The neurological outcome of acute spinal cord injury in a neurosurgical hospital of a developing country

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The neurological outcome of 146 patients who survived spinal cord injury in a neurosurgical hospital of a developing country, were compared to those reported from Stoke Mandeville, UK. The average recuperation in the two groups was similar.

Keywords: spinal cord injury; neurological outcome; developing country

Introduction

The neurological results of the treatment of spinal cord injury have not changed during the last decades.¹ According to many authors, good results are obtained in sophisticated medical units devoted exclusively to this type of disease.^{2–6}

For the last 9 years, the authors have managed acutely spinal cord injured patients in a general neurosurgical hospital located in a developing country. This hospital has no Emergency Room dedicated to trauma. Patients are referred from other hospitals in the city and neighbouring areas. No facility specifically designed to spinal cord injured patients is available in this hospital. The goal of the institution in this area is to afford initial care, giving patients the necessary conditions to be sent home and to perform rehabilitation as outpatients.

One can assume that the neurological results obtained in such circumstances may be worse than those obtained in specialised spinal cord injury units. This study compares the neurological results collected prospectively at Hospital São José (HSJ, Brazil) with those presented in the largest ever reported series of spinal cord injured patients evaluated by the Frankel scale – the series from Stoke-Mandeville (SM, UK).⁷

Patients and methods

All patients sustaining a traumatic spinal cord injury admitted to the care of the authors between August 1986 and July 1995 were studied. There were 164 patients. One hundred thirty four were male. The age distribution is presented in Table 1 and the causes of trauma in Table 2. The median time between trauma and admission was 3 days.

Upon admission patients were submitted to full neurological examination including the perineum. The

Frankel scale was used for initial and follow up evaluation (Figure 1). The median time of hospitalisation was 19 days. Eighteen patients (10.9%) died (15/100 cervical, 2/27 thoracic and 1/37 thoracolumbar) and were eliminated from the neurological outcome study. The length of follow up is presented in Table 3. Final neurological result was the one found upon last examination. In those who were lost to follow up (47 patients), the final result was the one found in the moment of discharge.

A detailed description of the treatment of each type of lesion will not be reported. The general goals of treatment were: to reduce vertebral dislocation, to provide spinal stabilisation and to decompress the spinal cord. Closed reduction was initially attempted in cervical dislocation. In the case of failure, reduction was obtained surgically. In the thoracolumbar segment dislocations were treated surgically. Spinal instability (White's criteria⁸ for the cervical spine and Denis' criteria⁹ for the thoracolumbar spine) was usually treated surgically if significant ligamentous injury was found, or if an operation had been previously indicated for other reasons. When spinal instability was mainly determined by osseous lesion, the treatment choice moved to external immobilisation, as long as the patient had sufficient skin sensibility to tolerate it. When spinal cord compression persisted after reduction a decision was made as to the necessity of decompression. In cases of complete spinal cord lesion it was never indicated. In those patients with incomplete spinal cord injuries a time of observation was allowed. In case of neurological stabilisation a decompression was indicated, usually from the anterior approach. In case of progressive and satisfactory recuperation, even in the presence of persistent spinal cord compression, no decompressive procedure was undertaken. Under these guidelines 106 patients were treated surgically.

Table 1 Patient distribution according to age

Age (years)	N
0–9	01
10–19	23
20–29	43
30–39	41
40–49	25
50–59	20
60–69	10
over 70	01
Total	164

Table 2 Causes of trauma

Causes	N
Vehicle accident	62
Fall from height	42
Gunshot	19
Water sports	12
Other	29
Total	164

A	Complete sensory-motor loss
B	Sensory preservation only
C	Motor useless preservation
D	Motor useful preservation
E	Normal

Figure 1. Frankel scale**Table 3** Length of follow up

Time	N
3 months	99
6 months	84
9 months	58
12 months	42
more than 12 months	31

Table 4 Initial × final grades. Cervical lesions

	HSJ					SM				
	Initial A	B	C	D	Final E	Initial A	B	C	D	Final E
A	17	00	01	02	00	A	81	21	10	00
B	00	03	02	01	04	B	03	09	02	05
C	00	00	11	10	12	C	00	01	04	05
D	00	00	00	07	15	D	00	00	00	11

In order to allow comparison with the Stoke-Mandeville series, surviving patients were subdivided into three categories: cervical, 85 patients; thoracic (T1–T10), 25 patients; and thoracolumbar (T11–L1), 36 patients. The correlation between initial and final evaluation from HSJ and SM patients are presented side by side in Tables 4, 5 and 6. Since the number of patients with complete and incomplete lesions differed significantly in the two groups, the comparisons between neurological recoveries was made within each sub-category (Cervical grade A, Thoracic grade C, etc), neurological recovery was estimated by the method utilised by Young.¹⁰ Net average neurological recovery (NANR) in Frankel grades was calculated by subtracting the total number of degrees lost and adding the total number of degrees gained in each sub-category, and dividing this value by the total number of patients in this sub-category. The *t*-test was used for statistical analysis. The significance level chosen was $P < 0.05$.

Results

The comparisons between the net average neurological recoveries obtained at HSJ and SM are demonstrated in Tables 7, 8 and 9. No statistically significant difference existed between all but one sub-category. The only exception occurred in patients sustaining cervical lesions grade D. In this situation the recovery at HSJ was superior to SM.

Discussion

The Frankel scale is not the ideal instrument to make comparisons between different patient series.¹¹ The arbitrary division between 'useful' and 'useless' motor recovery (respectively grades D and C) allows many different interpretations. Scales-based on sharper quantitative evaluation have been reported in the literature.^{12,13} So far, the best system available seems to be the International Standards proposed by ASIA and IMSOP in 1994, after exhaustive debate among specialists in this field.¹⁴ Nevertheless, the utility of the Frankel scale can not be overlooked. This is testified by the fact that it is an integrant part of the above mentioned International Standards. Data obtained from clinical series that used the Frankel scale are able to answer the main questions posed by patients

Table 5 Initial × final grades. Thoracic lesions (T1–T10)

	HSJ						SM				
	Initial A	B	C	D	Final E		Initial A	B	C	D	Final E
A	19	00	00	00	00	A	114	11	02	07	01
B	00	00	00	00	00	B	00	06	02	05	02
C	00	00	01	02	03	C	00	00	01	01	00
D	00	00	00	00	00	D	00	00	00	04	09

Table 6 Initial × final grades. Thoracolumbar lesions (T11–L1)

	HSJ						SM				
	Initial A	B	C	D	Final E		Initial A	B	C	D	Final E
A	14	01	02	00	00	A	102	12	02	10	00
B	00	02	01	01	00	B	01	04	02	15	02
C	00	00	04	06	03	C	01	00	04	16	04
D	00	00	00	01	01	D	00	00	00	18	09

Table 7 Comparison between Net Average Neurological Recovery (NANR) from HSJ and SM. Cervical

Grade	HSJ (NANR)	SM (NANR)	<i>t</i>	Significance (<i>P</i> < 0.05)
A	0.40	0.60	1.96	NS
B	1.60	1.27	1.96	NS
C	1.03	0.95	1.96	NS
D	0.68	0.26	1.96	Significant

NS = Not significant

Table 8 Comparison between Net Average Neurological Recovery (NANR) from HSJ and SM Thoracic (T1–T10)

Grade	HSJ (NANR)	SM (NANR)	<i>t</i>	Significance (<i>P</i> < 0.05)
A	0.0	0.29	1.96	NS
B	–	–	–	–
C	1.33	0.5	2.36	NS
D	–	–	–	–

NS = Not significant

Table 9 Comparison between Net Average Neurological Recovery (NANR) from HSJ and SM. Thoracolumbar (T11–L1)

Grade	HSJ (NANR)	SM (NANR)	<i>t</i>	Significance (<i>P</i> < 0.05)
A	0.29	0.36	1.96	NS
B	0.75	1.54	2.06	NS
C	0.92	0.88	1.96	NS
D	0.50	0.33	2.06	NS

and families in the moment of admission: ‘will I ever move my legs (grade C)?’, ‘is he ever going to walk even with some aid (grade D)?’, ‘will I ever be normal again (grade E)?’ While numerical scales can show to researchers the precise differences between therapeutic regimens, the neurological scale remains the best tool to deal with patients concerns.

Comparisons between series evaluated by the neurological scale were reported.^{10,15,16} The choice of the statistical approach depends on the demographic differences and similarities of the groups studied. In 1978 Young compared his personal experience with Frankel’s series.¹⁰ Due to the extreme similarity of the two populations, the comparison was simply made between the three basic groups: cervical, thoracic and thoracolumbar. In the present study, the proportion of complete and incomplete cases within each category differs significantly from Stoke Mandeville. Comparisons, therefore, were made between each ‘sub-category’. The net average neurological recoveries differed very little, sometimes superior in HSJ, sometimes superior in SM. These differences, however, were almost never statistically significant.

Global mortality was 10.9%. This mortality, specially in cervical cases (15%), lies above the one found in recently reported studies.^{17,18} The vast majority of deaths occurred among cervical complete cases. A higher mortality in this type of patient suggests intensive care management difficulties and is strongly related to economical factors.

The treatment protocol is not the focus of this study, but deserves some comments. The approach lies midway between radically surgical and radically conservative ones. From the neurological standpoint neither the surgical nor the conservative approach were ever demonstrated to be superior. Therefore no

difference or similarity of neurological results can be attributed to the fact that HSJ series comprised a large number of surgical cases.

The recommendation that spinal injured patients should be managed in specialised spinal units is frequently found.²⁻⁶ Deficient hospital conditions have been blamed for bad management results.¹⁹ Developing countries usually make little investments on the management of complex pathologies. In this context, spinal injured patients from developing countries are usually managed in general or neurosurgical hospitals. The initial hypothesis of this study was that a worse neurological outcome could be expected from spinal cord injured patients treated in a general neurosurgical hospital of a developing country. Results have shown a mortality that is still high. Among survivors, however, the management offered to these patients, did not worsen their neurological prognosis.

Conclusions

The neurological recovery of surviving spinal cord injured patients treated in a neurosurgical hospital of a developing country can be similar to the one found in a specialised spinal cord injury center.

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