + hiperextensão	C3:- fratura separaç. maciço articular (pura + tipo A + tibo B)

1)-b: AO: torácica e toraco-lombar

A: Compressão:	**B: Distração:**	**C: Rotação:**
A1:- impactadas	B1:- lesão ligamentar posterior	C1:- tipo A + Rotação
A2:- Split(separação)	B2:- lesão óssea posterior	C2:- tipo B + rotação
A3:- explosão	B3:- hiperextensão	C3:- Cisalhamento-rotação

2)Vaccaro:toraco-lombar: -score ≤ 3 não; =4 cirurgia x não cirurgia: ≥5 cirurgia

Morfologia:	*Exame neurológico:*	*Complexo ligamentar posterior*
-compressão.....1	-normal.....0	-normal.....0
-explosão.....2	-lesão radicular.....2	-indeterminada.....2
-translação/rotação.....3	lesão de cone/medula	-rompido.....3
-distração.....4	→completa.....2	
	→incompleta.....3	
	-cauda eqüina.....3	

b) Clínico: critérios utilizados: (colar, halo, corticoide, tempo):.....
.....

c) Cirúrgico: critérios utilizados:.....
.....

- Descrição sumária (via de acesso, técnica, tipo de implante, enxerto e outros, data):.....
.....
.....

IX)- Complicações:

- Imediatas:.....Tardia:.....

a) Paciente:.....

b) Técnica cirúrgica:.....

C) Implantes:.....

X)- Evolução:

a) Clínica e neurológica:
.....
.....

b) Radiológica:

RX:.....
.....

TC:.....
.....

RM:.....
.....

6. ANEXOS

ANEXOS – Aprovação no comitê de ética em pesquisa

FACULDADE DE MEDICINA DE SÃO JOSE DO RIO PRETO- FAMERP - SP

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: ASPECTOS CLÍNICOS, EPIDEMIOLÓGICOS E RADIOLÓGICOS DE IDOSOS COM TRAUMATISMO RAQUIMEDULAR

Pesquisador: JOAO SIMAO DE MELO NETO

Área Temática:

Versão: 2

CAAE: 34150714.1.0000.5415

Instituição Proponente: Faculdade de Medicina de São Jose do Rio Preto- FAMERP - SP

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 806.452

Data da Relatoria: 07/10/2014

Apresentação do Projeto:

Pesquisa para realização de Doutorado, sucinta, bem redigida e de relevância.

Objetivo da Pesquisa:

O objetivo deste estudo é analisar os aspectos clínicos, epidemiológicos e radiológicos de idosos que foram vítimas de TRM atendidos em hospital terciário.

Avaliação dos Riscos e Benefícios:

Não apresenta riscos por ser uma pesquisa retrospectiva, de análise de prontuários.

Benefícios:

Contribui para o surgimento de programas de prevenção mais apropriados, melhorar os dados analisados na avaliação da admissão, obter melhor programação dos recursos materiais necessários para o tratamento médico e de reabilitação, e consequentemente melhorar o prognóstico e qualidade de vida destes indivíduos.

Comentários e Considerações sobre a Pesquisa:

Pesquisa de grande relevância, bem elaborada e objetiva.

Considerações sobre os Termos de apresentação obrigatória:

Apresenta todos os termos obrigatórios preenchidos dentro das normas.

Endereço: BRIGADEIRO FARIA LIMA, 5416
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UF: SP **Município:** SAO JOSE DO RIO PRETO
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FACULDADE DE MEDICINA DE SÃO JOSE DO RIO PRETO- FAMERP - SP

Continuação do Parecer: 806.452

Recomendações:

Não há recomendações.

Conclusões ou Pendências e Lista de Inadequações:

Pesquisa aprovada para ser iniciada.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

Projeto Aprovado.

SAO JOSE DO RIO PRETO, 25 de Setembro de 2014

Assinado por:
Fernando Batigália
(Coordenador)