



Intraoperative total spinal anesthesia as a complication of posterior percutaneous endoscopic cervical discectomy

Wenkai Wu¹ · Zhengjian Yan¹

Received: 24 September 2017 / Revised: 6 November 2017 / Accepted: 9 December 2017
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Abstract

Purpose Percutaneous endoscopic cervical discectomy (PECD) is an emerging surgical treatment for cervical disc herniation in recent years, but the complications of PECD are rarely reported. In this case report, we aimed to report two cases of total spinal anesthesia, an unusual complication of PECD.

Methods and Results One patient became unconscious with unstable vital signs and another patient appeared with numbness of both arms and legs during PECD operation.

Conclusions From these two cases, we concluded that the operation of anchoring during PECD should be cautious and standardized, intravenous anesthesia should be chosen to enhance intraoperative anesthesia to prevent intraoperative total spinal anesthesia.

Keywords Total spinal anesthesia · Complication · Endoscopic · Cervical discectomy

Introduction

In recent decades, the endoscopic technique had been widely applied in spinal surgeries, and the minimal invasive technique brings less trauma and rehabilitation to the patients. However, during the development of technique, some complications happened, hematoma, sensitive or motor signs were most common. To minimize the injuries of nerve and spinal cord, local and intravenous anesthesia is a feasible anesthesia protocol. However, the local anesthesia could bring some risks of total spinal anesthesia. In this case report, we aim to report an accidental total spinal anesthesia, an unusual complication of PECD.

Case 1

A male patient, 60 years old, presented with the numbness of the left arm for half year and without obvious change after conservative treatments. Cervical MRI showed C3/4–C7/T1 cervical disk herniation and spinal cord of C4–5 level ischemic change. JOA scores: 14. Eaton test of left arm is positive. We diagnosed this case as cervical spondylosis and scheduled for C4/5 and C5/6 posterior percutaneous endoscopic cervical discectomy (p-PECD). The patient had third-stage hypertension for 30 years without regular medication treatments and had operation histories of internal fixation of tibial fracture and abdominal laparotomy. The patient had 20 years history of smoking 20 cigarettes each day and 20 years history of drinking 100 cc each day. The patient had no history of anesthesia complications. He had no disease of the respiratory system and the chest X-ray showed no significant lesion. Preoperative blood count: Hgb: 151 g/L, WBC: $6.69 \times 10^9/L$, PLT: $185 \times 10^9/L$, BUN: 6.72 mmol/L, AST: 19 U/L, ALT: 9 U/L, Ca: 2.47 mmol/L, Na: 139.6 mmol/L, K: 4.262 mmol/L, UA: 446.3 $\mu\text{mol/L}$, GFR: 73.68 mL/min. Preoperative cardiology medicine and pulmonology consultation were completed.

The p-PECD was planned in the operation room under the prone and cervical flexion position. The initiation blood pressure was 160/100 mmHg, heart rate was 80, and oxygen

✉ Zhengjian Yan
Yanzj2004@qq.com
Wenkai Wu
729052983@qq.com

¹ Orthopedics Department, The Second Affiliated Hospital of Chongqing Medical University, 76th Linjiang Road, Chongqing 400016, China

saturation was 97%. After regular sterilization of neck skins and localization of the subpoint of C6 left pedicle by C-arm, we made subcutaneous infiltration anesthesia on the operative region, and then we injected 10 mL mixed liquor with 0.5% lidocaine and 0.19% ropivacaine (mixed by 10 mL 2% lidocaine and 10 mL 0.75% ropivacaine and 20 mL 0.9% normal saline) to cervical muscle and deep fascia to make local infiltration anesthesia.

Incise the located point of skin to deep fascia for an 8-mm incision. Use paracentetic needle of percutaneous vertebroplasty (diameter of 3 mm) to puncture along the skin incision towards C6 lamina and made blunt dissection of the fascia and muscle. Slide the paracentetic needle tip along the lamina toward the lateral mass of C6. Use Kirschner wire (diameter of 2 mm) to puncture and anchor on the lateral mass of C6 and clarify by fluoroscopy (Fig. 1). Patient felt pain on the neck during the anchoring of Kirschner wire, so we stopped the anchoring and proceeded to insert dilator and operation sheath in turn (sheath outer diameter 5.9 mm, beveled opening). After insertion of the sheath, patient complained of intolerable neck pain; therefore, we removed the dilator and made a subperiosteal block above lamina and lateral mass by injecting 4 mL mixed liquor with 0.5% lidocaine and 0.19% ropivacaine.

Then, we inspected the sheath and endoscopy of SPINENDOS (diameter of 5.9 mm) and made the regular clean of soft tissue under visual control to expose bony structure. In the meantime, patient's BP and SpO₂ progressively declined to SpO₂: 84 BP: 90–70/61–45 mmHg, and there was no response to anesthetist's calling. We stopped

the operation immediately, overturned the patient, and made tracheal intubation and assisted ventilation at the same time. At this moment, the patient had loss of consciousness, no response to the calling, limb muscle weakness, bilateral pupil diameter of 2 mm, bluntness of the pupillary light reflex, and weak spontaneous respiration. After immediate intravenous injection of dopamine, metaraminol, doxapram hydrochloride, nalmefene, and dexamethasone, meanwhile endotracheal intubation and mechanical assisted ventilation were supplied. After those treatments, the patient's vital signs became stable for SpO₂: 97 BP: 120/80 mmHg, but the patient was still unconscious. To clarify the diagnosis and exclude other complications such as ACVD and so on, we made emergency contrast-enhanced CT scan of neck and brain. No brain abnormality was seen but a perforation of C6 lamina on the operation region was found by CT scan (Fig. 2). During the imageological examination, the patient became conscious gradually (about 165 min post surgery), the sensory and motor functions recovered gradually, and was able to communicate with doctors and relations. After CT scan, the patient was admitted into the Intensive Care Unit, mecobalamine, NGF, dexmedetomidine and ipratropium bromide nebulization were supplied to prevent neurological damages; after 5 h post surgery, the patient recovered spontaneous respiration and was extubated. After extubation, the patient had clear consciousness, normal sensory and motor function, T: 36.5 °C, P: 76/min R: 21/min, SpO₂: 99%. Postoperative blood count: WBC: $16.04 \times 10^9/L$, Mb: 107.30 µg/L, GFR: 70.81 mL/min, normal of BNP and PT. And the WBC became normal after 3 days post surgery.

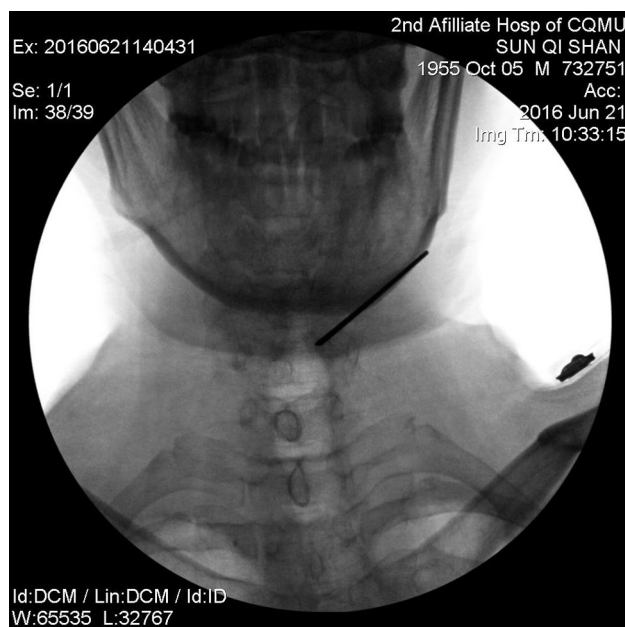
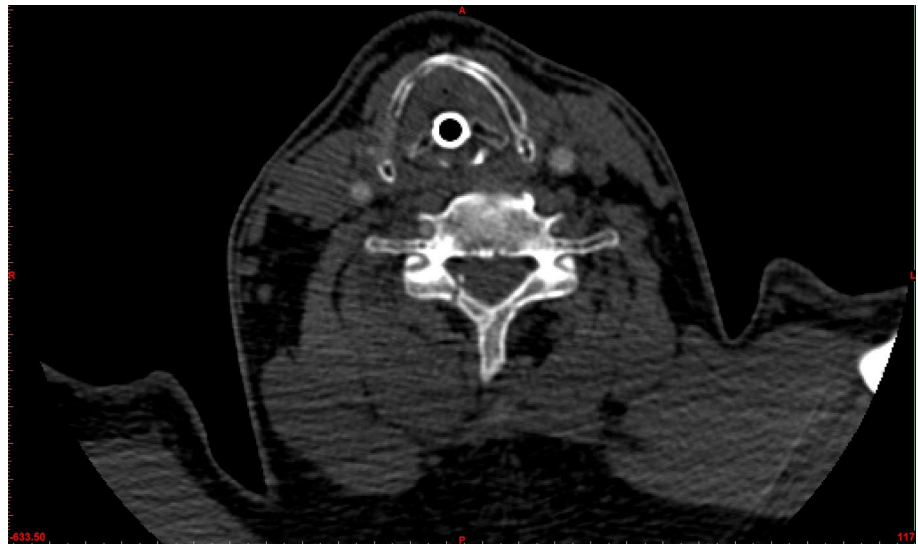


Fig. 1 Intraoperative fluoroscopy of the anchored Kirschner wire

Case 2

A male patient, 64 years old, with pain and weakness of the right arm for 2 years and he did the ACCF of C3–5 for 8 months, but the pain relapsed for 2 months and without obvious change after conservative treatments. Cervical myelography showed osteoproliferation of the posterior of C3/4 Luschka joint and the nerve root was compressed. Right shoulder shrug strength III+. Eaton test and Spurling test of right arm is negative. This patient was diagnosed as cervical spondylotic radiculopathy and scheduled for posterior percutaneous endoscopic cervical decompression (p-PECD). The patient had first-stage hypertension for 1 year without regular medication treatments, and the highest blood pressure was 140/90 mmHg. The patient had no history of operation, smoking, drinking and anesthesia complications. He had no disease of the respiratory system and the chest X-ray showed no significant lesion. Preoperative blood tests were normal. Preoperative cardiology medicine and pulmonology consultation were completed.

Fig. 2 A perforation of C6 lamina on the postoperative CT scan



The p-PECD was planned in the operation room under the prone and cervical flexion position. The initiation blood pressure was 130/90 mmHg, heart rate was 85, and oxygen saturation was 98%. After regular sterilization of neck skins and localization of the subpoint of C4 right pedicle by C-arm, we made subcutaneous infiltration anesthesia on the operative region, and then we injected 10 mL mixed liquor with 0.5% lidocaine and 0.19% ropivacaine (mixed by 10 mL 2% lidocaine and 10 mL 0.75% ropivacaine and 20 mL 0.9% normal saline) to cervical muscle and deep fascia to make local infiltration anesthesia.

Incision was made on the subpoint of C4 pedicle, skin and deep fascia was incised for an 8-mm incision. Use Kirschner wire (diameter of 2 mm) to puncture and anchored on the lateral mass of C4 after confirmed by C-arm. When we used bone hammer to anchor the Kirschner wire on the lateral mass, the patient was tensed and a kind of pain on the neck. As a consequence, we injected 4 mL mixed liquor with 0.5% lidocaine and 0.19% ropivacaine around the Kirschner wire by injector and prepared for the following process. About 1 min after the mixed anesthetics were injected, the patient felt numbness of both arms and legs, and felt oppressing sensation of the right chest, the motor functions of arms and legs are normal. The blood pressure was 110/70 mmHg and heart rate was 70, oxygen saturation was 98%. The patient's symptoms did not change after untied. We inspected the endoscopic system of SPINENDOS (diameter of 5.9 mm) and there is no significant rupture of lamina. The patient then had clouding of consciousness and lack of response to call, meanwhile the blood pressure decreased to 90/50 mmHg and heart rate was 40, oxygen saturation was 98%. The surgery ended immediately and the patient was turned over. Oxygen uptake was given to maintain the oxygen saturation, and 2 mg dopamine and 0.5 mg atropine were injected to increase the blood pressure, dilate blood vessels and prevent

shock. The blood pressure and heart rate increased to normal 5 min later and stabilized at BP: 70/110 mmHg, HR: 65/30 min later. Meanwhile, the symptoms also disappeared gradually. After 30 more minutes of observation, the patient was sent back to inpatient ward and no more abnormal vital sign appeared.

Discussion

Percutaneous endoscopic cervical discectomy (PECD) is a new surgical treatment for cervical disk herniation, it involved posterior percutaneous endoscopic cervical foraminotomy (p-PECF) or posterior percutaneous endoscopic cervical discectomy (p-PECD), anterior transcorporeal or transdiscal approach anterior percutaneous endoscopic cervical discectomy (a-PECD) or even anterior endoscopic cervical discectomy and interbody fusion (a-PECD and F). Some complications such as hematoma, sensitive or motor signs could appear during the operation or behind the operation but were rarely reported. Yang et al. [1] had reported the complications of a-PECD and p-PECD, including neurological deterioration and repeated surgery of p-PECD, meanwhile besides repeated surgery there were postoperative hematoma and postoperative headache for a-PECD. As for other p-PECD/PECF articles, Benedikt [2] reported no p-PECF complication. Ruetten et al. [3, 4] reported three p-PECF postoperation complications of transient, dermatoma-related hypesthesia. Oertel et al. [5] reported one postoperative hematoma and one transient worsening of preoperative existing triceps paresis which was completely reversible within 5 months postoperative. In the a-PECD articles, Ruetten et al. [6] reported two transient difficulty swallowing cases, Ahn et al. [7] reported transient swallowing discomfort and relapsed headache, Tzaan [8] reported

one postoperative temporary headache and one carotid artery injury, and Deng et al. [9] and Yao et al. [10] reported no complications. Among all those PECD article (a-PECD and p-PECD), total spinal anesthesia (TSA) has not been reported so far; one reason is because most PECD were implemented under total anesthesia, however, we thought local and intravenous anesthesia could be safer if the surgeon was not proficient.

Total spinal anesthesia is a rare but a serious complication that occurs as a result of accidental and unintentional injection of anesthetics at the wrong site. TSA is characterized by a sudden decrease in blood pressure (hypotension), rapidly increasing motor block, temporarily loss of breathing, loss of consciousness, and dilated pupils. In this report, the patient's performance fit with the TSA. TSA is more common in gynecology and obstetrics surgeries which were mostly under epidural anesthesia [11, 12], and as Musaid and Naranjo [13] reported, a total spinal anesthesia complication has a 2% risk during surgery in obstetrics and gynecology patients. TSA has been reported as an infrequent complication of many procedures, mostly was reported as a complication of epidural anesthesia [14–17], Albi-Feldzer et al. [18] and Beyaz et al. [19] reported TSA as a complication of thoracic paravertebral block. Dogan et al. [20] reported a TSA after lumbar plexus block. And there were several reports of TSA after intercostal nerve block [21–23]. Most TSA happened under the procedure of epidural or thoracic foramen, but there was no report about TSA during cervical procedure.

In this report, TSA was likely to be caused by leakage of anesthetics into the intradural space or even intracranial area. The postoperative CT scan (Fig. 2) of the 1st patient showed that there was a perforation on the lamina of C6, which was made before TSA. This perforation connected the epidural space or even subarachnoid space to the surface of C6 lamina. Therefore, on the second injection of anesthetics, the lidocaine might go to the subarachnoid space through the perforation on lamina and caused TSA. Although lack of clarify of the mechanism, considering that the time sequence of anchoring, pain, anesthetics injection and TSA was in order with little time span and the perforation on the lamina shown by postoperative CT scan, we thought this TSA was very likely to be caused by the reasons we predicted above.

On the basis of the prediction above, we can review the potential risk factors in those cases. First, we thought the critical reason of TSA is the Kirschner wire anchoring on lateral mass which was located too close to the central side. Second, the violent operation of Kirschner could cause rupture of lamina or ligamentum flavum. Besides, the amount of anesthetics and the injection pressure of second anesthetics injection were considered to be possible reasons. In addition, the cervical flexion position would increase the risk of TSA if the arachnoid was broken through which causes

the anesthetics to flow to the encephalocoele easily in this position.

According to Bernards CM's [24] tests, the drug movement through the meningeal hole is responsible for the TSA complication of epidural anesthesia, it proved the possibility of TSA's mechanism by the drug movement in the cerebrospinal fluid. The reports indicate that under procedures in epidural space or foramen of total spine, the TSA's risk cannot be ignored. Besides, Matsumoto et al.'s [25] study compared the effects of site of injection on the serum concentration of lidocaine following total spinal block, and proved that the mean maximum serum concentration of lidocaine in the cervical group was significantly greater than that in the lumbar group. So in cervical procedure, especially in PECD, there is more risk of TSA than PELD.

Conclusion

The TSA complication of PECD is rare, but still worth vigilance. To avoid TSA, we thought there were a few essential technical procedures that should be noticed. During the anchoring of Kirschner wire, the depth should not be more than the thickness of lamina, and the location of anchoring should be on the lateral mass with direction to be vertical. Besides, the operation should be gentle and under monitoring of fluoroscopy. To avoid leakage of anesthetics, the first injection of anesthetics should be sufficient and widely distributed. If local anesthesia could not effectively alleviate pain, we should choose intravenous anesthesia to reinforce anesthesia.

Funding Funding was provided by Chongqing Municipal Public Health Bureau, Chongqing People's Municipal Government (CN), Award number: 2017ZDXM031.

Compliance with ethical standards

Conflict of interest None of the authors has any potential conflict of interest.

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