



Radiological guidance for the recognition and reporting of osteoporotic vertebral fragility fractures (VFFs)

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This document has been endorsed by the British Society of Skeletal Radiologists, the Royal College of Physicians and the Royal Osteoporosis Society.



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Better bone health for everybody

Foreword

Vertebral fragility fractures (VFF) are common and are frequently present on imaging, but are rarely reported. This missed opportunity has an impact not only on patient morbidity and quality of life but vertebral fractures themselves are associated with an increase in age-adjusted mortality and are a predictor of future osteoporotic fractures.

The results of the UK national audit of radiology reporting of osteoporotic VFF demonstrated areas for improvement.¹ These include routine reporting of VFF on all imaging modalities that include the spine – not just computed tomography (CT) – reducing confusion by providing clarity over terminology and the requirement for a functional electronic alerting system to highlight patients with VFF to the fracture liaison service or equivalent.

The audit results indicated that we should move towards a uniform way of identifying and reporting these fractures as part of all our daily practice. These findings and this guidance should be used as a basis to move in that direction, which can be achieved by agreement of a local policy for identification and reporting.

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1. Key points

- Appointment of a radiology osteoporosis lead is desirable to support development, delivery and audit of policy and protocol in the identification and reporting of fragility fractures (including vertebral fragility fractures [VFFs]) and to act as part of a multidisciplinary team (within a local fracture liaison service [FLS] if available).
- Agree local policies for the opportunistic reporting of VFFs from imaging that includes the spine.
- Agree local policy for adopting a consistent approach to the identification and reporting of VFFs.
- Implement a policy of automatic sagittal spinal reformatting, display and storage on picture archiving and communication systems (PACS) for cross-sectional imaging studies that include the spine.
- Consider a policy for template reporting of cross-sectional imaging studies that include the spine to include bone integrity, presence of VFF, level and grade/severity.
- Implement a policy for standardised use of terminology for VFFs – using the term ‘vertebral fracture’.
- Implement routine audit processes around identification and reporting of VFFs.
- Agree local policy for onward alerting of referrers or referral to fracture prevention pathways.
- Agree service level agreements (SLA) with teleradiology contractors to adopt and adhere to VFF-reporting policies.
- Consider the use of standard phrases or short codes to create actionable reports or alerts to referrers.
- Where artificial intelligence (AI) technology is implemented to actively screen cross-sectional imaging, agree processes and policy for radiological correlation and alert reporting.
- Discuss and agree the use of alerts, report content and automation and clarify onward referral pathways. Clinical engagement is beneficial. Severe or multiple VFFs or cases with canal compromise will warrant urgent clinical evaluation.

2. Introduction

Vertebral fragility fractures (VFFs) are the most common type of osteoporotic fracture with an incidence of 12% in women aged 50–79 years, increasing to 20% in women over 80 years old.^{2,3} A VFF is also a powerful predictor of future osteoporotic fractures, in particular fractures of the hip; over 55% of patients with a hip fracture have evidence of previous VFFs.⁴ VFFs are associated with an eightfold increase in age-adjusted mortality and the costs and morbidity of osteoporotic VFFs and hip fractures are significant – previous work has indicated health and social care costs in year one post-hip fracture are over £33,000 per patient.^{5,6}

A range of pharmacological treatments are available, which are effective at substantially reducing both the risk of further VFFs and also subsequent hip fractures.² However it is well recognised that VFFs are often unsuspected by clinicians and under diagnosed by radiologists.^{7,8} Radiologists and reporting radiographers are well placed to diagnose VFFs on any imaging modality that includes the spine (including X-ray, barium studies, computed tomography [CT] and magnetic resonance imaging [MRI]). VFFs are best appreciated on

the lateral projection. Importantly, the diagnosis of VFFs can also be made opportunistically where the spine is not the focus of the study.

A number of factors have been identified in VFF under diagnosis following imaging.⁹

- Failure of radiologists to consistently review spinal components of imaging.
- Lack of awareness of the importance of early diagnosis of VFFs and use of ambiguous reporting terminology (for example, 'loss of height' or 'wedging').
- Immature or underdeveloped departmental radiology information systems (RIS) and alert processes inhibit rapid dissemination of reports.
- Onward referral systems (in particular fracture liaison services) may not be well developed locally.

In light of the perceived difficulties around opportunistic reporting of VFFs, The Royal College of Radiologists (RCR) undertook a UK-wide audit in 2019 to evaluate organisational reporting infrastructure and specific patient-related reporting data in the diagnosis of VFFs on CT, where the thoraco-lumbar spine was included in the field of view but was not the area of clinical interest.¹ This audit was undertaken as a collaboration with the Royal College of Physicians (RCP) and the Royal Osteoporosis Society (ROS) and used the ROS *Clinical guidance for the effective identification of vertebral fractures* as a template.¹⁰ The audit template is included in **Appendix 1**. The audit involved 6,357 patients with an overall radiology departmental response rate of 63%; 1,362 (21.4%) of patients had a VFF on auditor review.

The audit confirmed a lack of compliance with all audit standards – in particular pertaining to report comment on bone integrity, severity of fractures, use of recommended terminology ('vertebral fracture') and appropriate recommendations for further investigation/referral.

In light of the audit findings, this dedicated guidance is designed to facilitate radiological recognition and actionable reporting of VFFs. The recommendations are applicable to all individuals who report imaging that may incorporate the spine, including radiologists reporting on- and offsite (including teleradiology) and reporting radiographers.

3. Radiological recognition of VFFs

A number of methods are currently used to facilitate the systematic identification and definition of vertebral fractures. It is beyond the scope of this guidance to cover these in detail or to recommend one system over another – individual reporters/departments should consider the various options and what works best for their style of reporting, liaising with clinical colleagues.

The most widely used technique is the semi-quantitative method described by Genant *et al.*¹¹ This system involves the visual recognition of a loss of vertebral body height on a lateral projection combined with careful assessment of the vertebral endplates to diagnose a fracture and to exclude non-fracture vertebral deformity. A severity assessment can also be made as follows.

- Grade 1 (mild) fracture 20–25% loss of height.
 - Grade 2 (moderate) fracture 25–40% loss of height.
 - Grade 3 (severe) fracture >40% loss of height.
-

The ROS guidance indicates a $\geq 20\%$ loss of height (with endplate assessment) as diagnostic of fracture; in most cases formal vertebral height/area measurements are not required.¹⁰

The algorithm-based qualitative (ABQ) approach is another visually based system that involves qualitative recognition of vertebral endplate deformity to diagnose fracture.^{9,10}

Whichever method is chosen, a uniformity of approach and terminology across reporters in a department is recommended.

The departmental radiology events and learning meeting (REALM) or equivalent would be a suitable environment to discuss and agree reporting policy. Engagement of radiology trainees, reporting radiographers and, where possible, remote reporters (teleradiologists) is also encouraged. Appointing a radiology departmental lead for osteoporosis may be helpful.

4. Radiological reporting of VFFs

A key aim of this guidance is to increase awareness of VFFs among reporting radiologists and radiographers and to emphasise the importance of a timely and accurate diagnosis.

Radiologists are uniquely placed to diagnose VFFs opportunistically. This requires careful assessment of the spine on all imaging investigations where the spine is included in the field of view, whether or not the spine is the area of clinical concern. Image acquisition and storage is discussed in **Section 5. Optimising image acquisition in the diagnosis of VFFs**.

- Use of recommended terminology is essential and, in particular, the use of the word 'fracture' when an osteoporotic VFF is visualised is important.^{10,12} The use of ambiguous phraseology (such as 'loss of height' or 'wedging') should be avoided as they may result in VFFs being overlooked by those reading the report.
- Radiology reports should indicate that the bones have been reviewed, which can be facilitated with the use of template reporting.
- If an osteoporotic VFF is diagnosed it is important to look for and comment on the presence/absence of additional VFFs, the levels of fractures and their severity and if there is evidence of canal/cord/cauda equina compromise (which would necessitate urgent discussion and onward referral, see **Section 6. Actionable reporting of VFFs**).
- The radiology departmental REALM is well placed to discuss the reporting of VFFs. Periodic audit of the terminology used by reporters and compliance with agreed departmental best practice for VFF reporting is also recommended (see **Appendix 1** for a suggested audit template).

5. Optimising image acquisition in the diagnosis of VFFs

Detection of VFFs depends on assessing the height of the vertebral body and endplate on lateral views of the spine. Vertebral body height can be evaluated on various imaging modalities. It is not recommended that any additional ionising radiation is applied for evaluation of the spine for opportunistic VFF identification in imaging examinations undertaken for other clinical reasons. However, it is important for radiologists to recognise and use the correct terminology whenever a VFF is visible incidentally.

With body CT scanning, performing sagittal bone reformats of the spine does not require additional scan times or radiation dose, nor does it require significant additional storage space. An RCR audit demonstrated that in departments where sagittal CT bone reformats of the spine were routinely obtained and stored, this was associated with a statistically significant increased likelihood of the reporting radiologist commenting on bony integrity. Therefore, to increase VFF detection on body CT, sagittal reconstruction of the spine using bone windows should be sent routinely to PACS for storage and display.

6. Actionable reporting of VFFs

The RCR supports actionable reporting and this topic is covered in *Standards for interpretation and reporting of imaging investigations*.¹² The importance of an actionable report – one that answers the clinical question and is worded to prompt appropriate action for the patient – is also highlighted in the ROS guidance.¹⁰

The wording used in reports will depend on local service models and agreed pathways. If a VFF is identified (and reported as such) the report should flag to the referring clinician the need for further investigation/assessment, which may include a recommendation for dual energy X-ray absorptiometry (DXA) and referral to the local fracture liaison service (FLS) or metabolic/rheumatology clinic. In the absence of an established FLS pathway, the further assessment/management of suspected osteoporosis may best be undertaken in primary care. The actionable report should give the appropriate advice to the referring clinician on the need for the general practitioner (GP) to arrange relevant further investigation/referral. This may be particularly relevant in smaller/remote hospitals without direct access to metabolic/osteoporosis services where the GP may be better placed to access specialist support.

The report should also use the principles of fail-safe alerts (in line with the RCR guidance on this topic).¹³ Examples of standard report phraseology which can be saved as a short code and automatically inserted into the report are included in the ROS guidance and in **Section 8. Onward referral systems – the fracture liaison service (FLS)**.¹⁰ The departmental REALM is an appropriate setting to discuss and agree the use of alerts, report content and automation and to clarify onward referral pathways. Clinical engagement is beneficial. Severe or multiple VFFs or cases with canal compromise will warrant urgent clinical evaluation.

7. Artificial intelligence (AI) and VFFs

Emerging AI technology and algorithms have scope to support the identification of VFFs through routine scrutiny of cross-sectional imaging via PACS and the creation of 'alert lists' of those patients with suspected VFFs. Radiological interpretation may still be required to verify absence or presence of AI-identified VFFs since this technology is currently limited in differentiating between VFFs and non-fracture deformities such as Scheuermann's disease or Schmorl's nodes.

While AI technology may identify patients with VFFs and append this data to PACS, processes will need to be developed by individual services to ensure radiological actionable reports and alerts are issued for these patients to access appropriate onward assessment and care (see **Section 6. Actionable reporting of VFFs**).

8. Onward referral systems – the fracture liaison service (FLS)

Effective secondary fracture prevention is delivered through well-evidenced and established processes.^{14,15}

- Identification of patients with fragility fractures.
- Investigations that include assessment of fracture risk, bone densitometry (DXA scans), appropriate blood tests to determine secondary causes for osteoporosis and falls risk assessment.
- Informing the patient of outcomes of investigations, risk assessments, lifestyle advice and any management plans to reduce fracture risk.
- Intervention through management plans for pharmacological and non-medical management including anti-osteoporosis medication and falls intervention, for example.
- Follow-up at appropriate intervals to ensure concordance with management plans.
- Quality-assurance processes to support national standards and audit.

Typically, this process is delivered through an FLS, which is normally located within the acute hospital; community and primary care FLS networks are also in operation. An FLS is a specialised service that co-ordinates and delivers secondary fracture prevention through systematic identification, investigation, treatment recommendation and monitoring. These services are mandated to submit to a national audit programme with defined key performance indicators and are managed by the Royal College of Physicians.¹⁵

The fracture liaison service

Where an FLS exists, close links with the local radiology department should be developed to support the FLS' ability to identify those patients with VFFs – both those presenting clinically and those found opportunistically through imaging services.

Where a radiology service has appointed an osteoporosis lead, this would be an ideal role to facilitate communication and to support the FLS with VFF identification. This might occur via radiology participation in the multidisciplinary team or through collaboration to develop a short code reporting system or 'actions list' via PACS to support the FLS in systematically identifying patients with these fractures.

There is also opportunity to develop a direct referral system from an imaging service to the FLS for those patients with a newly diagnosed VFF, which should be developed collaboratively between both services.

Non-FLS pathways

Where there is no FLS available, further assessment for osteoporosis should be undertaken according to agreed local protocol. Local pathways should be defined and radiology report/alert mechanisms established to support the referrer in appropriate actions following the identification of an incidentally found VFF.

Further assessment will usually involve the patient's GP using a recognised fracture risk assessment tool such as FRAX® or NOGG.^{16,17} These tools support decision-making for onward assessment by DXA and use treatment thresholds to direct management. FRAX® assessments may also be refined following DXA with the inclusion of femoral neck bone mineral density.

Radiology reports should include clear statements that:

- There is a newly diagnosed fragility fracture
- The referrer must ensure arrangement of appropriate assessment for osteoporosis and fragility fracture and subsequent treatment and management.

Short-code reporting can be developed and implemented for this purpose. Examples of short codes in use are:

'This patient has experienced a fragility fracture. Please make further assessments of fracture risk and osteoporosis and consider appropriate treatment for secondary fracture prevention – as per NICE and XXXXXX Formulary guidance. Further advice and support can be provided by the metabolic bone/rheumatology/osteoporosis service. This service is contactable via XXXXXXXXXXXX.'

'The identified vertebral fractures put this patient at high risk of further fragility fractures. Osteoporosis should be excluded in line with local clinical guidance and pathways.'

'There is a newly identified vertebral fragility fracture suggestive of osteoporosis. Please ensure further assessment of fracture risk is made and refer to DXA where indicated.'

The ROS actively supports local hospital services to develop FLS, implement quality improvements in service delivery and has a clinical lead in post to deliver this support.

9. Conclusion

The solutions to under diagnosis of VFFs are complex and multifactorial, involving both reporting radiologists and radiographers, but also clinicians, FLS networks and GPs.

Development and improvement of departmental alert/electronic report systems and onward referral networks (FLS and pathways) will be required in many instances. A co-ordinating radiology osteoporosis lead may be helpful.

This guidance aims to increase awareness of the importance of accurate and timely reporting of VFFs, but also highlights an opportunity for radiologists and radiographers to make a significant positive impact on the health and wellbeing of a large cohort of patients. This guidance also supports published RCR standards for actionable reporting of radiological images and communication of reports.^{12,13}

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Appendix 1. Audit template

Descriptor

Improving the recognition and reporting of vertebral fragility fractures (VFFs) on computed tomography (CT) examinations.

Background

In an aging population, identification of VFFs is an opportunity to reduce the significant burden of future hip fractures by beginning osteoporosis treatment.⁴⁻⁶ Many VFFs present as incidental findings on imaging (in particular CT) where the spine is not the primary anatomical region being examined and may go unreported.^{7,8} The use of ambiguous terminology in reporting may lead to the fracture being overlooked by the referring clinician, who may also be unaware of services such as the fracture liaison service (FLS)/metabolic units. In 2019, a UK-wide audit led by The Royal College of Radiologists confirmed a lack of compliance with audit standards relating to reporting incidental VFFs on CT (the standards were derived from Royal Osteoporosis Society guidance)¹⁰ – in particular pertaining to report comment on bone integrity, severity of fractures (using the semiquantitative technique from Genant *et al*),¹¹ use of recommended terminology and appropriate recommendations for further investigation/referral.¹

The standard

1. The reporting radiologist or radiographer should comment on the integrity of the bones.
2. Moderate/severe VFFs should be correctly identified in the report.
3. VFFs should be reported using correct terminology (that is, 'vertebral fracture').
4. Reports of scans with VFFs should contain appropriate recommendations for further assessment.
5. A local policy for adopting a consistent approach to the identification and reporting of VFFs should be agreed.

Target

1. 100%
2. >90%
3. 100%
4. 100%
5. Agreed

Indicators

1. The proportion of reports in which the reporting radiologist or radiographer has commented on the integrity of the bones.
2. The proportion of reports in which moderate/severe VFFs are correctly identified.
3. The proportion of VFFs reported using correct terminology.
4. The proportion of reports of scans with VFFs which contain appropriate recommendations for further assessment.
5. Whether a local policy for adopting a consistent approach to the identification and reporting of VFFs has been agreed.

Data items to be collected

- CT chest, abdomen and pelvis scans (CT-CAP) in patients aged 70 and over. Findings are compared to the radiology report.
- Local policy for adopting a consistent approach to the identification and reporting of VFFs.

Suggested number

- Based on an incidence of 21% using 50 scans across a large number of sites,⁸ 50 scans is the recommended minimum but larger numbers – more than 100 – are encouraged.

Suggestions for change if target not met

- Consider a policy for template reporting of cross-sectional imaging studies that include the spine to include bone integrity, presence of VFFs and level and grade/severity.
- Implement a policy for standardised use of terminology for VFFs.
- Agree local policy for onward alerting of referrers or referral to fracture prevention pathways.
- Appoint a radiology osteoporosis lead to support development, delivery and audit of policy and protocol in the identification and reporting of fragility fractures (including VFFs) and to act as part of a multidisciplinary team (within a local FLS if available).



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