Epidemiology of Cervical OPLL

Summary

Many reports indicate that the incidence of cervical OPLL differs according to race, with a higher incidence among Japanese and East Asian people than in Western people. Cervical OPLL is more common among men, whereas thoracic OPLL is common among women. Cervical OPLL often develops in middle age (approximately 50 years of age). The presence of cervical OPLL indicates a high rate of concurrent ossification in other spinal ligaments. Patients that present with serious ossification such as that extending in the entire spine are often women.

Commentary

1. Incidence in Japanese and differences according to race

In a study using plain X-rays in Japanese, the incidence of cervical OPLL was approximately 3% (1.9-4.3%) \(^{11}\). In a study using CT, the incidence of cervical OPLL was 6.3% \(^{15}\). In East Asian studies of the incidence of cervical OPLL, i.e., 2.8-3.0% in Taiwanese \(^{12}\), 0.95-3.6% in Korean \(^{13}\), and 1.1-1.7% in Chinese, were approximately equal to that in Japanese \(^{14}\). On the other hand, in an American study using CT, the prevalence of OPLL according to race was 1.3% among Caucasians, 4.8% among Asians, 1.9% among Hispanics, 2.1% among Africans, and 3.2% among Native Americans \(^{15}\), indicating a difference between races, with OPLL found to be more common among Asian people.

2. Differences in incidence according to gender

In a Japanese report, the incidence of cervical OPLL was 3.2% (4.3% in men and 2.4% in women) \(^{16,17}\). In an evaluation using CT, the incidence was 6.3% (8.3% in men and 3.4% in women) \(^{18}\). On the other hand, the male/female ratio of thoracic OPLL was the contrary to that of cervical OPLL. The incidence of thoracic OPLL was 0.25% in men and 0.74% in women \(^{19}\). Furthermore, in another study using CT, the incidence of thoracic OPLL was 1.0% in men and 3.1% in women \(^{20}\).

Therefore, the incidence of cervical OPLL in Japan was approximately twofold higher in men than in women, whereas the incidence of thoracic OPLL was 1.5-3-fold times higher in women.

3. Common age of OPLL onset

The onset of cervical OPLL was reported to be more common from 50 years onward \(^{21}\). In a study using CT, the onset of cervical OPLL was noted in individuals in their 30s and 40s as well; however, the incidence increased from 50 years onward \(^{22}\). Furthermore, with regard to thoracic OPLL, a study using CT revealed that the onset increased from 40 years onward, peaking in individuals in their 60s \(^{23}\). Based on the above results, cervical OPLL also develops in individuals in their 30s and 40s, and the incidence increases after 50 years of age.

4. Cervical OPLL and ossified lesions of the entire spine
In a report on the prevalence of ossification of spinal ligaments in Japanese individuals examined using CT, cervical OPLL was present in 6.3%, thoracic OPLL in 1.6%, thoracic OLF in 12%, lumbar spine OPLL in 0.7%, lumbar spine OLF in 0.3%, diffuse idiopathic skeletal hyperostosis in 12%, cervical ossification of the anterior longitudinal ligament in 8%, thoracolumbar ossification of the anterior longitudinal ligament in 37%, and ossification of the nuchal ligament in 23% of patients. Furthermore, the range of ossified lesions in the entire spine tended to be greater in women than in men. Particularly, ossification of the thoracolumbar spine tended to be more serious in women.

**Natural Course of OPLL (Symptoms, Imaging, Type of Onset, Involvement of Trauma, and Risk of Spinal Damage)**

**Summary**

- Natural course (progression of ossification and myelopathy): The form of ossification correlates with the appearance of symptom. No significant correlation was observed between ossification progression and symptoms.
- Onset risk: Onset of myelopathy relates to small anteroposterior diameter of the spinal canal.
- Involvement of trauma: OPLL is a risk factor of cervical cord injury without bony injury.

**Commentary**

1. **Progression of ossification**

   a. **Evaluation using plain X-ray**

   Followed up for at least 10 years, the progression of ossification in cervical OPLL was observed in 49% of patients. Furthermore, the progression was observed in 57% of aged <50 years. The rate of progression tended to be higher for the mixed type and the segmental type.

   b. **Evaluation using CT**

   A report of the three-dimensional progression of OPLL showed a mean annual increase of 4.1%. The risk factors for OPLL progression are young age, high body weight, and high BMI. Another study revealed that involvement of multilevel and mixed type significantly correlated with progression of ossification, while trabeculation of OPLL and connection of the OPLL with the vertebral body showed a significant correlation with the absence of ossification progression.

2. **Myelopathy**

   Most of the cases with aggravation of myelopathy in the natural course were segmental type or mixed type, having a triangular shape of spinal cord on axial MRI, and an intramedullary high intensity region with T2-weighted imaging. Furthermore, in conservative treatment patients, 66.5% remained without myelopathy, 14.7% newly developed myelopathy, and 4.6% exhibited exacerbation of myelopathy. In contrast, the symptoms improved in 60.5% of subjects in the natural course group, and no clear relationship was observed between the progression of ossification and symptoms.

3. **Risk of onset**

   Mixed type of ossification was highly observed in myelopathy group. The rate of spinal canal stenosis and the range of motion at the site involving myelopathy was significantly greater in the group with myelopathy. Another study indicated that the minimum residual anteroposterior diameter of spinal canal of <6 mm was a risk factor to the onset of myelopathy, while the dynamic factors greatly contribute to the onset of myelopathy in patients with ≥6 mm.

4. **Involvement of trauma**

   The presence of OPLL was a risk factor for cervical cord injury and especially in patients without bony injury. Among OPLL patients, myelopathy was caused by trauma in 13% of OPLL patients. Among OPLL patients with a spinal canal occupancy rate of ≥60%, myelopathy was caused by trauma at high rates. Univariate analysis revealed a significant difference in elderly age, anteroposterior spinal canal diameter, and rate of spinal canal stenosis.

**Conflicts of Interest:** The author declares that there are no relevant conflicts of interest.

This is a part of *The Essence of Clinical Practice Guidelines for Ossification of Spinal Ligaments* (2019), which is listed below.

1. Epidemiology of OPLL, written by Tomohiko Hasegawa, MD, PhD, Hamamatsu University, School of Medicine, Japan. [https://doi.org/10.22603/ssrr.2021-0096](https://doi.org/10.22603/ssrr.2021-0096)
2. Pathology of OPLL, written by Takashi Kaito, MD, PhD, Osaka University Graduate School of Medicine, Japan. [https://doi.org/10.22603/ssrr.2021-0074](https://doi.org/10.22603/ssrr.2021-0074)
3. Diagnosis of OPLL, written by Hirotaka Chikuda, MD, PhD, Gumma University, School of Medicine, Japan. [https://doi.org/10.22603/ssrr.2021-0118](https://doi.org/10.22603/ssrr.2021-0118)
4. Treatment of Cervical OPLL, written by Toshitaka Yoshii, MD, PhD, Tokyo Medical and Dental University Hospital, Japan. [https://doi.org/10.22603/ssrr.2021-0100](https://doi.org/10.22603/ssrr.2021-0100)
5. Treatment of Thoracic OPLL, written by Shiro Imagama, MD, PhD, Nagoya University Graduate School of Medicine, Japan. [https://doi.org/10.22603/ssrr.2021-0095](https://doi.org/10.22603/ssrr.2021-0095)
6. Diagnosis of OLF, written by Masao Koda, MD, PhD, University of Tsukuba, Japan. [https://doi.org/10.22603/ssrr.2021-0116](https://doi.org/10.22603/ssrr.2021-0116)
7. Treatment of Thoracic OLF, written by Kanji Mori, MD, PhD, Shiga University of Medical Science, Japan.
The original version of this clinical practice guidelines appeared in Japanese as Sekichu Jintai Kokkashou Shinyo Guidelines 2019, published by the Japanese Orthopaedic Association and the Japanese Society for Spine Surgery and Related Research, and its translated version in English appeared in the Journal of Orthopaedic Science 26 (2021) 1-45.

References

1. Yoshimura N, Nagata K, Muraki S, et al. Prevalence and progression of radiographic ossification of the posterior longitudinal ligament and associated factors in the Japanese population: a 3-year follow-up of the ROAD study. Osteoporos Int. 2014;25(3):1089-98.

2. Shingyouchi Y, Nagahama A, Niida M. Ligamentous ossification of the cervical spine in the late middle-aged Japanese men. Its relation to body mass index and glucose metabolism. Spine. 1996;21(21):2474-8.

3. Ohtsuka K, et al. An epidemiological study of ossification of the cervical and thoracic spine ligaments in residents aged 50 years. J Jpn Orthop Assoc. 1986;60(11):1087-98. Japanese.

4. Sasaki E, Ono A, Yokoyama T, et al. Prevalence and symptom of ossification of posterior longitudinal ligaments in the Japanese general population. J Orthop Sci. 2014;19(3):405-11.

5. Fujimori T, Watabe T, Iwamoto Y, et al. Prevalence, concomitance, and distribution of ossification of the spinal ligaments: results of whole spine CT scans in 1500 Japanese patients. Spine. 2016;41(21):1668-76.

6. Kurokawa T. The incidence of cervical ossification of the posterior longitudinal ligament in Taiwan, Hong Kong, and Singapore. Ministry of Health and Welfare, Research group for ossification of the spinal ligaments. 1977;1978:26-7. Research report. Japanese.

7. Inamasu J, Guiot BH, Sachs DC. Ossification of the posterior longitudinal ligament: an update on its biology, epidemiology, and natural history. Neurosurgery. 2006;58(6):1027-39.

8. Izawa K. Comparative roentgenographic study on the incidence of ossification of the posterior longitudinal ligament and other degenerative changes of the cervical spine among Japanese, Koreans, Americans, and Germans. J Jpn Orthop Assoc. 1980;54(5):461-74.

9. Ueyama K, et al. An epidemiological study of cervical ossification of the posterior longitudinal ligament in China. 1999 annual report on research on specific disease control of the Ministry of Health and Welfare. Survey of ossification of the spinal ligaments; 2000. p. 157-60.

10. Tomita T, et al. An epidemiological study of ossification of the cervical posterior longitudinal ligament and degenerative cervical spine disease in China. East Jpn J Clin Orthop. 1995;7(4):549-51.

11. Harada M, et al. An epidemiological study of ossification of the cervical posterior longitudinal ligament in China. Clin Orthop Surg. 1994;29(6):671-6.

12. Fujimori T, Le H, Hu SS, et al. Ossification of the posterior longitudinal ligament of the cervical spine in 3161 patients: a CT-based study. Spine. 2015;40(7):E394-403.

13. Ohtsuka K, Terayama K, Yanagihara M, et al. A radiological population study on the ossification of the posterior longitudinal ligament in the spine. Arch Orthop Trauma Surg. 1987;106(2):89-93.

14. Ohtsuka K, et al. The epidemiology and statistics of ossification of the spinal ligaments. J Orthop Surg MOOK. 1987;(50):12-25.

15. Ono M, Russell WJ, Kudo S, et al. Ossification of the thoracic posterior longitudinal ligament in a fixed population. Radiological and neurological manifestations. Radiology. 1982;143(2):469-74.

16. Mori K, Imai S, Kasahara T, et al. Prevalence, distribution, and morphology of thoracic ossification of the posterior longitudinal ligament in Japanese: results of CT-based cross-sectional study. Spine. 2014;39(5):394-9.

17. Sohn S, Chung CK, Yun TJ, et al. Epidemiological survey of ossification of the posterior longitudinal ligament in an adult Korean population: three-dimensional computed tomographic observation of 3,240 cases. Calcif Tissue Int. 2014;94(6):613-20.

18. Hirai T, Yoshii T, Nagoshi N, et al. Distribution of ossified spinal lesions in patients with severe ossification of the posterior longitudinal ligament and prediction of ossification at each segment based on the cervical OP index classification: a multicenter study (OSL CT study). BMC Musculoskelet Disord. 2018;19(1):107.

19. Kajiru K, et al. Progression of cervical ossification of the posterior longitudinal ligament: an examination of patients followed up for at least 10 years. 1998 Annual Report on Research on Specific Disease of the Ministry of Health and Welfare. Research group examining bone and joint diseases; 1998. p. 1468.

20. Takeiomi E, et al. The natural course of cervical ossification of the posterior longitudinal ligament: long-term follow-up observation focusing on ossification progression. Orthop Traumatol. 1987;35(3):780-3.

21. Katsumi K, Watanabe K, Izumi T, et al. Natural history of the ossification of cervical posterior longitudinal ligament: a three-dimensional analysis. Int Orthop. 2017;42(4):835-42.

22. Choi BW, Baek DH, Sheffler LC, et al. Analysis of progression of cervical OPLL using computerized tomography: typical sign of maturation of OPLL mass. J Neurosurg Spine. 2015;23(5):1-5.

23. Sawamura S, et al. The prognosis of non-surgical inpatients with myelopathy caused by cervical ossification of the posterior longitudinal ligament. Clin Orthop Surg. 1998;33(4):505-10.

24. Okano T, et al. The natural course of cervical ossification of the posterior longitudinal ligament. J Western Jpn Res Soc. 1994;20(1):83-6.

25. Ohashi T, Nagata K, Abe J, et al. Natural history and clinical results after expansive laminoplasty for the posterior longitudinal ligament in the cervical spine. Orthop Traumatol. 1994;43(4):1319-22.

26. Morio Y, Nagashima H, Teshima R, et al. Radiological pathogenesis of cervical myelopathy in 60 consecutive patients with cervical ossification of the posterior longitudinal ligament. Spinal Cord. 1999;37(12):853-7.

27. Matsunaga S, et al. The clinical progress of patients receiving conservative treatment for cervical ossification of the posterior longitudinal ligament. J Orthop Surg. 2004;45:37-40.

28. Chikuda H, Seichi A, Takeshita K, et al. Acute cervical spinal cord injury complicated by preexisting ossification of the posterior longitudinal ligament: a multicenter study. Spine. 2011;36(18):1453-8.

29. Kato H, Kimura A, Sasaki R, et al. Cervical spinal cord injury without bony injury: a multicenter retrospective study of emergency and critical care centers in Japan. J Trauma. 2008;65(2):373-9.

30. Matsunaga S, Sakou T, Hayashi K, et al. Trauma-induced myelopathy in patients with ossification of the posterior longitudinal ligament. J Neurosurg. 2002;97(2 Suppl):172-5.

31. Jung JM, Chung CK, Kim CH, et al. Risk factors and prognosis for acute progression of myelopathic symptoms in patients with ossification of the posterior longitudinal ligament after minor
Spine Surgery and Related Research is an Open Access journal distributed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view the details of this license, please visit (https://creativecommons.org/licenses/by-nc-nd/4.0/).