Three-year study of spinal cord injury outcomes and related secondary complications in a tertiary centre – a retrospective analysis

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Submitted: 25 July 2008
Accepted: 22 October 2008

Arch Med Sci 2009; 5, 2: 190-194

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Abstract

Introduction: The purpose of this study was to determine the outcomes and occurrence of secondary complications in an acute spinal cord injury (SCI) during the in-patient phase.
Material and methods: The records of all patients (n = 357) admitted between June 2003 and June 2006 to the spinal ward were reviewed retrospectively. A proforma was prepared to obtain relevant information regarding demographic data, complications acquired and treatment received by the patients.
Results: Of 357 patients, only 77 (58 male, 19 female) who presented with neurological deficits were included in this study. Thirty-nine percent of them were between 54 and 64 years. Motor vehicle accidents (39%) were identified to be the leading cause of SCI. Paraplegia (72.7%) was the commonest resultant outcome. In terms of outcome grading, a larger number of subjects were in ASIA D (42%) followed by ASIA C (31.2%), with only 5.2% recovered fully. Of the complications, bladder and bowel problems were the most frequent (65%), followed by spasticity (27.3%) and pressure ulcer (26%). Obviously those with tetraplegia were at higher risk for all secondary complications. Mechanical loading was effective in prevention of spasticity in around 70% of cases. The importance of breathing exercises was evident in that 80.5% did not develop pulmonary complications Although psychological problems had a lower incidence (13%), it could be due to the fact that it was under-recognized. Depressive symptoms were the predominant mode of presentation.
Conclusions: This study gives us information on SCI related complications in our centre which then sets a background to look into reducing incidence of urinary problems, pressure ulcer and severity of spasticity, and also implementing and improving SCI care services.

Key words: spinal cord injury, epidemiology, complications.

Introduction

Spinal cord injury (SCI) is a life-threatening condition that requires a co-ordinated multi-disciplinary approach in order to effectively manage the problem and to care for the potential secondary complications satisfactorily [1]. It affects the physical, psychological, social, vocational and avocational aspects of one's life [2]. The incidence of traumatic spinal injuries in Malaysia is on the rise following a trend of rapid urban development, whereby an increased number of building construction site accidents and motor vehicle accidents were also reported [3].

A previous study suggested that spinal trauma most commonly affected the productive age group of predominantly the male population with motor vehicle accidents accounting for the highest incidence [4, 5]. Furthermore, it was identified that the epidemiology of SCI and associated sequelae varied widely from place to place and it is therefore important that each SCI care centre must review its own epidemiological data so as to provide services that are current [6]. Hence our study could be justified in that it was reasonable to conduct a review on the 3-year epidemiological data of the SCI disease outcomes, management and the incidence of secondary complications in our tertiary centre. Moreover, such a review has never been conducted before in the spinal unit since the time the SCI services were started.

The Spinal Unit, Department of Orthopaedics and Traumatology, University Kebangsaan Malaysia Medical Centre (UKMMC), was established in 2003. It provides acute rehabilitation services as well as long-term review and management of SCI related problems. This unit offers a multidisciplinary team approach to SCI. The multidisciplinary team members include the spine surgeons, rehabilitation physicians, nurses, physiotherapists, occupational therapists, social workers, psychologists and orthotists. As there was no previous study that highlighted epidemiological presentations of SCI as well as in-patient care complications in our spinal unit, it prompted us to embark on this study. Therefore the main objective of the study was to acquire epidemiological data of SCI in the spinal unit and to improve the current services for potential complications and care requirements.

Material and methods

This is a retrospective study conducted in the Spinal Unit, Department of Orthopaedics and Traumatology, University Kebangsaan Malaysia Medical Centre (UKMMC). The records of all patients (n = 357) admitted to the spinal unit with SCI between June 2003 and June 2006 were reviewed. Out of 357 patients, only 77 patients (58 male, 19 female) who had neurological deficits were included in this study.

A proforma was prepared to acquire relevant data according to the main objective of the study. The data collected using the first part of the proforma include age, sex, mode of injury, level of injury and type of management (conservative/surgical). The neurological status of SCI was also collected in the acute stage during admission and before discharge by using the American Spinal Injury Association Impairment Scale (ASIA). The rehabilitation physicians assessed the neurological level according to the International Classification of Spinal Cord Injury [7, 8].

The second part of the proforma looked into the complications acquired by the subjects during the hospital stay. The third part of the proforma collected data regarding the various treatments received by the SCI patients, which included immobilization (body cast or Halovest/Philadelphia collar/traction), analgesics and physiotherapy treatments, specifically early pulmonary rehabilitation (breathing exercises) and mechanical loading by standing using a tilt table or standing within the parallel bars.

The collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 12.0. Descriptive and analytical statistics were used for data analysis. Pearson χ^2 analysis was used to study the relationship between the variables and the level of significance was set at $p < 0.05$.

Results

The mean time of follow-up of the patients in this study was 7 weeks, with a range between a minimum of 6 weeks and a maximum duration of 8 weeks of hospital stay. Of the 77 patients with neurological deficits, 75.3% (58 patients) were males and the remaining 24.7% were females (19 patients). The range of age for patients with spinal cord injury is wide in this study, with the youngest 16 years old and the oldest 89 years old. However, the majority of patients (23.4%) were 55-64 years of age. The younger clients (25-34 years) were the next highest in numbers (Table I).

As for the mode of injury, motor vehicle accidents and falls from heights constituted 39% (30 patients) and 32.4% (25 patients) respectively. Spinal diseases constituted 26% (20 patients) and assaults made up another 2.6% (2 patients) (Table II). In terms of the SCI level of injury, 72.7% (56 cases) developed paraplegia, while tetraplegia constituted 27.3% (21 patients). A total of 36% were treated non-operatively, while the other 64% underwent various operative procedures.

Table I. Age distribution among spinal cord injury cases

Age [years]	Percent
15-24	6.5
25-34	20.8
35-44	11.7
45-54	15.6
55-64	23.4
65-74	16.9
75-84	2.6
85-90	2.6

Table II. Causes of spinal injury

Causes	Number	Percent
Motor vehicle accident (MVA)	30	39
Fall from height	25	32.4
Assault/violence	2	2.6
Spinal diseases	20	26.0
Sports	0	0

The neurological status of the patients in comparison between admission and discharge revealed improvement towards ASIA B and C, while 5.2% (4 patients) improved completely to ASIA E. However, 13% (10 patients) remained in ASIA A (Table III). Almost all tetraplegic patients developed neurogenic bladder and bowel, while 30 patients (53.6%) with paraplegia developed neurogenic bladder and 29 patients developed neurogenic bowel. Pearson χ^2 test showed that there was a significant relationship ($p < 0.05$) between level of injury and bladder and bowel problems.

The level of lesions was directly proportionate to the incidence of pressure ulcer formation, as the incidence of pressure ulcer is 42.9% in tetraplegia and 19.6% in paraplegia respectively. Pearson χ^2 results showed that the relationship between level of injury and occurrence of pressure ulcer was significant ($p = 0.039$).

A significant relationship ($p = 0.038$) between level of injury and presence of pulmonary complications was also noted in 33.3% of tetraplegics and 14.3% of paraplegics. Psychological problems were more common among the tetraplegic patients (23.8%) (Table IV) and depression constituted the highest percentage (80%).

Among all of the patients who had breathing exercises as treatment, only 15 patients (19.5%) suffered from pulmonary complications, while the remaining 80.5% ($n = 62$) were devoid of any complications. Pearson χ^2 test showed that there was a significant relationship ($p = 0.014$) between level of injury and occurrence of spasticity, with a higher number of tetraplegics presenting with spasticity (47.6%). Out of the 77 patients (both paraplegic and quadriplegic), 27.3% ($N = 21$) had spasticity as one of the complications, while 72.7% ($N = 56$) were reported to be free from spasticity.

Discussion

A detailed understanding of the epidemiological, demographic and pathological features of SCI within a national system of care is vital in directing further system development, determining the priorities for funding, resource management and identifying the greatest potential for injury prevention.

Table III. Recovery of neurological status

ASIA scale	On admission				On discharge			
	Incomplete		Complete		Incomplete		Complete	
	n	%	*n*	%	*n*	%	*n*	%
A	0	0	11	14.3	0	0	10	13.0
B	11	14.3	0	0	6	7.8	0	0
C	28	36.4	0	0	24	31.2	0	0
D	27	35.1	0	0	33	42.8	0	0
E	0	0	0	0	4	5.2	0	0

Table IV. Complications

Complications	Tetraplegia ($N = 21$)		Paraplegia ($N = 56$)		*P* value
	n	%	*n*	%	
Neurogenic bladder	21	100	30	53.6	0.000
Neurogenic bowel	21	100	29	51.8	0.000
Pressure ulcer	9	42.9	11	19.6	0.039
Pulmonary complications	7	33.3	8	14.3	0.038
Spasticity	10	47.6	11	19.6	0.014
Psychological problems	5	23.8	5	8.9	–

In this study, an epidemiological analysis was performed on all SCI patients admitted to the spinal unit, UKMMC during the period June 2003 to June 2006. No past figures were available for accessing the incidence and complications of SCI in the centre prior to the spinal unit and therefore it was not possible to compare and to illustrate the benefits of our study results. The incidence of SCI was higher in males than in females, with the ratio of 3 : 1, which was similar to the findings of a previous study [3]. Among them, motor vehicle accident was the most common cause of SCI, accounting for 39%, followed by other causes such as fall from a height, and our study results were quite similar to the previous other studies [1, 3, 9]. There was a higher percentage of patients in the middle age group (55-64 years) in this study as compared to the other studies [1, 3], which showed that the age group commonly involved was the productive age group.

Among the subjects, 72.7% developed paraplegia, while tetraplegia made up the rest. About 64% of the SCI patients in the spinal unit underwent various spinal surgeries and this figure was closely similar to the Western figures [10]. This might have contributed to the improvement seen in the ASIA impairment scale at discharge.

Neurogenic bowel was higher among the tetraplegic group (N = 21), whereas less than half of those with paraplegia (N = 29) had symptoms of neurogenic bowel. A significant correlation between neurological level (severity/functional loss) and development of neurogenic bowel was noted in this study. The presence of pressure ulcers correlated with the level of the lesions (p = 0.039), with tetraplegics reported to have higher incidence of pressure ulcers. In general, it can be claimed that because of the proper nursing care and turning programme in our spinal unit, pressure ulcer was observed only in about a quarter of the total patient population. This finding is reflective of the specialised care that is afforded to patients in this dedicated unit.

According to Ash (2002), 56% of spinal cord injury patients developed an ulcer at some stage during the injury and discharge from the spinal unit [12], while our study found an incidence of only 26%. This big difference may be attributed to the fact that our patient pool is that of the acute and short-term hospitalization period (mean of 7 weeks) as opposed to longer-term stay of patients in that study. In our study, the mean period of hospitalisation for patients was 7 weeks, which could probably be the reason for this low incidence of pressure ulcers. Model system data reported that approximately one-third of patients developed pressure ulcers during their initial rehabilitation and up to 80% of patients with SCI develop a pressure ulcer at some point in their lifetime [13-15].

It was not a surprise that the incidence of pulmonary complications was higher among the tetraplegics (p = 0.038). A retrospective review reported that 67% of acute injured individuals experienced some respiratory complications during the initial hospitalization that included atelectasis (36%), pneumonia (31%), and respiratory failure (22.6%) [16]. There was a greater incidence of acute complications with increasing age, higher level of injury, and complete tetraplegia [17].

Spasticity was noted in less than one third of this patient population and this lower incidence of spasticity in our study could be attributed to early aggressive physiotherapy intervention. Spasticity was a common medical complication of upper motor neuron SCI. The incidence was approximately 70%, with roughly half the patients requiring pharmacological intervention [18, 19]. In our study, mechanical loading was shown to be effective in preventing spasticity in 69.8% of cases. It has to be noted that the effectiveness of mechanical loading in preventing spasticity has to be studied longitudinally in a randomised controlled study design to claim its effectiveness. However, there is evidence that weight bearing helped proprioceptive facilitation and promotion of the development of extensor patterns which in turn could reduce spasticity [20]. Similar results were reported in another study [20].

Psychological problems were seen in up to 13% (N = 10) of all patients (N = 77) and depression constituted the highest percentage (80%). This lower percentage of psychological problems may be attributed to lower pick-up rate by health care personnel and this could be explained by our cultural attitude of resilience to pain and suffering. Among the patients with psychological problems, 23.8% (N = 5) were tetraplegics and 8.9% (N = 5) were paraplegics. Concerns regarding "depression" were commonly reported by SCI survivors, staff, or their families. A person who sustained an SCI was at risk for the four D syndrome: dependency, depression, drug addiction, and, if married, divorce [21].

The retrospective design was identified as a limitation in this study. The other limitation would be that this study considered only in-patients in the acute phase of SCI and acute phase of hospital stay of about 7 weeks. Hence the applicability of the results of this study was limited and cannot be applied to the longer duration of spinal cord injury patients as the complications might rise with time. Epidemiological data of out-patients and longer period of follow-up for neurological status and SCI outcomes await future studies.

In conclusion, this study considered the patients from a pool of acute in-patient spinal cord injury rehabilitation with a short-term hospitalization

period of 7 weeks. The results from this study provided a background to look into reducing incidence of bladder problems, pressure ulcers and severity of spasticity among our patient population. Further studies are planned to investigate the long-term follow-up data and the ongoing care in the community for our SCI patient population.

References

1. O'Connor RJ, Murray PC. Review of spinal cord injury in Ireland. Spinal Cord 2006; 44: 445-8.
2. Mena Quinones PO, Nassal M, Al Bader KI, et al. Traumatic spinal cord injury in Qatar: an epidemiological study. Middle East J Emergency Med 2002; 2: 67-9.
3. Roohi SA, Naicker AS, Shukur MH, Mohammad AR. Spinal injury in a level-one trauma centre: demographic study. Med J Malaysia 2006; 61 (Suppl A): 30-5.
4. Thurmann DJ, Burnett CL, Jeppson L, Beaudoin DE, Sniezek JE. Surveillance of spinal cord injury in Utah, USA. Paraplegia 1994; 32: 665-9.
5. Saboe LA, Reid DC, Davis LA, Warren SA, Grace MG. Spinal trauma and associated injuries. J Trauma 1991; 31: 43-8.
6. Cardenas DD, Hoffman JM, Kirshblum S, McKinley W. Etiology and incidence of rehospitalization after traumatic spinal cord injury: a multicenter analysis. Arch Phys Med Rehabil 2004; 85: 1757-63.
7. Maynard FM Jr, Bracken MB, Creasey G, et al. International standards for neurological and functional classification of spinal cord injury. American Spinal Injury Association. Spinal Cord 1997; 35: 266-74.
8. Waters RL, Adkins RH, Yakura JS. Definition of complete spinal cord injury. Paraplegia 1991; 29: 573-81.
9. Shingu H, Ikata T, Katoh S, Akatsu T. Spinal cord injury in Japan: a nationwide epidemiological survey in 1990. Paraplegia 1994; 32: 3-8.
10. Capaul M, Zollinger H, Satz N, Dietz V, Lehmann D, Schurch B. Analysis of 94 consecutive spinal cord injury patients using ASIA definition and modified Frankel score classification. Paraplegia 1994; 32: 583-7.
11. Hanson RW, Franklin MR. Sexual loss in relation to other functional losses for spinal cord injured males. Arch Phys Med Rehabil 1976; 57: 291-3.
12. Ash D. An exploration of the occurrence of pressure ulcers in a British spinal injuries unit. J Clin Nurs 2002; 11: 470-8.
13. McKinley WO, Jackson AB, Cardenas DD, DeVivo MJ. Long-term medical complications after traumatic spinal cord injury: a regional model systems analysis. Arch Phys Med Rehabil 1999; 80: 1402-10.
14. Rodriguez GP, Garber SL. Prospective study of pressure ulcer risk in spinal cord injury patients. Paraplegia 1981; 32: 150-8.
15. Fuhrer MJ. Rehabilitation research and training center in community-orientated services for persons with spinal cord injury: a progress report. Houston, TX: the Baylor College of Medicine and the Institute for Rehabilitation Research 1991.
16. Jackson AB, Groomes TE. Incidence of respiratory complications following spinal cord injury. Arch Phys Med Rehabil 1994; 75: 270-5.
17. Chen D, Apple DF Jr, Hudson LM, Bode R. Medical complications during acute rehabilitation following spinal cord injury: current experience of the Model Systems. Arch Phys Med Rehabil 1999; 80: 1397-401.
18. Maynard FM, Karunas RS, Waring WW 3rd. Epidemiology of spasticity following traumatic spinal cord injury. Arch Phys Med Rehabil 1990; 71: 566-9.
19. Levi R, Hultling C, Seiger A. The Stockholm Spinal Cord Injury Study: 2. Associations between clinical patient characteristics and post-acute medical problems. Paraplegia 1995; 33: 585-94.
20. Johnson RL, Gerhart KA, McCray J, Menconi JC, Whiteneck GG. Secondary conditions following spinal cord injury in a population-based sample. Spinal Cord 1998; 36: 45-50.
21. Gill M. Psychosocial implications of spinal cord injury. Crit Care Nurs Q 1999; 22: 1-7.