Cervical disc herniation causing Brown-Sequard syndrome
Case report and review of literature (CARE-compliant)

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Abstract

\textbf{Rationale:} Brown-Sequard syndrome (BSS) is manifested as ipsilateral motor deficit and contralateral sensory loss. BSS caused by herniated cervical disc is extremely rare and easily be misdiagnosed, and clinical features of this problem were not fully understood.

\textbf{Patient concerns:} A 57-year-old man presented with a 3-month history of weakness in his right arm, and he experienced progressive right hemiparesis at 2 days before admission, along with contralateral deficit in sensation of pain and temperature below T2.

\textbf{Diagnoses:} Magnetic Resonance Imaging (MRI) showed severe cord compression due to a large paracentral extradural C4-C5 cervical disc herniation (CDH).

\textbf{Interventions:} Subtotal cervical corpectomy, decompression, and fusion through anterior approach were performed. The patient recovered rapidly after surgery.

\textbf{Outcomes:} Complete recovery of sensory and motor functions was obtained at a 4-months follow-up after surgery.

\textbf{Lessons:} Our case, along with a review of the literature, highlights that careful medical history inquiries, detailed neurologic examinations, and cervical spinal MRI scans are essential for diagnosis of CDH caused BSS. Prompt surgical decompression according to individual condition is commonly warranted. Early diagnosis with prompt surgical decompression could lead to favorable recovery.

\textbf{Abbreviations:} BSS = Brown-Sequard syndrome, CDH = cervical disc herniation, IDH = intradural disc herniation, MRC = Medical Research Council, MRI = magnetic resonance imaging.

\textbf{Keywords:} Brown-Sequard syndrome, cervical spine, disc herniation, surgical decompression

1. Introduction

Brown-Sequard syndrome (BSS) is caused by hemi-compression or herniation of the spinal cord, which is characterized by ipsilateral loss of motor function, deep sensation and crude touch, as well as contralateral loss of pain and temperature sensitivity.\textsuperscript{[1,2]} The syndrome is mostly seen in traumatic injuries and spinal cord neoplasms. A herniated cervical disc is an exceptional cause of BSS with rare cases.

In 1928, Stookey reported the first case of BSS produced by cervical disc herniation (CDH).\textsuperscript{[3]} BSS caused by CDH is rare and often be delayed or incorrectly diagnosed.\textsuperscript{[4-6]} The patient might initially be admitted into the medical ward for suspected cerebrovascular accidents as the manifestation of hemiparesis. Although a number of cases had been reported, clinical features of this problem were not fully understood, and no consensus was reached for the choice of treatment strategies. Herein we report a case of BSS resulted from C4-C5 cervical herniated cervical discs, along with a review of the pertinent literature.

2. Case report

A 57-year-old man presented with a 3-month history of weakness in his right arm, and he experienced progressive right hemiparesis at 2 days before admission, along with contralateral deficit in sensation of pain and temperature below T2. He claimed no history of trauma. Upon physical examination, he demonstrated reduced neck mobility. No atrophy was shown on either side. Muscle power was measured by Medical Research Council (MRC) grading, and neurological evaluation revealed motor weakness in the right arm (MRC Grade 3/5) and lower limb (MRC Grade 1/5). Spasticity and hyperreflexia were also revealed in the right lower extremities. Reduced sensation of pain and temperature below T2 was noted on the left side. These findings were consistent with the diagnosis of BSS.

Magnetic Resonance Imaging (MRI) of the cervical spine showed a large central and right-sided extradural C4-C5 CDH severely compressing the spinal cord, associated with spinal stenosis (Fig. 1A and B). Computed tomography (CT) scan revealed evidence of spondylosis at C5-C7 vertebrae and posterior vertebral osteophyte of C5 and C6 (Fig. 1C). No ossified posterior longitudinal ligament was showed.

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We made prompt preoperative preparations and performed the surgery the day after admission. Subtotal vertebrectomy of the C5 and titanium mesh cages filled with autogenous bone were carried out for reconstruction through anterior approach (Fig. 1D and E). The patient was immobilized in a rigid cervical collar for 8 weeks postoperatively. After the operation, the patient recovered rapidly in 4 days. The motor power of right lower limb improved to MRC Grade 3, significant relief in pain and temperature sensation on the left side of the body was acquired. At 3 months follow-up, motor power of right upper and lower extremities improved to MRC Grade 4. The patient could walk independently without limitation on daily activities. 4 months after surgery, he had a normal motor and sensory function.

3. Discussion
Rare cases of BSS resulting from CDH have been reported. According to our knowledge, 69 cases have been reported in the
### Table 1

Reported Cases in the Literature.

| N | Reference | Age | Sex | Location | Level | Symptom Duration | History of Trauma | Surgery | Recovery |
|---|-----------|-----|-----|----------|-------|------------------|-------------------|---------|----------|
| 1 | Stookey, 1928 [3] | 44 M | ED | C3-C4 | NR | N | N | LAM | NR |
| 2 | | 52 M | ED | C5-6 | NR | N | N | LAM | NR |
| 3 | Düerig et al., 1977 [7] | 52 M | ID | C5-6 | 2MTH | Y | LAM | INCR |
| 4 | Roda et al., 1982 [8] | 52 M | ID | C4-5 | 1D | N | LAM | INCR |
| 5 | Eisenberg et al., 1986 [9] | 43 M | ID | C5-6 | 4D | Y | LAM | INCR |
| 6 | Schneider et al., 1988 [10] | 50 F | ID | C5-6 | 1D | N | ACD | INCR |
| 7 | | 61 M | ED | C5-7 | 4MTH | N | ACD | INCR |
| 8 | | 46 F | ED | C4-5,C5-6 | 13MTH | N | ACD+LAM | INCR |
| 9 | | 65 F | ID | C5-6 | 5WK | Y | ACD | CR |
| 10 | Clatterbuck et al., 2000 [17] | 40 M | ID | C4-C5 | 5WK | N | ACD+LAM | INCR |
| 11 | | 39 M | ED | C5-6 | 8MTH | N | ACD | INCR |
| 12 | | 44 F | ED | C5-6 | 9WK | N | ACD | INCR |
| 13 | | 45 M | ID | C6-7 | 15MTH | N | AOF | INCR |
| 14 | | 41 F | ED | C5-6 | 3D | N | ACD+LAM | CR |
| 15 | | 35 F | ED | C5-6 | NR | Y | ACD | CR |
| 16 | | 55 M | ED | C4-5 | NR | Y | ACD | CR |
| 17 | | 64 M | ED | C5-6 | 6MTH | N | ACF | CR |
| 18 | | 39 M | ED | C5-6 | 1MTH | N | ACD | CR |
| 19 | | 54 M | ED | C5-6 | 3MTH | N | ACD | INCR |
| 20 | | 36 M | ED | C5-6 | 9MTH | N | ACD | CR |
| 21 | | 46 M | ED | C5-6 | 2WK | N | ACD | CR |
| 22 | | 44 F | ED | C5-6 | 6WK | Y | ACD | CR |
| 23 | | 44 M | ED | C5-6 | 45D | NR | ACD | CR |
| 24 | | 35 M | ED | C5-6 | 2WK | N | ACD | INCR |
| 25 | | 56 M | ED | C5-6 | 8D | N | AF | CR |
| 26 | | 47 M | ED | C5-6 | 2WK | N | AF | CR |
| 27 | | 45 M | ED | C5-6 | 2MTH | N | AF | CR |
| 28 | | 63 M | ED | C5-6 | 8D | N | ACD | CR |
| 29 | | 46 M | ED | C5-6 | 3MTH | N | ACD | CR |
| 30 | | 31 M | ED | C5-6 | 4MTH | N | ACD | CR |
| 31 | | 44 M | ED | C5-6 | 4MTH | N | ACD | CR |
| 32 | | 45 M | ED | C5-6 | 2MTH | N | AF | CR |
| 33 | | 46 M | ED | C5-6 | 8D | N | ACD | CR |
| 34 | | 50 F | ED | C3-C4 | 1W | NR | ACD | CR |
| 35 | | 79 M | ED | C4-5 | 1MTH | N | ACD | CR |
| 36 | | 61 F | ID | C4-5 | 2WK | Y | ACD | CR |
| 37 | | 34 M | ED | C5-6 | 2MTH | N | ACD | CR |
| 38 | | 35 M | ED | C5-6 | 4MTH | N | ACD | CR |
| 39 | | 36 M | ED | C5-6 | 3MTH | N | ACD | CR |
| 40 | | 43 M | ED | C5-6 | 1D | N | ACD | CR |
| 41 | | 52 M | ED | C5-6 | 7D | Y | ACD | CR |
| 42 | | 35 M | ED | C5-6 | 21D | N | ACD | INCR |
| 43 | | 72 M | ED | multiple | 30D | N | ACD | INCR |
| 44 | | 51 M | ED | multiple | 10D | N | ACD | INCR |
| 45 | | 31 M | ED | C5-6 | 1D | Y | ACD | CR |
| 46 | | 52 M | ED | C5-6 | 6MTH | N | ACD+LAM | CR |
| 47 | | 73 F | ED | C4-5 | 1D | N | AOF+LAM | CR |
| 48 | | 44 F | ED | C5-6 | 2WK | N | ACF+LAM | CR |
| 49 | | 39 M | ED | C5-6 | 6WK | N | AOF+LAM | CR |
| 50 | | 46 M | ED | C5-6 | 4WK | N | ACF+LAM | CR |
| 51 | | 54 M | ED | C5-6 | 9WK | N | AOF+LAM | CR |
| 52 | | 32 M | ED | C5-6 | 15MTH | N | ACF+LAM | CR |
| 53 | | 41 F | ED | C5-6 | 3D | N | AOF+LAM | CR |
| 54 | | 35 M | ED | C5-6 | 8D | N | ACD | CR |
| 55 | | 47 M | ED | C5-6 | 2WK | N | ACD | CR |
| 56 | | 33 M | ED | C5-6 | 2MTH | N | ACD | CR |
| 57 | | 31 M | ED | C5-6 | 14D | Y | ACD | CR |
| 58 | | 39 M | ED | C5-6 | 6MTH | N | ACD+LAM | CR |
| 59 | | 50 F | ED | C5-6 | 21D | N | ACF+LAM | CR |
| 60 | | 72 M | ED | multiple | 30D | N | ACD | INCR |
| 61 | | 51 M | ED | multiple | 10D | N | ACD | INCR |
| 62 | | 31 M | ED | C5-6 | 1D | Y | ACD | CR |
| 63 | | 52 M | ED | C5-6 | 6MTH | N | ACD+LAM | CR |

(continued)
English language literature up to now (Table 1). According to a review of those reported cases, the mean age of the patients was 47.2 years and ranged between 23 and 86 years. C5-C6 was the most vulnerable level of discogenic BSS, which was involved in 45.7% of the case series. A male predominance was shown with a percentage of 70%. Single level disease was shown in most cases, but no significant relationship was found between the number of involved discs and clinical prognosis. Classic manifestation of BSS caused by CDH is very rare; most of the reported cases were partial BSS. This can be explained by the anterior compression of spinal cord by CDH, thus the racile of the reported cases were partial BSS. This can be explained by anterior cervical discectomy and fusion surgery. Cases with CDH and ipsilateral spinal cord compression. The 2 cases both anterior foraminotomy, CR = complete recovery, D = day(s), ED = extradural, ID = intradural, MTH = month(s), N = no, NR = not reported, SD = symptom duration, WK = week, Y = yes.

| N | Reference                           | Age | Sex | Location | Level          | Symptom Duration | History of Trauma | Surgery        | Recovery  |
|---|------------------------------------|-----|-----|----------|----------------|------------------|------------------|--------------|----------|
| 64| Guan et al, 2015[20]               | 51  | M   | ED       | C4–C5          | 6MTH             | N                | ACF           | INCR     |
| 65| Hamil et al, 2016[16]              | 32  | M   | ED       | C3–C4          | 1D               | N                | ACFDF         | CR       |
| 66| Meng et al, 2016[18]               | 51  | F   | ED       | C3–C4,C5–C6    | 5D               | N                | ACF           | INCR     |
| 67| Porto et al, 2016[45]              | 86  | M   | ED       | C4–5           | 1WK              | N                | ACFDF         | INCR     |
| 68| Baudracco et al, 2017[46]          | 45  | F   | ID       | C4–C5          | 1MTH             | NR               | ACF           | INCR     |
| 69| Lau Janice et al, 2017[48]         | 27  | M   | ED       | C3–C4          | 3WK              | N                | ACFDF         | INCR     |

ACD = anterior cervical discectomy, ACF = anterior cervical foraminotomy and fusion, AF = anterior foraminotomy, CR = complete recovery, D = day(s), ED = extradural, ID = intradural, MTH = month(s), N = no, NR = not reported, SD = symptom duration, WK = week, Y = yes.

Two cases manifesting BSS and Horner syndrome that caused by CDH were reported. Though the clinical manifestations of the 2 patients were exceptional, treatment principles were similar to other cases. Satisfactory clinical outcomes could also be achieved after surgery. Including our case, all of those 70 patients underwent surgery. The most adopted approach was anterior in 35 patients (78.6%), and 38 patients (54.3%) underwent the anterior cervical discectomy and fusion surgery. Posterior surgery in the form of laminectomy or hemilaminectomy was performed in 12 patients. 3 patients carried out anterior combine with posterior approaches. The treatment decision of surgical approaches is based on multiple factors, such as the size or location of herniated discs, numbers of involved vertebral levels, the dimensions of the spinal canal, as well as whether presenting ossification of posterior longitudinal ligament or ligamenta flava. We believe that favorable outcomes could obtain if adequate decompression is achieved by early surgery.

We report a case of BSS resulted from C4–C5 cervical herniated cervical disc, and complete recovery of sensory and motor functions was obtained after surgery. Our case, along with the review of the literature illustrated that BSS caused by CDH is very rare and often be delayed or incorrectly diagnosed. Careful medical history inquiries, detailed neurologic examinations and cervical spinal MRI scans are indispensable for early diagnosis of CDH caused BSS. Prompt surgical decompression according to individual condition is commonly warranted. Proper treatment could lead to apparent recovery of neurological function in a short time and result in favorable prognosis.

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