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CASE REPORT

Cerebellar and brainstem infarction as a complication of CT-guided transforaminal cervical nerve root block

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Abstract A 60-year-old man with a 4-year history of intractable neck pain and radicular pain in the C5 nerve root distribution presented to our department for a CT-guided transforaminal left C5 nerve root block. He had had a similar procedure on the right 2 months previously, and had significant improvement of his symptoms with considerable pain relief. On this occasion he was again accepted for the procedure after the risks and potential complications had been explained. Under CT guidance, a 25G spinal needle was introduced and after confirmation of the position of the needle, steroid was injected. Immediately the patient became unresponsive, and later developed a MR-proven infarct affecting the left vertebral artery (VA) territory. This is the first report of a major complication of a cervical root injection under CT guidance reported in the literature. We present this case report and the literature review of the potential complications of this procedure.

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Introduction

Cervical radiculopathy has been a diagnostic and therapeutic challenge for all clinicians. Patients present to the clinicians with long-standing radicular pain which may be attributable to various causes like degenerative disc disease, bone spurs, spinal canal or foraminal stenosis, or epidural fibrosis due to previous surgeries. These patients usually have conservative treatment for a long time. Failure of conservative treatment can lead to intractable pain, and in many institutions selective cervical nerve root blocks have been performed in this group of patients as an alternative to surgery or to determine the exact level of the symptoms. Various institutions adapt different techniques to perform the procedure, including fluoroscopic guidance, CT guidance, CT fluoroscopy and digital subtraction with real-time fluoro.

Case report

A 60-year-old man with a 4-year history of intractable neck pain and radicular pain along the C5 nerve root distribution presented to our department. He suffered from mild angina and had been prescribed aspirin for the same, but had stopped taking aspirin 2 years before. No other significant medical history was noted. He had a MR scan of his neck which showed disc dehydration and mild disc bulge at C4/5 and C5/6 levels with foraminal stenosis. Clinically, his pain was in the C5 nerve root distribution. He had been referred to our department for bilateral C5 nerve root blocks. He had

had a CT-guided transforaminal C5 nerve root block on the right side about 3 months previously, and had had significant pain relief; hence, he had come to have his left side also injected at the same level.

Procedure

The patient was informed of the potential complications of the procedure, including arterial puncture, spinal and medullary infarction. The patient was then placed in a supine position on the CT table. The patient's head was turned to the contra-lateral side and secured. The injection area was cleaned. No local anaesthetic was administered because only a 25G needle was used. A lateral transforaminal approach was adopted to introduce a 25G spinal needle into the posterior aspect of the neural foramen, posterior to the cervical vessels. The senior author's technique was to direct the needle tip towards the posterior bony margin of the foramen. Once bony contact was made, the needle tip was redirected and positioned into the paraforaminal space. One should be cautious using this approach, as it is very important to make the initial bony contact with the transverse process before placing the needle into position, otherwise inadvertent puncture of the vertebral artery may occur. An oblique anterolateral or posterolateral approach has been used by other authors, but these approaches may direct the needle towards the vertebral artery; therefore, these approaches are not used by the senior author. It is important for the clinician performing the procedure to realise that there is an inherent risk to the procedure despite the different approaches advocated in the literature. A quantity of 0.3 ml of contrast (omnipaque) was injected to confirm the correct position of the needle tip (Fig. 1). After a negative blood aspiration, 1 ml (40 mg) of triamcinolone was injected. The patient was immediately sat up to prevent cranial migration of the drug.

Post-procedure

Immediately post-procedure, the patient was disoriented, with loss of normal speech. He was maintaining his airway but was very hypertensive. A cerebro-vascular event was suspected. An intensive care consultant evaluated the patient's condition and an immediate neurosurgical opinion was also obtained. A noncontrast CT of the head was immediately performed to exclude intracranial haemorrhage, which showed subtle hypodensity within the left cerebellum and left half of the brainstem, indicating early changes of an infarct. The patient showed an apparent clinical improvement; hence, his symptoms and signs were attributed to possible vasospasm. He was admitted to High Dependency Unit for close monitoring. Approximately 8 hours later, the patient's condition deteriorated. The patient had a fit followed by a reduced Glasgow Coma Scale (GCS) from 14/15 to 6/15. An urgent brain MR and MRA was performed. The MR brain (Fig. 2) revealed extensive high signal changes on the T2-weighted images in the left cerebellum and left side of the brain stem, in the left vertebral artery territory. However, on the MRA no conclusive evidence of a vertebral artery dissection was found. The patient was intubated and required intensive care support.

The patient's condition improved 48 hrs after the procedure. On examination, he had a GCS of 15/15, normal power in his limbs but still had diplopia, mild dysphasia and poor balance. He was making steady progress with intense physiotherapy. One month after the event the patient had made progressive recovery.

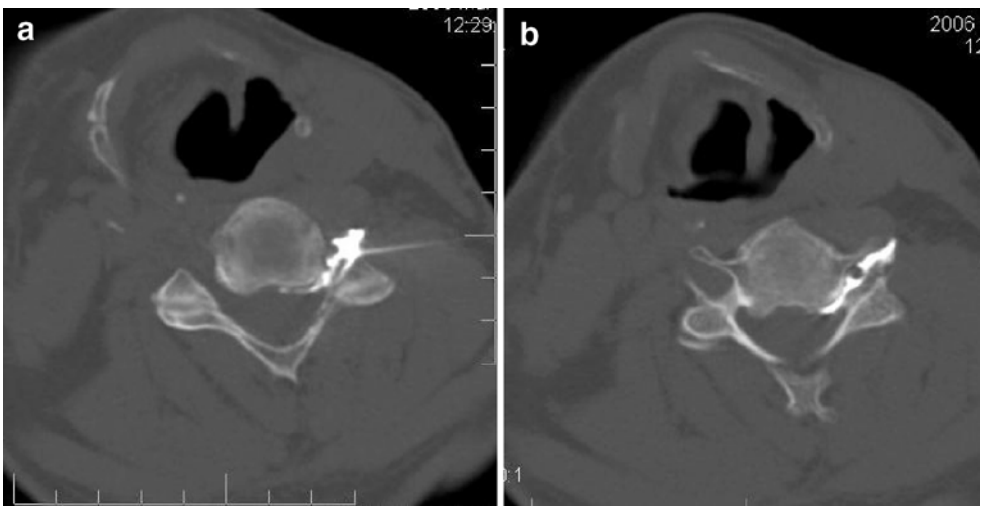

Fig. 1 **a** Axial CT shows the needle position and contrast in the epidural space. **b** Axial CT shows the contrast outlining the left vertebral artery

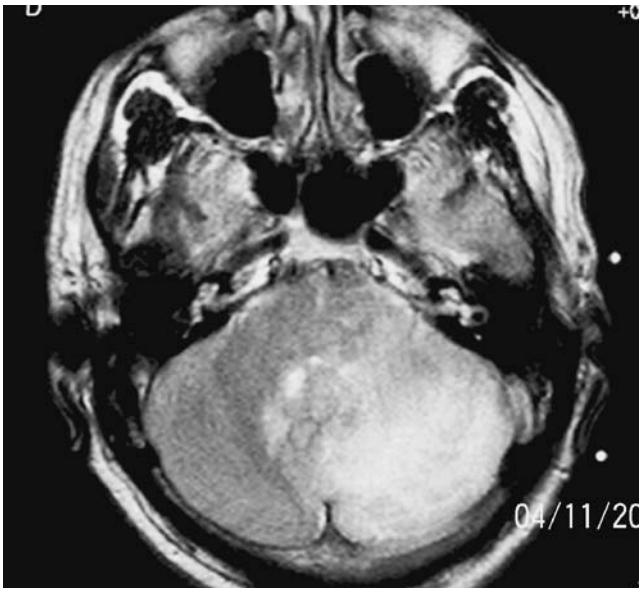

Fig. 2 Axial T2 MR shows high signal in left posterior fossa, indicating oedema and infarct in the left VA territory

Discussion

The symptoms of cervical radiculopathy are neck and brachio-radicular pain, with or without motor weakness or paraesthesia. The radicular pain may be attributable to various causes such as degenerative disc disease, bone spurs, spinal canal or foraminal stenosis or epidural fibrosis due to previous surgeries. These patients have various conservative treatments including physiotherapy, analgesics, anti-inflammatory agents and muscle relaxants. But failed conservative treatment can lead to intractable pain, and in many institutions selective cervical nerve root blocks have been performed in this group of patients as an alternative to surgery or to determine the exact level of the symptoms.

The technique varies and includes fluoroscopic guidance, CT guidance or CT fluoroscopy. Various studies recommend CT [1], CT with fluoro [2, 3] and also digital subtraction imaging to prevent arterial injections [4]. CT has been advocated by many authors, as it can allow precise needle placement and offers excellent anatomical resolution. It has been described as a safer technique than the use of fluoroscopy [2, 3]. It also offers the ability to identify and avoid important vascular structures like the jugular, vertebral and carotid vessels. Some authors advocate CT fluoroscopy, as it can offer the advantage of real-time visualization of the contrast when it is injected [3]. But other authors have argued that potential hazardous complications secondary to a small radicular artery puncture can occur if one relies on fluoro guidance, and hence have advocated use of digitally subtracted real-time fluoroscopic imaging [4]. Certainly an imaging modality is required to exclude arterial puncture, as studies have proven that blood in the needle hub either spontaneously or after aspiration should not be considered a reliable predictor of an intravascular injection as it is only 45.9% sensitive [16]. Literature search has revealed that there is no consensus yet, as to the safest imaging technique that should be used for this procedure.

To date, there are no randomised controlled trials showing the true benefit of cervical nerve root blocks, although good results have been reported by various authors [1, 2, 5–7]. One study with 18 patients with cervical radiculopathy reported >50% long-term pain relief in 11 of their patients after CT-guided foraminal injections [1]. In another large study, 60 patients underwent CT fluoroscopy-guided injections, with a mean 46% reduction in pain and 6 patients with complete (100%) pain relief [2]. Other authors have injected corticosteroids in 68 patients with cervical radiculopathy. All these patients were potential surgical candidates who recovered without need for surgical intervention [5]. Literature search has also revealed that selective nerve root block is still a subject of great controversy [4, 8].

It is essential for the clinician performing the procedure to realize that there is an inherent risk associated with the procedure because of the site and the close proximity to the vital structures. The potential for severe complications with cervical spine interventions is significantly higher than that with lumbar spine interventions. There are sporadic case reports of various catastrophic complications due to this procedure attributed to various causes, some of which remain unknown.

These include anterior spinal artery syndrome [9] — in this case a large spinal cord infarction was attributed to an impaired perfusion of the main anterior radicular artery after an injection of local anaesthetic and steroid for a C6 nerve root block using a 22G needle under fluoroscopy guidance. A further study showed potential spinal cord infarction due to injection of radicular artery, and suggested that this can be minimised by use of digitally subtracted real-time fluoroscopic imaging [4]. Further case reports of intrinsic spinal cord damage due to this procedure has also been reported [10, 11]. Epidural haematoma requiring surgical decompression after repeated epidural steroid injections has been reported [12]. Epidural abscess is another potential complication reported following steroid injections [13].

Corticosteroid particulate embolus due to unintended intra-arterial injection as a potential mechanism causing quadriparesis and progressing to brainstem herniation causing death has also been reported [14]. The authors in this article found that the particles in dexamethasone and betamethasone were rod-like and lucent, whereas particles of methylprednisolone (MPA) and triamcinolone (TA) tended to coalesce into larger aggregates of more than 100 μm. Hence, they concluded that MPA and TA contain significant amounts of larger particles contributing to

microvascular "sludging" and subsequent occlusion and infarction. Finally, death due to vertebral artery dissection causing haemorrhagic infarction during a C-7 nerve root block using a 25G spinal needle has also been reported using fluoroscopic technique [15]. One paper describes at least six other cases causing severe neurological disability, which are still sub-judice and not reported in the literature [4].

Conclusion

In our institution, the procedure was performed under CT guidance by a consultant who had the experience of having performed about 200 such procedures with no major complications. The technique in the present case was very good, with optimal placement of the needle, and contrast injection confirmed the needle tip in the epidural space. Although the patient has had an infarct, a definite dissection of the vertebral artery could not be seen on imaging. The infarct is likely to be secondary to severe vasospasm, as there has been considerable clinical improvement. This vasospasm is probably secondary to an arterial puncture which might have occurred secondary to minimal movement of the needle between confirmation with contrast and injection of the steroid. As there is no evidence of a dissection on imaging it is very difficult to explain the causative mechanism of the complication, and one has to accept the inherent risk of the procedure itself.

After exhaustive review, we will continue to offer this procedure at our institution following strict guidelines. We have also analysed the results of a prospective study we did in our institution which demonstrated that more than 50% of the patients were prepared to have the procedure done again, although there was potential risk of life-threatening complications. These were the patients who had benefited from the procedure, and had been debilitated by the pain prior to the procedure. This study is currently under review for publication.

Hence we have made certain changes in our practice to make the procedure safer. All patients are informed of the complications—including spinal cord damage, arterial injection, brainstem infarct and death—by the referring clinician and not by the treating radiologist, so that the patient has adequate time to contemplate the risks and benefits of the procedure, and give informed consent. We have reviewed the choice of steroids and changed our practice. We now use corticosteroid solutions like betamethasone instead of suspensions, to avoid potential microembolization [14]. We continue to use a 25G needle under CT guidance and contrast to confirm the needle tip position within the epidural space. Aspiration before injection is recommended, although not very reliable [16]. We now use a micro-bore attachment to minimize needle manipulation after confirmation of its position.

It is important to note that this is the first major complication of transforaminal cervical nerve root block under CT guidance reported in the literature, as the complications in other cases reported have been performed under fluoroscopy guidance. We would like to propose the advent of a common registry to document the complications in various institutions performing this procedure, so that one can ascertain the true incidence of complications, related to this procedure.

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