



HOW TO DO IT

Communicating traumatic pathology to ensure shared understanding: is there a recipe for the perfect preliminary image evaluation?

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Introduction

The purpose of this article is to propose a recipe for preliminary image evaluation (PIE) that combines a search strategy and communication model to support radiographers and the wider multi-disciplinary team (hereafter collectively referred to as ‘reviewers’) to identify traumatic pathology on plain radiographs and accurately document their findings.

In terms of radiographic image interpretation, a timely, definitive report generated by a radiologist is the gold standard within the context of the Australian public health system.¹ It provides the patient with the best

Abstract

Medical imaging and emergency departments work collaboratively to interpret trauma radiographs. In addition to accurate radiographic interpretation, clear communication is crucial to ensure appropriate and timely management of musculoskeletal injuries. This two-step ‘how to guide’ provides the reviewer with a recipe for effectively evaluating trauma radiographs for traumatic pathology and succinctly documenting the findings. Step 1 is a systematic search of the radiograph: soft tissues, bones, alignment of joints and satisfaction of search (SBASS). Utilising SBASS increases reviewer confidence in identifying traumatic pathology of the appendicular and axial skeleton. Step 2 is a streamlined communication model for the documentation of pathological findings. The WWW acronym (What is it? Where is it? What is it doing?) can be adapted to describe simple or complex traumatic pathology.

probability of achieving appropriate treatment and a successful outcome. The Australian Council on Healthcare Standards recommends report availability within 24 h² but the National Emergency Access Target requires Australian public hospital emergency departments to process patients within four hours (assessment, diagnosis and discharge/admission).³ Unfortunately, a radiology report is often not available within four hours, placing diagnostic responsibility on emergency clinicians and health practitioners.^{4,5}

Incidences of missed and/or delayed radiological diagnoses, where in-experienced emergency clinicians make treatment decisions based on unsupported image

interpretation, potentially compromise patient safety.⁶ As such, there is an increasing weight of international evidence that advocates for radiographers to generate an opinion on pathology demonstrated on the radiographs they acquire and make that opinion available to the treating team.^{7–12}

The practice of radiographer commenting in the emergency department is not new, but it has evolved considerably since the early days of 'Red Dot'.^{13–16} Radiographer commenting is commonly referred to as preliminary clinical evaluation (PCE)⁹ in the United Kingdom (UK) and preliminary image evaluation (PIE)¹⁶ in Australia. Any practice of radiographer commenting will be referred to as PIE for the remainder of this article.

The Royal Australian and New Zealand College of Radiologists clearly dictates the expected format and scope of a clinical radiology written report.¹⁷ While sharing a patient focus, the required inclusion of clinical history, patient demographics, differential diagnosis, previous and recommended complimentary imaging (among other things) in a formal report makes PIE uniquely different. PIE is performed at the point of care and is necessarily succinct, a limited description of the presence or absence of traumatic pathology and, where identified, the location and key features.¹³ Although professional and regulatory bodies recognise that PIE is within the current scope of practice for radiographers,^{9,18,19} several potential barriers to the implementation of PIE in clinical practice are cited internationally and overall, uptake has been limited.^{20–25}

The Society and College of Radiographers (SCOR) in the UK, for example, stipulated in 2013 that all UK radiographers must provide comments on the clinical examinations they undertake.⁹ Yet regardless of universities reporting adequate undergraduate teaching,²⁶ and an established advanced practice model incorporating radiographer reporting and consultant radiographer positions,²⁷ <50% of facilities responding to a SCOR Scope of Practice Survey in 2015 had a PIE programme in place.²⁶

This is not just a UK phenomenon. The finding is echoed in the Australian literature where despite research into radiographer PIE, only one study has reported on results from clinical practice thus highlighting the impact that barriers have had in limiting practice development.¹² Almost unanimously, the barriers relate to education, perceived lack of radiological support and importantly, a lack of radiographer confidence.^{7,8,13,14,22,24,25,28}

Over the last two decades, there has been a devolvement of traditional roles in the management of musculoskeletal trauma in the emergency department in Australia and overseas.^{15,29} Physiotherapists and nurse practitioners in addition to emergency doctors are taking

shared responsibility for the diagnosis and treatment of musculoskeletal injuries; a key element being radiographic image interpretation.¹⁵ Evidence is widespread that a multi-disciplinary approach to radiographic image interpretation is beneficial from both a peer support perspective,^{10,11} as well as by means of improved pathology detection and overall accuracy.^{8,11,28,30–32}

Therefore, could the solution to overcoming barriers to radiographer preliminary image evaluation lie in sharing the PIE with our colleagues?

Method

Developing the recipe

The authors are experienced radiographers with backgrounds in PIE, radiographic reporting, management, service design and education. A decade long shared interest in communication and clinical reasoning led to the development of the 'recipe' described in this article. The authors identified a clinical problem; how can we ensure multi-disciplinary shared understanding in the communication of traumatic pathology? How can you generate a succinct, accurate, easily and uniformly understood written description on traumatic pathology in a time efficient manner?

There is a noticeable absence of published instructional literature related to the method of writing a written description; how to put the PIE together. The authors propose that combining a robust search strategy with a streamlined communication model that employs clear, cross-disciplinary taxonomy and nomenclature will optimise the message across a range of professions and be in the best interest of the patient.^{33,34}

Choosing the ingredients

Incorrect or incomplete radiographic image interpretation is a frequent cause of medical legal claims in the emergency department.³⁵ By employing a well-structured search strategy, a reviewer can be increasingly confident that they are comprehensively analysing all features of the available radiographs.³⁶ A search strategy can be described as a comprehensive plan for finding information. In this article, the term search strategy is used to describe the systematic review of a plain radiograph(s) for the purpose of identifying traumatic pathology (the PIE ingredients). A search strategy is a well-documented concept.^{37–40} A simple ABCs approach was described by Nicholson and Driscoll in 1993⁴¹ and subsequently adapted by Chan⁴² to include a measure of radiographic adequacy and a passing reference to satisfaction of search. Satisfaction of search (sometimes referred to as subsequent search miss (SSM)

error)⁴³ is a recognised source of radiological error that suggests a reviewer may miss subsequent pathology, once an initial pathological target has been identified. Research into this concept has roots in academic radiology and psychology with proposed contributors including the various and complicated components of visual search, interruptions and fatigue.⁴⁴ It is suggested that a visual search is more difficult in the presence of multiple targets in the same search display,¹⁵ a trauma radiograph for example. Importantly, this observation is made with novice and professional reviewers alike.^{43,45} In addition, where the severity of the first pathology is regarded as great, it has been shown to result in decreased gaze dwell times for subsequent radiographs, introducing the possibility of premature termination of the search.⁴⁶ Resource depletion, another factor, refers to the reviewer having insufficient working memory to process subsequent targets due to subconscious decision-making in relation to the primary finding.⁴³ It has also been suggested that the nature of the first pathology may bias a reviewer to look for other targets similar to the first, thereby overlooking targets of a different nature.⁴⁴

In response to the inherent SSM error in radiological review, the authors propose a strengthening of the search strategies previously described in the literature to incorporate soft tissues, bones, alignment of joints and satisfaction of search (SBASS). In contrast to the ABCs method, the proposed SBASS search strategy emphasises the importance of reviewing the soft tissues first. In addition, the inclusion of subsequent search in the mnemonic makes this critical reflective step explicit and integral to each search.

Putting the PIE together

While a search strategy provides the reviewer with all the ingredients necessary for a comprehensive PIE, what is necessary for any successful recipe is the correct method for combining the ingredients together.

When commencing academic teaching in 2008, one of the authors (EC) encouraged students while formulating their PIE's, to articulate their clinical reasoning as a method of securing intersubjectivity.^{34,47,48} EC reminded the students that they were communicating for shared understanding, and instructed them to reflect on three deceptively complex questions in relation to the radiographs they reviewed. Where one or more radiographic appearances were identified by the reviewer as abnormal; What was the abnormality? Where (exactly) was it? And since an appreciation of fracture morphology is recognised as being beneficial in the diagnosis and subsequent management, What was the abnormality doing? They proposed that the answers to these questions

allow the reviewer to decide whether, on balance, the individual abnormalities identified, represented traumatic pathology or not. What, Where and What is it doing? formed the basis of a communication model that became known as WWW.

Within the authors' practice in the context of the Australian public health system, SBASS and WWW were introduced together as an educational model in 2013. They are intended to be taught and applied together. The point of difference and purpose is to teach and practice interprofessionally; learning about, from and with each other.⁴⁹ SBASS and WWW are described in more detail below.

How to do it

SBASS: undertake a systematic search

A search strategy is only as good as the radiographic series provided. The radiographs must be assessed for diagnostic quality prior to any pathological review. As a minimum, two technically adequate, orthogonal views (90° to one another) to include the joint nearest the injury should be included. Assessing radiographic quality is outside the scope of this discussion.

The SBASS search strategy (see Figure 1) was devised to be easy to remember, simple, methodical in its application and systematic by design. It only applies to musculoskeletal trauma radiographs and should not be used to assess chronic and degenerative disease and benign or malignant lesions.

S – Soft tissues

Soft tissue structures are well demonstrated in digital radiography but are easy to disregard when obvious and more significant abnormalities are visible in the bones and/or joints. With this mnemonic, reviewers are directed to evaluate the soft tissue before reviewing any other regions on the radiograph. Assessing the soft tissue forces the reviewer to the periphery of the image, where clues to

S: Soft Tissue
B: Bones
A: Alignment of joints
SS: Satisfaction of Search

Figure 1. The systematic search strategy SBASS.

technical adequacy and trauma patho-mechanics are often present. Soft tissue findings can serve to localise the site of a subtle injury and can also aid in differentiating bony abnormalities as acute, chronic or a normal variant. The soft tissue findings to search for include localised or generalised soft tissue swelling, joint distension, obliteration of muscle/fat interfaces, displacement or effacement of fat pads and presence of foreign bodies or air (see Figure 2).

B - Bones

When searching for fractures, the reviewer must first trace the outline of each bone on each projection, assessing the integrity of the cortex (see Figure 3). Examining the entire cortical surface, while tedious, is the only way to ensure subtle fractures are not missed and that normal variants such as nutrient foramina are not misinterpreted. Next, the internal anatomy (trabecular pattern) of each bone must be scrutinised for any disruptions such as linear radiolucencies that may represent a displaced fracture or sclerotic (radiopaque) lines that may indicate an impacted fracture or overriding fracture fragments.

A – Alignment of joints

It is important to assess the integrity of each joint that is demonstrated on each radiograph (see Figure 4). The authors suggest always starting in the same region on the radiograph (e.g. bottom left corner) and then methodically reviewing each joint. While most joints are represented radiographically by two, approximately parallel articular surfaces, there are a number of different joint types with differing ranges of normal motion and joint space widths. Reviewers must be confident in normal radiographic anatomy. It is not recommended to decide upon the presence or absence of joint pathology from a single radiographic projection; always inspect at least two orthogonal projections.

SS – Satisfaction of Search

It is not uncommon for two or more abnormalities to be present on one radiograph. Often, once the first abnormality is identified, concomitant abnormalities are overlooked. As discussed previously, when interpreting radiographs, it is imperative that the systematic search continues despite the identification of an initial

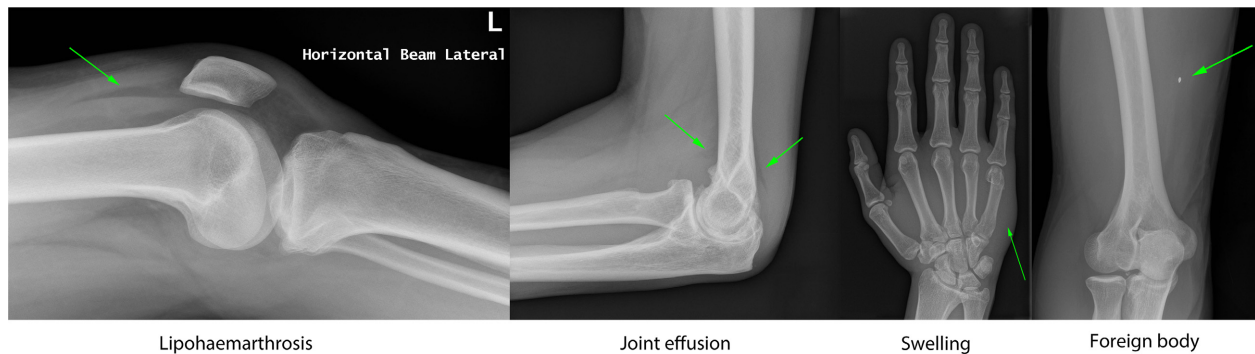


Figure 2. Soft tissue abnormalities that may be identified.

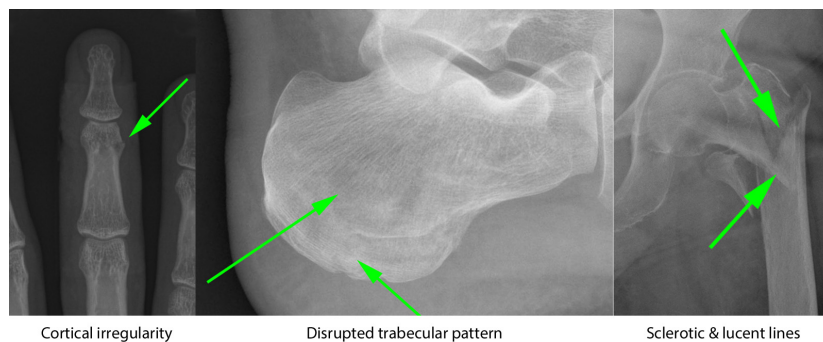


Figure 3. Bony abnormalities that may be identified.



Dislocation

Subluxation

Diastasis

Figure 4. Joint alignment abnormalities that may be identified.

abnormality. In the context of SBASS, satisfaction of search means ‘parking’ each abnormal finding as it is identified and continuing the search until each radiograph has been comprehensively reviewed.

WWW: describe the findings

Applying SBASS thoroughly helps the reviewer identify whether the radiographs are normal or if a collection of abnormal appearances have indicated traumatic pathology. The next step is to communicate the findings accurately. This part of the interpretation process has been described as challenging by numerous authors.^{24,50} The authors of this article have found that novices tend to be verbose in their description with many reviewers providing a disjointed and/or confusing message when trying to describe a traumatic pathology.

In an effort to address this, and ensure an increased level of intersubjectivity, or shared understanding, the authors discourage the use of medical eponyms. While common practice, the inaccurate application or interpretation of eponymous titles such as Colles’, and Bennett’s to describe traumatic pathology, may in fact give rise to misunderstanding between members of the interprofessional team. The WWW communication model encourages the reviewer instead, to generate a discrete list of descriptive terms relevant to the traumatic pathology identified. (see Figure 5).

W: What is it?

W: Where is it?

W: What is it doing?

Figure 5. The WWW approach to describing pathology.

What Is It?

Broadly classify the pathology

The first stage of describing any traumatic pathology is to broadly classify it. Is it a fracture, a joint disruption, a soft tissue injury or a foreign body?

Where Is It?

Localise the pathology accurately

The next stage is to state where exactly, the pathology is located. Which bone(s) is/are involved, which part of that bone or which joint(s) is/are involved. Having an in-depth anatomical knowledge is vital to be able to accurately locate (or localise) the pathology.

What Is It Doing?

Identify the key features of the pathology

The final stage is to identify the key components of the pathology. This important step contributes towards defining patient management by highlighting the prognostic significance of the injury. If the pathology is a fracture, features to consider include the following: Is it simple or multi-part? Does it involve a joint? The direction or composition of the fracture (e.g. oblique and spiral) and whether it is displaced, angulated and/or rotated. In general, describe the displacement, angulation or rotation of the distal fracture fragment relative to the proximal, with the patient in anatomical position. If the pathology is a joint disruption, identify the direction of movement of the distal articular surface (e.g. anterior dislocation).

Having identified the applicable terms, the reviewer can now formulate their PIE. Start the PIE with the side and site of the radiograph (e.g. Right Wrist), bullet point multiple or complex injuries and try to restrict the

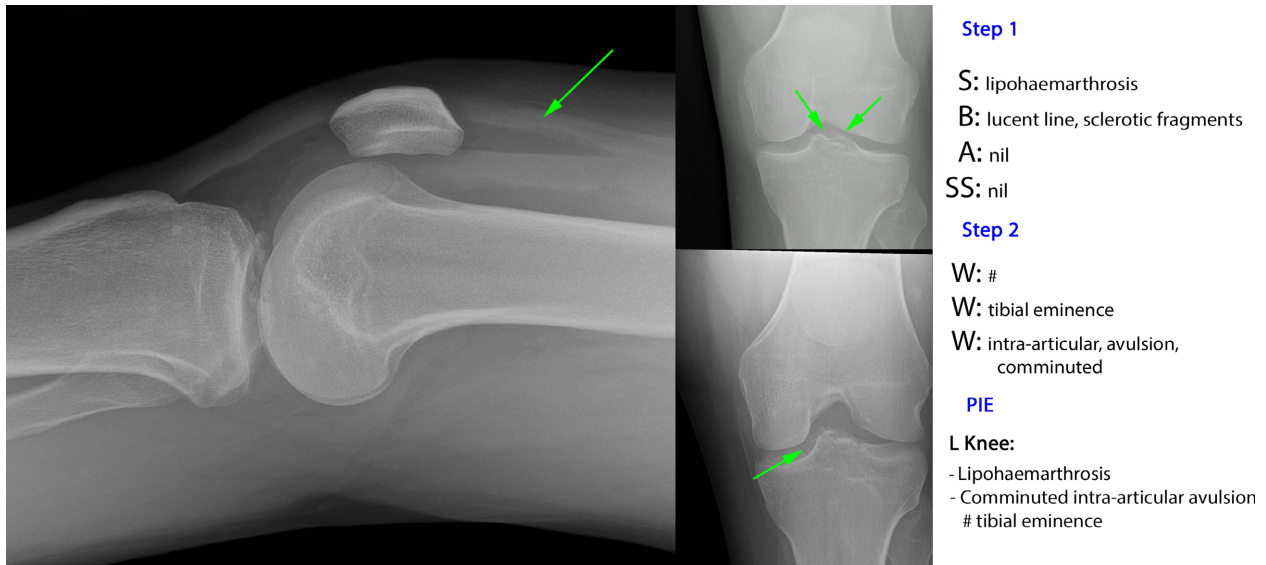


Figure 6. Formulating a PIE using SBASS and WWW.

number of times 'there is', 'in', 'and' and 'of the' are used (see Figure 6).

Future Research

The effectiveness of the SBASS and WWW educational model has been demonstrated in the multi-disciplinary teaching environment, however, has not yet been assessed in clinical practice and warrants consideration as an area for future research.

Importantly, the concepts described in this article resonate with the broad theoretical underpinning of clinical reasoning. In contrast to other professions including medicine, nursing, paramedicine and many of the allied health professions,⁵¹ references to clinical reasoning and intersubjectivity are largely absent in the field of radiography and represents an area of interest moving forward.

Conclusion

An accurate, timely interpretation of a radiograph is vital in the emergency setting and circumstances may dictate that one or more non-radiologist reviewers will be involved in the preliminary image evaluation. To minimise the likelihood of errors in both the identification and communication of traumatic pathology, radiographic image interpretation should be comprehensive and systematic, while the description should be accurate, concise and uniformly understood. This article has described a recipe comprising a search strategy and communication model to help reviewers achieve these aims.

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