Tips for Reporting Musculoskeletal Imaging Studies: Lessons Learned

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Abstract

This paper is designed to be read by radiological trainees who are starting out with reporting musculoskeletal imaging studies. Based on the author's experience of over 25 years, it provides tips on how to report musculoskeletal imaging succinctly and effectively using a prose style report.

Keywords

- musculoskeletal
- imaging
- report
- radiology
- MRI
- CT
- ultrasound

Whether writing a highly structured report, a hybrid-structured report with specific headings, or a freestyle narrative report, each radiologist develops their own personal style, whose nuances will be understood by their referring clinicians. With 25 years of experience of reporting musculoskeletal (MSK) examinations, this article outlines my own personal recommendations in writing prose-style reports. These pointers, which may seem blindingly obvious to experienced radiologists, are aimed at trainees beginning to report MSK examinations. We generally learn reporting style from mentors and peers, although not all radiologists have this opportunity. There are almost as many different opinions on how to write and what to include in a radiology report as there are MSK pathologies, and many of the pointers provided here may not necessarily suit every circumstance. Nevertheless, given this opportunity, these are my own personal recommendations, which I hope will offer help to those starting out with MSK imaging reporting. This article refers primarily to reporting ultrasound, computed tomography, or magnetic resonance imaging examinations rather than radiographic, nuclear medicine, and interventional studies.

General Recommendations on Report Writing

1. Concentrate first and foremost on answering the clinical question and explaining the patient's symptoms.[1,2] This is particularly true in musculoskeletal (MSK) examinations where the clinical question to be addressed is often very specific. Sometimes this clinical question is not outlined clearly or may have changed from that on the request form. In this regard, for magnetic resonance imaging (MRI), it can be helpful to ask patients to complete a short questionnaire regarding their clinical symptoms before the MRI examination. Particularly in traumatic injuries to the wrist, elbow, and knee, the likely pattern of structural failure can be predicted based on the injury mechanism.[3] ►**Fig. 1** shows a sample of one such questionnaire. Similar questionnaires in English and Chinese can be downloaded from http://www.diir.cuhk.edu.hk/wp-content/uploads/form/Patient_Questionnaire.zip.
2. Make the report commensurate with the clinical scenario. In other words, in someone with extensive severe disease,

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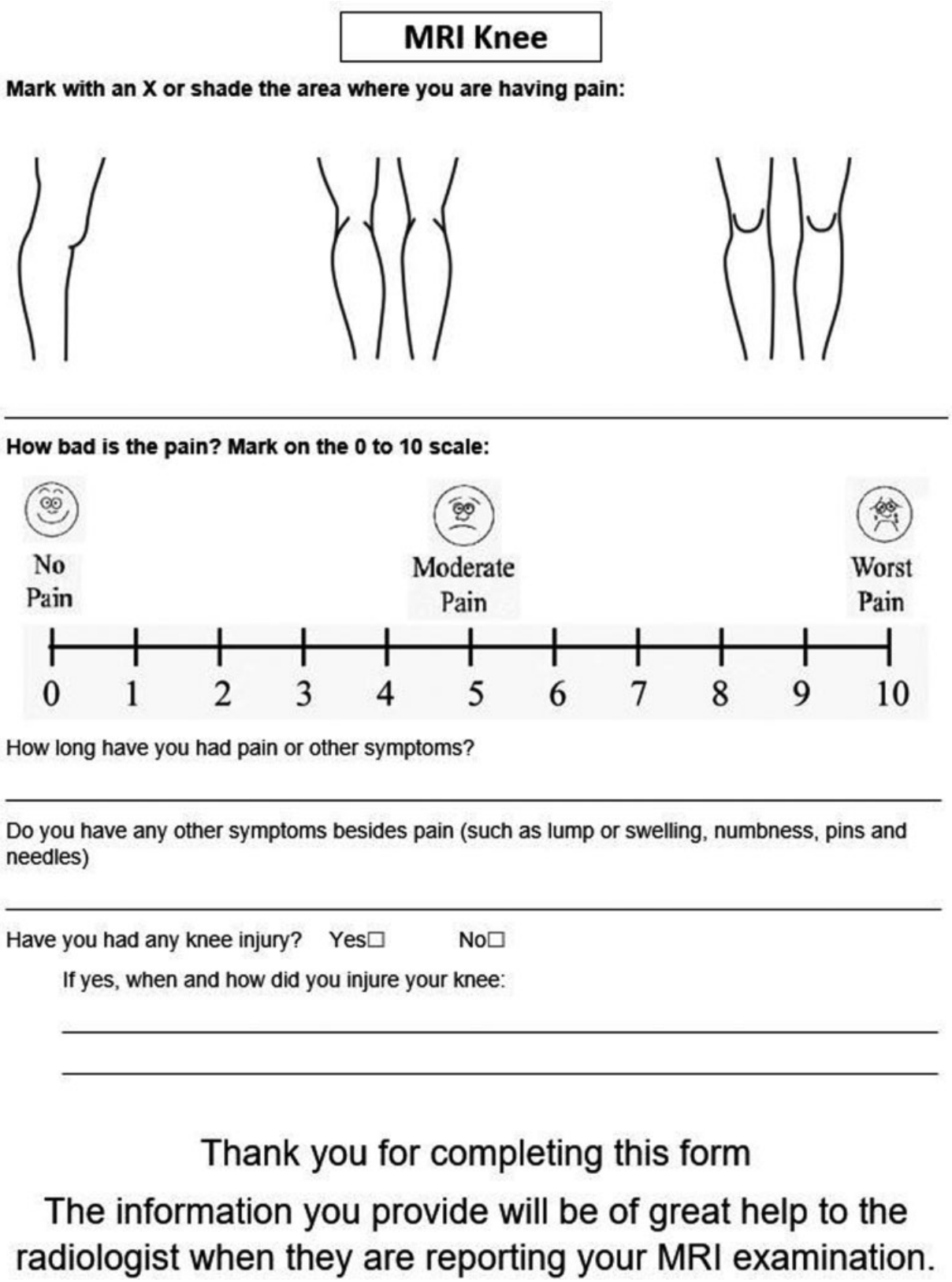

Fig. 1 Questionnaire regarding patients clinical symptoms completed by patient before MRI examination.

concentrate primarily on describing the main features rather than describing every single feature, many of which will not be of clinical significance given the severity of the overall disease. Conversely, in someone with a relatively normal examination, describe in detail even minor abnormalities that might be related to the clinical picture.

3. As a rule, proceed from the more serious abnormality to the less serious abnormalities.[2] For example, do not describe a lot

of normal or relatively minor abnormalities around the knee and then, near the end of the report, say there is "end-stage osteoarthritis of the lateral femorotibial compartment."

4. Try to reduce the word count of the report as much as possible. The more succinct the report, the more likely it is to be read in full. Orthopaedic surgeons, in particular, prefer brevity.[4] To this end, minimize any padding. Put yourself in the mindset of the clinician who may well be reading your report for the first time during a busy outpatient clinic. Focus on providing the key information that will help the clinician with decision making and affect clinical management.
5. Aim to minimize the length of all the sentences in your report. For example, shorten "evidence of previous C6–T1 anterior spinal fusion" to "C6–T1 anterior spinal fusion"; "moderate disk degeneration with disk space narrowing, marginal osteophytes, and subchondral sclerosis" to "moderate disk degeneration"; and "moderate tendinosis of the supraspinatus tendon" to "moderate supraspinatus tendinosis." That said, sentences need to be framed with the needs of the referring clinician in mind.[5]
6. If you see an abnormality that you think is clinically relevant, describe as much about it as you can. For example, if you see an osteochondral lesion in the talar dome, describe as many pertinent features as possible (e.g., size, location, bone collapse, chondral separation, chondral fracture or hypertrophy, subchondral edema, subchondral cyst, chronicity). Ask yourself at the end of describing these abnormalities whether any other relevant features can be mentioned. Most of your report should focus on describing the main abnormality or abnormalities.
7. Address pertinent negative features pertaining either to the main pathology or the clinical question.[2,6] Thereafter, terminology like "otherwise unremarkable appearances" can be used, rather than listing all irrelevant negative features. Although not everyone's preference,[7] I often use the term "unremarkable" rather than "normal" because not much is normal after middle age, and "normal for age" seems an even more nebulous phrase.
8. Do not use excessive radiologic terminology in the report. It is not necessary to give a detailed description of the imaging features in the report. Such descriptions are relevant when writing a figure legend for a journal article but are not appropriate for everyday clinical reporting. Such terminology may be second nature to us as radiologists, but it often means very little to most clinicians and patients reading our reports.[1] For example, rather than describing a lesion as a "T1-hypointense, T2-mildly hyperintense mass with central intermediate signal, mild contrast enhancement, and no blooming artifact on gradient-echo sequences," it is much better for you to decide whether you think the mass is, for example, mainly cystic, fatty, fibrous, or inflammatory in nature and then describe it as a fibrous-type or inflammatory-type mass etc. In other words, keep the report short and pertinent. It is not necessary to explain why you arrived at a particular diagnosis or conclusion in your report.

   Similarly, for ultrasound, a lesion should not be described as a "well-defined homogeneous hypodense nodule with moderate posterior acoustic shadowing and no color flow." It is much better to determine the likely etiology of the mass based on imaging appearances including compressibility and say there is a "well-defined fibrotic-type nodule" present. Similarly, rather than saying, "there is no abnormal periprosthetic lucency to suggest periprosthetic infection or loosening," it is best to note that "there is no evidence of prosthetic loosening or infection." Rather than saying, "there is moderate thickening of the extensor digitorum tendon (ECU) with altered signal intensity consistent with moderate ECU tendinosis," just say "there is moderate extensor digitorum tendinosis." Increased confidence in making specific judgments will come with more experience.
9. Suboptimal study. If the examination is suboptimal for whatever reason, stating this as the outset of your report confers negativity. It is best to report the examination as well you can. Then, toward the end of the report, mention that, for example, "image quality moderately limited by movement artifact." If the examination quality impedes your assessment, also mention this limitation in the conclusion.

Specific Recommendations

1. *Laterality,* that is, right/left side. For example, if you are reporting on the right hip, and you have included the title MRI RIGHT HIP, you do not need to mention the side subsequently in your report. That is, just say there is a "moderate-size effusion of the hip joint" rather than a "moderate-size effusion of the right hip joint." This helps keep the report short, clear, and minimizes laterality discriminator confusion (right/left), which, along with unnoticed speech recognition mistakes, are the two most common reporting errors.[8]
2. *Specificity.* If you can completely confirm or exclude an abnormality, use the terminology "present" or "not present" (i.e., "no joint effusion present," rather than "no joint effusion evident" or "no joint effusion noted").[6]

   If the imaging study is not sensitive enough to completely exclude an abnormality, use the term "evident," such as "no local recurrence evident," rather than "no local recurrence present."[6] Alternatively, you could say, "No visible tumor recurrence." Similarly, note "no adhesive capsulitis evident" or "no visible adhesive capsulitis," rather than "No adhesive capsulitis present."
3. *Terms to avoid.* Try to avoid using the terms "obvious" or "significant."[2] "No obvious tendon tear" suggests a tendon tear could be present, but it is not obvious. Better to say, "no tendon tear present." Similarly, "no discrete mass identified" suggests a mass could be present, but you have not identified it. Tendon tears and masses can be fully excluded in most cases. Better to say, "no discrete mass present."

If you are not completely sure about the presence of an abnormality, use the word "seems." For example, "there seems to be a tear of the popliteofibular ligament," and then, in the conclusion, you can report "possible tear popliteofibular ligament."

Try to avoid using the terminology "malignancy cannot be excluded." This is stating the obvious and creates a huge amount of anxiety both for the patient and the clinician. All imaging studies are not absolute, and a lot of abnormalities cannot be completely excluded. Instead, say, "there is no evidence of malignancy" or "overall, the lesion is more likely to be benign rather than malignant." If describing, for example, a large subfascial lipomatous tumor, say, "other than the large size and subfascial location, there are no particular suspicious features of liposarcoma. Overall appearances favor a large intermuscular lipoma."

4. Like- or -type classifiers. When, for example, describing mineralization in a tumour matrix, rather than saying osteoid or "chondroid mineralization is present", it is often better to use less specific terminology such as osteoid-like or "chondroid-like mineralization" as this distinction is often not clearcut. Similarly, when describing a vertebral fracture you consider to be osteoporotic, it may be best to describe it as "an osteoporotic-type fracture. No evidence of malignancy or infection" because you cannot always completely exclude prior trauma or, in some imaging studies, such as radiographs or computed tomography, malignant infiltration. You can also use this terminology for describing features such as lymphadenopathy when you think an enlarged lymph is more likely to be reactive ("reactive-type adenopathy") or malignant ("malignant-type" or "metastatic-type adenopathy").
5. *Best guess.* When you describe a focal lesion, always say what you think is the most likely reason for this abnormality. For example, do not say there is "an irregular partially sclerotic lesion in the medial femoral condyle" and leave it at that. Always try, based on your experience, to offer a best guess as to what is the most likely cause of the lesion. Best to say "there is an irregular partially sclerotic lesion in the medial femoral condyle. This is most likely a small intramedullary bone infarct."
6. *Syndromes and impingement.* When talking about a syndrome such as carpal tunnel syndrome or ulnolunate impaction syndrome, use terminology implying features are "suggestive of," "indicative of," or "compatible with" ulnolunate impaction syndrome, rather than saying explicitly that ulnolunate impaction syndrome is present. Such syndromes are a clinical entity, and patients may have imaging features compatible with this syndrome but not the clinical manifestation. The same suggestion applies to impingement syndromes, such as femoroacetabular impingement or ankle impingement.[9]
7. *Abbreviations.* Avoiding abbreviations helps minimize miscommunication in your report.[1] This caveat is particularly true for MSK imaging that is awash with abbreviations. What seems to you like an abbreviation that everyone supposedly knows is not likely to be known to the patient, and it may mean something entirely different to a nonspecialist clinician.[1] Abbreviations may overlap. For example, TA in the ankle region may mean either the tibialis anterior or the tendo Achilles. If a term is going to be used several times in the report and is an accepted abbreviation, spell out the full name the first time the term is used followed by the abbreviation in parentheses.[10] It is reasonable to use common acronyms such as PET imaging without spelling them out.
8. *Classifications.* MSK uses literally hundreds of grading and classification systems that are, as expected, continually being upgraded, refined, and replaced as more knowledge comes to light.[11] If you do wish to use such gradings or classifications in your report, first describe the abnormality and then mention the classification or grade. For example, "There is a complete detachment of both the foveal and styloid lamina of the triangular fibrocartilaginous complex (i.e., Palmer type 1B)."

Grading and Measurements

1. Always grade every abnormality.[2] Although grading systems do not exist for most abnormalities, nevertheless they should all be graded. There is little value in saying, for example, that "there is Achilles tendinosis present," which may mean anything from minimal tendinosis to severe tendinosis. It is much better to say there is mild/moderate/severe tendinosis present. Similarly, for all other abnormalities, such as bone marrow edema, inflammation, synovitis, and so on, it is important to grade the abnormality. The person reading your report should never have to refer to the images to gauge the severity of an abnormality.
2. Similarly, avoid terminology such as "pronounced" or "appreciable," as in, for example, there is "pronounced soft tissue edema." Better to be more specific and say, "mild to moderate soft tissue edema."
3. Only measure features with clinical relevance, such as tumors, tears, collection, fracture displacement, and spondylolisthesis. There is no need to measure features like bursal distension that can be easily graded as mild/moderate/severe, reactive-type cortical thickening, mucoid degeneration, and so on.
4. Do not use centimeters for one measurement and millimeters for another measurement in the same report.
5. When providing measurements on, for example, an MSK tumor, rather than reporting 14 mm CC $\times$ 15 mm TS $\times$ 17 mm AP, it is easier to read as 14 mm long $\times$ 15 mm wide $\times$ 17 mm deep. Also, if you describe the tumor as small/medium/or large just before providing the measurements, the person reading the report then does not have to consider the measurements and determine whether this is a small, medium, or large lesion. For example, describe as follows: "There is a medium-size (12 mm long $\times$ 6 mm deep $\times$ 11 mm wide) nerve sheath tumor arising concentrically within the ulnar nerve" or

"There is a small (2 mm long × 1.5 mm deep × 7 mm wide) ganglion cyst present."

6. When you address serial changes on imaging studies, mention whether there has been minimal, mild, moderate, or marked interval change rather than just citing that appearances have improved compared with the previous examination. In other words, offer a clear indication as to how much it has improved or deteriorated. For serial changes in tumor size, it is often useful to report tumor volume (i.e., width × height × length × 0.52) in addition to linear dimensions on the initial and serial examinations. Volume measurements allow an easier appreciation of change in size and may reduce errors with comparing linear dimensions.
7. In general, the more distinct the margins of the lesion, the more precise your measurements should be. When measuring an ill-defined area, it is reasonable to round off your measurements to the nearest millimeter or 0.5 cm.

The Conclusion

1. The conclusion is usually the first part of your report to be read and often the only part.[2,4,12]
2. Make the conclusion succinct, and always address the clinical question.[6,7] If you cannot answer the clinical question, suggest an alternative appropriate imaging investigation or follow-up that may help.[13] Bear in mind the experience of the referring clinician or clinical department when making such suggestions. Suggestions about what to do next do not have to be made to an experienced specialist surgeon but may be very relevant to a non-specialist.
3. Each conclusion point should be no more than one line. Try to limit the number of concluding points to a maximum of four to five significant abnormalities. List these from the most serious to the least serious.[14]
4. Do not give all the details in the conclusion. The conclusion should be a prompt to go back and read the main report, if necessary. Try to put yourself in the mindset of the clinician reading your report in a busy orthopaedic outpatient clinic. They do not have time to comprehend all the report details. Give the main features, and these can then be deciphered from the main report at leisure.
5. Confine your conclusion to those features that will affect clinical management. For example, in a knee injury report, conclude with main injuries found, and do not mention features such as "large joint effusion" or "bone marrow edema" in the conclusion.
6. Avoid using concluding terminology, such as "findings as described." Do not expect the clinician to read through your whole report to decipher the problem areas. Similarly, when reporting a lumbar spine study, do not conclude with "multilevel disc degeneration, canal stenosis, and nerve root compression as described." Instead, try as best as possible to summarize the main abnormal features.
7. Avoid using the term "clinical correlation is advised."[2,6,7] This is stating the obvious. If you do wish to address this, be more specific in your request, for example, "Has there been previous trauma to this area?"[1]

The radiology report is the flagship of our profession and the main point of contact between radiologists, referring clinicians, and, increasingly, patients.[2,7,15] Nearly half a billion radiology reports are generated in the United States alone each year.[16,17] There is understandably no one-size-fits-all for radiology reports with a multitude of variations in approach and style. I have outlined my personal recommendations for writing an MSK imaging report to help those just starting out. We all obviously need to be mindful of continually reevaluating and improving our reports for clarity and readability, not least because these reports are reaching a much wider audience than ever before.[1,5,7,18]

Conflict of Interest
None declared.

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