

Inadvertent Subdural Spread Complicating Cervical Epidural Steroid Injection with Local Anaesthetic Agent

S. BANSAL*, M. J. TURTLE†

Anaesthetic Department, West Wales General Hospital, Carmarthen, United Kingdom

SUMMARY

Although cervical epidural steroid injection with local anaesthetic is considered a safe technique and widely practised, complications may occur. We report a patient experiencing unexpected delayed high block, moderate hypotension and unconsciousness eight to ten minutes after an apparently normal cervical epidural steroid injection. The most probable diagnosis was a subdural block. Anatomical peculiarities of the epidural and subdural space in the cervical region increase the risk of subdural spread during cervical epidural injection. Fluoroscopic guidance is important during cervical epidural injection to increase certainty of correct needle placement, thus minimizing the risk of complications.

Key Words: ANAESTHETIC, ANAESTHETIC TECHNIQUES: regional, epidural, subdural, steroid, analgesic.
COMPLICATIONS: cervical epidural, subdural injection

Literature on the incidence of the complications following cervical epidural steroid injection (CESI) with local anaesthetic has been inconsistent. Some studies make no mention of any^{1,2}, whereas others refer to a considerable number³⁻⁵. It is generally agreed amongst pain specialists that CESI in the hands of an experienced anaesthetist represents a safe treatment strategy for a variety of painful cervical conditions^{3,4}. We report a case of probable subdural block following cervical epidural steroid injection. As far as we are aware, subdural spread of local anaesthetic during CESI has not previously been reported.

CASE HISTORY

A 62-year-old male patient with cervical spondylosis presented for CESI. Over the previous six years he had undergone CESI on thirteen occasions at approximately four- to nine-month intervals, with dramatic improvement of his spondylotic symptoms for three to six months after each procedure. All of

his CESI procedures had been uneventful except for one at which he had a possible dural tap. Pre-procedure examination of this 170 cm, 78 kg, ASA physical status 2 patient was unremarkable and he was scheduled for CESI as a day case procedure.

In the procedure room, his baseline heart rate (HR) and blood pressure (BP) were noted to be 70 beats per minute (bpm) and 136/85 mmHg respectively. In the left lateral position, using full aseptic precautions, the epidural space was identified at a depth of 6.5 cm with loss of resistance to air (18 gauge Tuohy needle, C7-T1 interspace). After a negative aspiration test, triamcinolone acetonide 30 mg in 5 ml of bupivacaine 0.5% was injected slowly, with further aspirations during and after the injection.

Approximately eight minutes after injection the patient complained of a tingling sensation followed by a feeling of weakness of his left arm. At 10 minutes the patient complained of difficulty in breathing and by 12 minutes he had become unresponsive and his HR, BP and oxygen saturation (SpO₂) were noted to be 66 bpm, 80/60 mmHg and 89% respectively. His respiratory pattern was slightly uncoordinated, at a rate of 22 breaths.min⁻¹. His oxygen saturation improved to 94% on oxygen at 5 l.min⁻¹ by Hudson mask so it was decided not to intubate at that stage. The BP improved following one intravenous bolus of ephedrine 15 mg. His pupils were larger than normal but not widely dilated. He remained unresponsive for 50 minutes but his cardiorespiratory status remained stable without further intervention. After 50 minutes

*M.D.(Anaesthesia), Senior House Officer, Anaesthetic Department, Walsgrave Hospital, University Hospitals Coventry and Warwickshire NHS Trust, Coventry.

†F.R.C.A., Consultant Anaesthetist, Anaesthetic Department, West Wales General Hospital, Carmarthen.

Address for reprints: Dr S. Bansal, Anaesthetic Department, Walsgrave Hospital, University Hospitals Coventry and Warwickshire NHS Trust, Coventry, CV2 2DX, United Kingdom.

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his level of consciousness returned to normal over a period of two or three minutes, with good power in all four limbs and with no residual sensory or motor deficit. He recalled an awareness of some events and reported that he had been unable to respond to commands. The patient was kept under observation overnight and was discharged the next morning. When contacted by telephone 48 hours later, he was well, had no spondylitic symptoms and had suffered no headache or other adverse effects. We expressed our reservations about future CESI in view of this episode, but the patient was very keen to be considered for CESI again if clinically indicated.

DISCUSSION

Administration of steroid in combination with local anaesthetic into the epidural space (lumbar and cervical) has attained popularity in the treatment of a variety of painful conditions^{6,7}. CESI is considered a safe treatment modality, with a low incidence of complications such as unintentional dural puncture, vasovagal syncopal attack and neck stiffness^{3,4}. There is a high incidence of incorrect placement of the epidural needle in clinical practice. Stojanovic et al⁸ found a 53% rate of false loss of resistance during the first attempt to enter the cervical epidural space without fluoroscopic assistance. He concluded that the loss-of-resistance technique may not be an adequate method for ensuring accurate needle placement in blindly performed cervical epidural injections. Similarly, White et al⁹ found incorrect placement of the needle during lumbar epidural injection to be as high as 30% after radiographic studies. In a series of one hundred epidurals at various spinal levels, sited by experienced anaesthetists, unexpected partial subdural placement of the Tuohy needle occurred in seven cases¹⁰.

Consequently, to avoid drug administration through an incorrectly placed needle, some authors have advocated performing epidural steroid injections under fluoroscopic control¹¹. However, the use of fluoroscopy is guided by individual experience and the availability of resources. Cluff et al¹², in a recent nationwide survey within the United States, reported that only 39% of academic institutions used fluoroscopy while performing CESI. Though there are a few case reports of accidental subdural block after lumbar epidural injection, with a probable incidence of 0.8% according to a retrospective study¹³, to the best of our knowledge, accidental subdural spread had not previously been reported after cervical epidural injection.

The subdural space is a potential space containing

a small volume of serous fluid between the dura and arachnoid mater. The space extends from the lower border of the second sacral vertebra into the cranial cavity. It has no communication with the subarachnoid space but it is continued along the cranial and the spinal nerves for a short distance¹⁴. The subdural space is larger in the cervical region compared with the lumbar¹⁵, so theoretically the chances of an accidental subdural injection of drug are higher in the cervical region than elsewhere. Local anaesthetic preferentially travels anti-gravitationally in a cephalic direction¹³, but there is some caudal spread as well in the narrow subdural space, producing extensive sensory, sympathetic and motor blockade. In a study of 2182 consecutive lumbar epidural steroid injections, Lubenow et al¹³ concluded that subdural block should be considered when there has been an extensive sensory or motor block after a negative cerebrospinal fluid (CSF) aspiration test and only a small volume of local anaesthetic has been utilized.

The time of onset of subdural block following epidural injection has been described variously from 5 to 30 minutes¹³. Our patient complained of tingling sensations of the left arm, and difficulty in breathing after eight to ten minutes of epidural injection, which is consistent with subdural block. Although our patient complained of difficulty in breathing, this did not progress to apnoea and was easily managed conservatively. Progressive respiratory depression and incoordination, as noted in our patient, rather than sudden apnoea, are other points suggestive of subdural block¹⁶. We were able to maintain saturation within the normal limits with supplementary oxygen by Hudson mask.

The subdural space has been described as being widest in its lateral and dorsal aspects, favouring posterior subdural compartmentalization of drugs. Thus hypotension following subdural block has always been reported to be moderate, due to relative sparing of anterior roots which transmit the motor and sympathetic modalities¹⁶. In our patient the lowest blood pressure recorded was 80/60 mmHg and was easily managed with intravenous fluid and a single dose of ephedrine, requiring neither a further dose of vasopressor nor repeated boluses of intravenous fluid.

On the basis of the clinical picture, we are of the opinion that at least part of the local anaesthetic entered the subdural space. The features favouring subdural rather than intrathecal injection were the slow onset of symptoms (expected onset of one to two minutes with intrathecal block); respiratory depression with inco-ordination rather than sudden apnoea

(expected with up to 25 mg of bupivacaine injected intrathecally); and moderate and easily treatable hypotension rather than sudden cardiovascular collapse. Unconsciousness can be attributed to the spread of some of the local anaesthetic into the cranial cavity. These were characteristic features of subdural block but with a single shot CESI it was not possible to confirm this radiologically.

Subdural spread of local anaesthetic can be considered a cause of many of the unusual accompaniments of epidurals encountered in practice^{8,14,17}. In the absence of routine fluoroscopic guidance we believe that subdural block is under-diagnosed in clinical practice, as the reliability of clinical signs in differentiating subdural from other types of block is conjectural, and the diagnosis requires it to be considered in a differential diagnosis. This case strengthens our view that epidural steroid injections with local anaesthetic should be performed under fluoroscopic guidance, to increase confidence in the correct placement of the needle, thus minimizing complications.

With fluoroscopy, the volume of drug solution required to adequately cover the desired area of pathology is reduced, thus reducing complications related to the dose of local anaesthetic injected⁸. X-ray appearances of the injection into the cervical subdural space are quite characteristic, with a very fine radiopaque line on the lateral view that extends for some distance in the dural sac and characteristic bilateral images like a "nail scratch shape" confined to the interior of the canal on the antero-posterior image¹⁸. These characteristic X-ray appearances on fluoroscopy warn about accidental subdural spread of solution¹⁴. Nevertheless, fluoroscopy should not be considered foolproof, because subdural haematoma has been reported following cervical epidural injection performed under fluoroscopic guidance¹⁹. In addition, close monitoring and vigilance are important to ensure a good outcome.

In conclusion, an unusual presentation of delayed onset of unexpected high block with moderate hypotension, respiratory inco-ordination and unconsciousness after apparent normal cervical epidural steroid injection with local anaesthetic should alert the anaesthetist to the possibility of subdural block. We propose that epidural steroid injections should be performed under fluoroscopic guidance to minimize complications.

REFERENCES

1. Rowlison JC, Kirschenbaum LP. Epidural analgesic techniques in the management of cervical pain. *Anesth Analg* 1986; 65:938-942.
2. Mangar D, Thomas PS. Epidural steroid injections in the treatment of cervical and lumbar pain syndromes. *Reg Anesth* 1991; 16:246.
3. Cicala RS, Westbrook L, Angel JJ. Side-effects and complications of cervical epidural steroid injections. *J Pain Symptom Manage* 1989; 4:64-66.
4. Waldman SD. Complications of cervical epidural nerve blocks with steroids: a prospective study of 790 consecutive blocks. *Reg Anesth* 1989; 14:149-151.
5. Shulman M. Treatment of neck pain with cervical epidural steroid injection. *Reg Anesth* 1986; 11:92-94.
6. Winnie AP, Hartman JT, Meyers HL Jr, Ramamurthy S, Barangan V. Pain clinic. II. Intradural and extradural corticosteroids for sciatica. *Anesth Analg* 1972; 51:990-1003.
7. Raj PP. Epidural steroids. In: Raj PP, ed. *Practical management of pain*. Chicago: Year Book Medical Publishers, 1986; 682-686.
8. Stojanovic MP, Vu T, Caneris O, Slezak J, Cohen SP, Sang CN. The role of fluoroscopy in cervical epidural steroid injections: an analysis of contrast dispersal patterns. *Spine* 2002; 27:509-514.
9. White AH, Derby R, Wynne G. Epidural injections for the diagnosis and treatment of low-back pain. *Spine* 1980; 5:78-86.
10. Mehta M, Salmon N. Extradural block. Confirmation of the injection site by X-ray monitoring. *Anaesthesia* 1985; 40:1009-1012.
11. el-Khoury GY, Ehara S, Weinstein JN, Montgomery WJ, Kathol MH. Epidural steroid injection: a procedure ideally performed with fluoroscopic control. *Radiology* 1988; 168:554-557.
12. Cluff R, Mehio AK, Cohen SP, Chang Y, Sang CN, Stojanovic MP. The technical aspects of epidural steroid injections: A national survey. *Anesth Analg* 2002; 95:403-408.
13. Lubenow T, Keh-Wong E, Kristof K, Ivankovich O, Ivankovich AD. Inadvertent subdural injection: a complication of an epidural block. *Anesth Analg* 1988; 67:175-179.
14. Collier CB. Accidental subdural block: four more cases and a radiographic review. *Anaesth Intensive Care* 1992; 20:215-225.
15. Shapiro R. *Myelography* 3rd Ed. Chicago, Year Book Medical Publishers, 1975; 124-126.
16. Collier C. Total spinal or massive subdural block? *Anaesth Intensive Care* 1982; 10:92-93.
17. Reynolds F, Speedy HM. The subdural space: the third place to go astray. *Anaesthesia* 1990; 45:120-123.
18. Ischia S, Maffezzoli GF, Luzzani A, Pacini L. Subdural extra-arachnoid neurolytic block in cervical pain. *Pain* 1982; 14:347-354.
19. Reitman CA, Watters W III. Subdural hematoma after cervical epidural steroid injection. *Spine* 2002; 27:E174-176.