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Epidural Cyst with Cauda Equina Syndrome after Epidural Anesthesia

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Short running title:

Epidural Cyst after Epidural Anesthesia

Abstract

A 40 year-old woman without relevant medical history received epidural anesthesia for uterine cervix conization. Six hours after the surgery, cauda equina syndrome (CES) occurred. MRI of the spine revealed epidural fluid accumulation around L5 besides incidentally found L4/5 HIVD. Surgical decompression was performed with H-reflex monitoring. We reported that epidural injection per se could result in cystic accumulation complicated with CES.

Key words:

Epidural injections, Epidural Anesthesia, Cauda Equina Syndrome, H-reflex

Introduction

Neurological complication rate of neuraxial blockades was around 1/20,000-30,000. Cauda Equina Syndrome (CES) is the second most frequent neurological complication following neuraxial blockades while spinal hematoma was the first¹. We presented a case of CES resulted from cystic accumulation of injected epidural local anesthetics.

Case Report

A 40 year-old woman without relevant medical history was scheduled for uterus cervix conization under epidural anesthesia. No history of lower back pain, sciatica, previous spine abnormality or other contraindications for epidural anesthesia was noted.

With standard intraoperative monitors, the patient was put into decubitus knee-chest position after intravenous midazolam 2.5mg. After skin preparation, 3ml of 2% lidocaine was infiltrated subcutaneously. Attempt was made with a Perican Epidural Needle with Tuohy bevel (18Gx3.25") contained in a Perifix soft 501 Filter Set (LOR) (B.Braun Melsungen AG, D-34209 Melsungen) at L3/4 inter-vertebral space via paramedian approach. Loss-of-resistance to air signaled epidural space entrance with no remarkable difficulty. The bevel was turned caudally and the epidural catheter was advanced downward. As the catheter was advanced 8cm beyond the bevel, pain and paresthesia over legs were reported and were relieved after catheter withdrawal by 2cm. The epidural catheter was fixed 6cm caudally in the epidural space. Shah test excluded intrathecal or intravascular misplacement². Subdural injection was excluded by 2ml of 2% lidocaine as test dose. Epidural anesthesia was conducted smoothly with 15ml of 1.5% lidocaine mixed with 2ml of 7% sodium bicarbonate. Pinprick level up to T10 was attained. The patient was put into supine lithotomy position during the surgery for 90

minutes. The surgery and anesthesia were uneventful otherwise. The epidural catheter was removed at PACU and the patient was transferred to the ward.

However, 6 hours after the surgery, the patient complained bilateral lower extremities weakness and voiding difficulty. Physical examination revealed bilateral muscle weakness for knee and ankle flexion. Babinski's reflex was absent bilaterally. Perception to pinprick and cold over peri-anal area and posterior aspect of both thighs and legs was also decreased. Under the impression of CES, MRI of spine was taken. L4/5 HIVD with decreased anterior space of the cauda equina was noted (Fig.1).

Besides, a space occupying lesion of fluid signal was found at the same level pushing the cauda equina against the herniated disc (Fig.2) Emergent surgical decompression was planned, though it was carried out 24 hours after symptoms onset due to patient hesitation.

Midazolam 2.5mg, lidocaine 20mg, propofol 100mg was given intravenously for induction of general anesthesia. Intravenous succinylcholine 60mg was used to facilitate endotracheal intubation followed by intermittent rocuronium during the operation. After induction of anesthesia and patient positioning, H-reflex was recorded bilaterally from the gastrocnemius muscle following 0.5ms stimulations to tibial sensory fibers in the popliteal fossa (Fig.3). Anesthesia was maintained with sevoflurane no more than 2%

end-tidal concentration carried by 2L/min of air/oxygen mixture ($FiO_2=0.5$) and intravenous fentanyl. Intravenous bolus of rocuronium and fentanyl was avoided during critical periods of potential surgical injury to minimize pharmacological interference of H-reflex. During the operation, a cyst of about 1.5cm in diameter with clear watery content was noted around L4-5. The cyst ruptured during surgical manipulation and its watery content flooded out. The H-reflex from both legs attenuated markedly within a minute and returned to its previous level about 20 minutes later (Fig.3). At the conclusion of the operation, the H-reflex amplitude increased and the latency shortened compared with baseline.

The patient's muscle power of lower extremities improved markedly after the operation. At the first post-op day, the patient could walk with a cane. However, constipation and saddle numbness bothered her for the next two months. Voiding difficulties remained unresolved 5 years after the operation.

Discussion

The incidence of CES was 2.7 in 100,000 epidural blockades. More than two-third of CES resulted in permanent neurological deficits¹. Favorable neurological outcome tend to occur in patients underwent surgical decompression within 8 hours of diagnosis³.

No evidence was found comparing the incidence of fluid accumulation following epidural injection via median or paramedian approach. However, Cardoso et al reported that injection speed directly related to peak epidural pressure which in turn correlated with the duration of effect and inversely correlated with the extent of epidural blockade⁴. More rapid epidural injection resulted in much limited distribution and longer duration. For patients with spinal stenosis, slower speed of injection was reasonable to lower the risk of possible mass effect from fluid accumulation. Paresthesia during needle or catheter placement and pain on injection were risk factors of neurological complications⁵. Among those who experienced paresthesia during needle placement or pain on injection, 62-66% had persistent paresthesia^{6,7}. Therefore, symptoms during regional anesthesia should be regarded as a warning and should call for more careful neurological follow-up or even change of anesthesia plan.

Pre-existing spinal stenosis had been reported as a risk factor for neurological

complications after epidural anesthesia^{8,9}. Although there was no previous image available, a pre-existing asymptomatic HIVD was favored that resulted in a limited space for cauda equina. In this case, the cauda equina lied anterior to accumulated epidural fluid where as normal cauda equina grouped at the dependent site (Fig.2). Supposedly the cauda equina was pushed by the iatrogenic epidural cyst against the intruded intervertebral disc. Injection into perineural cyst^{10,11} (also known as Tarlov's cyst), although rare, was also a possible cause of cyst formation. The operative findings of the epidural clear watery accumulation excluded hematoma and abscess. H-reflex contributed in determination whether the watery contain of the cyst was CSF¹² or injectant per se^{13,14} in nature.

Gastrocnemius muscle was innervated by tibial nerve and was selected for H-reflex monitor in this case. Although not every single root of cauda equina, H-reflex of gastrocnemius muscle reflected nerve conduction of L4-5 and S1-2¹⁵. During the operation, the total disappearance of the H-reflex was considered the effect of lidocaine released from the ruptured cyst that flooded the adjacent nerve roots (Fig.3). Lidocaine, as an amino amide drug, underwent enzymatic degradation primarily in the liver. Although some degradation of the amide-type compounds may take place in tissues other than liver, the pharmacologic activity of lidocaine appeared to be preserved in the

cyst which is to-some-degree isolated from blood stream¹⁶. After flooding, the lidocaine was exposed to circulation and its effect worn off in 20 minutes.

★ Intraoperative H-reflex had not been understood thoroughly. Baars et al recently published their study about the effects of sevoflurane and propofol on the H-reflex. Sevoflurane resulted in dose dependent suppression of H-reflex. Propofol resulted in H-reflex suppression only in high plasma concentration. Practically, propofol do not significantly affect H-reflex¹⁷⁻²¹. Besides, hyper- and hypoventilation could affect H-reflex amplitude while H-reflex latency were unaffected²². Therefore, during the maintenance of anesthesia, concentration of volatile anesthetic and minute ventilation should be kept as stable as possible.

Conclusion

Paresthesia during epidural anesthesia signaled pre-existing spinal stenosis and warrant careful evaluation and re-consideration of anesthesia plan. The H-reflex presentation indirectly showed that epidural injection per se might, although rare, result in cystic accumulation of injectant and nerve compression. However, the image warning of "anti-gravity" cauda equina due to epidural cyst compression was challenging. Early diagnosis of CES after epidural anesthesia relied greatly on high index of suspicion.

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Fig.1: MRI(T2)- HIVD and accumulated epidural fluid impinging the cauda equina.

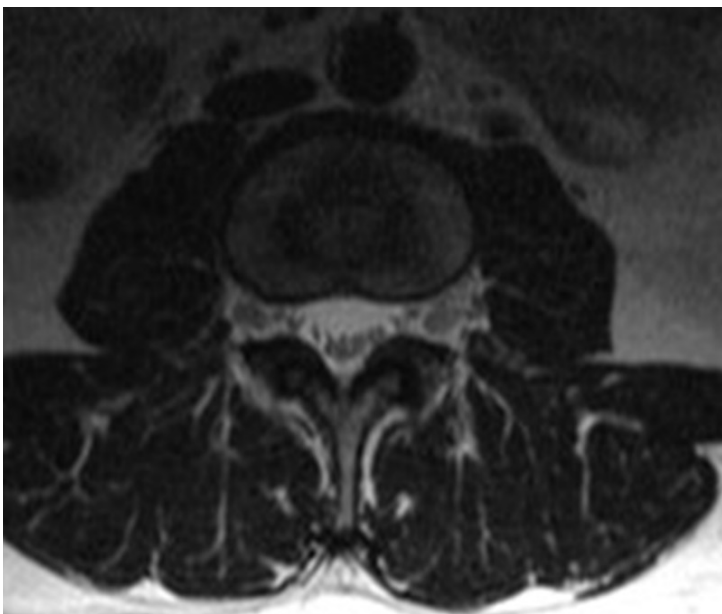
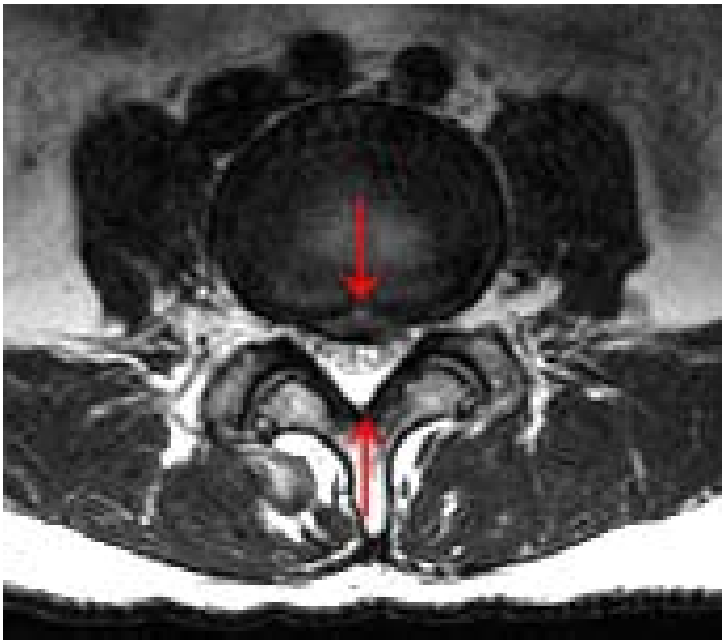


Fig.2: MRI(T2)- (Upper) Accumulated epidural fluid (upward arrow) pushing the cauda equina upward against the herniated disc (downward arrow); (Lower)- Normal cauda equina distribution at the same level of an age-matched female in which the nerves of cauda equina “sank” evenly in the spinal canal.

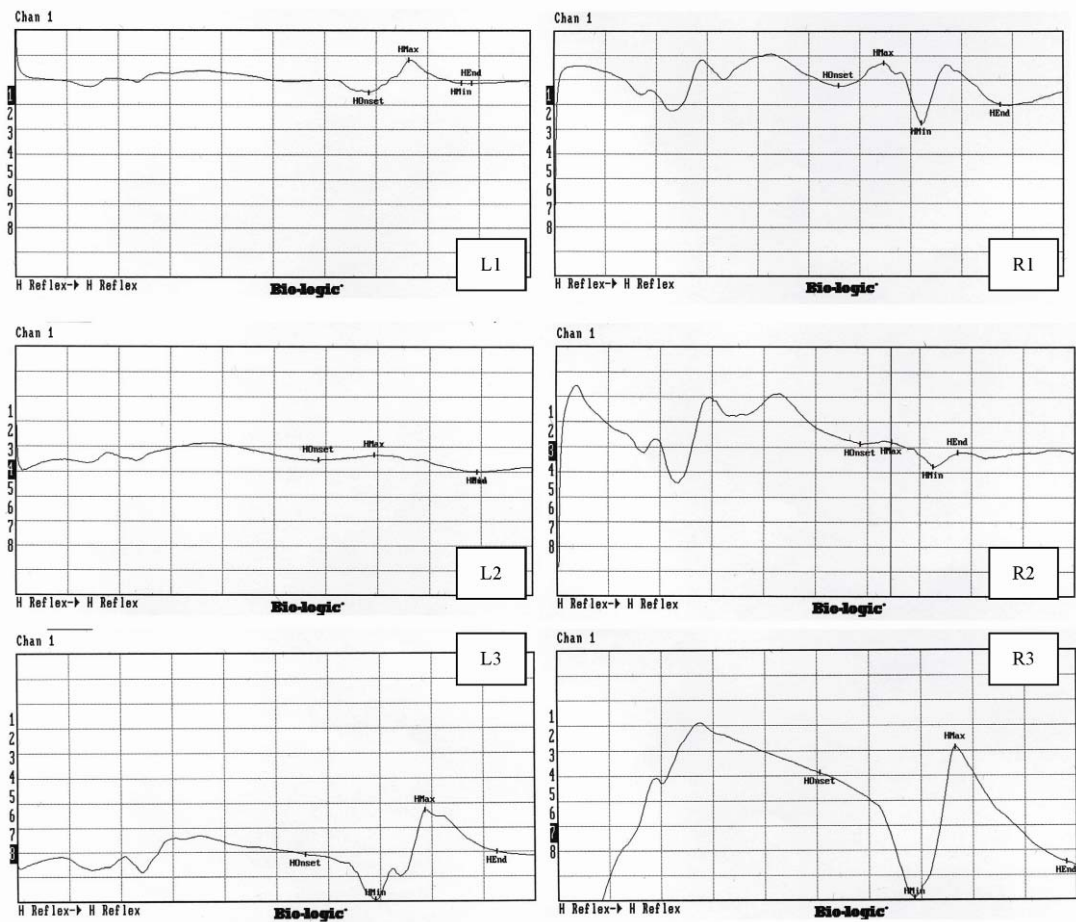


Fig.3:

Upper- Baseline H-reflex.

Middle- H-reflex under the effect of lidocaine.

Lower- Post-operative H-reflex.