Original Article

Rehabilitation outcomes following traumatic spinal cord injury in a tertiary spinal cord injury centre: a comparison with an international standard

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Study design: Retrospective descriptive analysis of data of patients with traumatic spinal cord injury (SCI) in a tertiary SCI centre.

Objectives: To identify the characteristics of the rehabilitation outcomes of patients with different levels of traumatic SCI and to compare the results with data reported in the American Consortium for Spinal Cord Medicine.

Setting: A newly established tertiary SCI centre in Tai Po Hospital, Tai Po, Hong Kong.

Methods: A total of 33 patients with traumatic SCI admitted in 2002 were included in the study. They were classified into different ASIA subgroups based on their levels and completeness of injury. The functional status changes measured by the Functional Independence Measure (FIM)[™] (on admission, placement and upon discharge, and at 1 and 3 months post discharge) and discharge placement were recorded as rehabilitation outcomes.

Results: A total, 24 patients were tetraplegic while nine were paraplegic. Seven and two from tetraplegic and paraplegic groups were readmitted with late complications due to urinary tract infection, spasticity and/or occurrence of pressure sores. The mean age was found to be 48.36 (SD = 15.64) years. In all, 16 (48.48%) sustained the injury from falling from height. The trend of FIM motor scores at discharge across different ASIA subgroups appeared to be comparable to those reported in the American Consortium for Spinal Cord Medicine with scores generally lower. Significant functional improvements during the hospital phase were found in the two tetraplegic and paraplegic ASIA D subgroups ($t(3) = 3.430$, $P < 0.05$; $t(2) = 4.083$, $P = 0.055$, respectively). Significant differences were also revealed among subgroups ($F(7,32) = 6.625$, $P < 0.0005$) with lower level tetraplegic groups appearing to stay much longer in the rehabilitation centre. In all, 64.5% of newly diagnosed patients returned to live in the community.

Conclusions: This report gives a preliminary overview on the characteristics of rehabilitation outcomes in one of the SCI centres in Hong Kong in relation to the international standard. Longitudinal study with larger population and community integration outcomes might be included in the future to reveal a better picture in the SCI rehabilitation in Hong Kong.

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Keywords: traumatic spinal cord injury; functional outcomes; ASIA classification; Functional Independence Measures; length of stay; American Consortium for Spinal Cord Medicine

Introduction

The Tertiary Spinal Cord Injury Rehabilitation (SCI) Centre at Tai Po Hospital in Hong Kong was established to provide intensive in-patient interdisciplinary rehabilitation for paraplegic and tetraplegic patients. As one of the three designated SCI rehabilitation centres in Hong Kong, the SCI unit in Tai Po Hospital provides rehabilitation service to SCI patients of the whole New

Territories region including Kwai Chung and Tsuen Wan region.

The tertiary SCI Centre provides a client-oriented programme for highly physically dependent clientele. We have 20 beds for intensive in-patient interdisciplinary rehabilitation, after the initial early post-trauma phase in an acute orthopaedics and traumatology unit. Paraplegic and tetraplegic patients are respectively provided a 4- to 8- month goal-directed programme.

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In order to establish a practice standard for this newly established rehabilitation centre, one of the widely accepted clinical practice guidelines, American Consortium for Spinal Cord Medicine,¹ was used.

The functional performance of patients with SCI after they have completed a course of intensive rehabilitation training has been reported in the literature.²⁻⁴ Few studies have been reported on functional outcome of SCI rehabilitation programme in a Chinese community in relation to the American Consortium for Spinal Cord Medicine. The aims of the current study were: (1) to obtain data on the characteristics of demographic and rehabilitation outcomes of the SCI programme; (2) to compare the rehabilitation outcomes from those of the American Consortium for Spinal Cord Medicine.

The comparison would highlight the characteristics of a newly established SCI rehabilitation programme in relation to an international standard. This would also help to direct further improvement of the newly established rehabilitation programme in a Chinese community.

Methods

A retrospective study of patients with SCI, who had been admitted to the SCI Centre, Tai Po Hospital, were recruited to this current study. Those who sustained other kinds of spinal diseases with nontraumatic nature, such as cervical myelopathy, tuberculosis of the spine, were excluded. Within 24 h after admission to the SCI Centre, a medical officer determined the level and completeness (grades A, B, C, and D) of the injury based on the revised version of American Spinal Injury Association (ASIA) system.^{5,6} It was stated that the classification of completeness of injury by ASIA grades A, B and C generated little differences in terms of functional status.³ Patients under these subgroups were hence categorized into one subgroup for further comparison with ASIA grade D. This classification differentiated patients into complete and incomplete injury. In terms of levels of injury, people in incomplete groups were classified into low or high level of tetraplegia or paraplegia. Since it was stated that relative small differences by neurological level of injury for individuals classified as ASIA grade D,² ASIA grade D patients were only grouped into either tetraplegic or paraplegia. Furthermore, since there were a number of patients readmitted to the SCI rehabilitation programme due to medical complications, they were simply classified as 'late effect of tetraplegia' for those acquired chronic SCI at C8 level or above, and 'late effect of paraplegia' for injury at T1 level or below. ASIA classification was no longer valid on these 'readmitters' since their injury was not newly sustained. Table 1 summarizes the definitions of each subgroup with different levels and completeness of traumatic SCI.

Apart from demographic data (such as age, gender, accommodation, premorbid functional status), initial FIM motor and cognitive scores were rated by case occupational therapists within 2 working days after

Table 1 Definitions of classification of patients with different levels and completeness of SCI

<i>Diagnostic group</i>	<i>Definition</i>
High tetraplegia	C1–C4 (ASIA ABC)
Low tetraplegia	C5–C8 (ASIA ABC)
High paraplegia	T1–T9 (ASIA ABC)
Low paraplegia	T10–T12, L, S (ASIA ABC)
Tetraplegia ASIA D	C1–C8 (ASIA D)
Paraplegia ASIA D	T1–S5 (ASIA D)
Tetraplegia-late effect	C1–C8 (late effect)
Paraplegia-late effect	T1–T12, L, S (late effect)

C = Cervical; T = Thoracic; L = Lumbar; S = Sacral

admission to the SCI centre. After a period of intensive training in the SCI centre, the scoring of the FIM motor and cognitive scores, along with other rehabilitation outcomes, such as length of stay and discharge placement, were then repeated upon discharge. At 1 and 3 months post discharge, patients were telephoned by occupational therapists to obtain the follow-up FIM motor and cognitive scores. Studies showed that there was satisfactory agreement between the clinician observational scores and subjects' self-reports on FIM motor and cognitive scores.^{7,8} The telephone version of FIM called FONE FIM was also validated locally with satisfactory psychometric properties.⁹

The functional status was measured by the Functional Independence Measure (FIM).¹⁰ The FIM is one of the most widely used instruments for functional outcome of various rehabilitation programmes. The SCI Model Systems used the FIM as a uniform functional measure to evaluate the effectiveness of a rehabilitation programme. This would also assist in establishing a standard for programmes. The FIM consists of 18 items with ordinal scale. Scoring of each item ranges from '7' representing 'complete independence (performs 100% timely, safely)' to '1' representing 'total dependence' (performs less than 25% of task). The instrument consists of two domains, namely motor (13 items) and cognitive aspects (five items), according to a Rasch analysis.^{11,12} Extensive studies have conducted on the psychometric properties of the instrument^{11,13-17} and they showed that FIM was a valid and reliable instrument for evaluating patients' functional status in rehabilitation programmes. Table 2 illustrates items of the motor and cognitive domains of FIM and the scoring system of each item.

Descriptive statistics was used for the demographics of the patients admitted with traumatic SCI, including age, gender, accommodations, and other socioeconomic parameters. Repeated measure ANOVA was used to find out significant changes of FIM scores from admission to 3 months post injury followed by tests of contrast to find the changes between specific time intervals. One-way ANOVA was used to compare the differences of the length of stay among different ASIA groups (including the readmitters).

Table 2 Motor and cognitive items and scoring system of Functional Independence Measure (FIM)

<i>Motor items</i>	<i>Cognitive items</i>
Self-care	Communication
Eating	Comprehension
Grooming	Expression
Bathing	Psychosocial Adjustment
Dressing upper body	Social interaction
Dressing lower body	Cognitive function
Toileting	Problem solving
Sphincter control	Memory
Bladder management	
Bowel management	
Mobility	
Bed/chair/wheelchair transfer	
Toilet transfer	
Tub/shower transfer	
Walking/wheelchair locomotion	
Stairs	
<i>Functional scoring for FIM scale levels</i>	
Independence:	
Seven complete independence (timely, safe)	
Six modified independence (extra time, devices)	
Modified dependence:	
Five supervision (cueing, coaxing, prompting)	
Four minimal assist (performs 75% or more of task)	
Three moderate assist (performs 50–74% of task)	
Complete dependence:	
Two maximal assist (performs 25–49% of task)	
One total assist (performs less than 25% of task)	

Results

During the year of 2002, 33 patients with various types of traumatic SCI were admitted to Tai Po Hospital situated in the northern region of Hong Kong. A total of 30 patients (90.9%) were male. The mean age was 48.36 (SD = 15.64) years. The major two reasons of traumatic SCI were road traffic accident (39.39%) and falling from height (30.30%). Seven tetraplegic and two paraplegic patients were readmitted with chronic postinjury complications, respectively, due to occurrence of pressure sores ($n=6$) or urinary tract infection ($n=1$), and management of spasticity and hand surgery ($n=1$). One of the patients was readmitted for 'pulse rehabilitation'. In all, 21 patients (63.64%) had a working role before the injury, whereas three (9.09%) required attendant care due to their dependence in activities of daily living (ADL). In terms of premorbid accommodation, 31 had been living in the community. The subjects' demographic data of with traumatic SCI is summarized in Table 3.

Table 4 illustrates all the FIM motor and cognitive scores of all patients in different levels and completeness of injury. Since the small number of patients and loss to follow-up after discharge, repeated measure ANOVA cannot be used to determine functional changes across time. Alternatively, paired t -tests were used to determine

the significant changes during the hospitalization period. Paired t -tests showed that significant FIM motor score changes were found in the tetraplegic ASIA grade D group during the hospitalization period ($t(3)=3.430$, $P<0.05$). Marginal significance in FIM motor scores was also found, on the other hand, in the paraplegic ASIA grade D group ($t(2)=4.083$, $P=0.055$). Although no significant changes were revealed statistically, increasing FIM motor scores were noted across all four other newly injured groups. Increases in the FIM motor scores were also shown in Table 4 at 1- and 3-month follow-up period even though magnitude of functional changes was not as great as the hospitalization period. However, this phenomenon was not found for the tetraplegic and paraplegic readmitters. It is worth to note that FIM motor scores of the 'late effect' groups not only did not show significant changes at admission and upon discharge, but also showed somewhat decreasing trend at follow-up period of 1- and 3-month postdischarge.

Ceiling effects of cognitive FIM scores were noted across all classified groups with the mean scores ranging from 29.50 to 35.50 at admission, and ranging from 32.14 to 35.00 (Table 4). Similarly, paired t -tests, instead of repeated measure ANOVA, were applied to compare the differences of FIM cognitive scores at admission and cognitive scores due to loss to follow-up post discharge,

Table 3 Demographics of patients with traumatic SCI

Number	n = 33
Male	30 (90.9%)
Age (SD)	48.36 (15.64)
Reason of injury	
Road traffic accident	13 (39.39%)
Falling from height	10 (30.30%)
Slipped and falling	6 (18.18%)
Premorbid status	
Independent	26 (78.78%)
Assisted	4 (12.12%)
Dependent	3 (9.09%)
Premorbid life role	
Working	21 (63.64%)
Self-maintainer	5 (15.15%)
Cared by others	7 (21.21%)
Accommodation	
Public housing estate	9 (27.27%)
Privately owned	17 (51.51%)
Rented	5 (15.15%)
Old-aged home	2 (3.03%)
Educational level	
No formal education	7 (21.21%)
Primary	15 (45.45%)
Secondary	9 (27.27%)
Tertiary	2 (6.06%)
No of admission	
One admission	20 (60.60%)
Two admissions	11 (33.30%)
Three admissions	1 (3.0%)

no significant changes were found statistically during the period of hospitalization. The FIM cognitive scores appeared to be stable at 1- and 3-month post discharge.

Figures 1–3 illustrates the comparison FIM motor scores at discharge of groups with various levels and completeness of injury of the current study in relation to those reported in the American Consortium for Spinal Cord Medicine.¹ When compared with FIM motor scores upon discharge reported in the American Consortium for Spinal Cord Medicine,¹ similar trend was found across the ASIA groups with different levels of injury in the current study. Since group classification in the Consortium was more detailed, they needed to be regrouped while being compared with the data obtained in this study. Motor FIM scores at discharge of high-level tetraplegic groups in the current study was 19.33 (SD = 13.60) which fell in the range of the corresponding mean scores reported in the American Consortium for Spinal Cord Medicine at C1–3 and C4 at ASIA Grades A and B (Figure 1) ranging from 13 to 18. In contrast, the FIM motor scores at discharge (19.86,

SD = 3.53) of the low tetraplegic groups appeared to be lower than the corresponding mean scores of C5 to C7–C8 groups (ASIA grades A and B) in the American Consortium for Spinal Cord Medicine, ranging from 23 to 50. The discrepancy of the mean FIM motor scores of this study and those reported in the American Consortium for Spinal Cord Medicine appeared to be even larger for the two paraplegic groups. The mean FIM motor scores were found to be 63.50 (SD = 4.95) and 61.00 (SD = 5.66) for high and low paraplegic groups in this study. Yet, the corresponding scores for ASIA grades A and B in the American Consortium for Spinal Cord Medicine ranged from 76 and 84. These discrepancies would be even larger when the mean FIM motor scores were compared to the corresponding scores for ASIA grade C in the American Consortium for Spinal Cord Medicine since the FIM motor scores were even higher as a whole.

As for the ASIA grade D groups, the mean FIM motor scores also appeared to be lower than those recorded in the American Consortium for Spinal Cord Medicine.¹ It was found that the means for the tetraplegia and paraplegia ASIA grade D groups were 61.50 (SD = 18.73) and 68.33 (SD = 22.94) respectively. Apart from the score for C4 group reported in the American Consortium for Spinal Cord Medicine (1999), the mean FIM motor scores ASIA grade D across all levels of injury ranged between 82 and 89.

As was mentioned in the American Consortium for Spinal Cord Medicine,¹ one of the occupational therapy interventions was to conduct home assessments. In terms of the discharge placement after the rehabilitation programme, among 31 patients with traumatic SCI who originally lived in the community, 20 (64.51%) returned to the community. Flats had been allocated to two patients under the compassionate rehousing policy after social and financial assessments had been conducted by a medical social worker. This was because their previous accommodations were found to be insufficient to provide the accessibility and space for additional use of various assistive equipment. Two patients were discharged to private old-aged home. For those patients who were not discharged back to the community, they were transferred either to other hospitals or post rehabilitation beds in order to wait for the settling down of final placement. When compared among different ASIA groups with different levels of injury, the proportion of returning home appeared to be higher in paraplegic groups even though the number of patients with paraplegic condition was small to result any representative findings.

In order to facilitate the smoothness of community reintegration, home assessments have been conducted to assess the accessibility of home and community environment. The American Consortium for Spinal Cord Medicine home assessment was indispensable part of the rehabilitation. Architectural modifications recommended by occupational therapist were followed up by patient's families. During the year of study, eight (out of 13) and three (out of six) home assessments had been

Table 4 Motor and cognitive FIM scores (at admission, discharge, 1 and 3 months after discharge) and length of stay of ASIA subgroups with different levels of injury

	<i>Tetra ABC</i>		<i>Para ABC</i>				<i>Late effect</i>	
	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>Tetra D</i>	<i>Para D</i>	<i>Tetra</i>	<i>Para</i>
<i>Motor FIM</i>								
Admission								
Mean (SD)	13.17 (0.41)	15.71 (6.34)	37.00 (22.63)	35.50 (10.61)	27.25 (23.92)	51.33 (23.12)	29.71 (19.60)	64 (12.73)
<i>n</i>	6	7	2	2	4	3	7	2
Discharge								
Mean (SD)	19.33 (13.60)	19.86 (3.53)	63.5 (4.95)	61.00 (5.66)	61.50 (18.73)*	68.33 (22.94) [†]	30.29 (21.22)	75 (2.83)
<i>n</i>	6	7	2	2	4	3	7	2
Post 1 month								
Mean (SD)	29.50 (23.33)	—	67.0	—	56.33 (19.14)	79.00 (2.83)	22.33 (7.66)	71.50 (2.12)
<i>n</i>	2	—	1	—	3	2	6	2
Post 3 month								
Mean (SD)	34.00 (24.04)	—	76.00	67.50 (9.19)	56.33 (43.29)	82 (0.00)	21.2 (7.98)	72 (1.41)
<i>n</i>	2	—	1	2	3	2	5	2
<i>Cognition FIM</i>								
Admission								
Mean (SD)	33.67 (3.27)	34.57 (1.13)	29.50 (2.12)	35.00 (0.00)	35.00 (0.00)	35.00 (0.00)	35.00 (0.00)	31 (5.66)
<i>n</i>	6	7	2	2	4	3	7	2
Discharge								
Mean (SD)	34.00 (2.45)	32.14 (7.56)	33.00 (2.83)	35.00 (0.00)	35.00 (0.00)	35 (0.00)	35.00 (0.00)	31 (5.66)
<i>n</i>	6	7	2	2	4	3	7	2
Post 1 month								
Mean (SD)	35.00 (0.00)	—	31.00 (0.00)	—	35.00 (0.00)	34.37 (0.00)	35.00 (0.00)	31.00 (5.66)
<i>n</i>	2	—	1	—	3	2	6	2
Post 1 month								
Mean (SD)	35.00 (0.00)	—	32.00 (0.00)	35.00 (0.00)	35.00 (0.00)	35.00 (0.00)	35.00 (0.00)	31.00 (5.66)
<i>n</i>	2	—	1	2	3	2	5	2
Length of stay	146.5 (75.39)	215.86 [‡] (56.13)	55.8 (43.04)	52.00 (1.41)	143.75 (69.25)	79.42 (20.07)	41.57 (40.73)	37.00 (39.71)

Paired *t*-test * $P < 0.05$; [†] $P = 0.055$. One-way ANOVA [‡] $P < 0.0005$ and *post hoc* test of Bonferroni $P < 0.05$

Figure 1 Comparison between FIM motor scores for ASIA grades A and B at discharge with scores reported in the Consortium for Spinal Cord Medicine

Figure 2 Comparison between FIM motor scores for ASIA grade C at discharge with scores reported in the Consortium for Spinal Cord Medicine

conducted for patients in the ASIA grade A, B and C tetraplegic and paraplegic groups, respectively. Besides, five (out of seven) home assessments had been provided for the patients in the ASIA grade D groups. In the total of 16 home assessments, 11 (68.75%) placements required home modifications.

Length of stay of all classified groups was also included in Table 4. One-way ANOVA showed that there were significant differences in the length of stay among different subgroups ($F(7,32) = 0.629$, $P < 0.0005$). When the data were inspected more closely, one can find that the length of stay of the lower-level tetraplegic group appeared to be much longer than low-level

paraplegic group, ASIA grade D paraplegia group and two re-admitter groups.

Discussion

This study has given a preliminary overview on rehabilitation outcomes of a SCI rehabilitation in a newly established tertiary SCI centre in the northwest region of Hong Kong. Functional status, length of stay, and change of discharge placement were chosen to be rehabilitation outcomes for evaluating the effectiveness of the SCI rehabilitation programme.

Figure 3 Comparison between FIM motor scores for ASIA grade D at discharge with scores reported in the Consortium for Spinal Cord Medicine

Despite the small sample size, the overall characteristics of the subjects in the current study are comparable to the previous findings^{18,19} with majority of the subjects is male and mean age around middle-age category. Interestingly, falling from height constituted more than 30% of the sample, which had not been addressed previously.^{18,19} These findings could be attributed to the multitude of high skyscrapers one can found in Hong Kong. People tend to work at height. Another possible reason is that jumping off from a building is one of the common suicidal means.²⁰

In terms of functional status reflected by FIM motor scores, more significant improvements in FIM motor scores found in ASIA grade D subgroups. This was consistent with previous findings in the Model Systems.² This confirmed that discharge scores were related to neurological level for people with different completeness of injury. Besides, the mean FIM motor scores increased as the level of injury descended from cervical to thoracic and lumbar region. This implied that patients in ASIA grade D required more continual assessment so that training intensity could be continually upgraded to meet their functional needs. As for the other groups, increasing trends were also noticed in the FIM motor scores for ASIA grade A, B and C subgroups at admission and upon discharge. Continual assessments should also be conducted for patients in these subgroups.

There was no significant change in all ASIA subgroups in FIM cognitive scores at admission and upon discharge. This was mainly due to the ceiling effects of the FIM cognitive scores at admission. This was not unexpected since the cognition of most patients with traumatic SCI would be intact postinjury. Among the 33 patients recruited in this study, no patients sustained head injury that could result deficits in cognitive functions. These ceiling effects were also reported in a previous study.¹ It was postulated that the cognitive domain might not be appropriate for

reflecting the rehabilitation outcome in SCI rehabilitation programmes. The main reasons they did not acquire maximum scores at the initial stage were that their verbal expression performance was hindered by the presence of tracheostomy, poor speech due to impaired pulmonary function, and postinjury psychological adjustment that in turns negatively affected their social interaction. Simple environmental control, such as bedside call bell, would be useful for patients to communicate with ward personnel. Communication board or simple pen-and-paper facilities would be invaluable for patients. The communication problem would be resolved at the later stage of rehabilitation process as tracheostomy tubes were removed or as the pulmonary function improved. It was also not surprising for patient to experience a period of psychological maladjustment after such a traumatic injury. Multi-disciplinary team approaches enhancing physical recovery and psychological adjustment should be adopted.

Another aim of this study was to compare the functional outcomes of the current study with those in the American Consortium for Spinal Cord Medicine.¹ Similar trend of FIM motor scores across different levels and completeness of injury was found in the current study when compared to those reported in the American Consortium for Spinal Cord Medicine.¹ Yet, the overall FIM motor scores appeared to be lower. As it was recommended that the scores reported in the American Consortium for Spinal Cord Medicine¹ (p 22) could be used as a reference so that appropriate actions could be taken to enhance the outcomes in the SCI patients in the current study. It was indicated that there was room for further functional improvement. More intensive training could be provided to low tetraplegia, low paraplegia, and ASIA grade D groups. Besides, there is another reason for the score discrepancy in the newly established center. The FIM scores recorded in this study were based on what a patient can perform actually instead of what they can perform potentially. During the

rehabilitation process, while the patients were encouraged to participate in various ADLs as much as they could, some of them would also prefer some human assistance from their next of kin as the family support was one of the key component. The rehabilitation team also adopted humanistic approach and respected patients' personal preference. As a result, the overall FIM scores might be lowered than those reported in the American Consortium for Spinal Cord Medicine.

The length of stay in this study appeared to be much longer than overseas studies. The length of stay reported in a previous study ranged from 50.3 for paraplegia to 93.4 for high tetraplegia (Frankel Grades A, B, or C).² In this preliminary study, the mean length of stay ranged from 52.00 (for low paraplegia group) to 215.86 (for low tetraplegia group). The longer length of stay found in this study was due to extensive time required for two crucial processes of SCI rehabilitation: home modification and equipment prescription.

The American Consortium for Spinal Cord Medicine¹ (p 12) recommended that providing 'the best opportunity for individuals with SCI to achieve the identified functional outcomes, a safe and architecturally accessible environment is necessary'. Home visit was one of the integral components of the SCI rehabilitation programme for successful community integration. There are three main types of housing required for home assessment followed by home modifications: privately owned accommodations, and public housing estates and rented accommodation settings. Nine out of 33 subjects (27.27%) in this study lived in public housing estates before injury. Flat re-allocation procedure by the Hong Kong Housing Authority was processed for two patients since the existing flats were not sufficient for accommodating and access of newly prescribed assistive equipment. By policy, the home modifications recommended by occupational therapists needed to be completed by the Hong Kong Housing Authority. Extra operational time was required for flat re-allocation and home modification process for patients who originally lived in the public housing estates. Even though the process might be shorter for those who originally lived in private flats, the process would be hindered by the insufficient financial and social support. Furthermore, in the American Consortium for Spinal Cord Medicine,¹ assistive equipment requirement was also suggested for each SCI group. Two factors would lengthen the length of stay, namely funding application and equipment ordering and delivery processes. For those patients who required financial support for the purchase of assistive equipment, funding application would be processed. As for equipment delivery process, this waiting time would be up to 1–2-months' time since customized and durable equipment recommended would only be available through overseas manufacturers or suppliers.

The length of stay is determined by health-care provision and community services. In the whole SCI rehabilitation, patients went through not only physical but also psychosocial rehabilitation, including change of home placement, assistive equipment prescription and

psychology adjustment. The settlement of these rehabilitation components required collaboration among different parties and an extended period of time was needed. Without designated transitional placements or extensive community services, patients might need to stay in the hospital before the final community re-integration.

Although no sophisticated statistical analysis could be conducted due to the small sample size and loss to follow-up, gradual improvements in functional status occurred in patients with SCI, especially high tetraplegia grade ABC group, after they were discharged from the SCI rehabilitation programme. One point worthy to note is that the 'late effect' tetraplegic group have much higher FIM scores than the corresponding rehabilitation group. This finding also suggested functional improvement after patients were discharged from the hospital. Apart from some neurological recovery, these improvements might be attributed to the fact that patients would apply the knowledge they learned in the hospital setting onto the real-life situations. Hence, longer period time of follow-up would be beneficial to give a clearer profile on patients' functional status over time.¹⁷

The traumatic injury to the spinal cord could have devastating effects on patients' life roles.^{21–25} This implied that each of the patient and their significant others needed to go through a certain period of adaptation to his/her new life roles. Besides, family or caregivers also needed to learn how to take care of their family members who have just acquired the debilitating injury. This implies that continual pragmatic and psychological support would be necessary for both patients and their caregivers. Therapists should serve as resource persons especially at the post-discharge period so that they could be integrating into the community in a more seamless, smoother manner. Patients could also be referred to community support groups or community resources for long-term community support.²⁶

The reasons of readmission to the SCI rehabilitation programme also provided insight on the long-term functional changes on patients with SCI. Studies revealed reported various complications after patients with traumatic SCI were discharged from rehabilitation programmes, including pressure sores, spasticity and urinary tract infection.^{27–30} Multidisciplinary primary and secondary education on preventing occurrence of pressure sores, urinary tract infection and spasticity would be the ways to decrease episodes of readmission. Occupational therapist could play a role in preventing occurrence of pressure sores after patients are discharged to the community by prescribing appropriate seating system with proper pressure relieving properties. Reinforcement of splintage compliance could also enhance the musculoskeletal integrity of spastic extremities along with pharmaceutical and other physical modalities. Besides, some trends of functional decline in the late effect groups were noted. Studies have postulated deterioration in functions after they were discharged to the community.^{18,28} Condition deterioration,

aging process and social support from caregivers should also be considered in this groups.

In terms of future study direction, longitudinal study with larger number of patients with traumatic SCI could be recruited to investigate the long-term effects of the SCI on functional status. Other outcome domains, including community integration, and quality of life measures recommended in the American Consortium for Spinal Cord Medicine (1999) could also be incorporated into the on-going assessment of the SCI programme. Other parameters, such as carers' stress and their quality of life might also be included.^{31–34}

Conclusions and implications

The current study has highlighted rehabilitation outcomes, namely functional status, hospital length of stay, and discharge placement, of a newly established SCI centre in the Hong Kong community. This study has also illustrated how to relate a local rehabilitation programme outcomes with an existing international standard to direct further programme development. With increasing number of patients with traumatic SCI as years to come, our data set, along with those from other local designated SCI centres, should be combined to compare with overseas standard. A collection of 'normative' data on rehabilitation outcomes might be established to represent local Hong Kong Chinese SCI population.

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