Case Report

A case of paraparesis with thoracic ossification of the posterior longitudinal ligament and the ligamentum flavum induced by falling down on the abdomen

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Aim: To describe an educational case.

Methods: Case report.

Results: A 71-year-old female was transported to our emergency department with complaints of lower abdominal pain and gait disturbance after falling down on her abdomen. She had lower abdominal painful paresthesia in the dermatome from the twelfth thoracic to the first lumbar level without signs of peritoneal stimulation. Paraparesis and dysesthesia of the lower extremities was predominant on the left side. Abdominal computed tomography revealed severe thoracic ossification of the posterior longitudinal ligament and the ligamentum flavum at the thoracic level 10/11. Laminectomy and spinal fusion with rods resulted in recovery of the patient's symptoms.

Conclusion: Physician should pay attention to thoracic spinal cord injury induced by hyperextensive stress on the spine, even in cases of minor trauma, among patients with preexisting bony pathologies at the thoracolumbar level.

Key words: Abdominal pain, fall, ligamentum flavum, ossification of the posterior longitudinal ligament, spinal cord injury

INTRODUCTION

THORACIC MYELOPATHY INDUCED by degenerative disease is rare. Aizawa *et al.* reported the annual rate of surgery to be 0.5–0.9 per 100,000 inhabitants, which is less than one-tenth of that for cervical myelopathy.¹ This disease is predominant in males, and patients aged in their sixties and seventies account for 80% of all cases.¹ Ossification of the ligamentum flavum (OLF) and the posterior longitudinal ligament (OPLL), intervertebral disc herniation, and posterior spur formation are the spinal factors that most consistently contribute to thoracic myelopathy, with half of patients showing OLF, followed by OPLL, intervertebral disc herniation, and posterior spur formation.¹ The incidence of OPLL is 2.4% in the Asian population, and 0.16% in the non-Asian population.^{2,3} Ossification of the posterior longitudinal ligament is twice as common in males as it is in females, and

symptomatic OPLL usually presents in the fifth to sixth decade of life. In animal models, the degeneration or herniation of the nucleus pulposus has been reported to be a local factor that initiates OPLL formation.⁴ Additional studies have reported that various genetic, hormonal, environmental, and lifestyle factors are the cause of the pathology and progression of OPLL.⁴ The risk factors related to lifestyle including the frequent consumption of pickles, non-daily consumers of rice, a family history of myocardial infarction, a high body mass index at age 40 years, long working hours, and working the night shift, whereas the frequent intake of chicken or soy products and good sleeping habits reduce the risk of OPLL.^{5,6} Among 1,736 Chinese people whose average age was 38 years, OLF was identified in 3.8% of the population (52 females and 14 males).⁷ In 45 (68.2%) cases, OLF was present at a single level, whereas in 21 (31.8%) cases, OLF was present at multiple levels. The most common site of involvement was the lower thoracic spine, but OLF can also occur in the upper thoracic spine. Differences exist between OPLL and OLF, but there are also many similarities at the molecular level, and possibly at the genetic level, including the development of diffuse idiopathic skeletal hyperostosis.^{7–9} The most common initial symptoms include gradual onset and worsening of numbness and tingling or pain in the lower

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extremities, followed by a spastic gait and/or weakness.¹ Due to the rarity of this clinical entity, the duration from initial symptoms to surgery averages 2 years, most likely due to misdiagnosis.¹ In cases of traumatic thoracic myelopathy, sudden onset accompanied by thoracic spinal fracture or dislocation is observed.^{1,10,11} Here, we report a case of paraparesis with thoracic OPLL and OLF induced by a fall on the abdomen.

CASE REPORT

A 71-YEAR-OLD FEMALE WAS transported to our emergency department with complaints of lower abdominal pain and gait disturbance after stumbling over another person's leg and falling down on her abdomen, positioning her trunk so as not to hit her face on the road. Her past history included hypertension, diabetes mellitus, and hysterectomy due to myoma. Her family history was not specific. On arrival, her vital signs were as follows: Glasgow Coma Scale, E4V5M6; blood pressure, 176/84 mmHg; pulse rate, regular at 116 beats per minute; and saturation of peripheral oxygen on room air, 98%. She had lower abdominal painful paresthesia in the dermatome from the 12th thoracic to the first lumbar level without signs of peritoneal stimulation. Paraparesis and dysesthesia of the lower extremities was predominant on the left side (manual muscle test scale: right, grade 4; left, grade 2). A blood examination showed no specific findings, except for leukocytosis and hyperglycemia. Abdominal computed tomography revealed no traumatic lesions in either the abdominal wall or intra-abdominal organs; however, severe thoracic OPLL with OLF was observed at the thoracic level 10/11 (Fig. 1). Urgent spinal magnetic resonance imaging disclosed multiple thoracic segmental OPLL with significant signal changes in the spinal cord at the 11th thoracic level (Fig. 2). Laminectomy from the sixth thoracic to the first lumbar and posterolateral fusion with instrumentation from the sixth thoracic to the second lumbar vertebra carried out on the second hospital day resulted in recovery of the patient's symptoms. She was transferred to another hospital for rehabilitation on the 46th hospital day. In 8 months, she could walk without a cane with normal right lower extremity function and was classified as level 5 on the manual muscle test for the left lower extremity.

DISCUSSION

THIS IS A case of thoracic spinal cord injury with thoracic OPLL and OLF induced by falling down on the abdomen, without the development of bony fractures or dislocation. This is the second reported case of such minor trauma resulting in paraparesis due to thoracic spinal cord

Fig. 1. Abdominal computed tomography carried out on a 71-year-old female on arrival at emergency department. Abdominal computed tomography revealed no traumatic lesions in either the abdominal wall or the intra-abdominal organs; however, severe thoracic ossification of the posterior longitudinal ligament and the ligamentum flavum was observed at the thoracic level 10/11.

Fig. 2. Spinal magnetic resonance imaging carried out on a 71-year-old female on arrival at emergency department. Urgent spinal magnetic resonance imaging disclosed multiple thoracic segmental ossifications of the posterior longitudinal ligament.

injury without bony fracture development or dislocation in an adult. The first patient was injured by falling down on the back, whereas the present patient fell on her abdomen.¹² In pediatric cases, the incidence of thoracic spinal cord injury is also extremely rare; however, once it occurs, thoracic spinal cord injury without radiological abnormalities is not rare.¹³ Children's ligaments and facet joints are immature in

Table 1. Previous published reports of thoracic spinal cord injury without fracture or dislocation

Reporter	Year	Age, years	Sex	Mechanism of injury	MRI finding	Cause of spinal cord injury	Level	Outcome
Park	2012	38	Male	Fall	None	None	Th8	Almost cured
Shen	2007	26	Male	Motorcycle accident	Valuable finding	None	Th7/8	Minimal improvement
Shen	2007	27	Male	Motorcycle accident	Valuable finding	None	Th9	Full recovery
Shen	2007	35	Female	Motorcycle accident	Valuable finding	None	Th6	Permanent
Shen	2007	45	Male	Motorcycle accident	Valuable finding	None	Th9/10	Minimal improvement
Rivierez	2001	30	Male	Football game	Hemorrhage	Ossification of the ligamentum flavum	T10/12	Almost cured
Hirsh	1993	20	Male	Motorcycle accident	Spinal cord disruption	Interspinous ligament injury	T6/7	Permanent
MacMillan	1990	26	Male	Powerboat accident	Not examined	Severe post-traumatic kyphosis	T4	Full recovery
MacMillan	1990	69	Male	Falling down from back in a slope	Not examined	Kyphotic angulation	T8	Full recovery
Present case		71	Female	Falling down on abdomen	T2 high lesion	Ossification of the posterior longitudinal ligament	Th12	Almost cured

MRI, magnetic resonance imaging.

strength and development, which can allow for subluxation without the development of bony fractures.¹³ Thoracic spinal cord injury in adult cases is usually induced by thoracic spinal fracture and/or dislocation.^{1,10,11} Concerning thoracic spinal cord injury without bony fractures in adult patients aged 20 years or older, four cases out of 10 have had underlying pre-existing bony pathologies^{12–16} (Table 1). One possible mechanism of spinal cord injury without bony fractures or dislocation due to minor trauma, such as a fall, involves pre-existing OPLL and OLF in which the level of spinal canal stenosis at thoracolumbar lesions might be important. The transition zone from the thoracic to the lumbar vertebrae appears to be at high risk of injury due its anatomical characteristics (change in the spinal curve and facet angle at this level) and mobilization.^{15–18} Pre-existing OPLL, OLF, and vertebral motion may induce spinal cord injury. Another possible mechanism involves extensive stress on the trunk. When the spine is in hyperextension, the overlapping vertebral arch and/or buckling of the ligamentum flavum results in narrowing of the spinal canal.¹⁹ Preexisting spinal canal stenosis caused by OPLL and OLF in addition to narrowing of the spinal canal induced by hyperextensive motion work together to create thoracic spinal cord lesions.

There are many cases of cervical spinal cord injury without fractures or dislocation due to minor injury resulting from pre-existing spinal canal stenosis.²⁰ One of the reasons

for the difference in the incidence of spinal cord injury without fracture and dislocation between the cervical and thoracic spine may be the range of motion of the spine. The average range of motion of cervical combined flexion–extension is greater than that of the thoracolumbar transition zone, so that a smaller range of motion might lead to less frequent occurrence of spinal cord injury.²¹ The other reason for the difference may be the incidence of spinal canal stenosis.¹ The unique mechanism of trauma in this case report adds another cause to the list of documented etiological conditions resulting in thoracic spinal cord injury.

CONCLUSION

WE REPORTED THE first case of paraparesia with thoracic OPLL and OLF induced by falling down on the abdomen. Physicians should pay attention to thoracic spinal cord injury induced by hyperextensive stress on the spine, even in cases of minor trauma, among patients with pre-existing bony pathologies at the thoracolumbar level.

CONFLICT OF INTEREST

NONE.

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