

## Original Article

# Safe radiological spinal intervention: A multicenter snapshot survey of musculoskeletal radiologists in the UK and India

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## ABSTRACT

**Objectives:** Research, knowledge, and technological advances have promoted minimally invasive image-guided diagnostic and therapeutic intervention. Such interventions are increasingly performed for musculoskeletal diseases by radiologists within outpatient settings. The objective of this study was to ascertain levels of safe practice among musculoskeletal radiologists in the United Kingdom and the Indian public health-care system, as defined by access to spinal surgeons and anesthetists during radiological spinal procedures.

**Material and Methods:** An online cross-sectional survey of eight questions (multiple choice and free text) was circulated among musculoskeletal radiologists in the UK and India, to evaluate: (i) Image-guided practice among musculoskeletal radiologists. (ii) Types of interventions undertaken. (iii) Practice setting. (iv) Availability of supportive, backup access to spinal surgery services.

**Results:** A total of 53 replies were received of which 43 (81.1%) were from musculoskeletal radiologists who perform spinal interventional procedures. Spinal biopsies and injections were the most common procedures performed by the 43 eligible radiologists (79.1% and 74.4%, respectively), with vertebroplasty and sacroplasty performed by only 16.3% and 11.6%, respectively. Less than half (46.5%) of musculoskeletal radiologists performing interventional procedures did so within a hospital setting with both a spinal surgeon and an anesthetist on site, 20.9% had an anesthetist on site but no spinal surgeon and 16.3% had neither on-site.

**Conclusion:** Minimally invasive image-guided diagnostic and therapeutic intervention is a niche sub-specialty practiced by a few musculoskeletal radiologists. Enhanced resource allocation, skills training, and multidisciplinary service provision will ultimately minimize existing deficiencies, improving patient-related clinical outcomes, and quality of care.

**Keywords:** Interventional radiology, Patient safety, Percutaneous vertebroplasty, Musculoskeletal diseases, Spine Intervention

## INTRODUCTION

Recent technological developments have accelerated the expansion of the scope of work performed by the radiologist, by popularizing minimally invasive image-guided diagnostic and therapeutic intervention within outpatient settings. Compared to conventional surgery, this alternative boasts improved cost-effectiveness and reduced complication rates.<sup>[1,2]</sup>

Such innovation in imaging modality and techniques has driven a transformation in interventional musculoskeletal radiology, particularly concerning the spine. Various options are now available for managing pain, fractures, and tumors using percutaneous radiological intervention,

ranging from steroid injections and radiofrequency ablation (RFA) to percutaneous biopsies and vertebral augmentation.<sup>[3,4]</sup> However, these procedures are not without their risks which include infection, hematoma formation, as well as pneumothorax and tumor seeding along the needle tract.<sup>[3,5]</sup> Furthermore, major complications of specific procedures such as vertebral augmentation include cement leakage into the spinal canal or venous system, resulting in cord compression or a paravertebral vein embolism, respectively, some of which may require immediate surgical management.<sup>[6,7]</sup>

With increased population sizes and longer life expectancy without matching the gain in healthy life years, the global

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burden of musculoskeletal disease is rising steadily.<sup>[8]</sup> As such, reliance on radiological spinal intervention performed by musculoskeletal radiologists is growing concurrently, and therefore, it is crucial to ensure that such procedures are performed within an adequately safe environment. As per National Institute for Health and Care Excellence (NICE) guidelines, procedures such as vertebral augmentation should only be performed in facilities with good access to spinal surgery, and following a multidisciplinary discussion between the performing radiologist and a spinal surgeon to ensure patient suitability and adequate resources.<sup>[9]</sup> At present, it is not clear whether such guidelines are being adhered to by musculoskeletal radiologists in the UK and overseas, which may consequently compromise patient safety.

Thus, herein, we present findings from a survey targeting musculoskeletal radiologists in the UK and India, with a focus on characterizing the basic safety levels when performing percutaneous radiological spinal interventions in these two settings which offer varying levels of resources and capacity.

## MATERIAL AND METHODS

### Objectives

The objective of this study was to ascertain levels of safe practice among musculoskeletal radiologists in the United Kingdom and the Indian public health-care system, as defined by access to spinal surgeons and anesthesiologists during radiological spinal procedures.

### Design and dissemination

This cross-sectional study (online questionnaire survey) was conducted from February 10, 2022, to March 3, 2022, among musculoskeletal radiologists in the United Kingdom and the Indian public health-care system, as defined by access to spinal surgeons and anesthesiologists during radiological spinal procedures. An online questionnaire was developed, with both multiple-choice and free text questions, using the Google Forms platform to maximize ease of administration and data handling and facilitate fast participant response (Supplementary file 1).

Supplementary file 1: Survey questions and answer options

1. Do you perform spinal interventional procedures?
  - a. Yes
  - b. No.
2. If yes, where do you perform them?
  - a. Hospital with an anesthetist and spinal surgeon on site
  - b. Hospital with a spinal surgeon on site
  - c. Hospital with an anesthetist on site

- d. Hospital without an anesthetist or spinal surgeon
  - e. Other.
3. Which spinal procedures do you perform? (Tick as many as appropriate)
    - a. Spinal injection
    - b. Spinal biopsy
    - c. Spinal RFA
    - d. Vertebroplasty
    - e. Sacroplasty
    - f. All the above.
  4. Have you had any significant complications?
    - a. Yes
    - b. No.
  5. How many spinal interventional procedures do you perform per month?
    - a. Less than 10
    - b. 10 to 20
    - c. More than 20
  6. Are you aware of NICE guidance for vertebroplasty stating that there should be access to spinal surgery services?
    - a. Yes
    - b. No.
  7. Have you completed basic life support (BLS) or advanced life support course?
    - a. Yes
    - b. No.
  8. Any other comments (free text box)

No funding was received from any individual or institution for this study. Institutional Review Board approval was not required for this survey-based study.

All survey responses were answered anonymously. Information was sought regarding the type and frequency of spinal interventional procedures performed, if any; occurrence of perioperative complications; availability of on-site support including a spinal surgeon; and anesthetist and acquisition of accredited life support training. The survey was kept open for response submission for 3 weeks, with a reminder notification sent halfway through, after which submitted responses were analyzed and summarized accordingly. No cash or any other incentive was offered to the participants for responding to the survey.

### Inclusion criteria

The target population was non-trainee musculoskeletal radiologists in India and the UK, the majority of whom were either members of the Musculoskeletal Society of India or the British Society of Skeletal Radiologists.

### Data collection and analysis

The responses submitted were checked for duplication, pooled, analyzed, and summarized.

## Evaluation

The focus of the survey was on the following points:

- Scope of interventional radiology practice
- Practice setting
- Use of guidelines
- Complications encountered
- Availability of supportive, backup access to spinal surgery services.

## RESULTS

A total of 53 replies were received. The majority (43/53, 81.1%) of surveyed musculoskeletal radiologists performed spinal interventional procedures. In terms of types of procedures performed, spinal biopsies and injections were among the most common, with 79.1% (34/43) and 74.4% (32/43) of eligible musculoskeletal radiologists performing these, respectively [Figure 1].

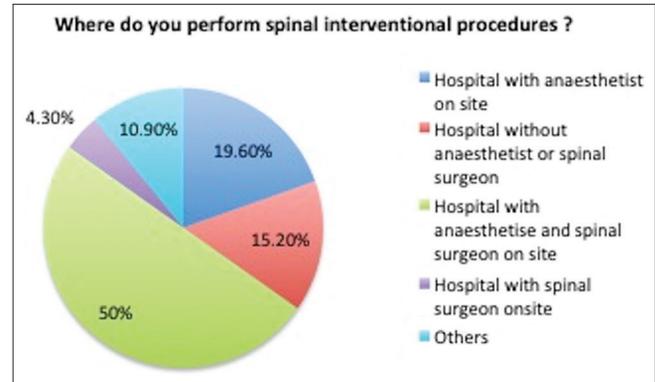
Less commonly, spinal RFA was performed (11/43, 25.6%) followed by vertebroplasty (7/43, 16.3%) and sacroplasty (5/43, 11.6%). These figures include four radiologists whose practice consisted of performing all five procedures. Most radiologists were performing an average of <10 procedures a month (31/43, 72.1%), with 9 (20.9%) performing between 10 and 20 procedures monthly and the remaining 3 (7.0%) performing more than 20 monthly.

Only 46.5% (20/43) performed spinal interventional procedures in a hospital setting with both a spinal surgeon and an anesthesiologist on site, while 20.9% (9/43) had an anesthesiologist on site but no spinal surgeon and 16.3% (7/43) were performing spinal interventions without the presence of either [Figure 2].

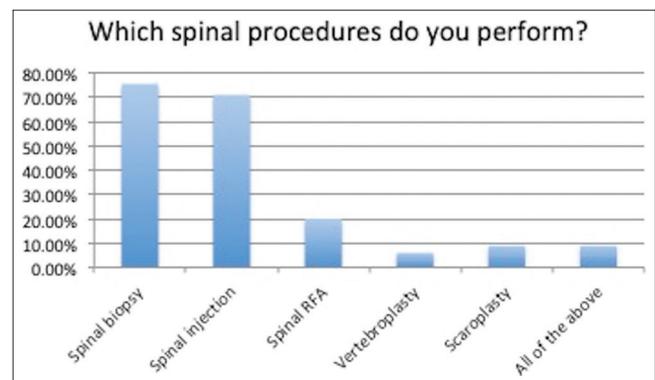
A large proportion (26/43, 60.5%) were aware of NICE guidelines regarding performing procedures such as vertebroplasties in a setting with access to spinal surgery facilities, including all seven radiologists who performed vertebroplasties in practice. Almost all musculoskeletal radiologists performing spinal interventional procedures had at least a BLS qualification (39/43, 90.7%). Of the remaining four, who were also among those performing <10 procedures a month, all performed spinal injections, three additionally performed spinal biopsies, and one also performed spinal RFA.

## DISCUSSION

To the best of our knowledge, although one study has characterized the types of musculoskeletal interventional procedures performed by radiologists in Italy,<sup>[10]</sup> the present study is the first multicenter survey to assess the safety of spinal interventional procedures performed by musculoskeletal radiologists. We aimed to obtain a snapshot of typical practice and evaluate basic safety levels



**Figure 1:** Graphical representation of answer distribution to question 3.



**Figure 2:** Graphical representation of answer distribution to question 2.

as characterized by factors such as access to onsite spinal surgeons and anesthesiologists, and life support training.

This survey found that spinal biopsies and injections are the most common interventional procedures performed by musculoskeletal radiologists (79.1% and 74.4%, respectively), with vertebral augmentation and sacroplasty least commonly performed. This may reflect the greater familiarity of current musculoskeletal radiologists with established procedures such as biopsies and steroid injections, which have been in the radiologist's armory since as early as the late 1950s following the development of the trephine needle.<sup>[11]</sup> On the other hand, vertebral fracture treatment has long relied on open surgery; minimally invasive vertebroplasty was first performed recently in 1984, and sacroplasty was first described just two decades ago.<sup>[12,13]</sup> The relative novelty of vertebral augmentation combined with its commonality to both spinal surgeons' and radiologists' caseloads, and availability of appropriate facilities limited to tertiary centers may explain the low prevalence among our sample of interventional musculoskeletal radiologists performing these. General lack of exposure to interventional musculoskeletal procedures may also be an important factor in radiologists

not performing procedures such as RFA, vertebroplasty, and sacroplasty. A survey by Albano *et al.* found that 62% of radiologists were not expected to learn interventional musculoskeletal procedures and 36.9% were trained in institutions where such procedures were not performed at all.<sup>[14]</sup> This is particularly the case in low-resource settings such as India, within which a proportion of our survey's sample practice and where only 17.4% of trainees are expected to learn interventional musculoskeletal procedures compared to 49.5% in the UK.<sup>[14]</sup> Although our survey does not provide results stratified by country, the mainstay of the radiologist's work in India would likely be biopsies and steroid injections with RFA, vertebroplasty, and sacroplasty largely performed in tertiary referral centers.

Our survey found variation in onsite multidisciplinary support during interventional spinal procedures, with less than half of radiologists having access to both a spinal surgeon and anesthesiologist in the hospital. Of the seven radiologists who were performing procedures without access to neither a spinal surgeon nor an anesthesiologist, six performed only spinal biopsies and/or injections. The lack of a spinal surgeon or anesthesiologist may be explained in this case by the very low complication rate of these routine procedures, ranging from 1% to 2.4%, and usually transient and minor nature such as pain at the injection site or a self-resolving hematoma, not requiring specialist anesthetic input.<sup>[15,16]</sup> The NICE guidelines strongly recommend performing vertebral augmentation in facilities with "good access to spinal surgery,"<sup>[9]</sup> however of the eight radiologists performing sacroplasty and/or vertebroplasty, two did not have access to a spinal surgeon. This is important to address as the literature reports patients may require decompressive surgery if there is nerve root or spinal cord compression due to cement extravasation after these procedures.<sup>[6,17-19]</sup>

Most, but not all, eligible musculoskeletal radiologists in the present survey have attended at least a BLS course. In the UK, the Resuscitation Council and the General Medical Council stipulate that being able to provide basic first aid and cardiopulmonary resuscitation is an essential competency for all clinicians and BLS training is increasingly being provided earlier in the medical undergraduate curriculum, with refresher courses recommended annually for qualified health-care professionals.<sup>[20,21]</sup> Meanwhile, recent studies have found a significant lack of BLS knowledge among Indian medical students and doctors.<sup>[21,22]</sup> Among radiologists, in particular, proficiency in life support is poor.<sup>[23-25]</sup> For instance, there is a noticeable discrepancy in self-perceived ability to initiate life support versus actual knowledge, with a study by Tapping and Culverwell finding that only 13% of radiologists could answer all questions correctly despite

high levels of confidence.<sup>[23]</sup> In addition, although our survey did not assess recency of attendance, this is important to consider as Tapping and Culverwell found that only 61% of radiologists attended a life support course in the preceding 4 years, with this subgroup being more likely to perform cardiopulmonary resuscitation correctly.<sup>[23]</sup> As such, greater emphasis needs to be placed in healthcare systems on building both the confidence and expertise of radiologists performing spinal interventional procedures in initiating management of potentially life-threatening situations, to optimize patient care.<sup>[25]</sup>

There are some limitations of this study. First, the survey was anonymous and did not ask about the location of practice (i.e., the UK or India), and hence, results cannot be stratified by country and compared with one another. Second, we asked radiologists if any "significant complication" had occurred without defining what "significant" may mean or asking for the frequency of such complications. Third, the relatively small sample size of responses could be due to the relatively lower proportion of MSK radiologists performing interventional procedures such as vertebroplasty, sacroplasty, and RFA.

## CONCLUSION

Results from this brief survey provide a stimulus and direction for further work to take place in the shape of multicenter transnational surveying with stratification of responses based on country of practice. This will enable a deeper understanding of the safety of radiologist practice during spinal interventions and provide an opportunity for targeted initiatives to improve resource allocation, skills training, and multidisciplinary service provision, ultimately minimizing existing deficiencies and improving patient outcomes.

## Declarations

- No sources of support to declare
- No sources of funding to declare
- No conflicts of interest to declare.

## Declaration of patient consent

Patients' consent not required as patients' identity is not disclosed or compromised.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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