Drop Foot After Spinal Anesthesia

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ABSTRACT

Introduction: Neurological complications after spinal anesthesia are very rare and often transient. The prevalence has been reported as 0–36 per 10 000 cases after epidural anesthesia and 35 per 10 000 cases after spinal anesthesia.

Case Presentation: A healthy 25 years old man was arranged for elective ESWL therapy due to a stone in the right upper ureter. The patient was categorized ASA I, spinal anesthesia was performed using a 27 gauge pencil-point spinal needle into L3-L4 space in a sitting position. During the procedure of inserting the spinal needle, the patient had no complaints. After the withdrawal of the cerebrospinal fluid, 4 ml of hyperbaric bupivacaine 0.5% was injected and the patient was moved to a supine position. The operative procedure went well without any complications. Six hours after surgery patient was unable to move his left foot meanwhile the right foot was normal. The neurologist was consulted and the patient was treated using methylprednisolone iv, mecobalamin, and pregabalin. MRI of the lumbosacral showed normal results, and EMG studies showed a functional partial lesion on the left radix of L4-5 and L5-S1. After 7 days of treatment, the patient felt improvement in his symptoms, and the patient was discharged. The patient came for a follow-up with a neurologist and physiotherapist 24 days after surgery, and the symptoms gradually get resolved.

Conclusion: Management of neurological complications after spinal anesthesia depends on its etiology, so it's important to do an early diagnosis to make further treatment.

Keywords: anesthesia; complications; drop foot; spinal; local anesthetics

Kejadian *Drop Foot* Setelah Anestesi Spinal

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ABSTRAK

Pendahuluan: *Komplikasi neurologis setelah prosedur anestesi spinal merupakan kasus yang sangat jarang terjadi dan sering bersifat sementara. Dilaporkan bahwa prevalensinya sekitar 0–36 per 10.000 kasus setelah anestesi epidural dan 35 per 10.000 kasus setelah anestesi spinal.*

Presentasi Kasus: *Pada kasus ini seorang laki-laki berusia 25 tahun tanpa ada riwayat penyakit dahulu direncanakan untuk tindakan ESWL elektif karena adanya batu pada ureter kanan atas. Pasien dikategorikan ASA I, anestesi spinal dilakukan dengan menggunakan jarum spinal pencil point ukuran 27 pada L3-L4 dalam posisi duduk. Pasien tidak merasakan adanya keluhan pada saat memasukkan jarum spinal. Setelah keluar cairan serebrospinal, 4 mL bupivakain 0,5% hiperbarik dimasukkan dan pasien dipindahkan ke posisi terlentang. Prosedur operasi berjalan dengan baik tanpa komplikasi. Enam jam setelah operasi pasien merasakan masih tidak dapat menggerakkan kaki kirinya, sementara kaki kanannya normal. Pasien dikonsultasikan ke neurologis dan dilakukan terapi dengan menggunakan metilprednisolon, mecobalamin dan pregabalin. MRI lumbosakral menunjukkan hasil normal, studi EMG menunjukkan fungsional lesi parsial pada radix kiri L4-5, L5-S1. Setelah 7 hari pengobatan, pasien merasakan perbaikan gejalanya, dan pasien dipulangkan. Pasien datang untuk tindak lanjut ke neurologis dan fisioterapis sampai 24 hari setelah operasi, dan gejalanya secara bertahap teratasi.*

Simpulan: *Manajemen dari komplikasi neurologis setelah prosedur spinal anestesia tergantung pada etiologinya, sangat penting untuk melakukan diagnosis dini untuk penanganan lebih lanjut.*

Kata kunci : *anestesi; drop foot; komplikasi; lokal anestesi; spinal*

INTRODUCTION

Regional anesthesia may be preferable to general anesthesia for patients undergoing urogenital surgery. Neurological complications after spinal anesthesia are very rare. The prevalence has been reported as 0–36 per 10.000 cases after epidural anesthesia and 35 per 10 000 cases after spinal anesthesia.[1] Another study showed that neurological complications following central neuraxial blockade are estimated to be between 1/1000 and 1/1.000.000. The incidence of complications was higher for spinal than for epidural anesthesia.[2]

Although it is very uncommon, postoperative neurological complications can be very distracting for both patient and anesthesiologist. The case is often transient, but if they occur we need to make other examinations to make sure that we do not need urgent medical surgery. These complications may be caused either due to mechanical injury from the needle or drug toxicity.[1]

Drop foot after spinal anesthesia is one of the complications that can occur in daily clinical practice as an anesthesiologist. So the purpose of this study is to raise awareness about neurological complications that can happen in case of delayed recovery from the regional block.

CASE PRESENTATION

We present a case of a healthy 25 years old man with 70 kg weight and 170 cm height that was arranged for elective ESWL therapy due to right abdominal pain. The CT Urography finding was hydronephrosis with a stone located in the upper right ureter. He had no history of cardiopulmonary, nervous, or sensory-motor problems before the procedure. The patient was categorized ASA I, with no history of operative procedure and smoking. After a written informed consent and an overnight fast he was premedicated with fentanyl 50mcg & midazolam 2mg IV. The usual monitoring such as pulse oximetry, electrocardiography, and blood pressure is performed without any remarkable findings. His baseline blood pressure and heart rates were 120/75 mmHg and 90 bpm. Spinal anesthesia was performed, using a 27 gauge spinal needle into L3-L4 space in a sitting position. During the procedure of inserting the spinal needle, the patient had no complaints. After the withdrawal of the cerebrospinal fluid, 4 mL of 0.5% hyperbaric bupivacaine was injected and the patient was moved to a supine position. After the sensory block was achieved at T10 levels, the operative procedure began and went well without any complications. The patient was moved to the post-operative care unit to be observed and then was transferred to the ward. Six hours after surgery patient was unable to move his left foot with a motoric scale of 0/V and paresthesia, especially on the lateral side, meanwhile the right foot was normal. The neurologist was consulted and the patient was treated using methylprednisolone IV 125 mg three times a day, mecobalamin 500 mg tab three times a day, and pregabalin 50 mg tab two times a day. MRI of the lumbosacral showed normal results, so the patient underwent Electromyography studies the next day. The EMG showed a functional partial lesion on the left radix of L4-5 and L5-S1. The Neurologist then tapered off the methylprednisolone therapy and consulted a physiotherapist. After 7 days of treatment, the patient felt a slight improvement in his motor power (II/V), and the patient was discharged. The patient came for a follow-up with a neurologist & physiotherapist 24 days after surgery, and the symptoms gradually get resolved.

DISCUSSION

Neuraxial anesthesia including spinal anesthesia and epidural anesthesia is a technique in which local anesthetic is placed directly in the intrathecal space (subarachnoid space). Neuroaxial blocks may be used alone or with general anesthesia for the most procedure. Spinal anesthesia has proved most useful in lower abdominal, inguinal, urogenital, rectal, and lower extremity surgery.[3,4]

The patient needs to be well informed about the procedure and have to sign an informed consent form before proceeding to the operation room. Since the procedure is generally performed in awake or slightly sedated state, the suggestion for spinal anesthesia and what to anticipate during placement of neuraxial block, pitfalls,

benefits, and indispensable procedures are some of the conversations that can help relieve anxiety. It's important to let the patient understand that they will have little or no capability to move their lower extremities until the resolution of the block. There are major known contraindications of spinal and epidural anesthesia. The absolute contraindications are lack of consent from the patient, infection at the site of the procedure, and elevated intracranial pressure (ICP), primarily due to intracranial mass. And the relative contraindications are preexisting neurological deficit, severe hypovolemia due to risk of hypotension, and thrombocytopenia or coagulopathy due to the risk of epidural hematoma.[3,4]

Spinal anesthesia is performed in the lumbar area, specifically the mid to low lumbar levels to avoid damage because the penetration of the needle to the spinal cord and also to prevent intrathecally injected drugs from having any activity in the upper thoracic and cervical regions.[3] The end of the spinal cord in the caudal is the conus medullaris and is located usually at the lower border of the first or sometimes the second lumbar vertebral body. There is no significant difference in conus position between male and female patients or with increasing age, and the dural sac usually extends to S2/3 levels. In pediatric patients, the end of the spinal cord is a little more inferior, generally ending around L3. Meanwhile, in the adult population, the mean conus position is at the lower third of L1, varying from the middle third of T12 down to the upper third of L3 in some people. The insertion of the spinal needle for spinal anesthesia is usually at the L3/4 or L4/5 interspace for this reason. Especially in obese patients, spinal cord trauma happened more likely when choosing higher interspaces.[3,4]

Lidocaine, tetracaine, and bupivacaine are the local anesthetic agents most commonly used for spinal anesthesia. The mechanism of action of local anesthetics is when the local anesthetics reach and enter the sodium channels of nerves, they are able to interrupt nerve activity and conduction block occurs. For an effective conduction block, an estimated 75% of the sodium channels have to be inactivated. Sodium channels exist in inactivated-closed, activated-open, and rested closed states during the action potential phases. Sodium channels are able to distribute impulses in an activated or opened state. Local anesthetics bind to open channels and convert these into an inactivated or closed state. The speed of entry and exit of local anesthetics are classified into short, intermediate, and long-acting. Intermediate-acting agents such as lidocaine and mepivacaine have a short-in and short-out profile, and long-acting agents such as bupivacaine have a fast-in and slow-out profile.[5]

Neurological complications following regional anesthesia are peripheral nerve injury, nerve root or cord damage, cranial nerve palsy, spinal cord compression, meningitis, arachnoiditis, and cauda equina syndrome[6]. Intraneural injection of local anesthetic, direct needle trauma, and local anesthetic neurotoxicity are the most common causes of neurologic complications related to neuraxial anesthesia, but permanent trauma to the spinal cord or nerve roots is rare[6]. Auroy et al found evidence of neurologic injury in 24 of 40.000 spinal anesthesia and 6 of 30.000 epidural anesthesia, and most patients fully recover within 3 months, but there were several cases of persistent deficits lasting beyond 3 months. If neurological symptoms persisted beyond 6 months, the neurological injury was categorized as permanent.[7] From a review of spinal anesthesia in more than 10.000 patients, 17 patients reported minor nerve root damage with symptoms lasting up to 1 year.[8] In another study, pain during needle placement or local anesthetic injections is reported in two-thirds of patients with neurological complications. Anesthetic dose, needle size, and the type of local anesthetic have been shown to be significant in the development of neurological complications. In the event of paresthesia, the needle should be immediately removed to avoid radiculopathy after surgery.[9]

The local anesthetic itself can cause neurotoxicity effect. Early reports reveal that moderate to severe pain in the lower back, buttocks, and posterior thigh that appears within 24 hours after complete recovery from spinal anesthesia can be a manifestation of transient radicular irritation of the lumbosacral nerves. The symptoms will usually last for 5-7 days until recovery. Early

reports suggested that neurotoxicity is dose-dependent, but the incidence is similar after intrathecal placement of 1 ml/kg of either 5 or 2% lidocaine in 7.5% glucose. Mepivacaine 4% has also been associated with transient radicular irritation. Spinal anesthesia using 0.5% bupivacaine or 0.5% tetracaine is associated with a lower incidence of transient radicular irritation compared with lidocaine.[5] It is also recommended that repeated injections of local anesthetics should be avoided to prevent toxic effects on the spinal cord.[9]

The exact mechanism of local anesthetic toxicity are not fully understood. There are several aspects that involved in the local anesthetic toxicity, including inhibition of voltage dependent calcium channels, apoptosis, mitochondrial dysfunction, endoplasmic reticulum calcium depletion and DNA damage. Yu et al. also reported that there are bupivacaine-activated ROS production and autophagy involvement in the local anesthetic toxicity.[10] The pathway of cell death depends on the concentration of local anesthetic toxicity. For example, clinically relevant concentrations of lidocaine induced apoptosis in Jurkat cells, whereas higher concentrations caused unspecific cell death and necrosis. Local anesthetics also can lead to fragmentation of DNA and disrupt the membrane potential in mitochondria. This results possibly leading to apoptosis with the uncoupling of the oxidative phosphorylation, which subsequently causes the release of cytochrome c and the initiation of the caspase pathway.[11]

During the epidural or spinal procedure, painful paraesthesia often occurs. The sensory deficit area can differ depending on whether there is damage to a nerve root or a peripheral nerve. The most common symptoms of direct trauma to the spinal cord are burning severe pain in the lower back and lower extremities, dysesthesia, and numbness not following the usual dermatome distribution, along with bladder, bowel, and/or sexual dysfunction. When major neurological symptoms occur following neuraxial blockade procedure, the clinician turns to image techniques such as MRI of the affected area to exclude an epidural space-occupying lesion that would require urgent decompression.[6]

In this case, the patient felt paresthesia with left foot motoric scale 0/V after spinal anesthesia. From the laboratory, radiographic findings and physical examination was normal, the patient was categorized ASA I. The site of the spinal anesthesia procedure in the L3-L4 space and absence of bladder dysfunction made it is unlikely for conus medullaris injury. The patient also had no complain during the inserting of spinal needle. The neurologist then performed an MRI of the lumbosacral, and it showed normal results which confirmed there is no damage on conus medullaris, and no possibility of spinal cord compression and inflammatory process. Electromyography studies can help detect evidence of denervation in recent-onset drop foot and can also help in establishing evidence of reinnervation in the more chronic lesion. EMG was performed and there are functional partial lesions on left radix L4-L5, L5-S1 which confirmed that the neurologic injury was not in the spinal cord. We suggest the possibility of etiology in this case was from the local anesthetics toxicity that irritate the left radix. Peripheral neuropathy can be treated with conservative management, physiotherapy and regular follow-up.

CONCLUSION

During or after spinal anesthesia, neurological injury may develop as either needle or drug-induced complications. Management of drop foot depends on its etiology, so it's important to do early diagnosis using imaging techniques such as MRI and electromyographic examinations to make further treatment.

CONFLICT OF INTEREST

We declare that there is no conflict of interest.

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