

FUNCTIONAL OUTCOMES OF PATIENTS WITH NONTRAUMATIC SPINAL CORD INJURY SECONDARY TO POTT'S DISEASE ADMITTED AT PHILIPPINE ORTHOPEDIC CENTER: A CROSS-SECTIONAL STUDY

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ABSTRACT

INTRODUCTION

Tuberculosis remain to be a major cause of ill health among developing countries and is one of the causes of non-traumatic spinal cord injury. There are far fewer studies pertaining functional outcomes of non-traumatic spinal cord injury secondary to Pott's disease. Surgery and chemotherapy remain the mainstay of treatment. Functional outcomes utilizing the Spinal Cord Independence Measure (SCIM) is not well established.

OBJECTIVES

The primary objective of this study is to determine functional outcomes of patients with spinal cord injury (SCI) secondary to Pott's disease.

METHODS

This is a descriptive analytical cross-sectional chart review of patients with SCI secondary to Pott's disease admitted at Philippine Orthopedic Center from November 2016 to December 2019. Data was obtained from patient charts and recorded to the hospital-based registry form. Descriptive statistics were utilized to present population characteristics. SCIM scores were also recorded. Mean SCIM scores were compared at admission and at discharge. Sub-group analysis was also done among SCIM domains.

RESULTS

Total of 78 patients were included in the study. More than half were males. Ten patients underwent surgery while 68 were treated conservatively. Majority of patients presented with incomplete and thoracic neurologic level of injury. The mean SCIM scores during admission, re-evaluation, and discharge are as follows: 30.0 ± 14.7 , 49.2 ± 20.5 , and 64.3 ± 20.1 , respectively. Statistical analysis showed significant improvement in SCIM score upon discharge compared to admission encompassing three domains: self-care, respiration and sphincter, and mobility.

CONCLUSION

Pott's disease is still one of the common etiologies of non-traumatic spinal cord injury. Surgery is still indicated when presence of neurological complications arises but must be done as soon as neurological insult occurs. Anti-TB chemotherapy is the cornerstone of management. Early detection and initiation of treatment should be done to maximize functional outcomes.

KEYWORDS

Non-traumatic Spinal cord injury, Pott's disease, Spinal Cord Independent Measure

INTRODUCTION

Tuberculosis (TB) remains a major cause of ill health and is one of the top causes of death worldwide and is the sixth leading cause of morbidity and mortality in the Philippines. (1,2) The World Health Organization (WHO) categorized the country having a high TB burden nation and constitute 8% of the total global incidence in 2018. (1)

Skeletal tuberculosis refers to the TB involvement of the joints or bones and account to 10-35% of cases of extrapulmonary TB. (3) TB spondylitis or Pott's disease causes chronic granulomatous inflammation which may directly compress the spinal cord or lead to destruction of the vertebral bodies causing neurologic deficits. (4) This is classified under nontraumatic spinal cord injury (NTSCI). The therapeutic management of Pott's disease is multidisciplinary, based on a specific medical treatment, on-demand surgery and a tailored rehabilitation protocol. (5)

NTSCI have far more different etiologies such as vertebral spondylosis (spinal stenosis), tumorous compression, vascular ischemia, infection, and congenital anomalies compared to traumatic SCI. (6,7) Global mapping of nontraumatic SCI incidence, prevalence, etiology, survival and level of injury which showed the percentage of NTSCI secondary to Pott's disease ranges from 15-25% in Southeast and South Asian region. Developing countries tended to have higher proportions of infections, particularly tuberculosis and HIV. (8) Developed countries, in comparison, tended to have a higher proportion of cases with degenerative conditions and tumors causing nontraumatic SCI. (7) This trend is consistent with incidence and prevalence rates of tuberculosis worldwide.

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Recent literature review reported poorer quality of epidemiological data on NTSCI than there are for traumatic SCI. Nontraumatic SCI patients managed in non-specialist units are less likely to be reported. Researchers propose the following standards to be followed to improve quality of research data in future studies of the incidence, prevalence and survival of nontraumatic SCI, Pott's disease included. (7,8) These includes 1) clear description of their study and distinguish chronic from acute cases 2) population-based study designs with incidence and prevalence 3) use of international standards for reporting results 4) use of international NTSCI data sets in describing etiology 5) survival studies of NTSCI patients 6) annual reporting of national statistics 7) explore options for centralized repository. (7)

Functional outcomes following discharge of patient's with NTSCI secondary to Pott's disease vary. The keystone of the treatment of spinal TB is anti-TB chemotherapy, which usually lasts from 6 to 12 months. Surgery offers the following benefits 1) better quality of instrumented fusion allows the patient to have early mobilization, 2) early surgery allows early drainage of the infected material and a better penetration and efficacy of drugs, 3) higher experience surgeons involved provides lower risk of significant benefit from routine addition of surgery to the chemotherapy. (9) Chandra, S. et. al. demonstrated improvement in ASIA scores in 58% of their subjects with medical treatment alone. (10) Akkerman, O. et al. found out better functional outcomes in terms of SCIM-III scores in their patients with Pott's disease compared to those with traumatic SCI. (9)

There are far fewer studies on nontraumatic SCI incidence including Pott's disease. (8) The majority of studies reporting on the demographic, injury patterns, and functional outcomes of individuals with SCI have focused on traumatic SCI, rather than nontraumatic etiology. (6) Furthermore, nontraumatic SCI have far more different etiologies compared with traumatic SCI. (8) Investigating each subset of condition such as Pott's disease will provide more accurate background information and prognosis. Furthermore, in the author's knowledge, there have been no locally published articles which entails incidence, epidemiology, and functional outcomes utilizing the Spinal Cord Independence Measure (SCIM) tool in a rehabilitation setting of patients with nontraumatic SCI secondary to Pott's disease. The author also aims to follow the recommendations suggested by previous authors in the documentation and data collection of nontraumatic SCI cases. Based on the available evidence, the author aims to establish treatment outcomes in our institution to provide patient's with sound treatment options and best possible plan of management.

MATERIALS AND METHODS

STUDY DESIGN

The study is an analytical cross-sectional study of nontraumatic spinal cord injury secondary to Pott's disease patients comparing functional outcomes during admission and discharge.

SELECTION AND DESCRIPTION OF PARTICIPANTS

The study population consisted of adult (18 years old and above) patients with nontraumatic SCI secondary to Pott's disease admitted and discharged at the Philippine Orthopedic Center in a 39-month period from November 2016 to December 2019. The diagnosis of Pott's disease or TB spondylitis was made by the hospital-based TB Directly Observed Treatment, Short Course (DOTS) under the Department of Health. SCI diagnosis was made by the rehabilitation medicine doctor in charge of the patient during admission which are based on the International Standards for Neurologic Classification of Spinal cord Injury (ISNCSCI). (11) Newly diagnosed cases during admission were included in the study. Re-admitted known cases were not included. The study population during the admission are managed by both an orthopedic and rehabilitation medicine physician. They have undergone routine physical/occupational therapy and was started on standard anti-TB chemotherapy regimen. The population may have also undergone spinal surgery (decompression, debridement and spinal stabilization with/without instrumentation) or managed conservatively with anti-TB medications and subjected to use of a spinal orthosis alone. Traumatic and other nontraumatic causes of SCI such as malignancy, primary tumors of the spinal cord, inflammatory, degenerative and autoimmune etiologies are excluded in the study population. Patients with prior or concomitant neurological diagnoses which may impair sensory and motor functions are excluded as well.

TECHNICAL INFORMATION

Data was retrospectively obtained from patient's hospital charts during the time of admission. Demographic information included age and gender which was recorded on the hospital's spinal cord injury registry set (see appendix, Figure 1). Additional clinical information during admission and discharge include level of injury, completeness of injury as designated by the ASIA impairment Scale and mean length of hospital stay.

The functional outcome was determined using the Spinal Cord Independence Measure (Version III, 2002-2011) tool (see appendix, figure 2). The SCIM is a validated outcome measure developed at the Lowenstein

Rehabilitation Hospital that assesses three domains; self-care, respiration and sphincter management, and mobility for persons with spinal cord injury.¹¹ SCIM is a 100 scale with a higher score denoting increasing level of independence. The functional outcomes were collected retrospectively after reviewing the patient charts.

STATISTICS METHOD

Descriptive statistics for demographic variables (age, gender), level and completeness of injury include proportions, means and standard deviation (for quantitative variables) was done. Mean SCIM scores are obtained during admission, re-evaluation and discharge of patients. Difference in mean scores of SCIM score upon admission vs re-evaluation vs discharge were statistically analyzed using ANOVA with repeated measures. Subgroup comparison was initially planned to compare surgical versus non-surgical treatment groups. Other variables such as age and length of hospital stay and its association with SCIM scores were also analyzed. However, noted number of patients who underwent surgery were inadequate to attain significant results.

INSTITUTIONAL REVIEW BOARD APPROVAL

The study has been approved by the hospital-based ethics review board.

RESULTS

PATIENT CHARACTERISTICS

A total of 78 patients were included in the study after consideration of the inclusion and exclusion criteria. Their mean age was 38.6 ± 15.9 years old. More than half were male ($n=49$, 62.8%). Most of the patients presented with paraplegia during admission ($n=73$, 93.6%) and the mean hospital length of stay was 97.9 ± 52.2 days. Out of the 78 patients admitted, 10 patients underwent spinal surgery which involves spinal decompression and with/without stabilization. (See Table 1)

LEVEL OF INJURY AND AIS CLASSIFICATION

Majority of patients had thoracic neurologic level of injury both at time of admission and at time of discharge. (See table 2) Majority of admitted cases fall under AIS B classification ($n=27$, 34.6%) while at discharge, most fall under AIS D (41.0%) classification. (see table 2) During the course of admission, two patients converted from AIS A to AIS C, three from AIS A to AIS C, four from AIS B to AIS C, seven from AIS B to AIS D and four from AIS C to AIS D. One patient was noted to have full recovery. The surgical group comprised of 10 patients. (see table 3) Five patients underwent posterior decompression with spinal fusion. Three patients underwent posterior decompression with spinal fusion and corpectomy/hemicorpectomy. One patient underwent laminectomy without stabilization. One patient underwent vertebroplasty.

FUNCTIONAL OUTCOMES

The mean SCIM scores during admission, re-evaluation, and discharge are as follows: 30.0 ± 14.7 , 49.2 ± 20.5 , and 64.3 ± 20.1 , respectively. The SCIM scores were noted to be higher at time of discharge compared to time of admission ($F\text{-stat}=66.5$, $p<0.001$). (see Table 4)

SCIM scores for each domain namely self-care, respiratory and sphincter, and mobility were also noted to be higher at time of discharge compared to time of admission with significant differences (self-care: $F\text{-stat}=34.5$, $p<0.001$; respiratory and sphincter: $F\text{-stat}=46.8$, $p<0.001$; Mobility: $F\text{-stat}=52.5$, $p<0.001$ respectively). (see Table 5)

OTHER VARIABLES

The other independent variables that may affect SCIM scores were also analyzed. Correlation analysis of age vs SCIM score on admission and age vs SCIM score on discharge were done. Results of analysis showed no significant correlation between age vs SCIM score on admission ($r= -0.212654$) and SCIM score on discharge ($r=-0.27397$) respectively. (see Table 6-8)

Correlation analysis of length of hospital stay versus SCIM score on discharge. There was no noted significant correlation between the two variables ($r=0.104324$). (See Table 9)

DISCUSSION

This study confirms that non-traumatic SCI secondary to Pott's disease remains to be common in developing countries such as the Philippines. (12) In our institution alone, a total of 39% of SCI cases documented discharges in 2019 were secondary to Pott's disease. Pott's disease more commonly affects the thoracic spine which is also demonstrated in this study wherein 61% of the study population had thoracic involvement. (12) The mean age of our population is 38.6 years and more than half are males. This is similar to the study done by Djientcheu et al wherein the mean age is 38.9 years with a male to female ratio of 1.15. (13) The mean length of stay is 97.9 days.

Management of patients with non-traumatic SCI secondary to Pott's disease include initiation of anti-TB medication and spinal decompression surgery. The standard regimen for extrapulmonary TB with bone involvement includes combination of Isoniazid, Rifampicin, Ethambutol, and Pyrazinamide taken for two months (intensive phase) followed by Isoniazid and Rifampicin taken for 10 months (continuous phase). (14) Gautam et. al. emphasized that surgery is necessary in advanced cases with extensive bone destruction, abscess formation and neurologic compromise. (15) It also offers the advantage of being able to obtain tissue samples for histologic diagnosis. (15,16) All patients in the study were indicated for surgery. However, only ten out of 78 cases included in the study received surgery with mean time of admission to surgery of 66.4 days. The low proportion and delay in timing of patients undergoing surgery is mainly due to financial constraints in acquiring implants needed for surgery as most patients from our institution are under the low-income bracket.

It was observed in this study that SCIM scores of the study population improved significantly from admission to re-evaluation and re-evaluation to discharge (p value <0.001). These improvements are noted across all three domains; self-care, respiratory and sphincter, mobility. A possible reason for this noted improvement is that SCIM scores upon admission are noted to be scored low because majority of patients are placed on strict bed rest to avoid further bony destruction and neurologic deterioration but with limited function. Group comparison of surgical vs non-surgical group could not be made due to small sample size of the surgical group. Nonetheless, those who underwent surgery demonstrated higher SCIM scores upon discharge compared to SCIM scores upon their admission.

However, it is worth noting that only one patient in this group had improvement in AIS category from C to D. Once severe neurological insult has occurred, the timing of surgery will help determine outcomes. Some authors recommend that in the presence of severe paraplegia presenting as inability to ambulate with or without bladder involvement, surgical decompression must be done within 48 hours (15) Surgery is best done early in the disease process before scarring and fibrosis develop. (15) Akkerman et. al. in their study noted improvement of ASIA impairment scale and SCIM scores following surgery 26.5 months after discharge. (9) Bouaziz et. al. also demonstrated regaining walking ability in their patients who in 5 out of their 9 with Pott's disease who underwent surgery. (5)

Our study is limited to observations done during hospital admission. Hence, longer follow-up may be needed to observe similar results. Chemotherapy utilizing anti-Koch's medication is still the cornerstone of management of Pott's disease. This study, together with the previous studies, emphasized the need for proper rehabilitation after treatment of nontraumatic spinal cord injury, to achieve optimal functional outcome. The adequate supply of assistive devices/orthoses adds positively to these patients' transportation and mobility independence.

In addition, rehabilitation is essential for a positive functional result and the prevention/management of medical complications after nontraumatic spinal cord injury. Zaoui et al. examined the rehabilitation management of patients with Pott's disease exacerbated by neurological problems and evaluated their recovery of autonomy in daily living activities and walking. All patients were observed to have developed a neurogenic bladder. After treatment with anti-tuberculosis chemotherapy, 6 cases underwent decompression surgery, while 2 female patients exhibited spinal postural impairments necessitating surgical revision with osteosynthesis during treatment. All patients underwent rehabilitation therapy, and after mean duration of hospitalisation in the Rehabilitation department of 47 days with sessions of physiotherapy, 3 patients persisted with total paraplegia, wheel-chair independence, and vesical and sphincter incontinence. Six patients had regained the capacity to walk, including 3 who did so with the assistance of a walking frame. Three patients were independent in their everyday lives and had returned to work.

Tuli et. al. provided practical classification of neural complications and prognostic factors. (16) Those with incomplete cord involvement, presenting at early stage of the disease with insidious and slow disease progression has been said to have better prognosis. (16) Out of the total of 68 patients treated conservatively, only two patients converted from AIS A to AIS C, three from AIS A to AIS D, four from AIS B to AIS C, seven from AIS B to AIS D and three from AIS C to AIS D.

Other factors that may affect our outcome such as age and length of stay were analyzed. In our study, there was no noted correlation with age and length of hospital stay as to SCIM scores on discharge. This finding was also noted in a study by Equebal and Kumar which showed no association of age as to SCIM scores as well as ASIA classification. (17) The main determinant of SCIM score would still be dependent on the patient's neurologic level and completeness of injury. In the analysis by the Milicevic et al. (2014), better functional improvement was reported in patients with non-traumatic spinal cord injuries, reduced neurological levels of the lesion (odds ratio = 6.07), and those treated surgically; nonetheless, the degree of the spinal cord lesion was the most critical factor influencing outcome.

CONCLUSION

Overall, significant improvement of SCIM scores are noted at discharge for patients admitted at our institution. The author suggests long-term out-patient follow-up to further document the clinical course of the disease. Additional information in the institution SCI data sets may include date of onset of initial neurologic symptom date of initiation of anti- TB medication, presence of comorbidities, recording of kyphotic angle on imaging and judicious recording of data via data sets and the SCIM tool. Collaboration between orthopedic and rehabilitation specialist is highly recommended to maximize treatment regimen. Cohort studies with large sample size are recommended to determine predictors of treatment success in nontraumatic spinal cord injury.

Pott's disease remains a common disease condition in our region with devastating neurologic complications. Anti-TB mediations remain a mainstay of treatment. Early detection is essential to be able to initiate chemotherapy and avoid neurologic complications. Surgery provides a vital role in improving neurologic recovery but must be done as soon as there is observed findings of neurological decline to maximize outcomes.

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TABLES AND FIGURES

Table 1. Population profile of admitted patients with non-traumatic SCI secondary to Pott's disease

Total number of Patients	N=78
Age	38.6 ± 15.9
Sex	
Male	49 (62.8%)
Female	29 (37.2%)
Presentation	
Paraplegic	73 (93.6%)
Quadriplegic	5 (6.4%)
Management	
Conservative	68 (87.1%)
Surgical	10 (12.8%)
Mean number of days from admission to surgery	66.4 days (1-155)
Mean hospital length of stay	97.9 ± 52.2

Table 2. Neurologic level of injury and AIS classification proportion of the population upon admission and discharge.

ASIA Impairment Scale classification	
Admission	Discharge
A: 12 (15.4%)	A: 8 (10.3%)
B: 27 (34.6%)	B: 16 (20.5%)
C: 19 (24.4%)	C: 21 (26.9%)
D: 20 (25.6%)	D: 32 (41.0%)
	E: 1 (1.3%)
Neurologic Level of Injury	
Admission	Discharge
Cervical: 8 (10.2%)	Cervical: 7 (8.9%)
Thoracic: 61 (78.2%)	Thoracic: 59 (75.6%)
Lumbosacral: 9 (11.5%)	Lumbosacral: 11 (14.1%)

Table 3. Data profile of surgical group with mean SCIM scores on admission, re-evaluation and discharge.

Surgical group (n=10)		
Procedures		
Posterior decompression with spinal fusion (5)		
Posterior decompression with spinal fusion and corpectomy/hemicorpectomy (3)		
Laminectomy (1)		
Vertebrotomy (1)		
Mean Hospital Length of Stay: 104.4 days		
Mean number of days before surgery: 66.4		
Mean SCIM scores		
Admission: 37.2	Re-evaluation: 53.6	Discharge: 75.5
Neurologic Level of Injury		
Admission	Discharge	
Cervical: 0	Cervical: 0	
Thoracic: 9	Thoracic: 9	
Lumbosacral: 1	Lumbosacral: 1	

Table 4. Statistical analysis of total SCIM scores during admission, re-evaluation, and discharge using repeated measures analysis of variance (ANOVA)

Groups	N	Mean	Standard Deviation	Standard Error
Admission	78	29.97	14.67	1.66
Re-evaluation	78	49.20	20.48	2.31
Discharge	78	64.25	20.11	2.27
ANOVA (Between groups)				
Sum of Squares: 460602.04				
Mean Square: 23031.02				
F-Stat: 66.45				
P-value: 0.000				

Table 5. Repeated measures ANOVA of self-care subscores.

Groups	N	Mean	Standard Deviation	Standard Error
Admission	78	8.35	14.86	0.55
Re-evaluation	78	10.88	4.89	0.55
Discharge	78	14.64	4.54	0.51

ANOVA (Between groups)

Sum of Squares: 1564.64

Mean Square: 782.32

F-Stat: 34.45

P-value: 0.000

Table 6. Repeated measures ANOVA of respiration and sphincter subscores.

Groups	N	Mean	Standard Deviation	Standard Error
Admission	78	16.19	7.66	0.87
Re-evaluation	78	24.05	9.62	1.09
Discharge	78	29.33	8.20	0.93

ANOVA (Between groups)

Sum of Squares: 6821.08

Mean Square: 3410.54

F-Stat: 46.84

P-value: 0.000

Table 7. Repeated measures ANOVA of Mobility subscores.

Groups	N	Mean	Standard Deviation	Standard Error
Admission	78	5.44	6.51	0.74
Re-evaluation	78	14.27	9.48	1.07
Discharge	78	20.28	10.78	1.22

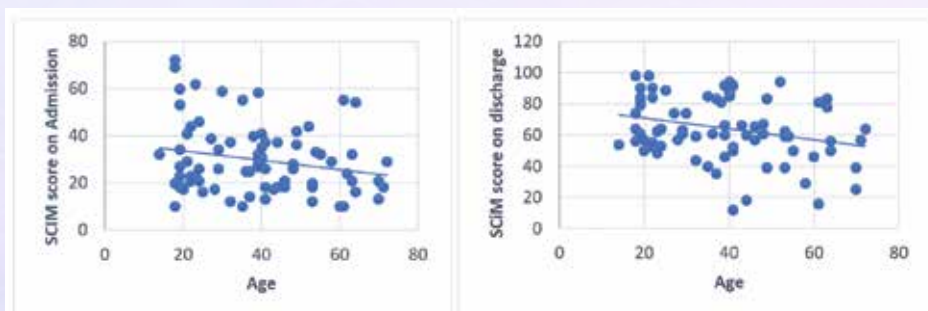
ANOVA (Between groups)

Sum of Squares: 8699.39

Mean Square: 4349.69

F-Stat: 52.52

P-value: 0.000

Table 8. Table on the left shows the scatter plot of age vs SCIM score on admission. Data plotted on the graph shows no identifiable trend. The table on the right shows scatter plot of age vs SCIM score on discharge and shows no identifiable trend as well.**Table 9.** Scatter plot of length of hospital day vs SCIM score on discharge. Data plots show no identifiable trend.