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Case Report

Tetraplegia after atrial fibrillation ablation: a rare complication due to unrecognized cervical ossification of the posterior longitudinal ligament

Hyeon Tae Kim[1*], Jin Ho Bae[1*], Young Duck Shin[1*], Jin Wook Park[1*], Byeong Ho Oh[2*], Joo Yong Lee[1*]

[1]Department of Anesthesiology and Pain Medicine, Chungbuk National University Hospital, College of Medicine, Chungbuk National University, Chungbuk 28644, Korea; [2]Department of Neurosurgery, Chungbuk National University Hospital, College of Medicine, Chungbuk National University, Chungbuk 28644, Korea. [*]Equal contributors.

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Abstract: Catheter ablation is widely regarded as a safe and effective treatment for atrial fibrillation (AF). However, rare but severe complications may occur, particularly in patients with undiagnosed structural abnormalities. A 60-year-old man with paroxysmal AF developed complete tetraplegia following catheter ablation under moderate sedation. The procedure was uneventful; however, the patient immediately developed profound quadriparesis. An urgent cervical spine Magnetic Resonance Imaging revealed extensive mixed-type ossification of the posterior longitudinal ligament (OPLL) from C2 to T2 with severe spinal cord compression at C5 and intramedullary high-signal changes, indicating acute compressive myelopathy. Despite emergent decompressive laminectomy and fusion, the patient remained tetraplegic with American Spinal Injury Association grade A status. No neurological improvement was noted at the two-year follow-up. This case underscores the importance of recognizing occult cervical spine pathology, such as OPLL, as a risk factor for spinal cord injury during procedures involving neck positioning or sedation. Preprocedural cervical imaging is warranted in high-risk individuals to prevent catastrophic outcomes. To the best of our knowledge, this is the first reported case of irreversible tetraplegia due to undiagnosed OPLL following AF ablation.

Keywords: Atrial fibrillation, catheter ablation, ossification of the posterior longitudinal ligament, cervical myelopathy, procedural neurologic complication

Introduction

Atrial fibrillation (AF) is one of the most common types of arrhythmia worldwide. It is closely associated with complications such as stroke, heart failure, and systemic embolism [1, 2]. Therefore, its clinical importance has been emphasized as the older adult population increases [3]. Catheter ablation is widely used as an effective treatment method for patients who do not respond to drug treatment or have recurrent relapses [4]. Catheter ablation is generally considered a safe procedure and large-scale studies have reported a low incidence of serious complications [5].

However, despite their low incidence, the complications can have a profound impact on functional outcomes once they occur. The most commonly reported complications include intracardiac perforation, pericardial tamponade, vascular injury, and stroke [5, 6]. Although rare cases of nerve injury have been reported, they are usually phrenic nerve injuries [7]. Neurological complications, such as central nervous system injury, especially spinal cord injury, have rarely been reported in the literature.

This case report describes the rare case of a patient with previously undiagnosed ossification of the posterior longitudinal ligament (OPLL) undergoing catheter ablation for atrial fibrillation under sedation, who developed acute spinal cord compression induced by cervical extension, resulting in complete quadriplegia at the C5 level. This demonstrates that environmental factors such as sedation and

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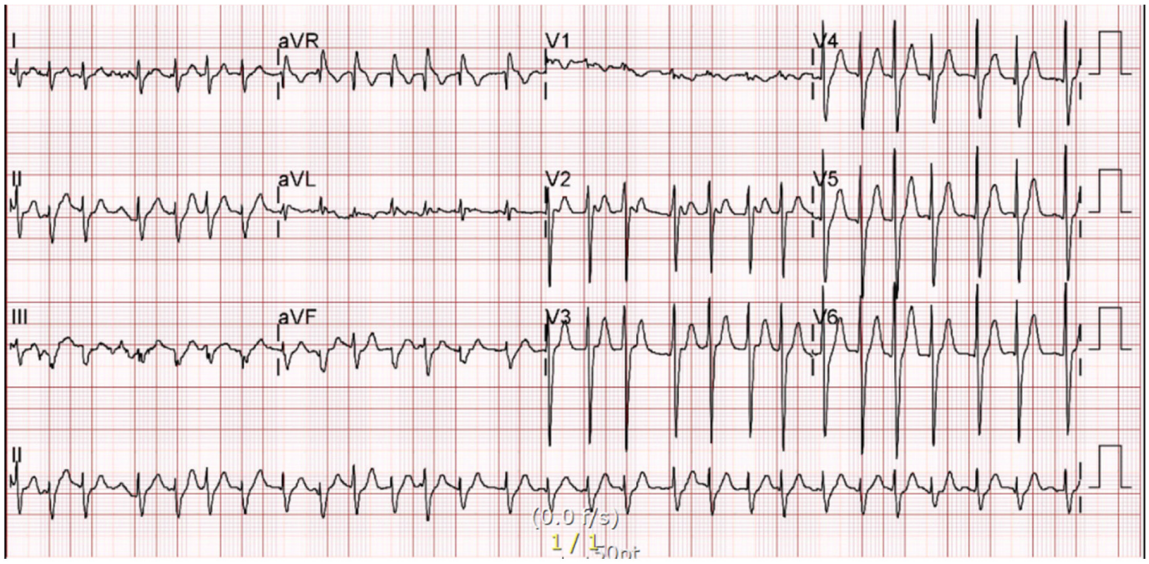

Figure 1. Preprocedural electrocardiogram showing atrial fibrillation with rapid ventricular response. The ventricular rate was approximately 181 bpm without evidence of ST-T segment changes.

positional changes may interact with the risk of the procedure itself.

Therefore, this report aimed to re-examine the need for pre-evaluation of underlying neurological diseases before cardiovascular procedures and the risk of spinal cord injury that may occur during positioning and airway maintenance in sedated patients.

Case report

A 60-year-old male presented at the emergency department with palpitations. He reported consuming approximately two bottles of soju twice weekly and had a 30-year history of smoking one pack per day, although he had quit smoking 10 years prior. He had no history of hypertension, diabetes mellitus, or dyslipidemia. He occasionally experienced mild posterior neck pain occurring once every few years but denied any prior neurological symptoms, such as paresthesia or motor weakness in his upper extremities.

At presentation, his heart rate was 181 beats/min, without dyspnea. Electrocardiography (ECG) revealed AF with a rapid ventricular response (**Figure 1**). Transthoracic echocardiography demonstrated non-valvular AF, an ejection fraction of 70%, and no regional wall motion abnormalities. Vagal maneuvers and pharmacologic interventions, including intravenous adenosine (6 mg and 12 mg) and diltiazem (12.5 mg), failed to restore sinus rhythm. Subsequently, he was started on rivaroxaban 20 mg daily, flecainide 50 mg twice daily, and propranolol 10 mg three times daily. Sinus rhythm was restored 14 h later.

One week after discharge, he visited the cardiology outpatient clinic with complaints of dizziness and generalized weakness that had persisted for 3 days, accompanied by a slow pulse rate. After 14 months, the patient continued to experience intermittent palpitations. Holter monitoring confirmed the episodes of paroxysmal AF. Despite the absence of chest pain, dyspnea, and syncope, catheter ablation was planned because of refractoriness to antiarrhythmic drug therapy.

The procedure was performed under moderate sedation, with propofol administered by target-controlled infusion at 3.0 mg/kg/hr. During ablation, the patient moved, prompting the administration of 5 mg of midazolam. Oxygen saturation (SpO_2) was maintained at 97-100%, although the respiratory pattern was irregular. To optimize the ventilation, the patient's neck was extended by approximately 15° using a pillow.

After the procedure, the patient was transferred to the ward. Approximately 30 min after the procedure, the vital signs were within the

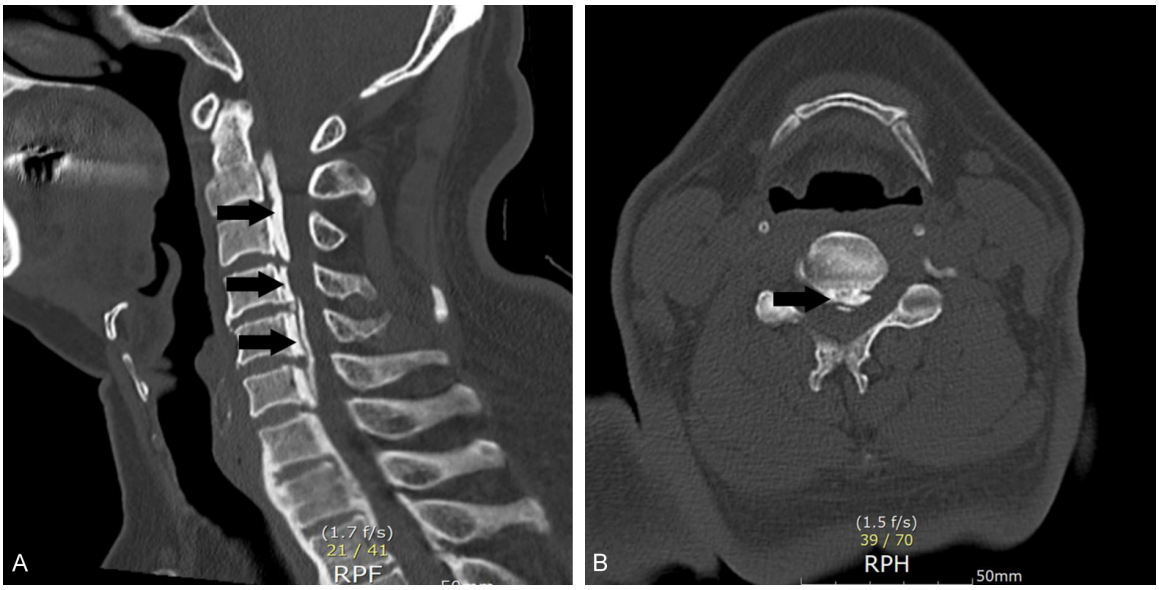

Figure 2. (A) Sagittal and (B) axial computed tomography images of the cervical spine showing extensive mixed-type ossification of the posterior longitudinal ligament (OPLL) from C2 to T2. The regions marked by arrows indicate areas of OPLL. Notably, severe central canal stenosis is observed at the C5 level, corresponding to the most compressed segment. These findings are consistent with high-risk cervical spinal pathology capable of precipitating acute compressive myelopathy.

normal range; however, the patient complained of decreased sensation in both arms and legs. Neurological examination revealed quadriparesis; motor strength was grade 2-3 in the upper limbs and 0 in the lower limbs.

Emergency cervical spine computed tomography (CT) and magnetic resonance imaging (MRI) revealed extensive mixed-type OPLL at C2-3, C4, C5-6, and C7-T2, resulting in central canal stenosis from C2/3 to C6 (most severe at C5). T2-weighted MRI showed a high signal intensity from C4 to C6, consistent with compressive myelopathy (**Figures 2** and **3**).

An emergency decompressive laminectomy and posterior fusion from C3 to C7 were performed (**Figure 4**). Postoperatively, the patient reported no sensation below the chest and was unable to move his limbs. Neurological examination revealed grades 3, 2-/1, and 0/0 motor strengths in the elbow flexors, wrist extensors, and all other muscle groups, respectively. He was diagnosed with C5-level tetraplegia and was classified as American Spinal Injury Association Impairment Scale grade A.

One month later, ECG confirmed sustained sinus rhythm; however, no neurological recovery was observed. At the two-year follow-up, the patient remained tetraplegic and wheelchair-dependent, and required a urinary catheter because of a neurogenic bladder.

Discussion

Atrial fibrillation is one of the most common arrhythmias worldwide and is recognized as an important public health problem with increasing prevalence in the older adult population [3]. AF-related embolisms tend to be more fatal in patients with stroke, and both survival and functional recovery rates have been reported to be lower than those of general stroke [8].

Many large-scale studies have shown that early rhythm control improves the long-term prognosis of patients with AF [9]. Accordingly, catheter ablation has become a major treatment option for patients who do not respond to drug treatment or whose symptoms recur repeatedly, and evidence of its safety and efficacy is gradually accumulating [4]. Catheter ablation achieves rhythm control by electrically isolating the pulmonary veins, where high-frequency re-entry potentials occur [10], and has demonstrated high success and low recurrence rates in selected patients [11].

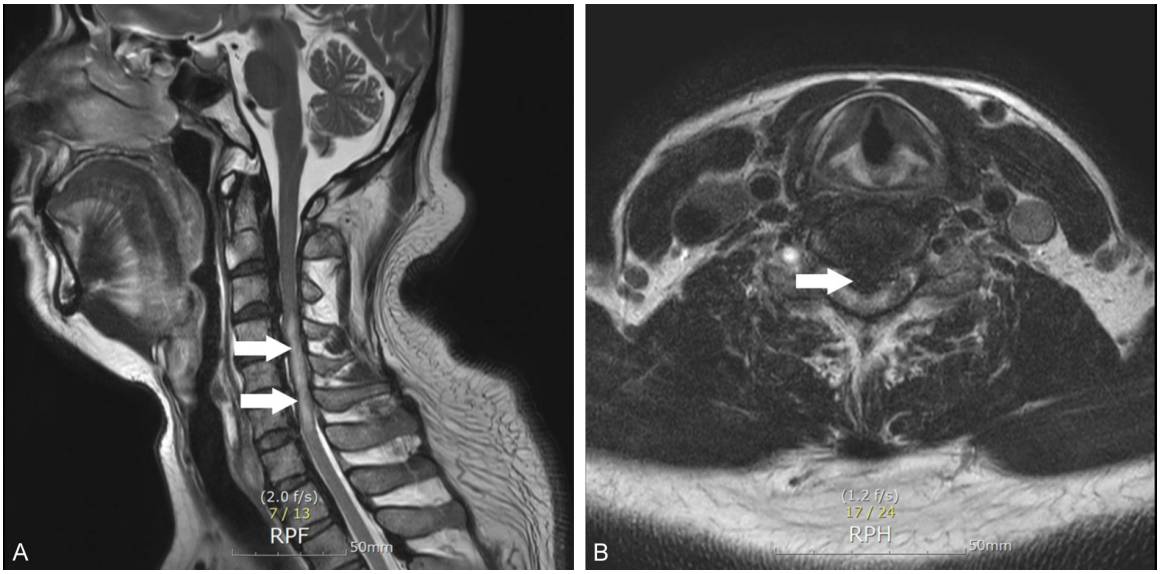

Figure 3. (A) Sagittal and (B) axial T2-weighted magnetic resonance images of the cervical spine showing intramedullary high signal change at the C4-C6 level, consistent with acute compressive myelopathy. The regions marked by arrows indicate areas of acute compressive myelopathy. Mixed-type ossification of the posterior longitudinal ligament is evident from C2 to T2, with the most severe central canal narrowing observed at the C5 level.

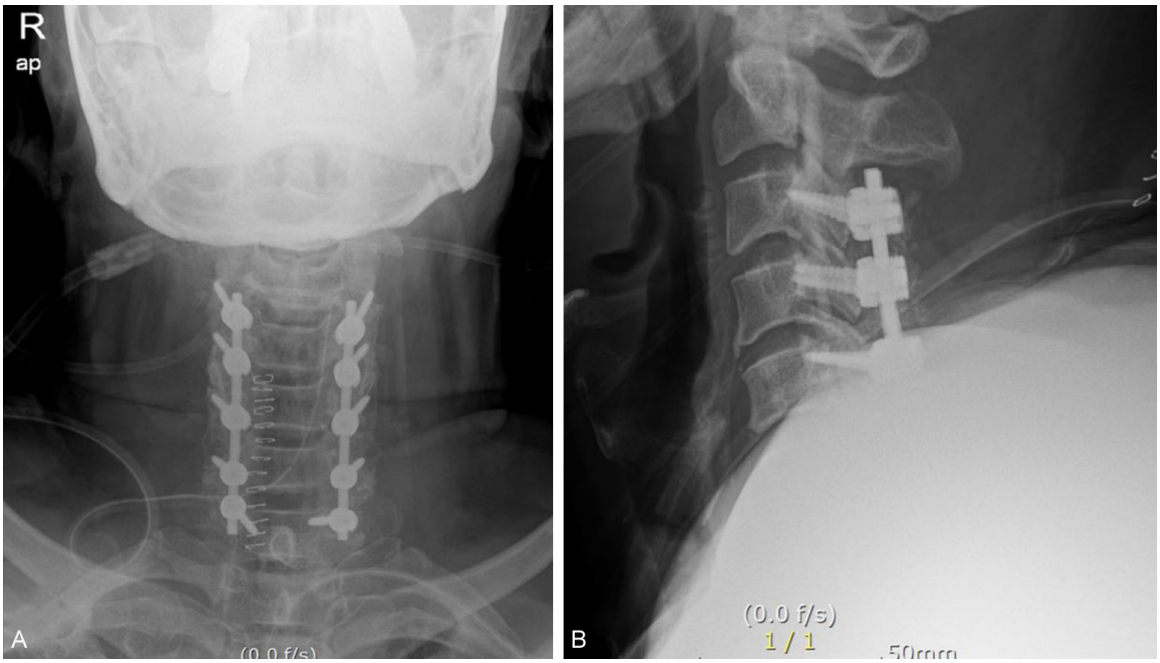

Figure 4. (A) Postoperative anteroposterior and (B) lateral cervical spine X-rays showing posterior decompression and instrumented fusion from C3 to C7. Pedicle screws and rods are in place, confirming appropriate alignment and stabilization following emergent laminectomy and fusion for compressive myelopathy caused by ossification of the posterior longitudinal ligament.

Although generally safe, catheter ablation has a low incidence of major complications, such as cardiac perforation, tamponade, stroke, and vascular injury [5-7]. However, as the number of procedures has increased, the interest in rare complications has also increased. In particular, the increasing use of sedation instead of general anesthesia has raised concerns regard-

ing positional and airway-related neurological complications.

OPLL has a particularly high prevalence in East Asian populations and is more common in males, older adults, and patients with diabetes [12]. OPLL is a disease in which the posterior longitudinal ligament ossifies pathologically, narrowing the spinal canal, and eventually causing spinal cord compression and neurological symptoms [12]. Pathophysiologically, the ossification of fibroblasts is the main mechanism [13]. The cause of this disease remains unclear; however, genetic, hormonal, environmental, and lifestyle factors are thought to affect the formation and progression of OPLL [14]. Many patients remain asymptomatic for a long time and are diagnosed incidentally [15]. Approximately 70% of patients incidentally diagnosed with OPLL remain asymptomatic for more than 30 years, and preventive surgery is generally considered unnecessary [16].

Trauma or hyperextension of the cervical spine can accelerate the development of serious symptoms such as quadriplegia in patients with OPLL; in such cases, the prognosis is very poor [14, 17]. In particular, spinal cord hyperintensity on T2-weighted MRI suggests a poor prognosis [18]. OPLL is classified into continuous, segmental, mixed, and focal types. Among these, the mixed type progresses rapidly and carries a higher risk of neurological deterioration [19].

In this case, the patient had extensive mixed-type OPLL from C2 to T2, indicating pre-existing cervical canal stenosis.

Propofol is widely used for procedural sedation because of its rapid onset and short half-life, and is generally considered safe [20]. However, deep sedation can reduce spontaneous respiration, obstruct the upper airway, and increase the risk of hypoxia, particularly in older adults [21].

Positioning-related spinal cord injury is a critical concern in patients with cervical spine pathology. Sedated or anesthetized individuals are unable to resist or report the discomfort caused by neck extension, which increases the risk of neurological injury, even in those with no prior symptoms. Therefore, neck positioning and airway management should be performed cautiously and pre-procedural imaging should be considered when clinically indicated.

Pre-procedural cervical spine imaging may be particularly beneficial in individuals with known risk factors for OPLL, including older age, male sex, East Asian ethnicity, diabetes mellitus, and a history of chronic neck stiffness [12, 14, 15]. Even in the absence of neurological symptoms, these patients may have an occult cervical pathology, which increases their vulnerability to positioning-related injuries during sedation.

This case report describes a rare case of acute compressive myelopathy caused by undiagnosed cervical OPLL, which progressed to complete quadriplegia at the C5 level following sedation and neck hyperextension during catheter ablation for drug-refractory AF. The following clinical lessons can be drawn from this case.

First, even asymptomatic OPLL may cause irreversible neurological injury after relatively minor cervical extension during sedation, particularly in older Asian men. Second, even when the procedure is performed without general anesthesia, a thorough assessment of the patient's anatomy and underlying conditions should be conducted before the procedure, and imaging studies should be considered when clinically indicated. Third, careful planning of sedation and neck positioning are essential to minimize the risk of spinal cord injury, and collaboration with anesthesiologists is especially important for high-risk patients.

Although OPLL is typically asymptomatic, it can acutely deteriorate under sedation-related mechanical stress. Therefore, when planning a cardiovascular procedure, including catheter ablation, selective evaluation through preoperative cervical spine imaging should be considered, especially in patients with risk factors such as old age, Asians, males, and diabetes. The early recognition of anatomical abnormalities and proper perioperative planning can prevent severe neurological complications related to positioning and airway management.

This case report describes an exceptionally rare but devastating neurological complication arising from routine electrophysiological procedures performed under sedation. Although

catheter ablation is widely regarded as a safe and effective treatment for AF, it may carry serious risks in patients with undiagnosed cervical spine pathologies, such as OPLL. Catastrophic outcomes may be prevented by early identification of high-risk individuals, especially older Asian men, and those with diabetes and chronic neck symptoms, through targeted pre-procedural screening, including cervical imaging when appropriate. Enhanced perioperative vigilance and multidisciplinary planning are essential to ensure neurological safety during sedation-based procedures.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Joo Yong Lee, Department of Anesthesiology and Pain Medicine, Chungbuk National University Hospital, College of Medicine, Chungbuk National University, 776, 1 Sunhwan-ro, Seowon-Gu, Cheongju, Chungbuk 28644, Korea. Tel: +82-010-4454-3384; Fax: +82-43-272-0264; E-mail: C503016@cbnuh.or.kr

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