Variations in selective nerve root block technique

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ABSTRACT

INTRODUCTION
Much literature reports on selective nerve root blocks (SNRBs) in cases of lumbosacral radiculopathy. Unfortunately, authors only inconsistently reveal the exact needle tip position relative to the causative pathology at the time of injection. Different injection sites may provide different symptomatic benefits. We investigated the variation in injection techniques of practitioners working in the UK.

METHODS
A clinical scenario was devised depicting a patient with radiculopathy secondary to an L4/5 vertebral disc prolapse. Participants were questioned on their chosen management of this patient, focusing particularly on SNRB technique. Questionnaires were sent to spinal surgeons, pain management specialists and musculoskeletal radiologists.

RESULTS
A total of 100 responses were detailed enough for inclusion. The majority (83%) of respondents reported they would inject local anaesthetic and steroids, 4% would inject local anaesthetic alone and 13% would inject a different substance. Over half (53%) would target the L5 nerve root, 26% the L4 nerve root, 12% the prolapsed disc itself and 9% two separate vertebral levels. Variation was also noted in needle tip location relative to the neural sheath.

CONCLUSIONS
When treating lumbar radiculopathy, there are apparent variations in the use and positioning of SNRBs for a given level of disc pathology. Needle tip position may have a direct influence on clinical outcome following SNRBs. Caution is therefore required when considering the validity of previously published studies investigating SNRBs and different injectates.

Keywords
Lumbar – Radiculopathy – Nerve root block – Technique

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Lumbosacral radiculopathy is a common disabling condition with a reported prevalence of up to 45%. When a prolapsed intervertebral disc directly inflames, compresses or stretches a nerve root, the resulting symptoms are often severe enough to force patients to seek medical attention. The financial and functional impact of this disabling condition make its optimal management paramount.

Patients with lumbar radiculopathy and minor neurological deficits generally recover well regardless of whether they are managed non-operatively or operatively. Based on this, to avoid the potential complications of surgery, selective nerve root blocks (SNRBs), first described in 1971, have become increasingly popular. SNRBs can be employed with diagnostic or therapeutic intent. By targeting local anaesthetic injections at specific anatomical sites, SNRBs allow the source of a patient’s pain to be predicted. This is particularly useful in cases of multilevel spinal disease or when symptoms do not correlate with the imaging performed. The use of various injectates has also been shown to provide permanent symptomatic relief in cases of both vertebral disc prolapse and spinal stenosis.

Despite the widespread use of SNRBs, a lack of level one evidence means there is still debate about whether injection of local anaesthetic alone or a combination of steroids and local anaesthetic is most effective at relieving symptoms. Interestingly, many of the studies reporting on this usually fail to specify the exact position of the needle tip at the time of injection relative to the level of the causative pathology. It would seem intuitive that this is an important parameter in the efficacy of SNRBs. Consequently, if clinicians’ injection sites vary for a given clinical scenario, then conclusions and comparisons drawn from these studies should be interpreted with caution. The external validity of meta-analyses and critical appraisals would also need to be questioned, given the potential for unaccounted variability in study designs.

In order to look at this further, a survey was performed of UK medical practitioners with an interest in the management of radicular pain. The aim was to investigate how varied their techniques are when performing an SNRB. In particular, the level of the SNRB relative to the level of the causative pathology was investigated.
Methods
A clinical scenario was devised depicting a patient suffering from radicular pain secondary to an L4/5 intervertebral disc prolapse. A questionnaire containing the scenario was sent to spinal surgeons, pain management specialists and musculoskeletal radiologists throughout the UK. Axial and sagittal magnetic resonance imaging showing a left-sided paracentral herniated disc and a diagram of the spinal segment related to the region were presented (Figs 1–3). Participants were asked to mark on the diagram where they would place the needle when performing an SNRB in this case. They were also asked for information about which substances they used.

Results
Questionnaires were sent to 519 practitioners and 155 responses were received. Insufficiently completed questionnaires and responses from practitioners who never perform SNRBs or would choose not to use a SNRB in the case presented were excluded. This left 100 eligible questionnaires for analysis (35 spine surgeons, 29 radiologists and 36 pain specialists).

Of the 100 respondents included in the analysis, 87% indicated they would inject a combination of local anaesthetic and steroids. Only 3% stated they would inject local anaesthetic alone with the remaining 10% choosing to inject either steroids in isolation, or mixed with clonidine or radiological contrast.

Only 39% of respondents said they would inject at the level of the pathology (L4/5) while 55% reported they would inject at the next caudal level. There was some variability between specialties (Table 1). The majority of practitioners who indicated that they would inject steroids also said that they would target the level below the pathology (Table 2). Six per cent reported they would inject at two vertebral levels.
Discussion

Various ways to perform SNRBs have been described in the literature with different therapeutic effects.\(^6\) A transforaminal approach to the epidural space is adopted by most practitioners.\(^7\) In cases of far lateral disc herniation, extraforaminal injections have also been shown to be effective.\(^7\) Injections can be placed inside the neural sheath, (intraepineural) around the neural sheath (extraepineural) or adjacent to but not touching the neural sheath (paraepineural).

The majority of published studies investigating SNRBs and radicular leg pain fail to specify the precise needle tip location at the time of injection relative to the causative pathology. Although injection techniques are usually described in some part, authors often fail to define whether they target the vertebral level where pathological compression occurs or the exiting nerve root at the vertebral level below. The vertebral levels of the pathological discs and stenoses involved are also often reported inconsistently (Table 3). We surveyed how a range of practitioners would perform an SNRB when faced with one specific clinical and radiological scenario. Although our initial response rate was low at 48% (a recognised limitation of postal surveys), responses demonstrated that variation exists between their chosen techniques, including the intervertebral level targeted.

Lower back pain is a common complaint and results in a significant number of patients requiring long-term sick leave.\(^2\) Non-operative management plays a large role in the management of those patients with radiculopathy secondary to nerve root impingement. SNRBs are used frequently for both diagnostic and therapeutic purposes. Our survey suggests that clinicians use a wide variety of SNRB injec-

| Table 1 | The intervertebral levels targeted by respondents |
|------------------|------------------|
| Spine surgeons   | 16               |
| Pain specialists | 19               |
| Radiologists     | 4                |
| Total            | 39               |

| Table 2 | The intervertebral levels targeted by respondents who would inject steroids in the case presented |
|------------------|------------------|
| Number of respondents | 36               |
| L4/5             | 54               |
| L5/S1            | 5               |
| Total            | 96               |

| Table 3 | Summary of studies investigating selective nerve root blocks |
|------------------|------------------|
| Study            | Design           | Injectates                                      | Causative pathology | Detailed description of injection site relative to pathology? |
| Weiner\(^7\)     | Prospective case series | 1% lidocaine with betamethasone | Lateral foraminal/extraforaminal herniated lumbar discs | Yes |
| Narozny\(^9\)   | Retrospective case series | 0.5% bupivacaine with triamcinolone | Disc herniations (protrusions, extrusions or sequestrations) and foraminal stenoses | No |
| Ng\(^11\)       | Randomised, double blind, controlled trial | 0.25% bupivacaine vs 0.25% bupivacaine with methylprednisolone | Lumbar disc herniations and foraminal stenoses | No |
| Riew\(^14\)     | Prospective, randomised, double blind, controlled trial | 0.25% bupivacaine vs 0.25% bupivacaine and betamethasone | Disc herniations and spinal stenoses | No |
| Pfirrmann\(^16\) | Prospective case series | 0.2% ropivacaine and corticosteroid suspension | Not defined | No |
| Vad\(^18\)      | Prospective trial (randomised by patient choice) | 2% lidocaine and betamethasone vs saline | Herniated nucleus pulposus (far lateral, paracentral and central protrusions) | No |
| Karpinen\(^19\) | Randomised, double blind trial | Methylprednisolone and bupivacaine vs saline | Symptomatic discs (bulges, contained herniations and extrusions) | No |
| Kraemer\(^20\)  | Prospective randomised trials | 1) Epidural perineural injection technique vs conventional epidural injection technique 2) Epidural perineural injection of triamcinolone and saline vs saline alone | Disc protrusions | No |
| Derby\(^21\)    | Prospective case series | 1–2ml of lidocaine plus 1cc Celestone® Soluspan® | Herniated discs/stenoses/herniated disc plus stenoses/spondylolisthesis | No |
tion techniques for a given clinical scenario. Extrapolating this to previous studies reporting on the clinical effectiveness of SNRBs, we feel that unless authors clearly communicate their injection techniques (specifically, the injection site relative to the causative pathology), the external validity of their results has to be questioned. This is particularly important given that the most effective injectate is still debated by many.

Although the pathophysiology of radiculopathy secondary to disc herniation is not fully understood, local inflammation is thought to play a role. The systemic anti-inflammatory effects of steroids are well recognised. Local anti-inflammatory effects of methylprednisolone on nerve roots coated with nucleus pulposus have also been reported. It would therefore seem reasonable to assume that if steroids are to have a role in SNRBs for radicular pain, they should be targeted at the site of the pathology (ie at the level of the disc lesion where the touching nerve root is potentially inflamed). This is supported by published work.

In our survey, out of 100 practitioners who used steroids, only 58 targeted the level of the disc lesion. Although we recognise that local anaesthetic injections given caudally to the site of inflammation may provide short-term benefit, we feel that targeting steroids at the next caudal foramen is of questionable value and comparable with treating an arthritic hip by injecting the knee.

Conclusions

The results of our survey highlight a number of issues. First, as might be expected, there is variation in the technique used between clinicians for a given pathology. Some of this variation may relate to the interpretation of symptoms in terms of which nerve root is involved. However, the pathology described was present at the L4/5 level and we have some difficulty understanding why steroid injections would be aimed at the level below. This argument would apply regardless of whether or not SNRBs were being used for diagnostic or therapeutic purposes.

Second, our survey emphasises the importance of being precise when requesting an SNRB from a radiologist or other practitioner. This will ensure any subsequent decisions made on the suitability of a patient for surgery based on the therapeutic effect of an SNRB will be meaningful.

Finally, our survey highlights the need for caution when applying the results of published studies to one’s own practice. There is a need for authors of future studies to clearly describe their own injection technique including the exact position of the needle tip in relation to disc pathology. This will allow readers to compare the results of published studies with their own practice in a more meaningful way.

References

1. Konstantinou K, Dunn KM. Sciatica: review of epidemiological studies and prevalence estimates. Spine 2008; 33: 2,464–2,472.
2. Olmarker K, Blomqvist J, Strömberg J et al. Inflammatory properties of nucleus pulposus. Spine 1995; 20: 665–669.
3. Nygaard OP, Meilgren SI, Osterud B. The inflammatory properties of contained and noncontained lumbar disc herniation. Spine 1997; 22: 2,484–2,488.
4. Gajaj NM. Selective nerve root blocks for low back pain and radiculopathy. Reg Anesth Pain Med 2004; 29: 243–256.
5. Weber H. Lumbar disc herniation. A controlled, prospective study with ten years of observation. Spine 1983; 8: 131–140.
6. Macnab I. Negative disc exploration. An analysis of the causes of nerve-root involvement in sixty-eight patients. J Bone Joint Surg Am 1971; 53: 891–903.
7. Weiner BK, Fraser RD. Foraminal injection for lateral lumbar disc herniation. J Bone Joint Surg Br 1997; 79: 804–807.
8. Lutz GE, Vad VB, Wisneski RJ. Fluoroscopic transformative lumbar epidural steroids: an outcome study. Arch Phys Med Rehabil 1998; 79: 1,362–1,366.
9. Nanzy M, Zanetti M, Boos N. Therapeutic efficacy of selective nerve root blocks in the treatment of lumbar radicular leg pain. Swiss Med Wkly 2001; 131: 75–80.
10. Cuckler JM, Berndini PA, Wiesel SW et al. The use of epidural steroids in the treatment of lumbar radicular pain. A prospective, randomized, double-blind study. J Bone Joint Surg Am 1985; 67: 63–66.
11. Ng L, Chaudhary N, Sell P. The efficacy of corticosteroids in periradicular infiltration for chronic radicular pain: a randomized, double-blind, controlled trial. Spine 2005; 30: 857–862.
12. Riew KD, Park JB, Cho YS et al. Nerve root blocks in the treatment of lumbar radicular pain. A minimum five-year follow-up. J Bone Joint Surg Am 2006; 88: 1,722–1,725.
13. Manchikanti L, Buenaventura RM, Manchikanti KN et al. Effectiveness of therapeutic lumbar transformative epidural steroid injections in managing lumbar spinal pain. Pain Physician 2012; 15: E199–E245.
14. Riew KD, Yin Y, Giliula L et al. The effect of nerve-root injections on the need for operative treatment of lumbar radicular pain. A prospective, randomized, controlled, double-blind study. J Bone Joint Surg Am 2000; 82: 1,589–1,593.
15. DelPalma MJ, Bhargava A, Sipurman CW. A critical appraisal of the evidence for selective nerve root injection in the treatment of lumbosacral radiculopathy. Arch Phys Med Rehabil 2005; 86: 1,477–1,483.
16. Pfirrmann CW, Oberholzer PA, Zanetti M et al. Selective nerve root blocks for the treatment of sciatica: evaluation of injection site and effectiveness—a study with patients and cadavers. Radiology 2001; 221: 704–711.
17. Lee JW, Kim SH, Choi JY et al. Transformal epidural steroid injection for lumbosacral radiculopathy: preganglionic versus conventional approach. Korean J Radiol 2006; 7: 139–144.
18. Vad VB, Bhat AL, Lutz GE, Cammissa F. Transformal epidural steroid injections in lumbosacral radiculopathy: a prospective randomized study. Spine 2002; 27: 11–16.
19. Kapponen J, Malmivaara A, Kurunlahti M et al. Pericircular infiltration for sciatica: a randomized controlled trial. Spine 2003; 28: 1,059–1,067.
20. Kraemer J, Ludwig J, Bickert U et al. Lumbar epidural perineural injection: a new technique. Eur Spine J 1997; 6: 357–361.
21. Derby R, Kine G, Saal JA et al. Response to steroid and duration of radicular pain as predictors of surgical outcome. Spine 1992; 17: S176–S183.
22. Steenstra IA, Verbeek JH, Heymans MW, Bongers PM. Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature. Occup Environ Med 2005; 62: 851–860.
23. Byrd G, Otani K, Brisby H et al. Methylprednisolone reduces the early vascular permeability increase in spinal nerve roots induced by epidural nucleus pulposus application. J Orthop Res 2000; 18: 983–987.
24. Manchikanti L. Transformal lumbar epidural steroid injections. Pain Physician 2000; 3: 374–398.