Case Report **IJCR (2021) 5:209**

International Journal of Case Reports (ISSN:2572-8776)

Acute cauda equina syndrome due to lumbar spinal stenosis caused by prolonged supine position during cardiac catheterization: a case report

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ABSTRACT

Background: Cauda equina syndrome (CES) is a severe neurologic condition marked by progressive loss of function of the neurologic elements in the spinal canal below the termination of the spinal cord. This article reports an instructive case of CES with acute aggravation of neuropathy after catheter ablation for atrial fibrillation. **Patient concerns:** A 63-year-old Japanese man underwent catheter ablation for atrial fibrillation. Because he complained of severe low back pain and numbness in the posterior of both lower limbs while in the supine position, he was given analgesia with pentazocine and sedated with propofol, and the procedure continued. He was then forced to maintain lumbar extension while in the supine position for 13 hours. After the treatment, he noticed urination disor-der, numbness, and paralysis of both lower limbs. **Diagnosis:** Neurological findings included sensory impairment and motor deficit of L5 and below, including bowel/bladder dysfunction. Lumbar magnetic resonance imaging showed severe lumbar spinal stenosis at L4-L5. He was diagnosed with CES due to lumbar spinal stenosis. **Interventions:** The patient received emergency surgery for L4-L5 decompression. Decompression of the spinal canal was achieved 33 hours after the start of catheterization. **Outcomes:** The patient's leg symptoms improved immediately after surgery, and he was able to walk with a walker. On postoperative day 6, the urinary catheter was removed. However, he experienced urinary retention and needed intermittent self-directed urination. Five months after surgery, he was able to urinate on his own, and completed the intermittent self-directed urination. Nine months after surgery, his muscle strength had recovered almost completely, and he was able to walk with a cane. However, bladder dysfunction such as frequent urination and residual urination remained 4 years after surgery. **Lessons:** If the supine position elicits low back pain and leg numbness, the presence of lumbar spinal stenosis should be considered. Forcing patients with such symptoms into a sustained posture can lead to CES.

Keywords:
cauda equina syndrome, lumbar spinal stenosis, supine position, cardiac catheterization

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How to cite this article:
Kazuki Kobayashi, Kazuyuki Watanabe, Kinshi Kato, Michiyuki Hakozaki, Jun-ichi Handa, Hiroshi Kobayashi, Takuya Nikaido, Koji Otani, Shoji Yabuki, Shin-ichi Konno. Subclinical chronic sinusitis causing presumed ventriculoperitoneal shunt sepsis in a child. International Journal of Case Reports, 2021 5:209.

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1. Introduction

Cauda equina syndrome (CES) is a constellation of symptoms that arise due to impairment of the function of the cauda equina. CES patients present with varying degrees of lower limb weakness, saddle anesthesia, complete urinary retention, and overflow incontinence.[1] CES is caused by various conditions such as neuraxial anesthesia, infection, ischemia, and compression of the cauda equina by either hematoma, lumbar spinal stenosis（LSS）, or lumbar disc herniation.[2-7] If the cause of CES is mechanical compression of the cauda equina, early decompression surgery is recommended, especially within 24-48 hours for better improvement of sensory and motor deficits as well as of urinary and rectal function. If decompression is delayed for more than 48 hours, outcomes are worse, including persistent paralysis and bladder dysfunction.[8,9]

This article reports an instructive case of CES due to LSS related to the treatment of atrial fibrillation（Af）by catheter ablation. Its aim is to provide information about this potential postoperative complication to catheterizing physician that require prolonged supine positioning.

2. Case report

A 63-year-old Japanese man was admitted to the cardiology unit of our hospital for treatment of Af. He had a medical history of posterolateral spinal fusion for lumbar disc herniation at 35 years old and of medication for ossification of the posterior longitudinal ligament of the cervical spine at 55 years old. He had low back pain, numbness in the posterior of both lower limbs, and residual urine sensation for 4 years. However, he had not seen an orthopedic surgeon for these symptoms, and had not told his cardiologist about them.

Catheter ablation for Af was performed with a right femoral artery puncture. The position was supine with the extension of the bilateral hip joint. As soon as the procedure started, the patient complained of low back pain and numbness in the posterior of both lower limbs. The patient was then allowed to flex only the left hip joint, but his symptoms did not improve. He was then given analgesia with pentazocine and sedated with propofol. It took 3 hours to finish the catheter ablation. After the treatment, he was instructed to rest in the supine position with hip extension for 6 hours for compression hemostasis. As the analgesia and sedation wore off, his back pain and the numbness in the posterior of his lower limbs returned. Therefore, analgesia and sedation were performed several times. Due to these symptoms, he was unable to maintain rest. Bleeding from the puncture site, he was asked to prolong complete resting state in the same position until the bleeding stopped. Eventually, he was instructed to rest in the supine position with hip extension for 13 hours during a catheter ablation series.

The day after the ablation, he noticed urination disorder, numbness, and paralysis of the lower limbs and was taken to the orthopaedic surgery unit. During a physical examination, the extension of the lumbar spine exacerbated the numbness of both lower limbs. The patient’s

perianal sensation was completely lost. Achilles tendon reflex was absent bilaterally. The tonus of the anal sphincter was deteriorated, and voluntary contraction of the anal sphincter was impossible. Motor weakness below the tibialis anterior of both lower limbs was observed, and the manual muscle testing (MMT) scores were less than 4. Plain radiographs of the lumbar spine showed spondylotic change (Fig. 1 A, B). Computed tomography (CT) showed continuous ossification of the anterior longitudinal ligament at Th11-L4, indicating a condition called diffuse idiopathic skeletal hyperostosis (DISH) [10] (Fig. 2 A). The vertebral bodies and facet joints between L5 and S1 were fused (Fig. 2 A, C). Magnetic resonance imaging (MRI) showed severe stenosis at L4-L5 (Fig. 3 A, B). We reached a diagnosis of CES due to LSS at the L4-L5 level and performed emergency surgery to decompress L4-L5 on the day of diagnosis. Decompression of the spinal canal was achieved 33 hours after the start of catheterization. On postoperative day 1, numbness of both lower limbs was decreased from 10 to 5 on a numerical rating scale (NRS). On postoperative day 3, he was able to walk with a walker. On a postoperative day 6, the urinary catheter was removed. However, he had moderate urinary retention and needed intermittent self-directed urination. Two months after surgery, he was able to walk with a cane and was discharged from the hospital. Five months after surgery, he was able to urinate on his own and completed intermittent self-directed urination. Nine months after surgery, his muscle strength was recovered almost completely. However, numbness (NRS 4) of both lower limbs and bladder dysfunction, such as frequent urination and residual urination, remained at 4 years after surgery.

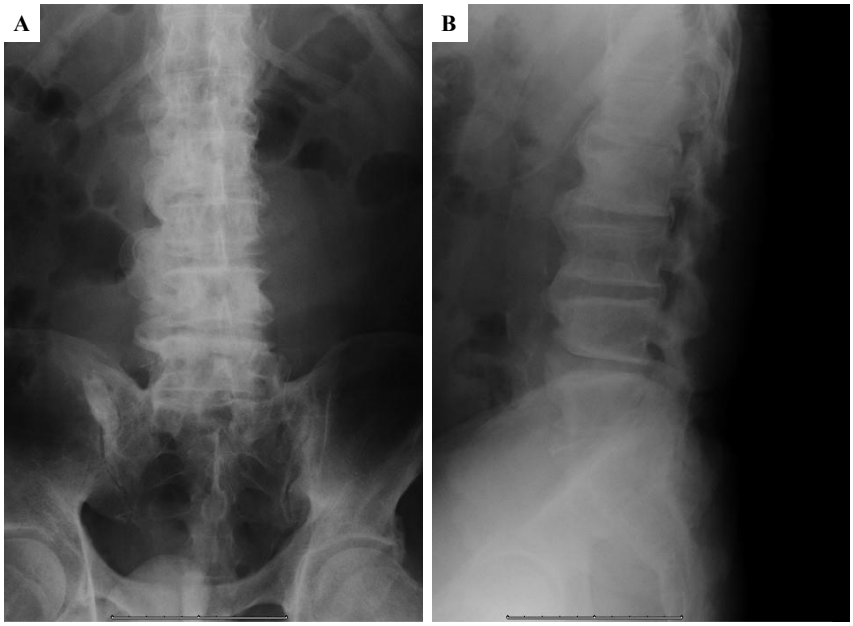

Figure 1. Plain radiograph of the lumbar spine (A: anterior and posterior views, B: lateral view). The radiographs show spondylosis of the lumbar spine.

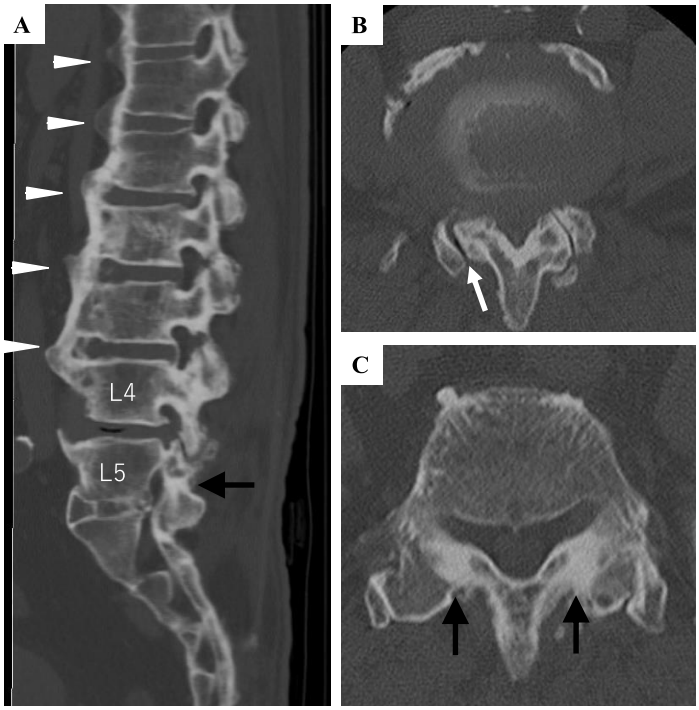

Figure 2. Computed tomography (CT) of the lumbar spine (A: sagittal view, B: L4-5 axial view, C: axial view of L5-S). Sagittal view shows ossification of anterior longitudinal ligament at Th11-L4 (A: white arrowheads). Synostosis at L5-S1 was completed (A, C: black arrows). Vacuum at intervertebral joint of L4-L5 appeared (B: white arrow). These findings mean that movement was focused in only the L4-L5 intervertebral space.

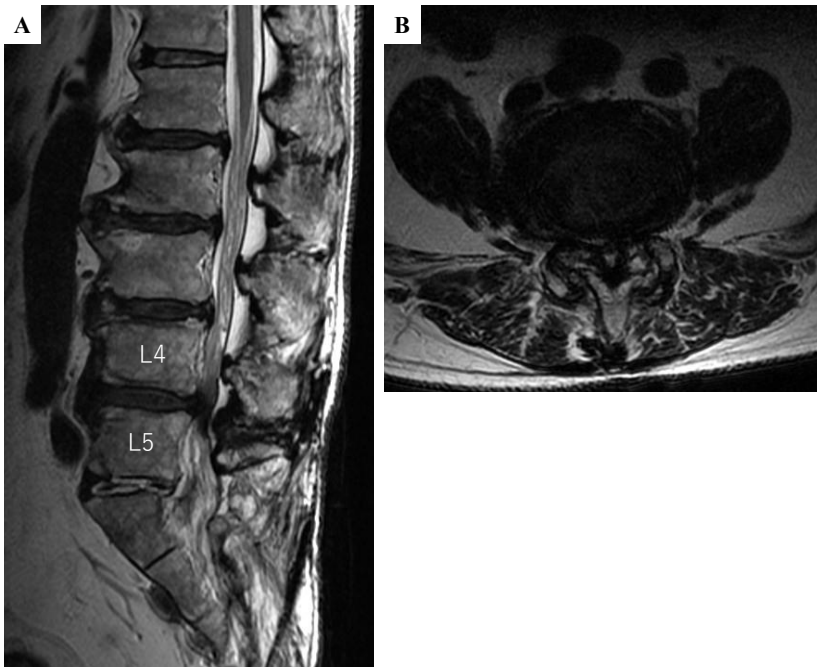

Figure 3. Magnetic resonance imaging (MRI) of the lumbar spine. Sagittal T2-weighted image (WI) (A) and axial T2-WI (B) shows degenerative severe stenosis at L4-L5.

3. Discussion

In this paper, we report a crucial case of CES caused by LSS that occurred during catheter ablation for Af. Once developed, CES can lead to permanent paralysis and dysuria. Therefore, the physician must pay attention to the presence of LSS in order to prevent CES.

LSS is a common degenerative condition in which changes in the discs, ligamentum flavum, and facet joints with aging cause narrowing of the spaces around the neurovascular structures of the spine.[11] The prevalence of symptomatic LSS by clinical diagnosis in Japan is about 5.7% to 10%.[12,13] Kalichman et al. reported the prevalence of 8.4% by radiological diagnosis using data from the Framingham Heart Study.[14] LSS causes nerve root damage, resulting in unilateral or bilateral radiculopathy and neurogenic intermittent claudication.[15] Especially with the cauda equina type, numbness of the sole and bowel/bladder dysfunction are typical. [16,17]

If low back pain or leg numbness occurs while resting in the supine position, there is a possibility of LSS and a risk of developing CES if the patient stays in the same position. Because lumbar extension increases epidural pressure and compression of the cauda equina and/or nerve root,[18] continuous lumbar extension induces or worsens lower extremity symptoms in patients with LSS. [19] Experimental studies show that blood flow to the cauda equina decreases, nutrient supply to the cauda equina also decreases, and compression induces the degeneration of nerve roots.[20,21] The venous stasis theory suggests that the underlying mechanism is inadequate oxygenation and accumulation of metabolites in the cauda equina due to venous pooling in multilevel stenosis.[22-24] Therefore, LSS symptoms appear during lumbar extension and the neuropathy worsens with continuous compression, which may finally lead to the development of CES.

In this case, our patient with LSS was instructed to rest in the supine position with his hips extended for 13 hours during a series of catheter ablations. Because supine rest triggered low back pain and numbness in the posterior of both lower limbs, analgesia and sedation were performed multiple times to enable the patient to stay in the same position. Then, while the symptoms were masked, compression of the cauda equina continued, resulting in the development of CES. In addition, the patient also had anterior longitudinal ligament ossification due to DISH. This indicated that the mobility of the lumbar spine during extension was concentrated in L4-5. Therefore, the patient may have been particularly susceptible to posture-related symptoms, which may have been involved in the rapid progression of symptoms.

Sakellariou et al. presented a case of CES as an uncommon complication after hip surgery, which was related to the patient's position at rest.[25] After the operation under regional combined anesthesia, the patient was directed to completely rest with a hip abductor brace. On postoperative day 1, he was diagnosed with CES due to LSS at L4-5 and underwent L4-L5

decompression. The pathomechanism of CES in that case was considered the same as in the present case. However, no case of CES associated with catheter ablation has been reported.

In this case, the problem may be that the catheterizing physician did not have sufficient knowledge of LSS and the potential development of CES. Even though symptoms became apparent after the examination, the patient was not consulted with an orthopedic surgeon, and the supine position was continued with sedation for further hemostasis. If the patient had been consulted immediately after the examination, an intervention may have occurred because patients with DISH are at an exceptionally high risk for LSS. Then, the irreversible progression of the neuropathy could have been prevented by adjusting the height of the head and shoulder blades with pillows, thereby maintaining the right hip extension and avoiding the lumbar extension.

If the catheterizing physician suspects perioperative LSS, they should consult with an orthopedic or spine surgeon. Because of a typical cauda equina disorder in the early stages, early therapeutic intervention is important to prevent the development of CES. LSS is a common musculoskeletal disorder in older people.[13] However, LSS is not well known in other medical areas.[26] Because cardiac catheterization as well as LSS are expected to increase in aged society, collaboration with orthopedic or spine surgeons will become increasingly important. After experiencing this case, at our university hospital the cardiologist now confirms that there are no lower extremity symptoms in lumbar extension or the supine position before scheduling catheterization. If there are findings that raise a suspicion of LSS, the orthopedic surgeon now checks for the presence of LSS in advance.

4. Conclusion

In conclusion, we report the first case of CES due to LSS with acute aggravation of neuropathy after catheter ablation for atrial fibrillation. If the supine position elicits low back pain and leg numbness during the procedure, the presence of LSS and the risk of CES should be considered, as should a consultation with orthopedic or spine surgeon.

Abbreviations:

CES, cauda equina syndrome; LSS, lumbar spinal stenosis; Af, atrial fibrillation; MRI, magnetic resonance imaging; CT, computed tomography; MMT, manual muscle testing; DISH, diffuse idiopathic skeletal hyperostosis; NRS, numerical rating scale.

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