

Effects of rehabilitation on spontaneous intramedullary spinal cord hemorrhage (hematomyelia) patient without surgery

A case report

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Abstract

Rationale: Spontaneous intramedullary spinal cord hemorrhage (hematomyelia) is a rare disease and most cases have specific etiologies such as cavernous malformations and tumor. Most reported cases are about surgical treatment of intramedullary spinal cord hemorrhage, but there are no reports of rehabilitation effectiveness reported. This case reports the first case with positive effect of rehabilitation on a patient with intramedullary spinal cord hemorrhage, who did not undergo surgery.

Patient concerns: A 79-year old female visited the department of emergency complaining of sudden-onset back pain, weakness and sensory disturbance in both lower extremities and voiding difficulty. The symptoms started 2 weeks prior to her visit.

Diagnoses: Whole spine magnetic resonance imaging revealed intramedullary spinal cord hemorrhage at the C7-T3 level and preoperative diagnosis was spinal cavernous malformation.

Interventions: Since the benefit of surgery was presumed to be low on her, she performed rehabilitation, divided into 2 sessions per day and each session took 30 min.

Outcomes: After 3 months of rehabilitation, numeric pain rating scale of back pain decreased, and Berg Balance Scale score, Korean version of modified Barthel index score improved. On discharge, she was able to walk independently under supervision and void without Foley catheter.

Lessons: This case suggests that early rehabilitation such as physical therapy is an effective treatment for improving function in patients with intramedullary spinal cord hemorrhage with or without operation

Abbreviations: BBS = Berg balance scale, JTHFT = Jebsen-Taylor hand function test, K-MBI = Korean version of modified barthel index, MMT = manual muscle test, MRI = magnetic resonance imaging, NRS = numeric pain rating scale, TPI = trigger point injection, TUG = timed up and go, UDS = urodynamic study.

Keywords: cavernous malformation, hematomyelia, intramedullary spinal cord hemorrhage, magnetic resonance imaging, McCormick grade, physical therapy

1. Introduction

Intramedullary spinal cord hemorrhage (Hematomyelia) is a rare neurologic disorder. Traumatic spinal cord injury is the most common cause and other etiologies are spontaneous intramedullary spinal cord hemorrhage, such as vascular malforma-

tions, tumor, and bleeding disorders.^[1,2] Anticoagulation therapy and hemophilia are also reported as causes of spontaneous intramedullary spinal cord hemorrhage.^[3,4] There are lots of case reports on the diagnosis, symptoms, and treatment of a wide variety of etiologies that cause spontaneous intramedullary spinal cord hemorrhage.

To diagnose intramedullary spinal cord hemorrhage, clinical examination on symptoms of myelopathy syndrome such as sudden and severe back pain, or neck pain with or without radicular pain based on the patient's history is first performed. The next step to evaluate spinal cord injury is to obtain images. Currently, magnetic resonance imaging (MRI) with and without gadolinium is preferred. MRI can differentiate other causes of myelopathy from intramedullary spinal cord hemorrhage that cause sudden or rapidly progressive myelopathy symptoms. Also, MRI provides clues to the etiology that cause the hemorrhage.^[2]

There is no clinical guideline of managing the acute intramedullary spinal cord hemorrhage to minimize spinal cord injury. However, many neurosurgeons agree that surgical treatment is effective. However, benefits of surgery in individual patients are unpredictable, and the optimal timing of surgical resection, or the prognosis of the operation is unknown.^[2] Most reported cases showed surgical treatment of intramedullary spinal cord hemorrhage and their prognosis. A few studies compared the outcome of

Editor: N/A.

The authors report no conflicts of interest.

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Medicine (2018) 97:48(e13414)

Received: 3 August 2018 / Accepted: 2 November 2018

<http://dx.doi.org/10.1097/MD.0000000000013414>

surgical treatment and conservative treatment in patients with intramedullary spinal cord hemorrhage.^[5,6] There was no significant or permanent neurological deficit in the course of conservative treatment. However, their functional parameters remained the same as during the initial assessment and did not show any improvement. In those cases, no rehabilitation was performed as intervention besides conservative treatment. There are few cases of immediate rehabilitation in patients. The following case is the first case demonstrating the effect of early rehabilitation on patients predicted with low surgical benefit instead of surgery.

2. Case presentation

A 79-year old female had back pain of numeric pain rating scale (NRS) 6 in early August of 2016. For the back pain, 3 times of trigger point injection (TPI) procedures were performed in the thoracic paraspinal muscle at a local clinic. However, back pain on the thoracic level became worse and symptoms such as sensory disturbance, motor weakness of both lower extremities, and voiding difficulty occurred from mid-august of 2016. She visited department of emergency.

In the initial neurological examination, her motor power was fair plus in the right lower extremity and poor plus in the left. She was unable to walk independently. Sensation decreased below the T4 dermatome and voiding was not possible. She had no history of trauma and had been taking calcium carbonate for osteoporosis and angiotensin II receptor antagonist, hydrochlorothiazide, and β 1-blocker for hypertension. Otherwise, she had no known diseases such as bleeding disorders, cardiovascular disorders, and other central nervous system disorders.

Laboratory test including CBC, ESR, CRP, BUN/Cr was performed, but the results were within normal limits. In the whole spine MRI, high signal was detected in the intramedullary spinal cord from C7-T3 in the T1-weighted image and low signal in the same lesions in the T2-weighted image, suggesting that there is hemorrhage in the area. Her preoperative diagnosis was cavernous malformation since the image showed variable intensities surrounded by a dark hemosiderin ring.^[2] (Fig. 1). She was transferred to the department of neurosurgery for surgical resection but did not undergo surgery because of low surgical benefit. She was 79 years old while weakness in the lower extremities was no longer progressive. Two weeks later, she was transferred to the department of rehabilitation and began rehabilitation.

On physical examination at transferring, her Berg Balance Scale (BBS) score was 13 and Korean version of modified Barthel index (K-MBI) score was 60. Her manual muscle test (MMT) marked fair plus motor power in the right lower extremity and poor plus motor power in the left lower extremity. Jebsen-Taylor hand function test (JTHFT) score was 74 in the right upper extremity and 75 in the left upper extremity, which is nearly normal (Table 1). In the urodynamic study (UDS), her voiding dysfunction was obstructive pattern and there was 300cc of residual urine. After Foley catheter insertion, she underwent bladder training along with taking tamsulosin and bethanechol. In addition, she took NSAID and gabapentin for back pain and neuropathic pain in the lower leg, respectively. Physical therapy was divided into 2 sessions per day and each session took 30 min. All training sessions were conducted by experienced physiotherapists with certification from the Korean Society of Physical Therapy. She underwent lower extremity strengthening exercise using sliding rehabilitation machine composed of a rail system, a patient-supporting carriage and a footplate moving up and down

to change the maximal angle of knee flexion.^[7] In addition, functional electrical stimulation device was applied to the quadriceps and tibialis anterior muscle of both lower extremities, and she was instructed to undergo knee extension during quadriceps stimulation and ankle dorsiflexion during tibialis anterior stimulation.

After 1 month of physical therapy, the BBS score improved from 13 to 33 and K-MBI score from 60 to 62. Her MMT marked fair plus motor power in the right lower extremity and fair minus motor power in the left lower extremity. She was able to walk independently using a high-walker. Using a high-walker, the timed up and go (TUG) test was 26.55 s, 10-m walk test was 24.09 s, and the 6-min walk test was 154 m (Table 1). However, she was unable to gait independently without a high-walker because the gait balance was unstable. She used a voiding diary for bladder training every 4 h. Filling and passage sensation were noted, and mean urine volume measured regularly was 300 cc. She tried to void after removing the Foley catheter, but residual urine was 400 cc using a bladder scanner and bladder training continued after insertion of Foley catheter. The patient's rehabilitation goal was walking independently and voiding without Foley catheter, so she decided to continue rehabilitation. Follow-up spine MRI was performed, and high signal of C7-T3 spine was slightly decreased in T1-weighted image, suggesting resolution of the hemorrhage.

After 2 months of additional physical therapy, right lower extremity strength improved to fair plus-good grade and left lower extremity strength improved to fair grade. The BBS score improved to 42, but since balance was still unstable, it was necessary to be supervised when walking. The TUG test improved to 22.29 s, 10-m walk test to 18.47 s, and 6-min walk test to 200 m. The K-MBI was 77. Categories with low scores in K-MBI were toilet, stair climbing, bladder control, ambulation, and chair to bed transfer (Table 1). It is probably due to difficulty in voiding and inability to walk independently. After 1 month of bladder training, she attempted to void again. She was able to void and the residual urine was below 100 cc using a bladder scanner. Residual urine remained below 100 cc in 2 more following scan. She continued to void after removal of the Foley catheter along with medication. No complication such as urinary tract infection appeared until discharge.

Her husband was the caregiver and she wanted to be discharged because she was considered to be able to walk independently and reach near normal performance under the supervision of her spouse. After 3 months of physical therapy, BBS improved from 13 to 42, and K-MBI improved from 60 to 77 (Table 1). In addition, functional level improved to a level independent walking was possible under supervision. However, there was balance impairment in walking and she decided to continue balance training as an outpatient. We followed up for 16 months after discharge and evaluated functional parameters, which were maintained without deterioration compared to the time of discharge, at every follow-up examination.

3. Discussion

A 79-year-old female patient who presented with symptoms of back pain, paresthesia of lower extremities, and motor weakness of lower extremities was diagnosed as intramedullary spinal cord hemorrhage through whole spine MRI and suspected etiology was spinal cavernous malformation.^[2] Common symptoms in patients with intramedullary spinal cord hemorrhage due to cavernous malformation are sensory deficit, motor weakness and

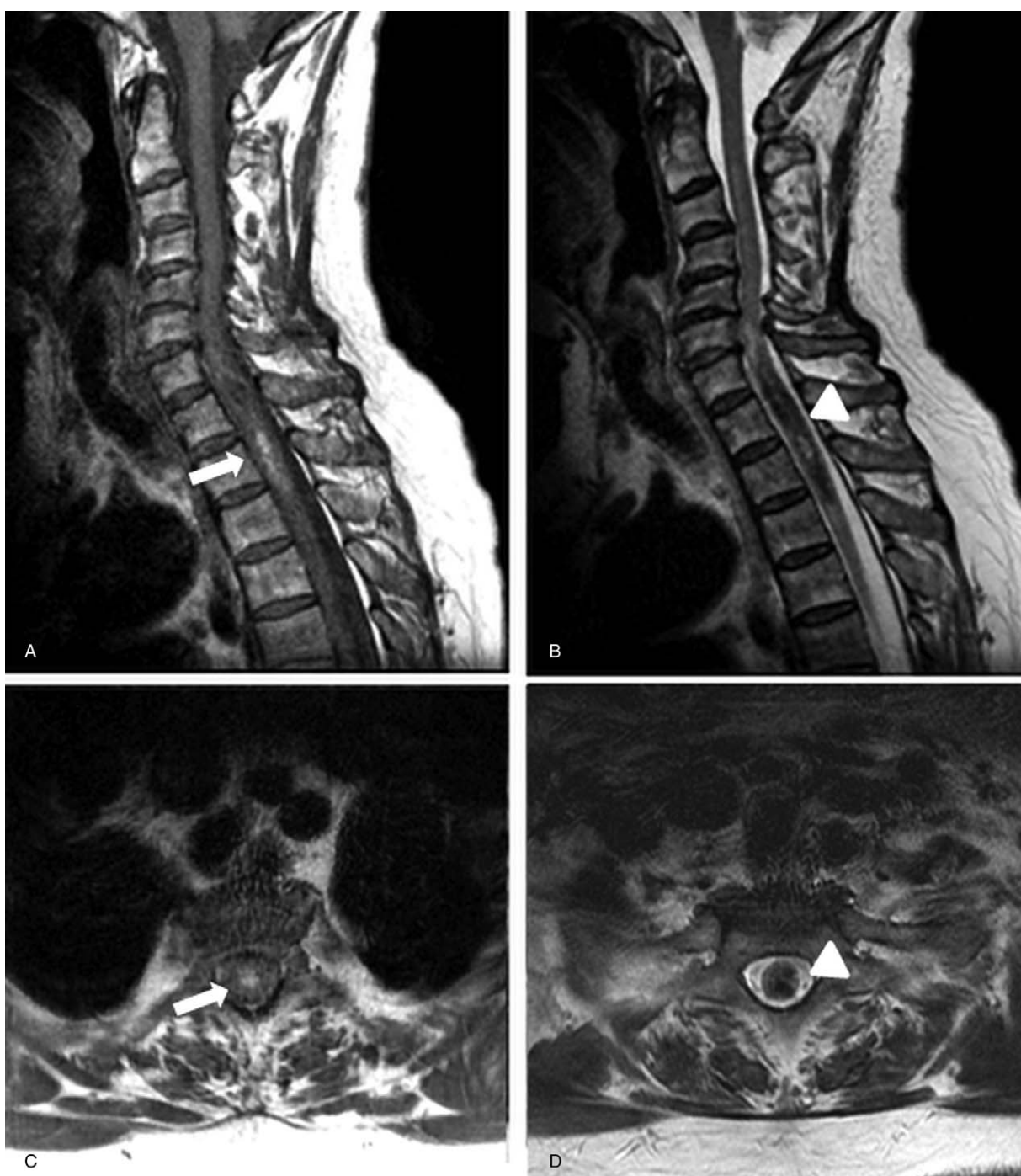


Figure 1. Initial MRI revealed an intramedullary spinal cord hemorrhage from C7-T3 level. T1 weighted sagittal image (A) and T1 weighted axial image (C) show high signal intensity (white arrows). T2 weighted sagittal image (B) and T2 weighted axial image (D) show low signal intensity and dark hemosiderin ring surrounding the hemorrhage (white arrowheads). MRI=magnetic resonance imaging.

dysesthesia. The most common lesion is thoracic region, as in this case report.^[5,8] The patient visited the department of emergency and was referred to department of neurosurgery for surgical resection. However, considering that the patient is old age and the motor weakness is no longer deteriorated, operation was not performed. There is no consensus on the treatment protocol of intramedullary spinal cord hemorrhage, and indication, proper timing, and prognosis of operation are controversial.^[2] However,

in most literature, early diagnosis and early surgery are reported as the most appropriate procedures for better outcome.^[9] Kharkar S et al compared the outcome of surgical and conservative treatment in the patients with cavernous malformation using McCormick grade. The McCormick classification distinguishes 4 functional stages: Grade 1 denotes neurologically normal, or mild focal deficit not significantly affecting function of involved limb with normal gait; Grade 2 indicates sensorimotor

Table 1**Outcome measurement during various time points in patient's hospital course.**

		Admission	HD 1 month	HD 2 months	Discharge (HD 3 months)
NRS		6	4	3	3
BBS		13	33	40	42
K-MBI		60	62	70	77
McCormick grade		4	4	3	2
MMT (Right/Left)		F+/P+	F+/F-	F+/F	F+~G/F
Dynamic test	TUG	NT	26.55 s	29.02 s	22.29 s
	10 m walk test	NT	24.09 s	22.27 s	18.47 s
	6-min walk test	NT	154 m	168 m	200 m

BBS=Berg balance scale, HD=Hospital day, K-MBI=Korean version of modified Barthel index, MMT=Manual muscle test, NRS=Numeric pain rating scale, NT=Not Tested, TUG=timed up and go.

deficit affecting function of the involved limb, mild to moderate gait difficulty, although patient still can walk independently; Grade 3 designates more severe neurological deficiency requiring a cane or brace for ambulation, and the patient may or may not be independent; Grade 4 suggests severe deficit, requiring wheelchair or with bilateral upper-extremity impairment, and usually is not independent.^[10] 10 patients with conservative management were followed up for 80 months. 8 patients had same McCormick grade at the last follow-up evaluation and 1 patient had McCormick grade better than the initial assessment. 4 patients were treated surgically and were followed up for 42 months. In 2 patients, McCormick grade remained unchanged, with improvement in one patient and worse in another patient.^[5] Likewise, there is controversy about the surgical management and conservative treatment of intramedullary spinal cord hemorrhage.

But, there are few cases on the effect of immediate rehabilitation after neural deficit due to intramedullary spinal cord hemorrhage. In the cases of Kharkar S et al, rehabilitation such as physical therapy was not performed during conservative treatment. Functional level in those cases was maintained rather than improved.^[5] This case is the first reported case on the effect of the early rehabilitation after intramedullary spinal cord hemorrhage. The patient underwent early rehabilitation intervention, 2 sessions a day for 3 months without surgery. After 3 months of physical therapy, McCormick grade improved from grade 4 to grade 2, NRS of back pain decreased from 6 to 3, BBS score improved to 42 from 13, and K-MBI score increased from 60 to 77. Her MMT ranged from marked fair plus to good motor power in the right lower extremity and fair motor power in the left lower extremity (Table 1). She was able to walk independently under supervision. In addition, she was able to void and the residual urine was below 100cc using a bladder scanner, therefore discharged without Foley catheter.

In conclusion, in this case, early rehabilitation intervention was effective in improving function in patients with intramedullary spinal cord hemorrhage with or without operation.

4. Method

Ethics committee or institutional review board approval was obtained. And patient signed informed consent for the publication of this case report.

Author contributions

Conceptualization: Hyun-Min Oh and Tae-Du Jung.

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