

CASE REPORT

Successful outcomes following transforaminal epidural steroid injections for C4/5 cervical disc prolapse associated with profound neurological deficit

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Abstract

Purpose To show that with C5 radiculopathy and profound neurological deficit, good outcomes can be obtained with injection therapy.

Method We present two cases of cervical radiculopathy secondary to disc prolapse associated with profound neurological deficit. In both cases, cervical injection therapy was used as the primary management.

Results The two cases presented were both male, 59 and 36 years, and were diagnosed on MRI imaging with C4/5 disc prolapses. They presented with severe motor deficit and were both treated with foraminal epidural steroid injections, one of the patients also had two previous injections elsewhere prior to the first review. In both patients, pain and neurological deficit improved in a timely manner resulting in full recovery. MRI taken after recovery showed complete resorption of the disc prolapse in both cases.

Conclusion In C5 radiculopathy, even with severe neurological deficit, cervical injection therapy should be considered. These cases illustrate that excellent results can be obtained without the need for open surgery with its inherent risks.

Keywords Cervical spine · Transforaminal epidural · Neurological deficit · Disc prolapse · Radiculopathy

Introduction/background

When dealing with cervical radiculopathies, it is often felt that profound neurological deficit is an indication for early surgical intervention. However, we illustrate that this is not always necessarily the case and that conservative measures can result in an excellent outcome both in terms of pain control and neurological recovery.

There was no need for ethical approval in this study as this was a retrospective review; both patients consented for publication of their clinical details.

Case report

Patient 1

This 59-year-old anaesthetist presented with a month of left-sided brachialgia, paraesthesia, and weakness of spontaneous onset. The pain score was 10/10 on the visual analogue scale. There was no history of trauma or previous spinal problems and he was generally fit and well. He awoke with a stiff neck which progressed to pain radiating into the left trapezius, deltoid, and upper arm. He also had intermittent paraesthesia of the thumb base and little and ring fingers. He was on multiple analgesic medications, taking paracetamol, tramadol, ibuprofen, and pregabalin. On examination, both active and passive cervical movements were restricted due to pain, neck extension in particular. Neurological assessment revealed profound weakness with shoulder abduction being 1/5 and external rotation 2/5 on the MRC scale. Elbow flexion was 2 +/5. The left supinator, biceps, and triceps tendon reflexes were absent too, but fine touch sensation was intact throughout the limb. Functionally, he had considerable difficulty

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raising his hand, for example, to do up the top button on his shirt.

He had initially been referred to a shoulder surgeon who had excluded shoulder pathology and referred him for osteopathy to the neck. He also had a cervical MRI scan 2 weeks after onset of symptoms. This showed a left C 4/5 disc protrusion with severe C5 root compression (see Fig. 1) and he was then referred for a CT guided root injection and then a cervical epidural via a lower inter-laminar approach. Neither intervention provided any relief of symptoms and he was, therefore, offered surgery but declined.

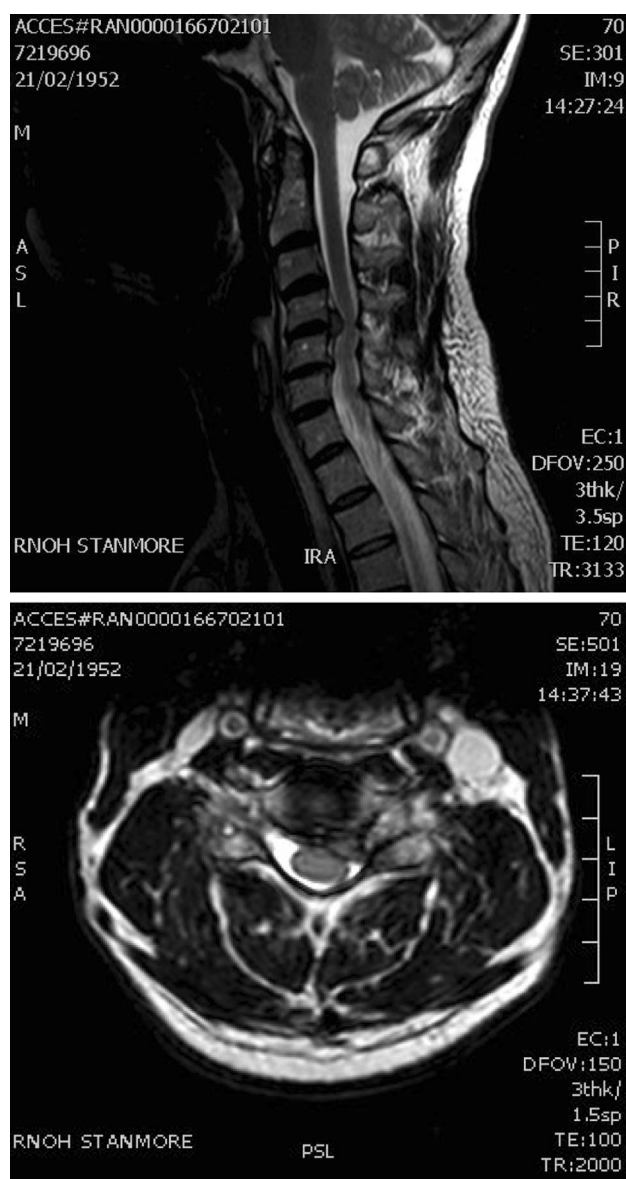


Fig. 1 MRI scan of the cervical spine of patient 1 (59-year-old male) 2 weeks after onset of symptoms with sagittal and axially oriented T2-weighted images. This shows a left-sided disc prolapse at C4/5 with severe left C5 root compression

One week after presentation, left C5 and C6 transforaminal epidural steroid injections were performed; 2 ml of 1% lidocaine with triamcinolone acetonide 40 mg was introduced—1 ml at each level. The reason for delaying a week was to give the previous injections a chance to work and to allow the systemic effect of the steroids to dissipate. At the time, the patient was informed that if his pain was not swiftly brought under control and if there was not an early trend towards neurological recovery, then expedient surgical decompression would be recommended.

One week following the injection, his visual analogue pain score had come down from 10/10 to 1.5/10. He had also stopped taking tramadol, ibuprofen, and pregabalin, but was just taking paracetamol occasionally. There was also a slight functional improvement, but the arm remained weak. Three weeks following the injections, his visual analogue pain score ranged between 1.5 and occasionally 0/10. Cervical movements were full and pain-free aside from some restriction of extension. Power had improved: shoulder abduction from 1/5 to 2/5, external rotation from 2/5 to 3/5, and elbow flexion from 2+/5 to 3+/5. The supinator and triceps jerks had fully recovered and the biceps reflex was present but diminished. Importantly, the patient was also now able to cope with a full day's work as an anaesthetist. Two and a half years post-intervention, the patient was almost completely pain-free and off all analgesia. Examination revealed no motor or sensory deficit whatsoever. He was working full time as an anaesthetist and was also engaged in exercise and sports including snow skiing without any ill effect. This situation was maintained at his 4-year follow-up when an MRI scan was performed to assess disc morphology (Fig. 2). This demonstrated complete resolution of the C4/5 disc prolapse.

Patient 2

This 36-year-old male investor presented with right-side neck and trapezial region pain with occasional right arm brachalgia. This originated 12 days earlier when he fell asleep sitting up with his head tilted to the left, he then developed severe right-sided brachalgia which rapidly improved over 2 weeks with his pain improving from 10/10 to 2/10 on the visual analogue scale. This, however, was accompanied by the development of profound right arm weakness. On presentation, examination revealed pain at the extremes of all passive cervical movements, particularly the Spurling manoeuvre. Neurological assessment revealed shoulder abduction and elevation weakness at 1/5, shoulder internal rotation at 3/5, and external rotation at 4/5 on the MRC scale. Elbow flexion was 1+/5. The right supinator and biceps reflexes were unobtainable despite reinforcement, but sensation was normal.

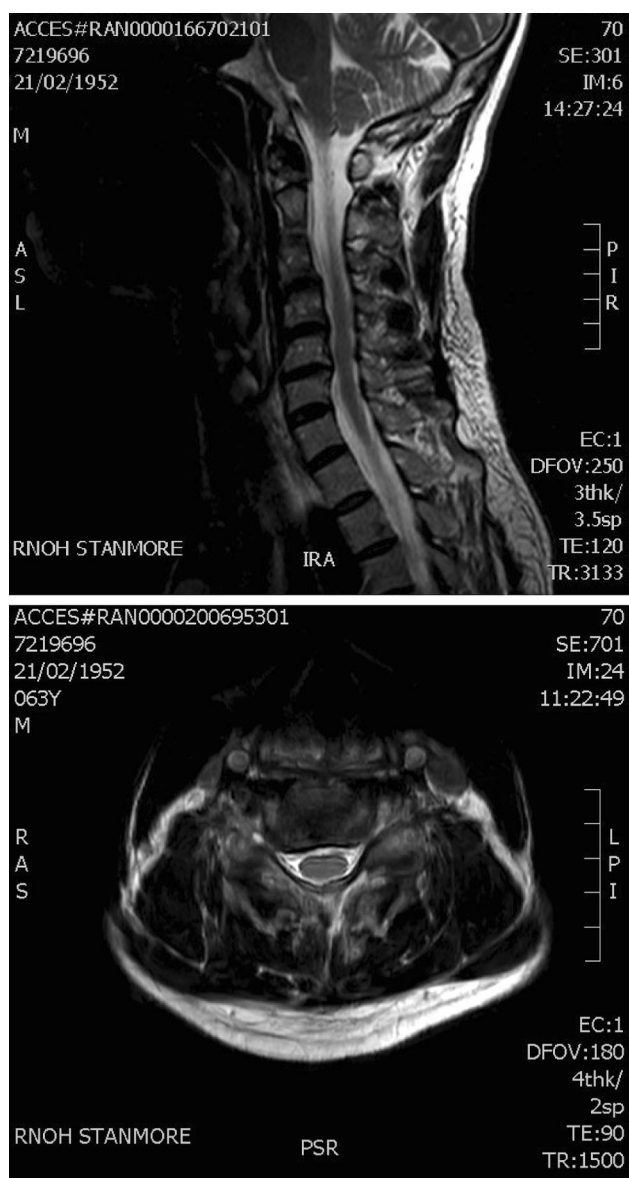


Fig. 2 MRI scan of patient 1 (59-year-old male) at 4-year follow-up with sagittal and axially oriented T2-weighted images. This shows complete resorption of the left-sided disc prolapse with resolution of the left C5 root compression

An MRI scan was performed 3-day post-presentation (Fig. 3). This showed some mid cervical degenerative change with straightening of the normal lordosis and most notably a soft C4/5 disc protrusion into the right foramen and extending below it towards the C5/6 foramen. There was also a C5/6 disc osteophyte bar causing medial right-sided indentation of the spinal cord. Electrophysiology performed 5-day post-presentation was consistent with C5, C6, and C7 nerve root compromise or idiopathic brachial neuritis/neuralgic amyotrophy/Parsonage Turner's syndrome.

When reviewed 21-day post-symptom onset, his function had improved, so that he could shave with this right

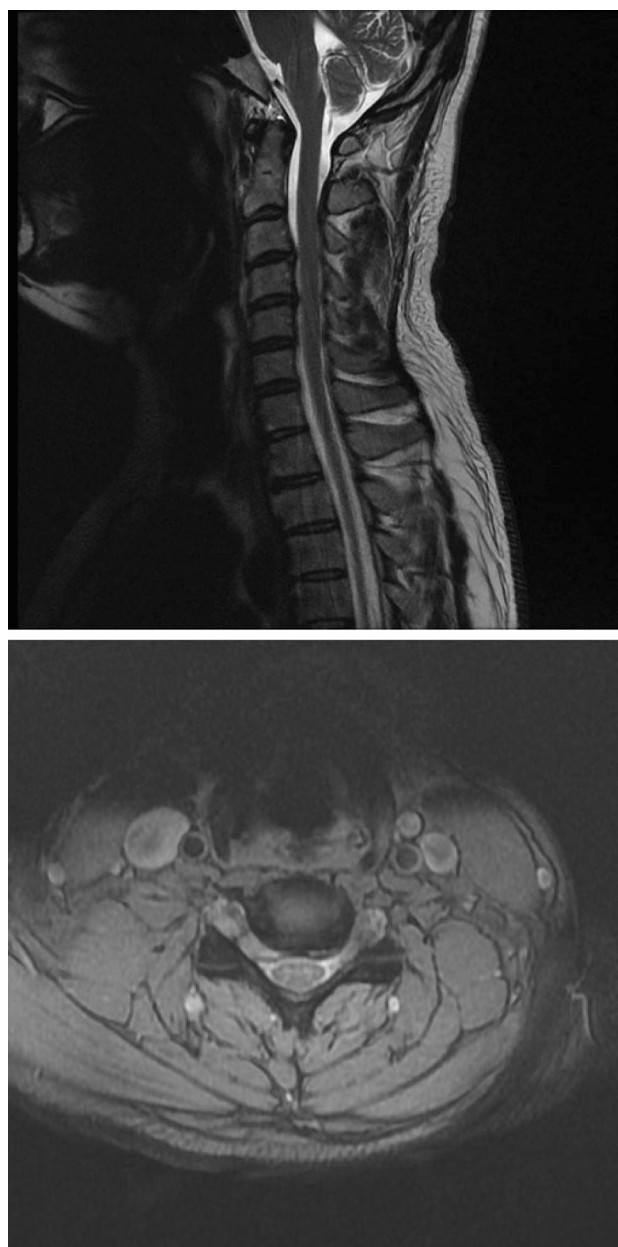


Fig. 3 Cervical MRI of patient 2 (36-year-old male) 2-week post-onset of symptoms with sagittally and axially orientated T2-weighted images. This shows a soft right-sided interforaminal disc prolapse at the C4/5 level with severe right C5 nerve root compression

hand and there was marginal improvement of shoulder abduction strength and elbow flexion. At this stage, surgery was considered; however, the patient was not enthusiastic. Therefore, in view of the residual pain, it was felt appropriate to carry out right C5 and C6 transforaminal epidural steroid injections with the additional chance that the anti-inflammatory steroid effect may improve neurophysiological status as well. These were performed 33-day post-onset of symptoms (see Fig. 4). 2 ml of 1% lidocaine with triamcinolone 40 mg was introduced—1 ml per level.

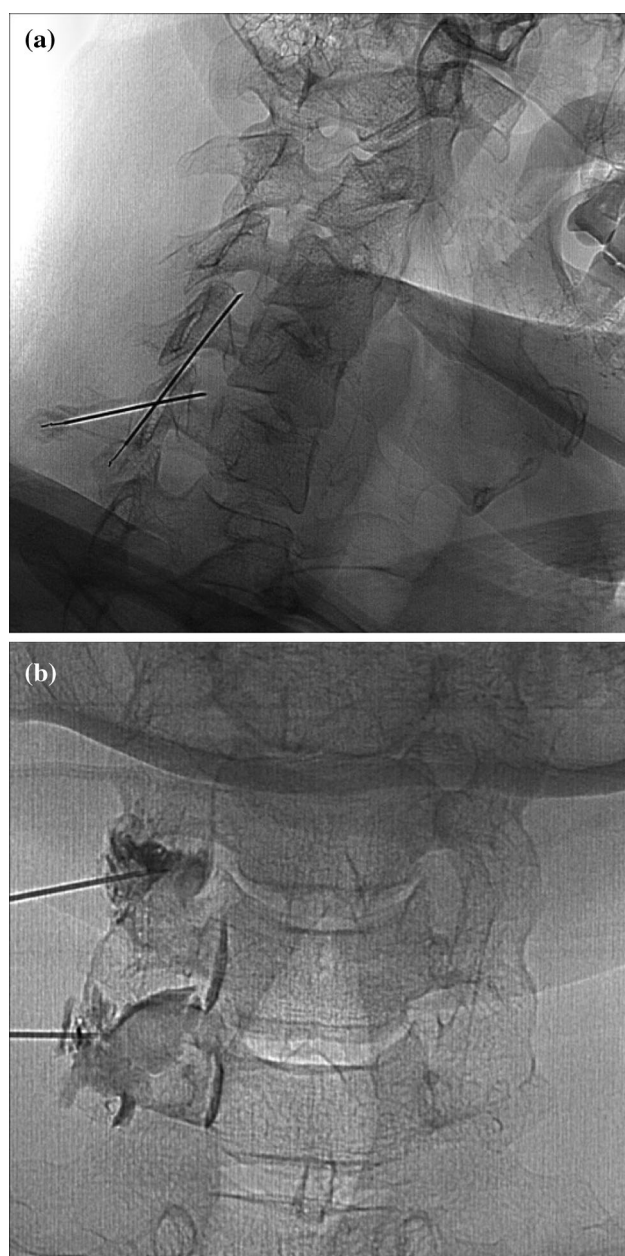


Fig. 4 **a, b** Oblique and AP peri-operative fluoroscopy images of the cervical spine of patient 2 (36-year-old male) taken during right C5 and C6 dorsal root ganglia blocks. **a** Positioning of needles in the oblique view prior to contrast injection. **b** Needles position on the AP view with per-radicular contrast flow to the medial aspect of the foramen at the C5 and C6 levels and epidural contrast rostral and caudal to this

At 3-week post-intervention (7½ weeks after onset), the patient was pain-free and had full and pain-free active and passive cervical movements. Shoulder abduction and elevation strength had improved from 1/5 to 3+/5, shoulder medial rotation had fully recovered from 3/5 to 5/5, external rotation remained weak at 4/5, but elbow flexion had improved from 1+/5 to 4/5. Both the supinator and biceps reflexes had fully recovered. At 2-month post-

procedure (14½-week post-onset), the patient was still pain-free with a normal neurological examination apart from right wrist dorsi-flexion being 4/5. At 4-months post-injection (5-month post-onset of symptoms), the patient had fully recovered with no neurological deficit. He was coping with all his work commitments and was back to his normal leisure activities such as running. This was maintained until review at 2 years. An MRI scan performed at 5-month post-injection and 6-month post-onset showed that the soft C5/6 disc fragment had regressed leaving only a small disc bulge with no foraminal narrowing or spinal cord compression (Fig. 5).

Discussion

We present two patients both with profound upper limb motor deficit associated with C4/5 intervertebral disc prolapses. Patient 1 presented relatively late at 4 weeks, in severe pain despite injection therapy having been carried out elsewhere on two occasions. Surgical referral was considered. However, the patient, who was an anaesthetist, was not keen to proceed to surgery, and therefore, non-operative management was continued with careful review over 2 weeks. A further injection was performed during this period with rapid resolution of pain followed by a more gradual neurological recovery. Full recovery occurred which was maintained for 4 years. Patient 2 presented early, interestingly with almost complete spontaneous resolution of pain. Operative management was again rejected by the patient. An injection was performed to reduce residual pain and to address any inflammatory component in the aetiology of the nerve root dysfunction. At 7½-week post-symptom onset, his power and function had improved considerably and he was fully recovered at 5 months.

Both patients were injected with triamcinolone acetonide, a particulate steroid. These injections occurred well before the investigation by the Federal Drug Administration in the USA comparing particulate and non-particulate steroids. KB who performed the injections was aware of the small but potentially catastrophic risks of intra-vascular injection. Additionally, in the consenting process, both patients were warned that the procedure did carry a small risk of major neurological deficit including stroke or death.

The natural history of cervical disc prolapse with radiculopathy is good. In most cases, resolution of pain and neurological deficit occurs with no treatment over a few months. A recent systematic review by Wong et al. showing that this benign course occurred in 83% of patients, they also found that the main association with prognosis was involvement of the patient in workers compensation and not clinical or radiological factors [1].

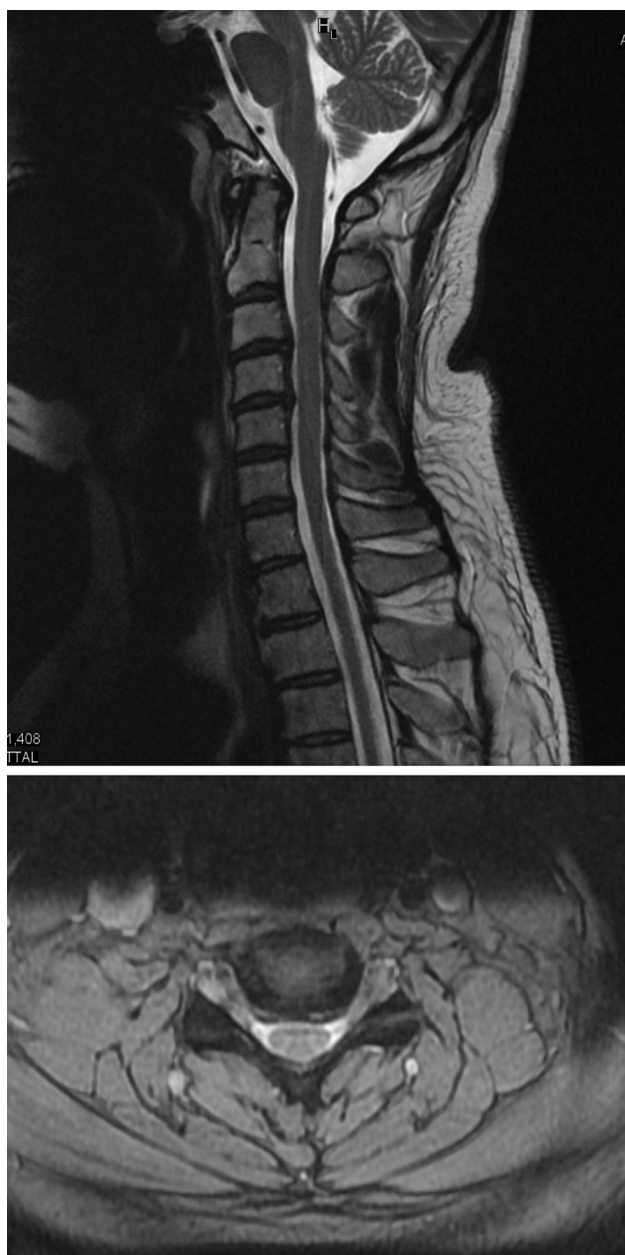


Fig. 5 Cervical MRI scan of patient 1 (36-year-old male) at 6-month follow-up with sagittally and axially orientated T2-weighted images. This shows complete resolution of the right-sided interforaminal disc prolapse at the C4/5 level with resolution of the right C5 nerve root compression

There is also strong evidence that symptomatic improvement occurs due to disc resorption which generally occurs within 12 months [2]. In patient 2, this occurred even earlier with complete resorption of the disc prolapse seen on MRI at 6-month post-onset of symptoms, closely correlating with the resolution of symptoms and signs.

There are a paucity of studies with high-level evidence addressing the efficacy of epidural steroid injections for cervical radiculopathy. Evidence-based clinical guidelines

produced by the North American Spine Society suggest that “Transforaminal epidural steroid injections using fluoroscopic or CT guidance may be considered when developing a medical/interventional treatment plan for patients with cervical radiculopathy from degenerative disorders. Due consideration should be given to the potential complications” [3].

There are, however, a number of non-randomised or controlled studies showing that transforaminal and interlaminar steroid injections are effective both in the short and longer terms for the treatment of cervical radiculopathy [2, 4, 5].

There appears to be a wide range of accepted treatments for acute cervical radiculopathy in the literature, ranging from non-operative management or injection therapy for most cases even with neurological deficit [4, 6] to a significant percentage of surgical decompressions being performed often early post-onset of symptoms [7–9].

To manage risk versus benefit, it would seem logical, however, that less invasive interventions with the added advantage of associated minimal interference with the patient’s life and activity would be preferable as a first line of treatment. Although decompressive surgery has a low rate of serious complications such as spinal cord injury, more minor, but still, very troublesome complications are more common. For the anterior approach for example, post-operative dysphagia can be a problem particularly in the elderly, with a reported incidence of up to 9% [10]. A more conservative approach would also seem particularly advisable in cases of soft disc prolapse, as presented here, in view of the known high incidence of spontaneous resolution by the mechanism of disc resorption [2].

As noted above, however, this is not standard practise. This may reflect patterns of referral from primary care and also interpretation of the literature which seems mixed for the efficacy of epidural steroid injections. In addition, there is increasing awareness of the chance of rare but often catastrophic complications of epidural injections, particularly via the transforaminal approach [11, 12].

It is likely that the results and safety of cervical transforaminal epidural injections are strongly dependant on technique [4, 13–16]. One of the authors (KB) has performed over 3000 cervical transforaminal epidural injections. All the injections were performed personally by KB on an outpatient basis with the patient fully conscious (i.e., there was no sedation). Following the procedure, the patients rest in the X-ray department for half an hour before leaving. Over the 32 years in which these injections have been performed, all the patients have walked out of the department and returned some weeks later for clinical review without having developed any catastrophic neurological deficit. That is not to say that the occasional patient has not suffered from a vasovagal attack or a number of

other minor complications associated with injections, local anaesthetics, or steroids. However, importantly, there have been no catastrophes; without a single significant neurological complication or indeed, any other significant complication for that matter.

It is accepted that C5 radiculopathies with motor deficit have a poorer prognosis than other levels. We have presented two cases of cervical disc prolapse at C4/5 with severe C5 motor deficit which we feel would be considered by many clinicians to require surgical decompression, possibly in an emergency. One of the authors (AM) is a spinal surgeon and feels that early surgical referral in such cases is mandatory. It is essential to inform the patients that if they have a profound deficit, it may not recover naturally. However, it is clear that a severe neurological deficit may also not recover fully after surgical intervention. These cases, however, show that in such scenarios, excellent short and long term results both in terms of pain relief and neurological function can be achieved without the requirement for surgery. This approach would seem logical in view of the natural history and the pathophysiology of cervical disc resorption [1, 2].

In all cases of neurological loss, we, however, advise close and timely follow-up and surgical referral if there is a profound and progressive neurological deficit.

Conclusion

These cases illustrate that even with severe neurological deficit involving the C5 root, the clinician reviewing a case of cervical radiculopathy should not rush to provide a surgical solution. Good results can be obtained with transforaminal epidural steroid injections performed by appropriately skilled personnel without the inherent risks and inconvenience of an open surgical procedure.

Compliance with ethical standards

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

References

- Wong JJ, Côté P, Quesnele JJ et al (2014) The course and prognostic factors of symptomatic cervical disc herniation with radiculopathy: a systematic review of the literature. *Spine J* 14:1781–1789. doi:[10.1016/j.spinee.2014.02.032](https://doi.org/10.1016/j.spinee.2014.02.032)
- Bush K, Chaudhuri R, Hillier S, Penny J (1997) The pathomorphologic changes that accompany the resolution of cervical radiculopathy. A prospective study with repeat magnetic resonance imaging. *Spine (Phila Pa 1976)* 22:183–186. doi:[10.1097/00007632-199701150-00010](https://doi.org/10.1097/00007632-199701150-00010) (discussion 187)
- Bono CM, Ghiselli G, Gilbert TJ et al (2011) An evidence-based clinical guideline for the diagnosis and treatment of cervical radiculopathy from degenerative disorders. *Spine J* 11:64–72. doi:[10.1016/j.spinee.2010.10.023](https://doi.org/10.1016/j.spinee.2010.10.023)
- Bush K, Hillier S (1996) Outcome of cervical radiculopathy treated with periradicular/epidural corticosteroid injections: a prospective study with independent clinical review. *Eur Spine J* 5:319–325. doi:[10.1007/BF00304347](https://doi.org/10.1007/BF00304347)
- Jorgensen SH, Ribergaard NE, Al-Kafaji OH, Rasmussen C (2015) Epidural steroid injections in the management of cervical disc herniations with radiculopathy. *Scand J Rheumatol* 44:315–320. doi:[10.3109/03009742.2014.992950](https://doi.org/10.3109/03009742.2014.992950)
- Peterson CK, Pfirrmann CWA, Hodler J et al (2016) Symptomatic, magnetic resonance imaging-confirmed cervical disk herniation patients: a comparative-effectiveness prospective observational study of 2 age- and sex-matched cohorts treated with either imaging-guided indirect cervical nerve root injections or spinal manipulative therapy. *J Manipulative Physiol Ther* 39:210–217. doi:[10.1016/j.jmpt.2016.02.004](https://doi.org/10.1016/j.jmpt.2016.02.004)
- Kim HJ, Nemani VM, Piyaskulkaew C et al (2016) Cervical radiculopathy: incidence and treatment of 1,420 consecutive cases. *Asian Spine J* 10:231–237. doi:[10.4184/asj.2016.10.2.231](https://doi.org/10.4184/asj.2016.10.2.231)
- Terai H, Suzuki A, Toyoda H et al (2014) Tandem keyhole foraminotomy in the treatment of cervical radiculopathy: retrospective review of 35 cases. *J Orthop Surg Res* 9:38. doi:[10.1186/1749-799X-9-38](https://doi.org/10.1186/1749-799X-9-38)
- Caridi JM, Pumberger M, Hughes AP (2011) Cervical radiculopathy: a review. *HSS J* 7:265–272. doi:[10.1007/s11420-011-9218-z](https://doi.org/10.1007/s11420-011-9218-z)
- Fountas KN, Kapsalaki EZ, Nikolakakos LG et al (2007) Anterior cervical discectomy and fusion associated complications. *Spine (Phila Pa 1976)* 32:2310–2317. doi:[10.1097/BRS.0b013e318154c57e](https://doi.org/10.1097/BRS.0b013e318154c57e)
- Manchikanti L, Hirsch JA (2015) Neurological complications associated with epidural steroid injections. *Curr Pain Headache Rep* 19:482. doi:[10.1007/s11916-015-0482-3](https://doi.org/10.1007/s11916-015-0482-3)
- Engel A, King W, Macvicar J (2014) The effectiveness and risks of fluoroscopically guided cervical transforaminal injections of steroids: a systematic review with comprehensive analysis of the published data. *Pain Med (United States)* 15:386–402. doi:[10.1111/pme.12304](https://doi.org/10.1111/pme.12304)
- Bush K, Hillier S (2015) Outcome of cervical radiculopathy treated with periradicular/epidural corticosteroid injections. *Pain Med* 16:2414–2416. doi:[10.1111/pme.12709](https://doi.org/10.1111/pme.12709)
- Klessinger S, Freund W, Karpel-Massler G, Halatsch ME (2014) Response to transforaminal injection of steroids and correlation to MRI findings in patients with cervical radicular pain or radiculopathy due to disc herniation or spondylosis. *Pain Med* 15(6):929–937
- Klessinger S (2015) Reply to Bush and Hillier. *Pain Med (United States)* 16:2416. doi:[10.1111/pme.12712](https://doi.org/10.1111/pme.12712)
- Klessinger S, Freund W, Karpel-Massler G, Halatsch ME (2014) Response to transforaminal injection of steroids and correlation to MRI findings in patients with cervical radicular pain or radiculopathy due to disc herniation or spondylosis. *Pain Med (United States)* 15:929–937. doi:[10.1111/pme.12415](https://doi.org/10.1111/pme.12415)