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Sung Hoon Choi, M.D., Ph.D., Keong Yoon Kim, M.D., Chang-Nam Kang, M.D., Ph.D.

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Korean Society of Spine Surgery

27, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do, Republic of Korea

Tel: +82-31-966-3413

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Spinal Subdural Hematoma and Cauda Equina Syndrome Occurring After Interlaminar Injection in a Patient Receiving Anticoagulant Therapy

Sung Hoon Choi, M.D., Ph.D., Keong Yoon Kim, M.D., Chang-Nam Kang, M.D., Ph.D.
Department of Orthopaedic Surgery, Hanyang University College of Medicine, Seoul, Korea

Study Design: A case report.

Objectives: This report presents a case of spinal subdural hematoma with cauda equina syndrome after interlaminar epidural injection for degenerative spinal stenosis in a 62-year-old woman who was on warfarin therapy due to valvular heart disease and arrhythmias.

Summary of Literature Review: Spinal subdural hematoma is rare and has a variety of causes, including traumatic, iatrogenic, and spontaneous. Subdural hematoma can compress the spinal cord or cauda equina and lead to acute neurological deficits.

Materials and Methods: A 62-year-old woman who was taking warfarin (5 mg) daily for 10 years was referred to our hospital with sudden-onset paraparesis and hypoesthesia that occurred 2 days after interlaminar epidural injection. The patient was diagnosed with spinal subdural hematoma and cauda equina syndrome. The patient underwent laminectomy, durotomy, and hematoma evacuation.

Results: The patient's motor weakness was relieved after surgery without any complications. She was able to stand independently and walk using a walker three days after surgery. Six days after surgery, she could walk without any support. She had mild neuropathic pain and numbness, so she was treated with medications. One year and six months after surgery, all her subjective symptoms had disappeared.

Conclusions: It is unclear in this case whether the cause was iatrogenic or spontaneous. For patients who take anticoagulant medications, spinal injections should be performed with caution after evaluating the risk of spontaneous bleeding.

Key Words: Subdural hematoma, Cauda equina syndrome, Epidural injection, Anti-coagulation therapy

Spinal subdural hematoma is a rare condition that can have a variety of causes. The causes include post-traumatic, iatrogenic (following surgery or lumbar puncture), and spontaneous occurrences (associated with underlying vascular malformation, neoplasm, or coagulation disorder).

We recently experienced a patient on warfarin therapy who developed a spinal subdural hematoma and cauda equina syndrome two days after interlaminar epidural injection.

Case Report

We report the case of a 62-year-old woman taking warfarin 5 mg daily for 10 years due to valvular heart disease and atrial fibrillation. She had undergone discectomy at the L4–5 level a decade ago. Despite the previous surgery, she had lower back pain and radiating pain on both buttocks and anterolateral thighs due to degenerative spinal stenosis.

One day, she underwent lumbar interlaminar epidural injection on L4–5 level at local clinic. Two days after the injection, the patient complained of worsening bilateral lower limb radiating pain without motor weakness. On the third day after the injection, motor weakness suddenly occurred, and she was unable to walk. Then, magnetic resonance imaging

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Corresponding author: Chang-Nam Kang, M.D., Ph.D.

ORCID ID: Sung Hoon Choi: <https://orcid.org/0000-0003-3328-2043>

Keong Yoon Kim: <https://orcid.org/0000-0003-4467-0420>

Chang-Nam Kang: <https://orcid.org/0000-0002-4633-3391>

Department of Orthopaedic Surgery, Hanyang University College of Medicine
222 Wangsimni-ro, Seongdong-gu, Seoul, 04763, Republic of Korea

TEL: +82-2-2290-8485, **FAX:** +82-2-2299-3774

E-mail: cnkang65@hanyang.ac.kr

(MRI) scan was done immediately. Left hemi-laminectomy was performed on L4–5 previously (Fig. 1A). The MRI results showed intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images at dorsal subdural space extending from T11 to S1 level, indicating hyperacute subdural hematoma (Fig. 1B–E). There was dorsal compression of the subarachnoid space and cauda equina due to the hematoma.

The patient was urgently transferred to the emergency department of our hospital for emergency surgery of the cauda equina syndrome. Neurological examination revealed paraparesis in both legs with motor grade of 2/2 in L2 myotome, and 3/3 in L3, L4, L5, and S1 myotome bilaterally. The patient had radiating pain and hypoesthesia on both L4, L5, and S1 dermatomes, suggesting cauda equina syndrome.

Fortunately, her bladder and bowel function were preserved at this time.

According to a blood test conducted in the emergency room, the International Normalized Ratio (INR) was 4.58. The platelet count was $267 \times 10^9/L$, which was within the normal range. Consequently, intravenous vitamin K 10mg was administered in the emergency room twice before emergency surgery. At the initiation of the surgical incision, the INR was 4.43.

Laminectomy was performed from the first lumbar level to the first sacral level using the Gill's procedure. No evidence of epidural hematoma was observed. The dura mater had a bluish discoloration without cerebrospinal fluid (CSF) leakage, and there was no evidence of dura puncture injury (Fig. 2A). Epidural scar was identified at the left L4–5 level,

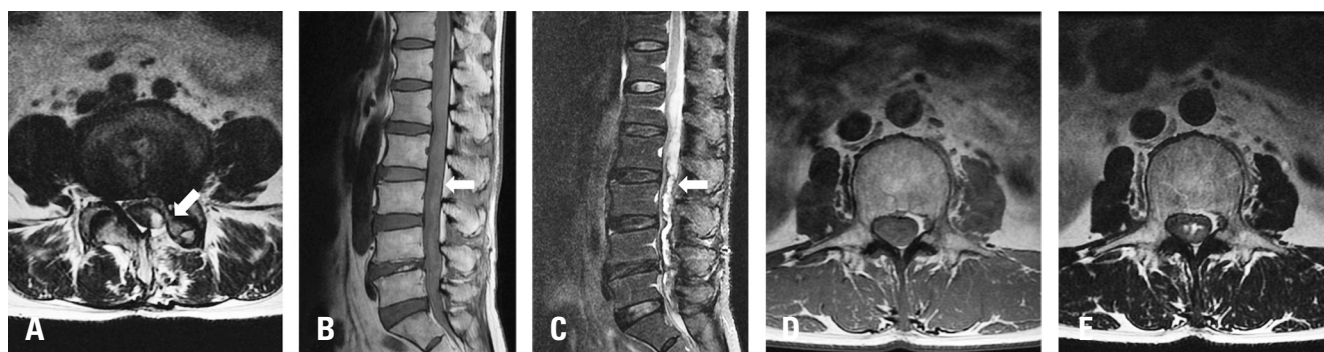


Fig. 1. Lumbar spine magnetic resonance images. (A) Axial images showing previous left hemilaminectomy at the L4-5 level and high signal intensity in the dorsal aspect of the intradural space on T2-weighted images. (B) T1-weighted sagittal image showed intermediate signal intensity and (C) T2-weighted sagittal image showing high signal intensity suggestive of hyperacute subdural hematoma extending from the 11th thoracic level to the first sacral level. Axial view. (D) T1-weighted axial image and (E) T2-weighted axial image at the L3-4 level.

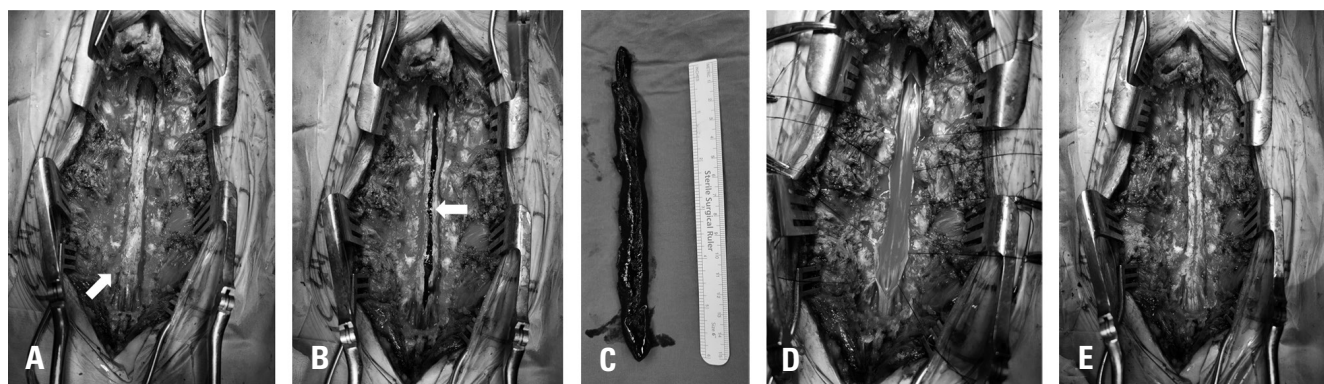


Fig. 2. Intraoperative images. (A) A bluish dura mater sac was seen, and there was no evidence of traumatic dura puncture injury. The white arrow indicates the epidural scar on the left side at the level of L4-5. (B) Durotomy was performed from the first lumbar level to the first sacral level, and there was a reddish hematoma on the dorsal aspect. (C) The hematoma was evacuated, and the length of the hematoma was more than 15 cm. (D) The arachnoid membrane was intact, and there was no cerebrospinal fluid leakage. (E) The dura was sutured tightly.

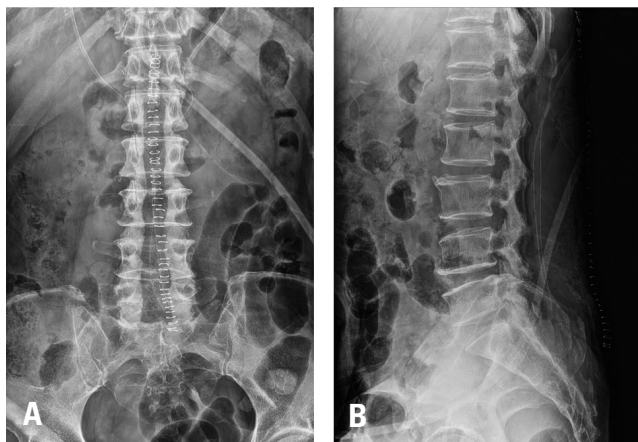


Fig. 3. Postoperative lumbar spine radiographs. **(A)** Postoperative anteroposterior view and **(B)** lateral view. The radiographs show laminectomy from the first lumbar level to the first sacral level via the Gill procedure.

likely resulting from previous discectomy. Then, the dura was opened from the first lumbar level to the first sacral level, and approximately a 15cm long hematoma was evacuated (Fig. 2B–C). The arachnoid membrane remained intact (Fig. 2D). Finally, the durotomy site was primarily closed using continuous suture and intermittent sutures, ensuring a water-tight repair. Dural sealant was applied to the dorsal side of the dura mater (Fig. 2E), and the operation was then concluded (Fig. 3A–B).

During the operation, 3 packs of red blood cells and 5 packs of fresh frozen plasma were transfused. The immediate postoperative INR was 1.55, and no further blood transfusions were required after surgery.

Three days after the surgery, the motor grade of both legs recovered to 4–5/5 degree. She was able to stand independently and walk with a walker. By the sixth day after surgery, she could walk without any support.

On the day following the surgery, the INR was well maintained at 1.34 and warfarin was discontinued until 2 weeks after surgery. At 2 weeks postoperatively, stitch removal was performed and warfarin was reduced to 3 mg and re-administered daily. One month after the surgery, the patient was switched to a new oral anticoagulant (NOAC) and continued follow-up on an outpatient basis.

The neuropathic pain in both lower limbs was improved after surgery, but some mild symptoms were remained. Consequently, the patient initiated a regimen of pregabalin 75mg twice a day. At 4 months postoperatively, thigh neuropathic pain had significantly improved and she was able

to walk for 1 hour. At 10 months post-operatively, plantar neuropathic pain had resolved. Finally, at 1 year and 6 months, her subjective symptoms had completely resolved.

Discussion

Spinal subdural hematomas are rare entity and less common than intracranial subdural hematomas as well as spinal epidural hematomas which were first described in 1984 by Schiller et al.¹⁾

In previous literature, spontaneous spinal subdural hematomas are predominantly located in the thoracic spine. The most common presenting symptoms include paraparesis or paraplegia, hypoesthesia and pain. Approximately 48% of these cases were caused by coagulopathy, most commonly due to coumarins.²⁾ Although a rare entity, there have been several reports of spinal subdural or intradural hematomas occurring atraumatically in patients taking warfarin.^{3–5)}

Several cases of iatrogenic spinal subdural or intradural hematoma following lumbar puncture have been reported.^{6–7)} Symptoms may initially manifest with a sudden onset of back pain, but can progress rapidly, resulting in severe or permanent neurological impairment. According to the case reported by Park et al.⁶⁾, iatrogenic subdural hematoma caused by lumbar puncture can lead to rapid neurological deterioration within 12 hours.

For early diagnosis and treatment of spinal hematomas, MRI is the gold standard, and urgent imaging is required. Due to the presence of oxyhemoglobin, the imaging characteristics of hematomas on MRI change over time. In the hyperacute phase, spinal hematomas appear as intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images. In the early subacute phase, subdural hematomas show low signal intensity on T1-weighted image and high signal intensity on T2-weighted image. In the late subacute phase, extracellular methemoglobin is formed, causing the hematoma to appear as low signal intensity on both T1 and T2-weighted images.⁸⁾

The authors considered this case to be a spontaneous subdural hematoma for the following reasons. First, the initial INR was 4.58 due to the long-term warfarin use, indicating high spontaneous bleeding tendency. Second, the patient complained of radiating pain on both lower extremities two

days after the injection and sudden motor weakness on the third day, rather than immediately after the injection. The neurological deterioration did not progress as rapidly as in other traumatic or iatrogenic cases. Third, the MRI performed three days after the injection showed intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images, suggesting a hyperacute phase of the hematoma. If it were a iatrogenic hematoma, it would typically exhibit high signal intensity on T1-weighted images and low signal intensity on T2-weighted images corresponding to the early subacute phases on MRI. Fourth, the authors found no evidence of dural puncture and the arachnoid membrane was intact with no CSF leakage under the microscope operating field.

However, the hematoma is mainly located at the lumbar lesion where the epidural injection was given. Due to the scar tissue from previous discectomy, the dural puncture site may not be clearly visible. Iatrogenic spinal subdural hematoma can also manifest as subdural and epiarachnoid hematoma. For these reasons, the possibility of iatrogenic subdural hematoma could not be completely ruled out.

Therefore, patients on long-term anticoagulant therapy, especially those with a high level of INR, should be treated with caution before undergoing procedures such as lumbar puncture or epidural injection, as these can cause spinal hematoma, which can lead to neurological deficits. It is important to accurately identify past medical history or medications that may increase bleeding tendency and to check the INR level. The American Society of Regional Anesthesia and Pain Medicine (ASRA) has issued guidelines for neuraxial injection.⁹⁾ According to the guidelines, injections are recommended when the INR is 1.4 or below in patients not receiving warfarin therapy. If the INR level exceeds the normal range, the spinal procedure should not be performed. However, if the procedure is still intended, it would be necessary to discontinue anticoagulant therapy for several days and assess for bleeding tendencies before proceeding.

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항응고제 치료를 받는 환자에서 추궁판간 경막외 주사 후 발생한 척추 경막하 혈종 및 마미증후군

최성훈 · 김경윤 · 강창남

한양대학교 의과대학 정형외과학교실

연구계획: 증례 보고

목적: 심장 판막 질환과 부정맥으로 와파린을 복용중인 62세 여자 환자에서 퇴행성 척추관 협착증으로 추궁판간 경막외 주사 후 척추 경막하 혈종과 마미증후군이 발생한 증례를 보고한다.

선행 연구 문헌의 요약: 경막하 혈종은 드물며, 외상성, 의인성 또는 자발성으로 발생할 수 있는 다양한 원인이 있다. 경막하 혈종이 척수 또는 마미를 압박하면 급성 신경학적 결손으로 이어질 수 있다.

대상 및 방법: 와파린 5 mg을 매일 10년 동안 복용 중인 62세 여자 환자가 추궁판간 경막외 주사 시행 2일 후에 갑작스러운 하지 마비와 감각 저하 증상이 있어서 내원하였다. 환자는 척추 경막하 혈종과 마미증후군으로 진단을 받았다. 환자는 응급 수술을 시행하여 후궁 절제술, 경막절개술 및 혈종 제거술을 받았다.

결과: 수술 후 환자의 하지 마비 증상은 합병증 없이 잘 회복되었다. 환자는 수술 후 3일부터 독립적으로 기립할 수 있었고, 보행기 의지 하에 보행을 시작하였으며 수술 후 6일째부터 단독 보행이 가능하였다. 그녀는 경미한 신경병증성 통증과 저림 증상을 보여 약물 치료를 받았다. 그리고 수술 후 1년 6개월이 경과한 후 환자의 자각 증상은 모두 없어졌다.

결론: 본 증례에서는 원인이 의인성인지 자발성인지 확실하지는 않다. 항응고제를 복용 중인 환자의 경우 환자의 자발성 출혈 위험성을 확인한 후 경막외 주사를 시행할 때 매우 주의해야 한다.

색인 단어: 경막하 혈종, 마미증후군, 경막외 주사, 항응고제 치료

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서울시 성동구 왕십리로 222 한양대학교 의과대학 정형외과학교실

TEL: 02-2290-8485

FAX: 02-2299-3774

E-mail: cnkang65@hanyang.ac.kr