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AN INTERESTING CASE OF SPINAL CORD INJURY WITH BROWN SEQUARD PLUS FEATURES: A SILVER LINING IN THE CLOUD JUSTIFYING THE EFFORT TO RECOGNIZE THE RARE SYNDROME

Medical Science

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ABSTRACT

BACK-GROUND : The incidence of traumatic spinal cord injury was estimated at 15 new cases per million per year in India with Brown Sequard Syndrome comprising of 2- 4% of the injuries. [1,2] The prognosis is usually favourable.
CASE CHARECTERSTICS: An adolescent male with history of fall from tree leading to loss of consciousness immediately and loss of movement and sensation in all the 4 limbs, reported to a Primary Health Centre. After giving IV Fluid and initial resuscitation, he gained his consciousness but was unable to move his limbs. 2 days post injury he was referred to AIIMS RAIPUR with motor and sensory deficit in all his four limbs. Clinically he appeared to be a case of BROWN SEQUARD PLUS SYNDROME or spinal hemiplegia (ASIA C) which has in general a favourable prognosis of ambulation and independence in ADL. [3]
INTERVENTION- Corticosteroid, SOMI brace, physical therapy interventions.
OUTCOME- After 1 month of combined treatment patient showed dramatic improvement and became independent in ambulation and ADL.
MESSAGE- Brown sequard syndrome being an incomplete injury can result in very good PROGNOSIS if timely managed with proper intervention.

KEYWORDS

INTRODUCTION

BROWN SEQUARD SYNDROME is caused by injury to half of the spinal cord from various etiologies. The hemi section of spinal cord can be caused by trauma (such as injury from stab or gunshot or rarely from fall), tumour, ischemia or infectious /inflammatory diseases such as tuberculosis/multiple sclerosis.[1,2,3] BSS result in paralysis & loss of proprioception on the ipsilateral side & loss of pain & temperature sensation on the opposite side of the lesion. The anatomical basis of BSS is due to the unique position of the spinal tracts which get involved in the spinal hemisection in a differential pattern.

The pure form of BSS is rare & most cases appear partially as the BROWN SEQUARD PLUS SYNDROME which consists of asymmetric paresis with hypoesthesia more marked on the less paretic side.[4] Cumulatively BSS & BSPS probably account for about 2-4% of all traumatic spinal cord injuries. [5,6] For the sake of this article we will club them together & refer to both as simply BSS.

Overall, patient with BSS have a favourable outcome. [7] For example, Ruth *et al* in their study of 38 BSS patients reported continent bladder and bowel function achieved in 89% & 82% respectively. Independent ambulation was achieved in 75% & nearly 70% were performing functional skills & activities of daily living independently at the time of discharge.[8]

We will be describing a case of BSS in our report which improved dramatically surpassing all the expectations of our treating team.

CASE REPORT

PRESENTING HISTORY:

A 15 year old male named MP reported to AIIMS Raipur in August 2019 with the chief complaint of inability to move both his upper extremity & lower extremity since 2 days along with severe pain in neck region. On brief history taking it was revealed that he fell down from a tree 2 days back following which he lost his consciousness and his limbs stopped functioning. He was resuscitated by a local healthcare professional but was still unable to move his limbs. Then he was shifted to a distant corporate hospital by an ambulance where both CT-Scan and MRI were done. MRI revealed C5 –C6 collapse, C4-C7 myelomalacic changes and long segment increased signal intensity from superior margin of C3 to inferior margin of C6 with mild degree of cord swelling.**(Attachment -1).** He was managed there with soft cervical collar & put on indwelling catheter. Finally he was referred to AIIMS Raipur for further management. The initial evaluation of spinal surgery team ruled out any necessity for surgical fixation considering no instability and involvement of only one vertebral column. So a plan for conservative management was initiated at PMR department of AIIMS Raipur by our team.

MANAGEMENT DURING HIS HOSPITAL STAY OF ONE MONTH:

Baseline findings: On initial assessment it was found that patient was having **C5 ASIA C** injury i.e., an incomplete spinal cord injury. There was very negligible muscle power below C5 myotome and sensory examination for light touch (LT) and pin prick (PP) revealed absence of any sensation below C5. Joint position sense, vibration sense, temperature and pain were lost on both the side below the lesion. Likewise all reflexes & tactile localisation cum discrimination were absent on both the side below C5. Overall the picture was quite bleak with only silver lining being presence of deep anal pressure (DAP) and some extent of gravity eliminated power being present in a patchy distribution in both upper and lower extremity. The SCIM score was standing at a very poor 10/100.

Initial pulsed corticosteroids therapy was given to the patient along with other supportive measures like SOMI brace, indwelling catheter & bedside physical therapy targeted towards preventing contracture, maintaining flexibility and avoiding pressure ulcer. Also proper nutrition, bowel care and catheter care was initiated. The patient also required counselling in view of the deteriorating morale.

During his one month of hospital stay weekly examinations were conducted and we will now briefly elaborate on how the things unfolded and changed the outlook for the same patient .

After one week: It was found on evaluation that the motor weakness is more persistent on the left side (Present motor index score is 20 and 14 on right and left side respectively whereas it was 6 and 5 respectively) along with more loss of LT sensation on that same left side. The PP sensation was however more affected on the right side. Since this discrepancy of motor loss (left more involved) versus sensory loss (right more involved as PP is the more dominant sensation) pointed towards a *Brown Sequard syndrome (BSS) like hemisection of cord* we decided to further evaluate the joint position sense (JPS), vibration sense (VBS) and temperature senses too. But unfortunately there were equal loss of those on both the sides.

On the basis of above findings we came to a conclusion that BSS might be a possible diagnosis in this patient but overall his condition was unfavourable and only a limited household ambulation with ankle foot orthosis (AFO) to right lower limb and knee ankle foot orthosis (KAFO) to left lower limb can be a possibility. Also since there is a significant gain in wrist dorsiflexion power in both upper limbs it was speculated that he can be independent in his ADLs in future including a self-clean intermittent catheterization (SCIC) regimen for his bladder management. For achieving those goals more focus was given towards hand function training.

After two weeks:
Now it was found that the motor versus sensory difference between left and right side of the body was persistent with some additional interesting findings. JPS and VBS was absent on left side (both for thumb and great toe) and was present on right side (both for thumb and great toe again). But temperature sensation was relatively diminished on the right side (both for thumb and great toe again). Now the diagnosis of left sided BSS was confirmed with an expected better prognosis. Our optimism was further strengthened by the fact that he has regained antigravity power in both his knee extensors. His SCIM score has also improved to 30/100.

We decided to continue with our same programme with a slightly more emphasis given towards prevention of postural hypotension (by using Tilt Table standing) and balance training. By this time the bowel care programme (including dietary changes) initiated for him had bore result and the patient is now mostly continent with a regular once daily evacuation. His hand function has also improved a lot to safely initiate SCIC**(Attachment -2).**

After three weeks:
Now we find that there is a dramatic improvement in motor recovery of his both lower extremities to the extent that he can now walk small distance without any orthosis which seemed quite improbable just two weeks ago. Regarding JPS and VBS there is still a loss present in the left great toe while the same was regained in the left thumb. In continuum of the good recovery in this patient, there is also sensory recovery over S4, S5 dermatome along with return of bulbocavernosus reflex (BCR).

We dropped our decision of providing LE orthotic support to the patient and only an assistive walking aid might be a necessity in future. Also taking into consideration the status quo maintained in hand muscle power recovery we decided to initiate SCIC in the next week without any further delay.

After four weeks and just before discharge:
We found that he is still having the same left sided predominantly motor loss and right sided predominantly sensory loss although at present the JPS, VBS and temperature sensation are equal on both sides. There is no further motor recovery but functional recovery has been significant as the patient can now walk even without walking aids with satisfactory balance. Also, when we tried to initiate SCIC after due clamping and removal of indwelling catheter the patient was able to manage self-voiding without any persistent complaint of leakage. Bedside post void residual (PVR) urine estimation was only 20 ml which was insignificant and allowed him to continue on self voiding with a plan to do USG and UDS evaluation later on. At the time of discharge his SCIM score was 80/100 which implies about 80% improvement from baseline. The patient still had some hyperalgesia in both his limbs for which medication was given to him at discharge targeting central pain generators. Similarly he was advised to re start his schooling as early as possible along with other recreational activities to avoid any psychological and vocational long term adverse effect.(**Attachment-3&4)**

DISCUSSION
On writing this case report we aimed to highlight the need to adhere to monitor the patient strictly according to INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SCI (ISNCSCI) i.e., ASIA scale and doing detailed neurological evaluation at regular intervals to avoid missing vital findings that could have direct role in planning the management.[10]

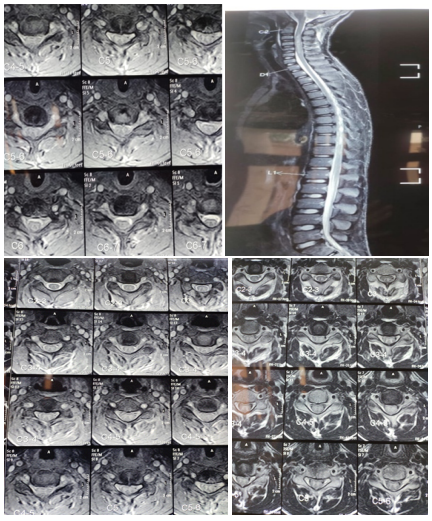
The classical signs of a BSS are well documented in the literature. Charles-Édouard Brown-Séquard studied the anatomy and physiology of the spinal cord and described this injury after observing spinal cord trauma which happened to farmers while cutting sugar cane in Mauritius. Most of the motor neurons from the cerebral cortex decussate in the lower medulla and then run in the descending corticospinal tracts (principal UMN pathway) of spinal cord. The posterior column is responsible for the ascending fibres for JPS and VBS sensation that enter through the dorsal root ganglion & ascends ipsilaterally. On the other hand the lateral spinothalamic tract is responsible for carrying the ascending fibres for the sensation of pain & temperature but here the afferent fibres decussate at the level of its entrance to the spinal cord and hence carries the contralateral sensation.[18,19,20,21] Therefore a hemisection of the spinal cord results in BSS with hallmark features of ipsilateral hemiplegia, ipsilateral loss of position & vibration sensation & contralateral loss of pain & temperature sense. It is a rare occurrence and is most often associated with penetrating trauma or gun-shot injury to the spine , but can also occur due to trauma such as fall (as in our case) or rarely in case of tumour or other inflammations.

BSS shows a favourable prognosis among other types of incomplete SCI.[22] In a study conducted by Pollard and Apple, BBS shown the best prognosis among 412 patients with traumatic incomplete SCI.[22] Our patient also achieved good independent ambulation within a month post injury & regained most of his ADLs in line with the general trend in recovery of BSS patients. Even he managed self voiding without any significant PVR at the time of discharge. The unique aspect of BSS was that the patient initially appeared to be having a grave prognosis (considering the high grade muscle power loss in both upper and lower extremity as well as the complete urinary incontinence. It was only on careful evaluation that BSS was identified in the patient and we could foresee a better outcome. With time our expectation was proved to be correct.,

The duration of recovery in BSS usually takes more than 1-6 months , although it may begin at 24 hours post injury & recovery usually progress in the order of extensor to flexor aspect & proximal to distal aspect of limb muscles. In our case also the wrist extensors has recovered a lot more in comparison to the wrist flexors.

CONCLUSION
So we can conclude that if immediate proper management is initiated along with regular fine tuning of management goals, incomplete SCI patients and particularly BSS ones can show excellent outcome.

Attachment-1



Attachment -2

Attachment -3

Attachment -4

Table to show the silent examination findings of the patient at different evaluation phase

Parameters Examined		Baseline examination		After 1week		After 2 week		After 3 week		After 4 week	
Motor Myotomes		Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
	C5	3	3	4	3	4	3	4	3	4	3
	C6	1	1	3	2	3	2	3	1	4	2
	C7	1	1	1	1	1	1	1	1	2	2
	C8	1	1	1	1	1	1	1	1	2	2
	T1	1	1	1	1	1	1	1	1	2	2
	L2	2	1	3	3	3	3	3	3	4	3
	L3	0	0	3	1	3	3	3	3	4	3
	L4	0	0	1	1	1	1	3	2	4	3
	L5	0	0	3	1	3	1	4	2	3	3
	S1	0	0	1	1	1	1	4	2	3	3
Sensory index score	LT	8/56	8/56	40/56	30/56	42/56	40/56	44/56	44/56	44/56	44/56
	PP	8/56	8/56	20/56	36/56	26/56	40/56	30/56	44/56	33/56	51/56
JPS/ VBS	Thumb	Absent	Absent	Present	Absent	Present	Absent	Present	Present	Present	Present
	Great toe	Absent	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Present

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