INTRODUCTION:

Computed tomography (CT) may be used for the diagnosis, evaluation and management of conditions of the hand, wrist, elbow and shoulder. CT is not usually the initial imaging test, but is performed after standard radiographs. CT is used for preoperative evaluation, or to evaluate specific abnormalities of the bones, joints and soft tissues of the upper extremities.

INDICATIONS FOR UPPER EXTREMITY CT (HAND, WRIST, ARM, ELBOW OR SHOULDER) (plain radiographs must precede CT evaluation):

Evaluation of suspicious mass/tumor (unconfirmed cancer diagnosis):
• Initial evaluation of suspicious mass/tumor found on an imaging study and needing clarification or found by physical exam and remains non-diagnostic after x-ray or ultrasound is completed.
• Suspected tumor size increase or recurrence based on a sign, symptom, imaging study or abnormal lab value.
• Surveillance: One follow-up exam if initial evaluation is indeterminant and lesion remains suspicious for cancer. No further surveillance unless tumor is specified as highly suspicious, or change was found on last imaging.

Evaluation of known cancer:
• Initial staging of known cancer in the upper extremity.
• Follow-up of known cancer of patient undergoing active treatment within the past year.
• Known cancer with suspected upper extremity metastasis based on a sign, symptom, imaging study or abnormal lab value.
• Prior cancer surveillance: Once per year (last test must be over 10 months ago before new approval) for surveillance of known cancer.

For evaluation of known or suspected infection or inflammatory disease: (e.g. osteomyelitis) and MRI is contraindicated or cannot be performed:
• Further evaluation of an abnormality or non-diagnostic findings on prior imaging.
• With abnormal physical, laboratory, and/or imaging findings.
• Known or suspected (based upon initial workup including imaging) septic arthritis or osteomyelitis.

For evaluation of suspected (AVN) avascular necrosis (e.g., aseptic necrosis, Legg-Calve-Perthes disease in children) and MRI is contraindicated or cannot be performed:
• Further evaluation of an abnormality or non-diagnostic findings on prior imaging.
For evaluation of suspected or known Auto Immune Disease, (e.g. Rheumatoid arthritis) and MRI is contraindicated or cannot be performed:
• Known or suspected auto immune disease and ordered by an orthopedist or rheumatologist and non-diagnostic findings on prior imaging.

For evaluation of known or suspected fracture and/or injury:
• Further evaluation of an abnormality or non-diagnostic findings on prior imaging.
• Suspected fracture when imaging is negative or equivocal.
• Determine position of known fracture fragments/dislocation.

For evaluation of persistent pain, initial imaging (e.g. x-ray) has been performed and MRI is contraindicated or cannot be performed:
• Chronic pain and/or persistent tendonitis unresponsive to conservative treatment*, which include medical therapy (may include physical therapy or chiropractic treatments) and/or physician supervised home exercise** of at least four (4) weeks.

Pre-operative evaluation:

Post-operative/procedural evaluation:
• When imaging, physical, or laboratory findings indicate joint infection, delayed or non-healing, or other surgical/procedural complications.
• A follow-up study may be needed to help evaluate a patient’s progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other indications for an Upper Extremity (Hand, Wrist, Arm, Elbow, or Shoulder) CT:
• Abnormal bone scan and x-ray is non-diagnostic or requires further evaluation.
• CT arthrogram when ordered by orthopedic specialist, surgeon or primary care provider on behalf of specialist and MRI is contraindicated or cannot be performed.
• To assess status of osteochondral abnormalities including osteochondral fractures, osteochondritis dissecans, treated osteochondral defects where physical or imaging findings suggest its presence and MRI is contraindicated or cannot be performed.

Additional indications for Shoulder CT:
• For any evaluation of patient with shoulder prosthesis or other implanted metallic hardware where prosthetic loosening or dysfunction is suspected on physical examination or imaging.
• Evaluation of recurrent dislocation and MRI is contraindicated or cannot be performed.
• For evaluation of brachial plexus dysfunction (brachial plexopathy/thoracic outlet syndrome) and MRI is contraindicated or cannot be performed.
• For evaluation of known or suspected impingement, rotator cuff tear, or labral tear (SLAP lesion, Bankart lesion) when ordered by orthopedic specialist and MRI is contraindicated or cannot be performed.
• Known or suspected impingement or when impingement test is positive and is ordered by orthopedic surgeon and MRI is contraindicated or cannot be performed.
• Impingement or rotator cuff tear indicated by positive Neer’s sign, Hawkin’s sign or drop sign and MRI is contraindicated or cannot be performed.
• Status post prior rotator cuff repair with suspected re-tear and findings on prior imaging are indeterminate and MRI is contraindicated or cannot be performed.

When additional indications for Wrist CT and MRI are contraindicated or cannot be performed:
• For evaluation of suspected ligament injury with evidence of wrist instability on examination or evidence of joint space widening on x-ray
• For suspected TFCC (triangular fibrocartilage complex) injury when ordered by orthopedic specialist or primary care physician on behalf of the specialist.

ADDITIONAL INFORMATION RELATED TO UPPER EXTREMITY CT:

*Conservative Therapy*: (musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices, (such as crutches, immobilizer, metal braces, orthotics, rigid stabilizer or splints, etc and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician supervised home exercise program, and/or chiropractic care. NOTE: for joint and extremity injuries, part of this combination may include the physician instructing patient to rest the area or stay off the injured part.

**Home Exercise Program - (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:
• Information provided on exercise prescription/plan AND
• Follow up with member with information provided regarding completion of HEP (after suitable 4 week period), or inability to complete HEP due to physical reason - i.e. increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).

CT to Evaluate Shoulder Pain – The initial work-up for chronic shoulder pain includes plain radiographs. When the diagnosis remains unclear, further testing including may include computed tomography. CT is the preferred imaging technique for evaluating bony disorders of the shoulders, e.g., arthritis, tumors, occult fractures, etc. CT may be useful in patients with suspected rotator cuff tears who cannot undergo magnetic resonance imaging (MRI).

Shoulder Dislocation – Glenoid bone loss occurs in anterior shoulder dislocation. Severe degrees of glenoid bone loss are shown on axial radiography, but it can be quantified more definitively using CT. This information is important as it helps to predict the likelihood of further dislocation and the need for bone augmentation surgery. The number of dislocations can not reliably predict the degree of glenoid bone loss; it is important to quantify glenoid bone loss, initially by arthroscopy and later by CT. In the CT examination, both glenoids can be examined simultaneously resulting in a comparison of the width of the glenoid in the dislocating shoulder and in the nondislocating shoulder.
**Shoulder fractures** – CT may be used to characterize shoulder fractures when more information is needed preoperatively. CT can show the complexity of the fracture, and the displacement and angulation.

**CT and Wrist Fractures** – CT is indicated for wrist fractures where there is fracture comminution, displacement, or complex intraarticular extension. CT can provide a detailed evaluation of radiocarpal articular step-off and gap displacement which can predict the development of radiocarpal osteoarthritis. CT can be performed in several planes, providing soft-tissue and bone detail. CT is also useful in determining the position of known fracture fragments and in assessing the union or status of fracture healing.

**CT for Preoperative Evaluation** – Where more information is needed preoperatively, CT is used to demonstrate fracture complexity, displacement and angulation.

**CT and Scaphoid Fractures** – CT is accurate in depicting occult cortical scaphoid fractures. It may be used as a second choice diagnostic method when patients are clinically suspected of having a scaphoid fracture but radiographs are negative or equivocal.

**CT and Avascular Necrosis Complicating Chronic Scaphoid Nonunion** – Preoperative CT of a scaphoid nonunion may be helpful in identifying avascular necrosis and predicting subsequent fracture union. If the results of CT suggest avascular necrosis, treatment options may include vascularized bone grafts or limited wrist arthrodesis.

**Occult Scaphoid Fractures** – Usually the diagnosis of a scaphoid fracture of the wrist is based upon clinical presentation and conventional radiographs. However, a large percentage of patients with a high clinical probability of a scaphoid fracture have unremarkable radiographs. Computed tomography (CT) is another diagnostic tool for patients who have symptoms of a scaphoid fracture but have negative findings on conventional radiographs. Multidetector CT allows coverage of the whole wrist with excellent spatial resolution. It has been proved to be superior to MRI in the detection of cortical involvement of occult scaphoid fractures.

**CT and Posttraumatic Elbow Effusions** – Multidetector computed tomography (MDCT) may help to detect occult fractures of the elbow when posttraumatic elbow effusions are shown on radiographs without any findings of fracture. Effusions may be visualized on radiographs as fat pads, which can be elevated by the presence of fluid in the joint caused by an acute fracture. MDCT may be useful when effusions are shown on radiographs without a visualized fracture, but there is a clinical suspicion of a lateral condylar or radial head fracture.

**CT and Avascular Necrosis** – Sports such as racquetball and gymnastics may cause repeated microtrauma due to the compressive forces between the radial head and capitellum. Focal avascular necrosis and osteochondritis dissecans of the capitellum may result. CT may show the extent of subchondral necrosis and chondral abnormalities. The images may also help detect intraarticular loose bodies.

**CT and Acute Osseous Trauma** – Many elbow injuries result from repetitive microtrauma rather than acute trauma and the injuries are sometimes hard to diagnose. Non-displaced
fractures are not always evident on plain radiographs. When fracture is suspected, CT may improve diagnostic specificity and accuracy.

**CT and Wrist Tumor** – Osteoma does not often occur in the wrist. Symptoms may resemble atypical tenosynovitis. Pain may seem to be related to an injury. CT may be used to evaluate a suspected tumor and may visualize a round lucency surrounded by a rim of sclerosis. CT can give details about the location of the tumor, relative to joints.

**Upper Extremity Osteomyelitis and Septic Arthritis** – CT helps to distinguish among the types of musculoskeletal infections. Its specific imaging features help identify the forms of infection in the bones and soft tissue. Osteomyelitis, a bone infection most commonly associated with an open fracture of direct trauma, is often not detected in the initial conventional radiographic evaluation because bone changes are not evident for 14-21 days after the onset of infection. CT is also used to help diagnose septic arthritis; CT features include joint effusion and bone erosions around the joint.
REFERENCES:


