

## Case Report

# Spinal Cord Injury Caused by Minor Trauma in a Patient With Silent Ossification of the Ligamentum Flavum: Case Report and Review



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## ABSTRACT

**Background and Importance:** Acute spinal cord injury without an apparent spinal fracture/dislocation in an asymptomatic subject with silent thoracic ossification of the ligamentum flavum (TOLF) is extremely rare with only seven fully documented examples of this specific scenario in the literature.

**Case Presentation:** A previously healthy middle-aged woman with a documented magnetic resonance imaging (MRI) history of silent TOLF presented severe lower extremity weakness immediately after a minor fall. Repeat MRI revealed the appearance of myelopathy at the silent T10-T11 ossification of the ligamentum flavum (OLF) site. Laminectomy and excision of the OLF result in complete recovery within 6 months.

**Conclusion:** We believe that our asymptomatic patient should have undergone prophylactic surgical intervention before this catastrophic event. In a survey of medical literature, we found that the presented case is the first example of a documented MRI of TOLF in its silence period.

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## Highlights

- Asymptomatic patients with significant thoracic spinal canal stenosis due to ossification of the ligamentum flavum (OLF) are at risk of spinal cord injury after trivial traumas.
- If thoracic ossification of the ligamentum flavum (TOLF) with significant canal compromise is incidentally detected in a previously asymptomatic subject, prophylactic laminectomy and excision of OLFs are highly recommended.
- An asymptomatic patient with silent TOLF who sustains spinal cord injury following a minor trauma should undergo decompressive laminectomy with subsequent OLF removal.
- In patients with incomplete cord injury, laminectomy and excision of OLFs result in good to excellent neurological recovery.
- Even those with complete spinal cord injury may benefit from decompressive surgery.

## Plain Language Summary

Significant canal compromise due to a silent TOLF may signal the onset of myelopathy even after trivial traumas.

### 1. Introduction

**W**ith the growing use of magnetic resonance imaging (MRI), neurosurgeons are increasingly faced with a scenario in which the clinical picture of the patients is inconsistent with their radiographic findings. One of these is acute spinal cord injury in patients with pre-existing silent ossification of the ligamentum flavum (OLF), a clinical scenario with only seven previously published examples within the medical literature [1-5]. Herein, we present a new example in a 58-year-old woman.

### 2. Case Presentation

A 58-year-old female presented with acute lower limb weakness following a trivial fall. Fourteen months before admission, an asymptomatic thoracic OLF at the T10-T11 spinal level was incidentally discovered on her thoracolumbar MRI. The initial presentation was due to a complaint of back and lower back pain, and periodic follow-ups were proposed (Figure 1 and 2).

On admission, lower extremity weakness was evident with an American Spinal Cord Injury Association (ASIA) impairment score of C along with a vague sensory level up to the umbilicus. In cases where plain radiographs of the spine were normal, a new MRI showed an apparent myelopathic patch at the T10-T11 level without significant change in the size of OLF (Figure 3). A computerized

tomography scan of the affected region showed a bilateral OLF with significant canal compromise (Figure 4).

### Surgical intervention

In surgical intervention, following laminectomy of the affected region, the corresponding OLFs were excised. At an 8-week follow-up, she could ambulate with support. At a 6-month follow-up, her neurological status improved significantly with an ASIA impairment score of E and no canal compromise was observed at T10-T11 OLF in her post-operative MRI (Figure 5).

### 3. Discussion

Symptomatic OLF is a relatively rare condition that affects the thoracic, lumbar, and cervical spine with decreased frequency [6-8]. This pathology, which occurs mostly in the lower thoracic spine, is a well-known entity in East Asian countries, although it is reported with increasing frequency in the Iranian population [9, 10].

### Prevalence

With the growing use of modern neuroimaging tools, the number of subjects with silent thoracic ossification of the ligamentum flavum (TOLF) is increasing. According to three broad epidemiologic studies, the prevalence rate of asymptomatic TOLF in Chinese, Japanese, and Korean populations was 63.9%, 36%, and 16.9%,



**Table 1.** Cases of trauma in background of TOLF, American Spinal Injury Association (ASIA) impairment scale

No.	Authors	Sex	Age (y)	Minimal Trauma	N Status	Ossification	Surgery	Outcome
1	Rivierez et al. (2001) [1]	M	30	Sport related	ASIA-C	T0-T12	Laminectomy	ASIA D
2	Li et al. (2002) [2]	M	49	Minor Fall	ASIA-C	T9-T12	Laminectomy	ASIA D
3	Nagayama et al. (2014) [3]	F	71	Minor Fall	ASIA -C	T10-T11, OPLL	Laminectomy+PSF	ASIA D
4	Kow et al. (2016) [4]	M	50	Sport related	ASIA A	T10-T11	Laminectomy+PSF	ASIA D
5	Machino et al. (2016) [5]	M	73	Minor Fall	ASIA C	T10-T11	Laminectomy	ASIA D
6	Machino et al. (2016) [5]	F	77	Minor Fall	ASIA C	T9-T10	Laminectomy	ASIA-D
7	Machino et al. (2016) [5]	M	65	Minor Fall	ASIA C	T11-T12	Laminectomy	ASIA E
8	Current case (2023)	F	58	Minor Fall	ASIA C	T10-T11	Laminectomy	ASIA E

ASIA: American spinal injury association; F: female; M: male



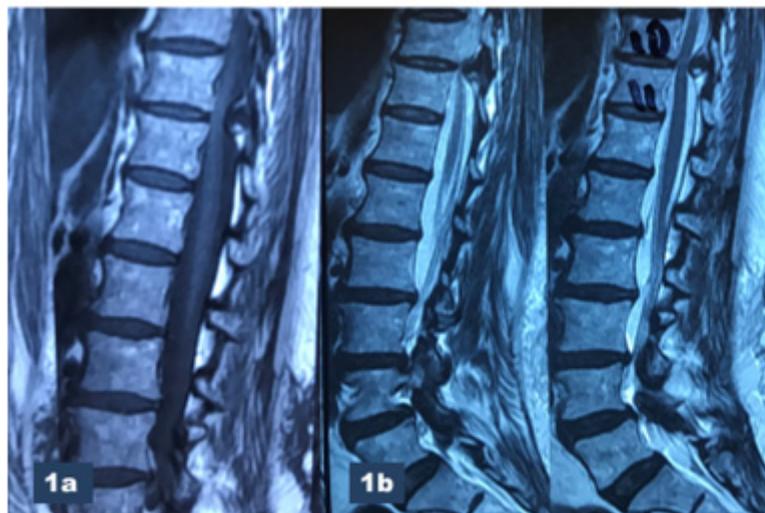
respectively [11-13]. T10-T11 was the most affected in all these surveys [11-13].

#### The natural history of asymptomatic TOLF

Natural history data on asymptomatic patients with TOLF was reported by Zhai et al. based on the data from a prospective study [14]. Accordingly, the mean rate of OLF thickness progression has been 1.2 to 1.6 mm per year [14]. In a patient with an asymptomatic TOLF, even a minimal traumatic event may result in an acute spinal cord injury without radiological and tomographic

evidence of fracture /dislocation, a rare scenario confined to 8 cases, including the current case (Table 1). The presented case is unique and different from the other previously published cases concerning thoracic MRI features before the trivial traumatic event.

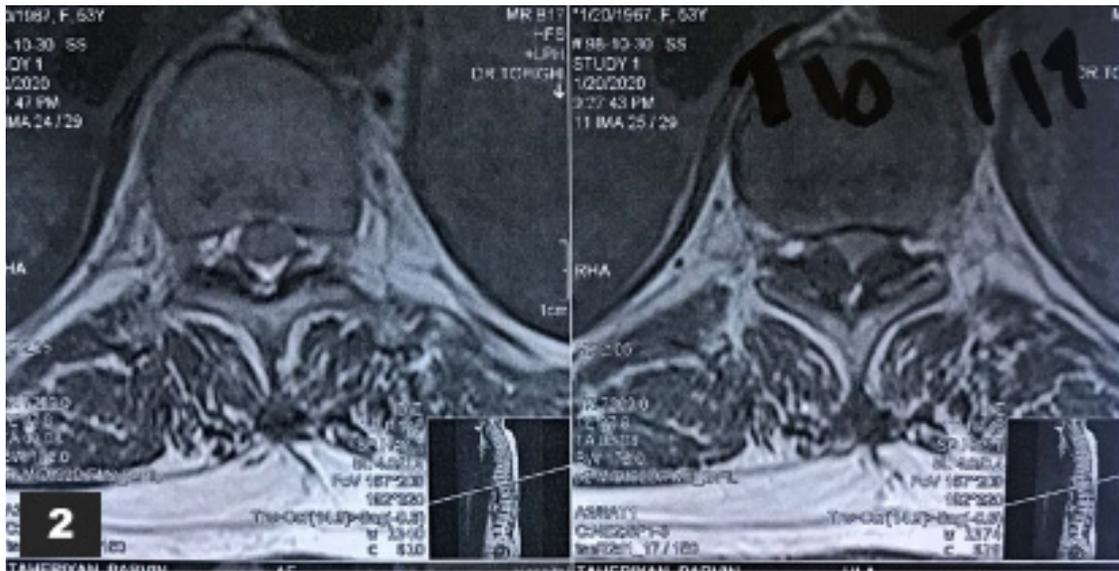
Our review showed that the age of patients ranged between 30 and 77 years, with a mean of 59.1 years at the time of injury [1-5]. Accordingly, men were more likely to be affected by this rare complex injury (5 out of 8). The location of the corresponding OLFs was at the lower thoracic region in all cases [1-5]. One patient became



**Figure 1.** Thoracolumbar MRI and silent TOLF

a) and b) T1 and T2-weighted sagittal images shows T10-T11 TOLF





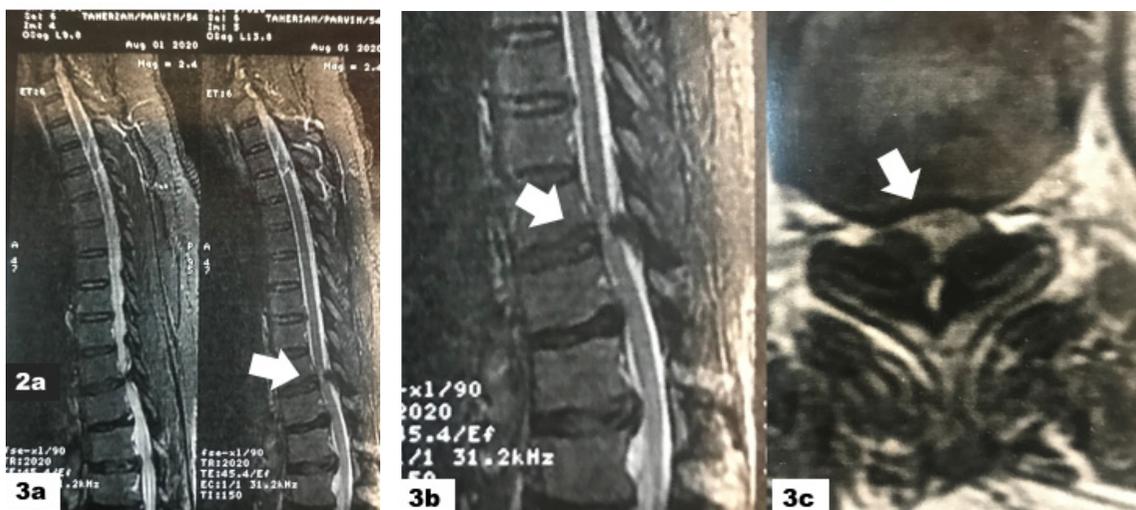
**Figure 2.** T2-weighted axial view showing bilateral OLF without myelopathy



paraplegic (ASIA: A) following the traumatic event and 7 became paraparetic (ASIA: C). However, emergent surgical intervention was performed in two cases with complete recovery and in the remaining 6 cases with an acceptable degree of neurological recovery [1-5].

#### Differential diagnosis

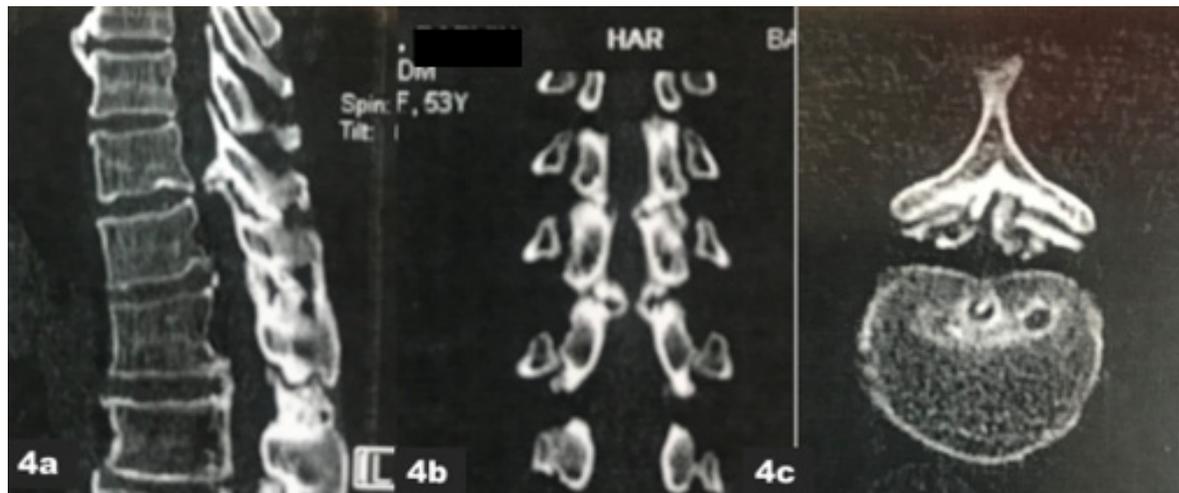
Acute spinal cord injury without radiological and tomographic evidence of fracture or dislocation is not confined to TOLF and has been described in acute traumatic disc herniation, traumas in patients with ossification of the posterior longitudinal ligament (OPLL), and in post-traumatic epidural hematomas [15-17].



**Figure 3.** Thoracolumbar on T2-weighted MRI after minor trauma



a) Sagittal view shows TOLF at T10-T11, b) Sagittal view closer view, the myelopathic path (white arrow) is observed clearly, c) Axial view shows bilateral OLF as well as the myelopathic patch (white arrow)



**Figure 4.** Computerized tomography scan



a) Sagittal view shows ossified TOLF, b) and c) coronal and axial view demonstrate bilateral TOLF

### Surgery

In patients with acute traumatic spinal cord injury related to TOLF, decompressive laminectomy and excision of the OLF are the mainstay of treatment [1-5].

### Outcome

Different degrees of recovery should be suspected with emergent surgical intervention.

### 4. Conclusion

Asymptomatic patients with thoracic stenosis due to silent OLF are at risk of acute spinal cord injury even after trivial traumatic events. For asymptomatic patients in whom silent TOLF is incidentally found, periodic clinical follow-up and avoidance of high-risk activities are highly indicated. However, prophylactic surgery should be proposed once canal compromise is around or more than 40% [17]. Furthermore, acute spinal cord injury in



**Figure 5.** At six-month follow-up



a) On postoperative sagittal T2-weighted MRI canal is open (white arrowhead), b) Photograph of the patient walking independently

a patient with this combined scenario requires emergent surgical intervention. Finally, postoperative neurological recovery is not confined to patients with incomplete neurological deficits, but even those patients with paraplegia may benefit from surgery.

## Ethical Considerations

### Compliance with ethical guidelines

The authors certify that they have obtained all appropriate patient consent.

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### Authors' contributions

All authors contributed equally to preparing this report.

### Conflict of interest

The authors declared no conflict of interest.

## References

- [1] Rivierez M, Vally P. [Ossification of ligamentum flavum unmasked by acute paraplegia (French)]. *Neuro-Chirurgie*. 2001; 47(6):572-5. [PMID]
- [2] Li KK, Chung OM, Chang YP, So YC. Myelopathy caused by ossification of ligamentum flavum. *Spine*. 2002; 27(12):E308-12. [DOI:10.1097/00007632-200206150-00026] [PMID]
- [3] Nagayama M, Yanagawa Y, Okuda T, Yonezawa I, Iba T, Kaneko K. A case of paraparesis with thoracic ossification of the posterior longitudinal ligament and the ligamentum flavum induced by falling down on the abdomen. *Acute Medicine & Surgery*. 2013; 10:54-7. [DOI:10.1002/ams2.3] [PMID] [PMCID]
- [4] Kow CY, Chan P, Etherington G, Rosenfeld JV. Acute traumatic cord injury associated with ossified ligamentum flavum. *Journal of Clinical Neuroscience: Official Journal of the Neurosurgical Society of Australasia*. 2016; 30:165-6. [DOI:10.1016/j.jocn.2016.02.008] [PMID]
- [5] Machino M, Imagama S, Ito K, Ando K, Kobayashi K, Kato F, et al. Thoracic spinal cord injury without major bone injury associated with ossification of the ligamentum flavum. *Journal of Orthopaedic Science: Official Journal of the Japanese Orthopaedic Association*. 2019; 24:174-7. [DOI:10.1016/j.jos.2016.10.002] [PMID]
- [6] Rahimizadeh A, Asgari N, Soufiani H, Rahimizadeh S. Ossification of the cervical ligamentum flavum and case report with myelopathy. *Surgical Neurology International*. 2018; 9:263. [PMID] [PMCID]
- [7] Rahimizadeh A, Sami SH, Amirzadeh M, Rahimizadeh S, Asgari N. Symptomatic thoracic ossified ligamentum flavum in achondroplasia: A case report and literature review. *Surgical Neurology International*. 2022; 13:70. [DOI:10.25259/SNI\_101\_2022] [PMID] [PMCID]
- [8] Rahimizadeh A, Soufiani H, Amirzadeh M, Rahimizadeh S. Ossification of the ligamentum flavum of the lumbar spine in caucasians: Case series. *Journal of Spine & Neurosurgery*. 2017; 6(5):1-9. [DOI:10.4172/2325-9701.1000283]
- [9] Alijani B, Yousefzadeh-Chabok S, Ramzannejad A, Behzadnia H, Emamhadi M. Simultaneous diffuse idiopathic hyperostosis, ossification of the posterior longitudinal ligament and ligamentum flavum. *Iranian Journal of Neurosurgery*. 2018; 4(1):51-5. [DOI:10.32598/irjns.4.1.51]
- [10] Rahimizadeh A, Habibollahzadeh P, Williamson WL, Soufiani H, Amirzadeh M, Rahimizadeh S. Symptomatic thoracic ossification of the ligamentum flavum in a patient with ankylosing spondylitis: Report of a case and review. *Surgical Neurology International*. 2021; 12:596. [DOI:10.25259/SNI\_1067\_2021] [PMID] [PMCID]
- [11] Lang N, Yuan HS, Wang HL, Liao J, Li M, Guo FX, et al. Epidemiological survey of ossification of the ligamentum flavum in thoracic spine: CT imaging observation of 993 cases. *European Spine Journal: Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*. 2013; 22(4):857-62. [DOI:10.1007/s00586-012-2492-8] [PMID] [PMCID]
- [12] Mori K, Kasahara T, Mimura T, Nishizawa K, Murakami Y, Matsusue Y, Imai S. Prevalence, distribution, and morphology of thoracic ossification of the yellow ligament in Japanese: Results of CT-based cross-sectional study. *Spine*. 2013; 38(19):E1216-22. [DOI:10.1097/BRS.0b013e31829e018b] [PMID]
- [13] Moon BJ, Kuh SU, Kim S, Kim KS, Cho YE, Chin DK. Prevalence, distribution, and significance of incidental thoracic ossification of the ligamentum flavum in Korean patients with back or leg pain: MR-based cross sectional study. *Journal of Korean Neurosurgical Society*. 2015; 58(2):112-8. [DOI:10.3340/jkns.2015.58.2.112] [PMID] [PMCID]
- [14] Zhai J, Guo S, Li J, Chen B, Zhao Y. Progression of spinal ligament ossification in patients with thoracic myelopathy. *Orthopedic Surgery*. 2022; 14(9):1958-63. [DOI:10.1111/os.13291] [PMID] [PMCID]
- [15] Bennett DL, George MJ, Ohashi K, El-Khoury GY, Lucas JJ, Peterson MC. Acute traumatic spinal epidural hematoma: Imaging and neurologic outcome. *Emergency Radiology*. 2005; 11(3):136-44. [DOI:10.1007/s10140-004-0371-2] [PMID]
- [16] Kwon SY, Shin JJ, Lee JH, Cho WH. Prognostic factors for surgical outcome in spinal cord injury associated with ossification of the posterior longitudinal ligament (OPLL). *Journal of Orthopaedic Surgery and Research*. 2015; 10:94. [DOI:10.1186/s13018-015-0235-3] [PMID] [PMCID]
- [17] Rahimizadeh A, Sami SH, Rahimizadeh S, Williamson WL, Amirzadeh M. Acute traumatic sequestered thoracic disc herniation: A case report and review. *Surgical Neurology International*. 2021; 12:108. [DOI:10.25259/SNI\_941\_2020] [PMID] [PMCID]

