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Epidemiology, Clinical Features and Consequences of Spinal Cord Injury in Children

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ABSTRACT

Objective: To describe epidemiology, clinical features and clinical consequences of Spinal Cord Injury (SCI) in children.

Study Design: Case series.

Place and Duration of Study: Paraplegic Centre, Hayatabad, Peshawar, from July 2011 to March 2017.

Methodology: SCI patients having age up to 15 years, admitted to Paraplegic Centre, were inducted in 2017. Exclusion criteria was foreign-national SCI patients, and/or SCI patients re-admitted to paraplegic centre. List of all SCI patients admitted to the centre was retrieved and 102 patients were identified. Data of these patients was evaluated for demographic information, physiological intactness (complete SCI/incomplete SCI), neurological level and complications.

Results: A total of 102 patients (66 males and 36 females) with mean age 10.9 ±3.7 years were included in this study. Firearm injury was the most common cause (n=39, 38.2%) of SCI in these patients, followed by fall from height (n=23, 22.5%), road traffic accidents (n=14, 13.7%), and weight fallen over (n=14, 13.7%). Bomb blast injury (n=7, 6.9%), diving accident (n=3, 2.9%), and sports related injuries (n=2, 2.0%). Majority of the patients (n=82, 80.4%) had complete SCI (ASIA A); the commonest SCI level was thoracic region (n=59, 57.8%) and the least reported region was (n=14, 13.7%) cervical. Out of the total, 50 (49.0%) patients had pressure ulcer in which 15 (30.0%) patients were having grade IV pressure ulcer, 9 (18.0%), 15 (30.0%) and 11 (22.0%) patients were had grade I, grade II and grade III pressure ulcer, respectively.

Conclusion: Majority of causes of SCI in children are similar to those reported in adult population. However, the commonest causes of SCI in children in Pakistan were firearm injury and bomb blast, which are rarely reported in other countries. Like adult population, these children with SCI are prone to developing pressure ulcer.

Key Words: Children. Epidemiology. Pakistan. Paraplegic. Spinal cord injury.

INTRODUCTION

Spinal Cord Injury (SCI) in children is uncommon yet associated with developing extreme physical and psychological problems to the children and their family members.¹ Assessment and care of children with SCI is difficult as most of the time children are unable to precisely localise their symptoms.² Some reports suggest that neurological recovery in children is better compared to adults.^{1,3} Although, children with SCI have been reported with low community participation, nevertheless they live a good quality of life compared to adult population who sustained SCI.² It has been reported that SCI in children ranged from 1 to 10%.^{4,5} It is noteworthy that anatomical and biomechanical differences exist between the spine of children and adults; and therefore, injury to child spine results in distinctive injury pattern.^{4,6} Moreover, medical, physical, psychological and social needs of children with SCI are

different compared to that of adult population.² In comparison with normal children, children with SCI have different developmental needs due to the challenges faced by these children.⁷ The latter challenges and their consequences on the development of children with SCI have been reported in the literature.^{1,2,8}

Pediatric injuries are more common in low and middle income countries compared to high income countries.^{9,10} However, data about the children with SCI in these countries are often not available. Pakistan is one such country where data regarding pediatric injuries is scarce. A limited number of published studies about the pediatric injuries in the country can be found in the literature.¹⁰⁻¹² To the authors' knowledge, there is not a single study conducted in Pakistan which reports SCI in pediatric population. Although traumatic SCI is common in young age, yet previously conducted research studies in Pakistan have not focused on this different young age group.¹³ Epidemiological characteristics and mechanism of injuries in children with SCI were different from those reported in adult population.¹ The latter fact suggests a dire need to conduct this study to report the epidemiology, clinical features and complications of SCI children in Pakistan. Presentation of epidemiological data, clinical features, associated injuries and complications of children with SCI in Pakistan will not only help in understanding the distinctive features of

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these SCI sufferers, but would provide guidance to prevention strategies for children.

METHODOLOGY

This study was conducted at Paraplegic Centre Peshawar. Paraplegic Centre Peshawar (PCP), is an autonomous body working under Department of Health, Govt. of Khyber Pakhtunkhwa, providing free-of-cost, comprehensive physical rehabilitation services to patients. SCI patients aged less than 15 years admitted to PCP from July 2011 to March 2017 were included in this retrospective study. Exclusion criteria was foreign-national SCI patients, and/or SCI patients re-admitted to paraplegic centre. Patients were categorised into three age groups in order to identify differences in demographics and clinical characteristics. These groups were 0-5 years, 6-10 years, and 11-15 years. Data of these 102 patients was accessed and information regarding demographics, physiological intactness of SCI (complete SCI/incomplete SCI), neurological level, and complications were recorded. Data was analysed using SPSS version 20. Descriptive statistics were used for analysis.

RESULTS

A total of 102 SCI patients having age 0-15 years were admitted to Paraplegic Centre, Peshawar from July 2011 to March 2017. The mean age of the participants was 10.9 ± 3.7 years. A total of 66 (64.7%) patients were boys while the rest 36 (35.3%) were girls. There were 11 children in age group 0-5 years, out of whom 5 (45.5%) were boys and 6 (54.5%) were girls. There were 32 children in age group 6-15 years, out of whom 23 (71.9%) were boys and 9 (28.1%) were girls; while there were 59 children in age group 11-15 years out of whom 38 (64.4%) were boys and 21 (35.6%) were girls. Only one (1.0%) girl, aged 15 years, was married while all others (n=101, 99.0%) were singles. Most of the patients 82 (80.4%) were from Khyber Pakhtunkhwa, while the remaining 20 (19%) were from either other provinces of the country or the tribal areas of Pakistan. By profession, 30 (29.4%) patients were students at primary level, 17 (16.7%) patients were students at middle level, 2 (2.0%) patients were students at matric level, while remaining 53 (52.0%) patients were uneducated or were below the schooling age.

Firearm injury (FI) was reported to be the most common cause (38.2%, n=39) of SCI in children followed by fall from height (FFH, n=23, 22.5%), road traffic accidents (RTA, 13.7%, n=14) and weight fallen over (13.7%, n=14). Other causes of SCI are given in Table I with age group-wise distribution.

Majority of the patients 82 (80.4%) had complete SCI (ASIA A) while the remaining 20 (19.6%) patients had incomplete SCI (ASIA B, C, D and E). More than half of the patients (57.8%, n=59) had complete thoracic paraplegia (Table II).

Table I: Table showing causes of SCI in different age groups.

Cause of injury	0-5 years	6-10 years	11-15 years	Total
FAI	4 (10.3%)	18 (46.2%)	17 (43.6%)	39
FFH	2 (8.7%)	4 (17.4%)	17 (73.9%)	23
RTA	2 (14.3%)	6 (42.9%)	6 (42.9%)	14
Weight fallen over	3 (21.4%)	2 (14.3%)	9 (64.3%)	14
BBI	0 (0.0%)	1 (14.3%)	6 (85.7%)	7
Diving accident	0 (0.0%)	0 (0.0%)	3 (100.0%)	3
Sports injuries	0 (0.0%)	1 (50.0%)	1 (50.0%)	2

FAI=Fire-arm injury; FFH=Fall from height; RTA=Road traffic accident; BBI=Bomb blast injury.

Table II: Table showing different levels of SCI in children with different age groups.

Cause of injury	0-5 years	6-10 years	11-15 years	Total
Complete cervical tetraplegia	0 (0.0%)	1 (12.5%)	7 (87.5%)	8
Incomplete cervical tetraplegia	0 (0.0%)	1 (16.7%)	5 (83.3%)	6
Complete thoracic paraplegia	7 (11.9%)	23 (39.0%)	29 (49.1%)	59
Incomplete thoracic paraplegia	0 (0.0%)	0 (0.0%)	0 (0.0%)	0
Complete lumbar paraplegia	4 (26.7%)	5 (33.3%)	6 (40.0%)	15
Incomplete lumbar paraplegia	0 (0.0%)	12 (85.7%)	2 (14.3%)	14

Out of these 102 patients, 50 (49.0%) patients were having pressure ulcer (PU) at the time of admission to the rehabilitation centre, while the skins of the remaining 52 (51.0%) patients were intact. Out of the former 50 patients, PU in 23 (46.0%) patients was located at sacrum-coccyx region, followed by trochanter (22.0%, n=11), gluteal (20%, n=10), ischial (10%, n=5) and elbow (2%, n=1) regions. In these patients with PU, 15 (30.0%) patients had grade IV PU while 9 (18.0%), 15 (30.0%), and 11 (22.0%) patients had grade I, II and III PU, respectively.

DISCUSSION

During the last decade, the number of studies conducted in Pakistan regarding traumatic SCI has increased suggesting the significance of the problem.¹³⁻¹⁵ However, limited data regarding children with SCI in the country has been reported in the literature. Children with SCI have distinct epidemiological features compared to those adults who sustained SCI,¹⁶ that is one of the reasons that this study was conducted to determine epidemiology, clinical characteristics, and complications of children with SCI. This was the first study conducted in Pakistan, which reported information regarding children with SCI. SCI patients having age between 0-15 years were included in the current study. There was a risk that inclusion of SCI patients aged 16 and above would inflate the results, therefore, SCI patients aged 16 and above were excluded from the study. Similar approach was adopted in previous studies conducted on children with SCI in other countries and SCI patients having age above 16 years were not included.^{2,17}

In this study, we reported the outcome of epidemiological features of more than 100 children with SCI who were admitted to rehabilitation centre during the last six years. The number of boys with SCI was high in all age groups compared to their counterparts (girls) except age group 0-5 years. This is in accordance to other studies carried out on SCI in adult population in the country.¹³⁻¹⁵ The number of boys who sustained SCI in this study was less (45.5%) compared to girls (54.5%) in the age group 0-5 years. American spinal injury association (ASIA) reported that in all age groups of SCI patients, males dominated in numbers compared to females, except in the age group 0-5, in which females outnumbered males.⁵

Although early age marriages are common in Pakistan, especially in Pashtun society,¹⁸ yet only one girl aged 15 years was married and the rest of the boys and girls were unmarried.

In comparison to other studies conducted in Pakistan regarding SCI where FFH was reported the most common cause of SCI, followed by RTA and FAI,¹³⁻¹⁵ results of the current study showed that the most common cause of traumatic SCI among children (38.2%) was FAI. These results are contrary to the results of previous studies carried out on SCI in children in other countries where RTA, FFH and sport injuries remained the main contributors to SCI in children.^{2,5} Though some previous studies reported that gunshot was a cause of SCI for considerable percentage of children, yet literature search revealed that current study was the first which reported that FAI was the major cause of SCI in children. This can be explained by the fact that majority of patients in the current study were from Khyber Pakhtunkhwa, where guns are kept and used as a cultural sign. Ariel firing is common in this region, practised at marriage ceremony celebrations, festivals and other occasions of happiness.

Besides FAI, results of the current study showed FFH and RTA as the major causes of SCI in children. These results are in accordance with the previous studies conducted in Pakistan on adult SCI patients.^{13-15,19,20} FFH has remained the commonest cause of SCI in both children and adults who belong to hilly areas of Khyber Pakhtunkhwa province. Kite-flying at roof of houses is quite common in both children and adults in some parts of the province and that might be one of the reasons that FFH remained the commonest cause of SCI in children. Apart from FFH, another commonly cited cause of SCI in children has been RTA.^{2,5,16} As children have not reached complete developmental, behavioural, and physical abilities, they have difficulties in evaluating speed and distances in complex situations making them vulnerable to RTA.² In this study, a unique cause like BBI was reported to be one of the causes of SCI in the included children. Very few studies throughout the world reported BBI as a cause of SCI in general population, and limited data might be seen related to children of the age group included in this study.²¹⁻²³ Pakistan is

continuously struggling against the war on terrorism and extremism, and the number of bomb blast attacks in the country has increased manifolds in the last two decades. Therefore, the number of casualties due to these attacks has increased. Apart from injuries to innocent adults in these attacks, a large number of injuries to children have been reported. This might be one of the reasons that BBI is one of the contributing factors to SCI in children in the country.

Majority of the patients (80.4%) in current study were having complete SCI while a small (19.6%) proportion of the patients were having incomplete SCI. ASIA reported that children with SCIs are more liable to complete injuries than incomplete SCI.⁵ In accordance with the results of previous studies, current study reported that majority of patients (57.8%) were having thoracic paraplegia,¹³⁻¹⁵ and cervical injuries were the least encountered injury in these patients. Brown *et al.* also reported that cervical spine injuries in children are rarely found, and children with SCI have injuries to other parts of their spines. Moreover, injuries to cervical region of specific age group, less than five years, may not be found in the literature.^{2,16} Analysis of data of this study showed similar results and no one in the included population was found having SCI in age group 0-5 during the last 5 years. This might be explained as children in the latter age group at a high risk of mortality rates and most of the children in the age group might have not survived.

Results of the current study revealed that almost half of the children with SCI were having PU at the initial presentation to the rehabilitation centre. Development of PU is common both in children and adults having SCI. Previous studies conducted in Pakistan reported high prevalence of PU in adult SCI patients.^{14,15,19,20,24} However, children have been reported more vulnerable to develop PU due to their thinner and resilient skin.⁵ Similarly, refusal to take care for themselves is another common issue in children with SCI.^{2,5} In addition, children with SCI are more prone to complications because of their dependency on other family members.⁷ It is, therefore, necessary to provide continuous counselling to children to prevent complications in children with SCI.² Majority of children with SCI in current study had PU at sacrum-coccyx region, followed by trochanter, gluteal, ischial and elbow regions. Similar pattern was also reported by other studies conducted in Pakistan, which reported PU in adult SCI patients.^{14,15,19}

Currently, there are no specific guidelines available in Pakistan for the prevention of SCI in children. Similarly, no specific documented protocols for the rehabilitation and community re-integration of these children are followed in our country. Though, in recent years, SCI rehabilitation centers in Pakistan have focused on evidence-based practice for the rehabilitation of adult SCI patients, yet children with SCI received less attention. Due to physical and psychosocial development, SCI in

children presents distinctive features which need to be addressed.¹³⁻¹⁵ SCI is lifelong disability and, therefore, effective rehabilitation programme is necessary for children who are suffering from SCI in the country. One of the primary steps for this might be developing proper guidelines for the rehabilitation of children with SCI in the country. This might help these children to combat the adverse environment where they are living. For this purpose, all centres working on rehabilitation of these children may pay special attention to this issue and may develop rehabilitation guidelines that enable these children to live an independent or nearly-independent life.

Despite the fact that current study is the first study, which reported information regarding children with SCI in Pakistan, it was conducted in a rehabilitation centre, thus has several limitations. First of all, the current study included only those children who were referred and admitted to rehabilitation centre. Secondly, a number of children with SCI may not survive after SCI, especially those with cervical injuries. So their characteristics are out of the scope of current study. Thirdly, information provided in the current study was limited to condition of children with SCI at the time of initial presentation at the rehabilitation centre. These patients may improve or worsen with time; but as their follow up was not reported, so no comments can be made regarding it.

CONCLUSION

Majority of causes of SCI in children are similar to those reported in adult population. However, the commonest cause of SCI in children in Pakistan are firearm injury which has not been reported in other countries. Moreover, a large number of these children sustained SCI due to bomb blasts, which is rarely reported in other countries. Like adult population, children with SCI are prone to developing pressure ulcer.

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