Imaging of Finger Injuries: A Practical Approach for Radiologists

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Finger injuries are extremely common, particularly in sports, occupational accidents and falls. Despite the small size of the injured structures, their functional consequences can be substantial. A few millimeters of tendon retraction, an inconspicuous avulsion fracture or an unrecognized ligament injury may result in chronic instability, loss of motion or permanent deformity.

Imaging is challenging because the fingers contain numerous small bones, joints, tendons, pulleys, ligaments and neurovascular structures within a very limited volume. Standard radiographs remain the first-line examination, but high-resolution ultrasound has become particularly valuable for superficial soft-tissue injuries, while MRI provides a comprehensive assessment when the diagnosis remains uncertain. CT is mainly useful for complex intra-articular fractures. The principal limitation of all imaging techniques is operator dependence; clinical examination in good hands can be very fruitful.

For the radiologist, the objective is not simply to identify a fracture. The key questions are: Which structure has failed? Where has it failed? Is the joint stable? Is there an avulsion fragment? And is surgical treatment potentially required?

Start with radiographs—but obtain the correct views

Conventional radiography remains the cornerstone of acute finger trauma. At least two orthogonal views are required, and an additional oblique view is frequently useful. Poor positioning can conceal small avulsion fractures or joint incongruity.

The radiologist should systematically assess cortical continuity, joint alignment and articular surfaces. Small bone fragments should never be dismissed as clinically insignificant before determining their origin.

In finger trauma, a tiny fragment may represent the footprint of a major soft-tissue injury. This leads to a fundamental rule: When you see a small avulsion fragment, identify the structure that normally attaches there. A small dorsal fragment at the base of the distal phalanx suggests terminal extensor tendon avulsion; a volar fragment at the base of the middle phalanx suggests volar plate injury; and a fragment adjacent to a collateral ligament insertion suggests ligament avulsion. Thus, radiographs frequently provide an indirect map of the injured soft tissues.

Ultrasound: an ideal tool for finger trauma

The fingers are exceptionally well suited to ultrasound because the relevant structures are superficial and can be examined with very high-frequency transducers. Ultrasound allows direct assessment of flexor and extensor tendons, pulleys, collateral ligaments and volar plates.

Importantly, it also provides dynamic information. A tendon can be followed during active or passive flexion and extension. Tendon discontinuity, retraction and abnormal motion can be demonstrated directly. Pulley insufficiency can be assessed dynamically by looking for bowstringing during resisted flexion.

Ultrasound also allows comparison with the contralateral finger, which is particularly useful for subtle ligamentous and pulley abnormalities. Knowledge of anatomy is essential, and the radiologist should resist focusing only on the painful point. The entire functional structure should be examined.

MRI: excellent overview, but resolution matters

MRI provides excellent soft-tissue contrast and can simultaneously evaluate bone marrow, cartilage, tendons, ligaments and surrounding tissues. However, finger MRI is technically demanding. Small field-of-view imaging, dedicated coils and thin slices are required. High-resolution imaging is much more important than extensive anatomical coverage.

MRI is particularly useful for occult fractures, complex ligament injuries, suspected tendon abnormalities when ultrasound is inconclusive, and persistent pain after apparently minor trauma. Bone marrow edema can reveal an occult fracture or identify the site of impact, thereby helping reconstruct the mechanism of injury. Nevertheless, MRI should not automatically replace ultrasound. For many superficial tendon and pulley injuries, dynamic high-resolution ultrasound provides information that static MRI cannot.

Mallet finger: look at the distal interphalangeal joint

Mallet finger results from disruption of the terminal extensor mechanism at its insertion on the dorsal base of the distal phalanx.The injury may be purely tendinous or associated with an avulsion fracture.

Radiographs are essential because the size of the bony fragment and the presence of volar subluxation of the distal phalanx influence management. Ultrasound can demonstrate terminal tendon discontinuity, thickening, retraction or an associated avulsion fragment. MRI is rarely necessary in straightforward cases. The radiologist should specifically assess joint alignment rather than merely reporting the presence of a small dorsal fragment.

Central slip injury and boutonnière deformity

Injury to the central slip of the extensor mechanism at the proximal interphalangeal (PIP) joint can initially be subtle. If unrecognized, progressive imbalance of the extensor apparatus can produce a boutonnière deformity, characterized by PIP flexion and distal interphalangeal hyperextension.

Ultrasound can directly assess the central slip insertion at the dorsal base of the middle phalanx and may demonstrate disruption or avulsion. MRI can also demonstrate the lesion, but clinical examination and dynamic ultrasound are often highly complementary. Early diagnosis matters because the deformity may not yet be present during the acute phase.

Jersey finger: do not miss flexor tendon retraction

Jersey finger results from avulsion of the flexor digitorum profundus (FDP) tendon from the volar base of the distal phalanx, typically following forced extension of an actively flexed DIP joint. The patient loses active DIP flexion.

Radiographs may be normal if no bone fragment is present.This is where ultrasound becomes particularly valuable. It can rapidly demonstrate tendon discontinuity and, critically, determine the level of tendon retraction. The location of the retracted tendon has implications for surgical management.

MRI can provide the same anatomical information but is usually less immediately accessible and lacks the dynamic advantage of ultrasound. The important imaging question is therefore not simply *"Is the FDP torn?"* but: "Where is the proximal tendon stump?"

Volar plate injuries: a common PIP lesion

Hyperextension injuries of the PIP joint frequently damage the volar plate. Radiographs may demonstrate a small avulsion fragment from the volar base of the middle phalanx. More severe injuries may be associated with dorsal subluxation or dislocation.

Ultrasound can demonstrate thickening, partial tearing or complete disruption of the volar plate and can assess the relationship of the injured structure to the joint dynamically.

MRI provides excellent anatomical demonstration but is usually reserved for complex or unclear cases.

Collateral ligament injuries: location and stability matter

Collateral ligament injuries may involve the MCP or interphalangeal joints. Radiographs should first exclude avulsion fractures and demonstrate joint alignment. Stress radiographs are less commonly required when clinical or ultrasound assessment can establish instability.

On ultrasound, a normal collateral ligament appears as a compact fibrillar structure. Injury may produce thickening, hypoechogenicity, partial discontinuity or complete rupture. Dynamic examination under gentle stress may demonstrate abnormal widening but should be performed cautiously in acute trauma.

MRI is useful when several stabilizing structures are injured or when the clinical and ultrasound findings disagree. As elsewhere in musculoskeletal imaging, simply identifying increased signal within a ligament is insufficient. The radiologist should determine whether fibers remain continuous and whether the joint remains mechanically stable.

Pulley injuries: think dynamically

Flexor tendon pulley injuries are particularly important in climbers but they also occur in the general population after forced flexion against resistance. The A2 (mid P1) and A4 (mid P2) pulleys are biomechanically important because they maintain the flexor tendons close to the phalanges. Rupture allows separation of the tendon from the bone—bowstringing.

Radiographs are generally normal. Ultrasound is particularly effective because the distance between the flexor tendon and phalanx can be evaluated dynamically during resisted flexion. This can reveal pulley insufficiency that is inconspicuous at rest.

MRI can directly demonstrate pulley abnormalities and associated edema, but static examination may underestimate functional bowstringing.

Sagittal band and extensor tendon instability

At the MCP joint, sagittal band injuries can result in instability or subluxation of the extensor tendon. The abnormality that is transverse displacement of the extensor tendon may only become apparent during flexion. Dynamic ultrasound is therefore particularly valuable. The extensor tendon can be observed during repeated MCP flexion and extension, demonstrating abnormal displacement relative to the metacarpal head. A static MRI performed with the finger extended may appear relatively normal. This is another example in which understanding the patient's clinical complaint should determine the imaging technique.

Fracture-dislocations: CT may be necessary

PIP fracture-dislocations can be complex, particularly when the articular surface of the middle phalanx is involved. Radiographs establish the diagnosis, but CT may be useful for defining fragment size, impaction and articular congruity when surgical reconstruction is considered. Similarly, complex fractures of the phalangeal heads or bases may benefit from CT assessment. The key issue is not simply fracture detection but restoration of a congruent articular surface. Small articular abnormalities in the fingers can have disproportionately large functional consequences.

For all these lesions, attention should be paid to the time delay between the trauma and the radiological investigation. Lesions investigated several weeks after trauma may be more difficult to fully explore.

Conclusion

Finger trauma demonstrates why the importance of an imaging abnormality cannot be judged by its size. A tiny avulsion fragment may indicate complete tendon or ligament failure, while a radiographically normal finger may contain a clinically important tendon rupture. Radiography, ultrasound, CT and MRI should therefore be regarded as complementary rather than competing techniques.

Radiographs demonstrate bone and alignment. CT defines complex articular fractures. MRI provides comprehensive assessment of bone marrow and soft tissues. High-resolution ultrasound adds something particularly valuable in the fingers: the ability to watch the injured structure move. Ultrasound also enables to compare with adjacent or contralateral fingers.