Complications corner: Quadriplegia after a minor hyperextension injury with severe OPLL teaching case and illustrative images

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INTRODUCTION

A previously healthy and extremely active male surviving into his ninth decade (86 years of age), a retired university professor, slipped and fell while descending his basement steps. He sustained an acute hyperextension injury when his forehead struck the floor. Although he remained conscious, he noted the immediate onset of quadriplegia.

Abstract

**Background:** A previously healthy and asymptomatic male surviving well into his ninth decade (86 years of age) was rendered immediately and completely quadriplegic after a minor fall associated with cervical hyperextension.

**Methods:** Since he was unable to undergo a magnetic resonance (MR) scan due to the presence of a cardiac pacemaker, a non-contrast computed tomography (CT) was performed. This study demonstrated extremely severe cervical spinal canal stenosis secondary to previously undiagnosed ossification of the posterior longitudinal ligament (OPLL) resulting in marked spinal cord compression between C5 and C6.

**Results:** Secondary to his severe and irreversible quadriplegia, the patient elected not to undergo any intervention; he expired 4 days later. Had his deficit not been so severe, and had he been diagnosed earlier and undergone prophylactic/preventive posterior decompression (e.g. laminectomy C4-C7) sufficient to allow his cord to migrate dorsally, his irreversible quadriplegic deficit might have been avoided.

**Conclusions:** Older patients with symptoms of progressive myelopathy should undergo early cervical MR (or CT if they have a pacemaker) screening looking for “silent” cord compression due to stenosis, spondyloarthrosis, and/or OPLL. This case highlights the devastating consequences of even a mild hyperextension injury in a patient harboring extremely severe but previously undiagnosed OPLL. Devastating life-threatening or life-ending injuries may be avoided by maintaining a low threshold for performing “screening” cervical studies in elderly patients with vague complaints that might signal the onset of myelopathy.

**Key Words:** Cord compression, irreversible deficit, non-surgical options, ossification posterior longitudinal ligament, quadriplegia
Neurological evaluation in the local Emergency Department documented a “complete” cervical spinal cord injury; motor and sensory functions were absent below the C5-C6 level. He also already exhibited labored diaphragmatic breathing, with paradoxical movement of the rib cage and supraclavicular retraction with inspiration.

**Prior history**
The past medical history and review of systems was negative for any evidence of cervical trauma. However, upon careful questioning, he had noted the onset of a “vague sensation” of fatigue in his legs over the past several months. Nevertheless, this had not been evaluated, as it had not significantly interfered with his vigorous lifestyle, which included hiking.

**Diagnostic imaging**
As magnetic resonance (MR) scanning was not feasible due to the presence of a cardiac pacemaker, the patient underwent a non-contrast computed tomography (CT) study. This examination, including two-dimensional (2D) and three-dimensional (3D) reconstructed sagittal and coronal images, revealed extremely large ossified processes consistent with ossification of the posterior longitudinal ligament (OPLL) bridging the posterior aspect of the C5/C6 disc space and extending to include the posterior aspect of the adjacent vertebral bodies [Figures 1-6]. Furthermore, on the axial studies, the OPLL mass occupied the majority of the cross-sectional area of the right side of the spinal canal and extended across the midline to the left. The axial bone window CT image also demonstrated what appeared to be a fracture within the ossified mass extending diagonally from the right lateral toward the center of the ossified mass at the C5 and C6 levels [Figure 2]. The sagittal 2D CT study also showed increased distraction of the C5 C6 disc space [Figure 3]. Also noted on Figure 3 was the discontinuity between the OPLL mass posterior to the C5 vertebral body and the more central OPLL mass (arrow) likely consistent with the double-layer sign (OPLL extending to/through the dura with the hyperdense ossified mass behind the vertebral body interrupted by the hypodense dura followed by the intradural ossified OPLL).

**Outcome**
Prior to the injury, and while of sound body and mind, the patient had explicitly expressed to his family the wish not to be supported in a debilitated or dependent state. Thus, he and his family declined intervention, other than comfort measures. He expired 4 days later, as his diaphragm gradually fatigued.

**DISCUSSION**
In this case, slowly progressive OPLL resulted in nearly complete obliteration of the spinal canal at the C5-C6 level. These findings are consistent with those recently summarized by Epstein.[1,2] Figure 4 is particularly diagnostic of the double-layer sign characteristic of OPLL on CT studies, as there is a hypodense band (residual dura) sandwiched between hyperdense ventral and dorsal OPLL (i.e. ossification behind the vertebral body followed by ossification extending to/through the dura). Other images were also consistent with severe OPLL [Figures 3 and 6]. Of note is the relative paucity of degenerative changes at the other levels of the cervical spine and some minor calcification at the atlanto-occipital level.

![Figure 1](image1.png)

**Figure 1:** Slightly left parasagittal CT scan. This scan demonstrating massive OPLL nearly fills the spinal canal extending from the C4-C5 through the C6-C7 levels. Although the arrows may indicate a focus of fracture through the OPLL mass, this may also represent the double-layer sign indicative of dural penetration. Note that the AP diameter of the spinal canal extending from the most dorsal OPLL mass to the leading edge of the lamina of C6 is approximately 2-3 mm (e.g. the minimal AP diameter of a normal cord is 0.8 mm)

![Figure 2](image2.png)

**Figure 2:** Axial CT scan (bone window) at the C5-C6 level. Massive OPLL fills the entire right and almost half of the left side of the spinal canal at the C5-C6 level. The inhomogeneity of the ossification reflects how OPLL forms (e.g. typically “pearls of ossification” progressively coalesce into the more solid masses). The traversing line indicates the very slightly parasagittal plane of Figure 1
With slow, gradual progression, neural tissue can accommodate astonishing levels of compression or displacement. However, even a minor traumatic event (such as a sudden concussive blow or hyperextension injury) can result in the sudden compression of the spinal cord secondary to acute narrowing of the residual anterior/posterior diameter of the spinal canal. Unfortunately, with severe OPLL, this is associated with an approximately 10% incidence of profound, permanent, and irreversible dysfunction.

As our population ages, and individuals survive into their ninth decade (like this patient), an increasing number will harbor cervical stenosis or OPLL which might become profoundly symptomatic following even relatively minor trauma. Greater awareness that elderly patients may harbor such lesions may prompt early preventive screening, and lead, when appropriate, to surgical decompression prior to the onset of catastrophic neurologic deficits.

REFERENCES

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