34 Rheumatoid and Other Arthritis of the Wrist and Hand

Gregory R. Mack and Dori J. Neill Cage

34.1 Introduction

Understanding the changes which occur in the hands and wrists with arthritis is essential for performing a comprehensive physical exam of these areas. Osteoarthritis, rheumatoid arthritis, crystalline arthropathy, psoriatic arthritis, and Systemic Lupus Erythematosus (SLE) have characteristic physical examination features. Hand and wrist changes may be the initial presenting abnormalities, and critical examination can frequently lead to a diagnosis.

Understanding the changes seen with inflammatory, crystalline, and other wrist and hand arthritis is important not only for physicians performing surgical treatment on these patients, but also for the physician evaluating the patient for possible infection, fracture, or dislocation. The changes seen in wrist and hand arthritis may mimic infection with warmth, swelling, and erythema. Bony erosions and structural deformities may mimic fractures and traumatic dislocations. Atraumatic dislocations may occur from rheumatoid arthritis and SLE, as well as advanced basilar thumb osteoarthritis. Treatment of a chronic arthritic dislocation involves correction of the underlying deformity and is addressed differently than an acute traumatic dislocation.

G. R. Mack (✉) · D. J. Neill Cage
San Diego Hand Specialists, San Diego, CA, USA

34.2 Common Features of Wrist and Hand Arthritis

Different types of arthritis affect the wrist and hand in unique ways. Osteoarthritis affects primarily the distal interphalangeal (DIP) joints and thumb carpal metacarpal (CMC) joint. Less often it involves the proximal interphalangeal (PIP) and wrist scaphotrapeziotrapezoidal (STT) joints. Joint enlargement occurs at the distal interphalangeal joints with loss of full DIP joint extension, and mucous cysts may be present with associated nail grooves. Osteoarthritis can also affect the proximal interphalangeal joints with limitation of range of motion, angular deformities, and pain. Arthritis of the base of the thumb has a higher prevalence in women but occurs frequently in both males and females. Basilar thumb arthritis physical examination features include deformity at the base of the thumb, enlargement of the thumb carpometacarpal joint, dorsal subluxation of the base of the metacarpal, and adduction contracture. Carpometacarpal grind testing axially loads the carpometacarpal joint and rotates the metacarpal, eliciting crepitus and pain. Osteoarthritis typically does not involve significant soft tissue swelling about the joints although variants known as inflammatory osteoarthritis do occur and have components that mimic inflammatory arthritis. Osteoarthritis generally does not involve the metacarpal phalangeal joints, whereas hemochromatosis and calcium

J. G. Lane et al. (eds.), *The Art of the Musculoskeletal Physical Exam*,
https://doi.org/10.1007/978-3-031-24404-9_34

pyrophosphate disease (CPPD) may result in osteoarthritis of the metacarpal phalangeal joints on the radial hand, mainly involving the index and long fingers.

Pseudogout occurs most frequently in the wrist with pain and swelling and mimics infection. As the treatment of pseudogout is nonoperative, it is important to be able to differentiate its inflammation from infection. Pseudogout generally occurs in older individuals and causes localized warmth and swelling without red streaking up the arm, fever, or systemic symptoms.

Gout is less common in the upper than the lower extremities. Like pseudogout, gout may present with wrist and finger swelling. Gouty tophi may erode soft tissue and give the appearance of a draining infection; they may also develop secondary infections. Gout may also cause thickening of the flexor tendon sheath and can result in flexor and extensor tendon ruptures. Physical examination of a finger with gout will demonstrate firm thickening which is generally irregular and can involve erosions with white granular crystals visible.

Psoriatic arthritis has many overlapping features with osteoarthritis, affecting primarily the distal interphalangeal joints. Nail pitting and patches of psoriasis are classic features of psoriatic arthritis. The so-called sausage finger swelling is a more advanced finding seen in psoriatic arthritis and can mimic infection.

Systemic lupus erythematosus has many of the same features as rheumatoid arthritis in terms of hand deformities by physical exam but tends to have less joint destruction on radiographs. Thinning of the fingertips, ulcerations of the distal digits, and tightening of the skin are all features seen in SLE.

34.3 Rheumatoid Arthritis

Rheumatoid arthritis is an inflammatory disease which presents with synovitis of the joints and tendons causing characteristic patterns of deformity. Examination of the hand with rheumatoid arthritis must not only address the patient's functional complaints but also be comprehensive in its scope. Patients with arthritis may present with specific complaints but are also at risk for further functional difficulties. Rheumatoid arthritis and its related conditions are progressive in nature, and understanding the basic pathomechanics is key to recognizing specific clinical patterns and identifying critical physical findings.

Patients with rheumatoid arthritis experience functional difficulties due to joint damage, soft tissue attenuation, ligament rupture, and/or tendon subluxation. These factors contribute to the imbalance of the dynamic forces which maintain the posture of the wrist, fingers, or thumb. As a result, pinch and grasp are affected, and activities of daily living are compromised. While multiple deformities may present in the same hand, there are predominant patterns which affect basic hand functions. A systematic approach to the patient will simplify the physical examination, bringing to light not only the basis for the patient's present complaints but also elements to be considered for future care.

34.4 General Considerations

Examination of the patient with arthritis is best preceded by a clear and relevant history including the duration of the disease, joints affected in all four limbs, spinal involvement, treatment to date, and the reason for the present visit.

For the hand and upper extremity, the initial examination is best done systematically. Proximal issues at the shoulder, elbow, or forearm may significantly limit upper extremity function and need addressing. Distal problems of the wrist or hand may adversely affect proximal function, for example, wrist or forearm stiffness which may lead to compensatory maladaptive postures at the shoulder.

The essential steps of evaluation include measurement of range of motion, identification of specific findings and deformities, functional assessment of current findings, and anticipation of further progression of hand impairment.

Findings in the rheumatoid hand are generally bilateral and frequently symmetrical. The patient presenting with problems on the one hand will

invariably have findings on the other, even if asymptomatic. Similarly, deformities of the digit are rarely confined to a single finger. In every stage of the disease, rheumatoid arthritis effects will usually be generalized.

34.4.1 Range of Motion

It is important to measure joint range of motion at the initial evaluation for both a current assessment and to provide a baseline against which progression of disease and deformity may be identified at future examinations.

Measurements are recorded bilaterally and in a systematic fashion. Our practice is to record standard measurements at the shoulder, elbow, forearms, wrists, thumbs, and fingers in a proximal to distal order, entering values as right/left. Following a consistent order and using preprinted diagrams or electronic macros ensures accuracy and minimizes omission of potentially helpful values and documentation of deformities.

Joint range of motion will determine which specific surgical procedures will be predictable choices for a given deformity. Depending on the degree of contracture, flexion or extension contractures of the MP or PIP joints may be treated with capsulotomy. For example, PIP contractures of 30° or less may not be substantially improved by volar capsulotomy. Extension contracture of the PIP joint is more likely to benefit from contracture release when it involves 60° or less of flexion than for contractures which allow 60° or more of flexion. The functional gains of addressing an extension contracture which already allows 60 degrees of PIP flexion are not predictable. Similar criteria are helpful for decision-making at the MCP joint.

34.5 Identification of Findings and Deformities

In a single hand, a patient may demonstrate swan neck deformity, boutonniere deformity, joint crepitus, joint subluxation, joint instability, and tendon rupture. Each will need to be assessed and documented. Clear and accurate documentation of findings, deformities, and their severity provides the basis on which treatment decisions are based.

Assessment of joint laxity, instability, subluxation, and dislocation is essential to evaluation of the rheumatoid hand. Although any joint may be affected, the most common joint disruptions include dorsal displacement of the distal ulna, supination deformity of the carpus with respect to the forearm, volar-ulnar subluxation or dislocation of the MCP joints of the fingers, and joint abnormalities associated with boutonniere or swan neck deformities of the fingers or thumb.

34.6 Functional Assessment

The deformities alone do not constitute indications for surgical treatment unless the surgical procedures being considered are predictably expected to improve function or decrease pain that is unresponsive to conservative treatment. The broader goal of evaluation is to identify functional impairments and to direct treatment to preserve versus restore hand capabilities.

A quick functional assessment can be made by evaluating the patient's ability to pinch and grasp. The patient may be asked to make a circle by pinching the tip of the thumb against the index finger, holding it firmly as the examiner tries to "break" the circle. Similarly, the patient may be asked to demonstrate grasping a glass-size object. With these simple maneuvers, the examiner may observe the effectiveness of pinch and grasp for their mobility, strength, and prehension.

Pinch and grasp require movement of the thumb from the radial side of the hand to oppose and contact a finger or fingers from the ulnar side. This requires stability of the thumb and opposing fingers to generate strength and position to be effective. The strength with which the two sides oppose each other will be limited by the weaker of the two. Position is determined by the patient's voluntary ability to flex, close, and oppose the thumb to the finger or fingers, and his or her ability to voluntarily open the hand. In rheumatoid

arthritis, this ability may be limited by joint damage or contracture, digital deformity, and/or weakness. Before a patient can grasp and lift a glass, he or she needs to expand the hand beyond the object's diameter. The elements of functional examination thus include assessment of voluntary opening, voluntary closing, effectiveness of opposition, and stability of the digits.

Some patients will be unable to voluntarily extend the fingers for grasp due do tendon ruptures or radial nerve palsy. The patient may then substitute extensor tenodesis function for voluntary finger extension by flexing the wrist.

A third functional capacity of the hand has been termed "hook," in which the fingers as a group can wrap around a handle such as would be found on door, suitcase, or handbag. This requires effective flexion of multiple interphalangeal joints at the same time. The hook function is most effective when full voluntary opening and full voluntary closing are present. For patients with rheumatoid arthritis and swan neck deformities, this function may be possible if those deformities are flexible, but if they are rigid, with PIP extension contractures, hook is impossible. Although this constitutes a significant impairment, loss of pinch and grasp is a far greater loss of functional capacity.

34.6.1 Inspecting the Wrist

Rheumatoid arthritis at the wrist may progress through four stages, including synovitis, instability, subluxation, and joint destruction. The areas which are most susceptible to attrition and secondary instability are the triangular fibrocartilage complex on the ulnar side of the wrist and the scapholunate ligament centrally. The earliest physical finding may be subtle swelling and tenderness of the ulnar fovea (overlying the sacciform recess) or the radiocarpal joint dorsally. Swelling in this area is to be differentiated from swelling due to extensor tenosynovitis. Either may demonstrate crepitus, but tenosynovium will move with the extensor tendons, whereas joint synovium will be less affected by tendon movement. Because both are commonly observed on the dorsum of the wrist, they need to be distinguished from wrist ganglia, which tend to be unilocular and may transilluminate.

Involvement of the TFCC results in increased translocation of the distal ulna in the dorsal-to-volar plane in any of the three standard testing positions. These positions include pronation, supination, and neutral rotation of the forearm.

As synovial disease weakens the critical anchors of the wrist, the consequence of ligament laxity is instability. It is not unusual for a rheumatoid wrist to demonstrate a dorsal intercalary segmental instability (DISI) pattern of deformity. More commonly, the distal ulna displaces and becomes hypermobile when the TFCC gives way and the ulna is disconnected from the ulnar side of the carpus.

As ligament attenuation progresses, the distal ulna may appear to subluxate dorsally. In fact, this abnormal position of the distal ulna is more commonly due to volar displacement of the ulnar side of the carpus, such that the hand and the carpus together as a unit tend to supinate with respect to the forearm. The result is exaggerated prominence of the distal ulna, which appears dislocated in pronation but may return to its proper location when the forearm is brought back to neutral or supination. In addition, the wrist may translocate ulnarly [1].

Unlike traumatic injury, scapholunate ligament laxity in rheumatoid arthritis tends not to present as wrist instability or clicking. Early in the disease, it may be a radiographic finding due to ligament attenuation and thereby a precursor of progressive synovial invasion and joint destruction. In later cases, the swelling and pain of aggressive wrist synovitis and altered radiocarpal relationships, including wrist dislocation and/or contracture, overshadow its involvement.

34.6.2 Fingers

The two classically described deformities of the fingers in rheumatoid arthritis are swan neck deformity and boutonniere deformity [2]. Both occur when the tightness of the intrinsic muscles overpower the stability of the interphalangeal

joints. The joints may also develop instability due to the stress of normal use associated with invasive synovitis, and/or the anti-metabolic effect of arthritis medications, resulting in loss of capsular and ligament integrity. Assessing the finger includes first evaluation of soft tissue imbalances and then an assessment of the joints themselves. X-ray may be necessary.

34.7 Role of the Intrinsic Muscles

Because the intrinsic muscle-tendon units act to flex the MCP joints and extend the proximal and distal interphalangeal joints, they may cause the finger or fingers to assume that position, best described as the intrinsic plus position, at rest. When the tightness of the intrinsic overpower the resistance of the volar capsule of the PIP joint, hyperextension of that joint and a swan neck posture is likely. Rupture of the terminal tendon at the DIP joint may also precipitate or contribute to the development of this deformity. If intrinsic tightness increases over time, the deformity may become rigid.

34.8 Bunnell Test

Intrinsic tightness restricts passive PIP flexion when the MCP joint is concurrently extended. This phenomenon can be measured by first assessing the PIP joint's maximal flexion arc with the MCP flexed, i.e., in the composite "fisting" position. Passively extending the MCP with one of the examiner's hands tenses the intrinsics; normal intrinsic tension allows for a full or comparable degree of PIP flexion in the testing position, but a tight intrinsic will limit passive PIP flexion with the MCP held in extension. This test is especially significant when the test restricts PIP flexion to 60° or less, noting that "normal" PIP flexion is approximately 100°. This test can also be performed in each of three positions in the plane of radial versus ulnar deviation of the MCP joint. Those three positions are the neutral position, radial deviation, and ulnar deviation, allowing selective testing of the relative tension of the intrinsics on the radial versus ulnar side of the finger. Each intrinsic of each finger (radial versus ulnar) should be tested, especially for surgical planning.

34.9 Swan Neck Severity

When arthritis is more advanced, joint involvement and progressively increasing intrinsic tightness allow not only the proximal and distal interphalangeal joints, but also the metacarpal phalangeal joint to be overpowered. The MCP may sublux or dislocate, most commonly in a volar direction and/or ulnarly [3] causing the digits to assume the characteristic intrinsic plus posture, with PIPs extended, MPs flexed with the digits in a straight extended position. Ulnar drift is common with this deformity, and an attempt to do the Bunnell test for intrinsic tightness will usually demonstrate that tightness is greater on the ulnar side of the digit than the radial side. MCP involvement will commonly be addressed by arthroplasty, concurrent with which the ulnar-sided intrinsics are often released by tenotomy. Arthroplasty itself will be expected to partially relax the intrinsic tendon by shortening the "column of the finger" so to speak, which they are tethering.

34.10 Swan Neck Classification

Swan neck deformity develops with a progressive imbalance of forces which lead to increased functional impairment and additional considerations for medical management. Based on severity, there are four types or degrees of swan neck deformity [4].

Type I swan neck deformity. The finger at rest postures in the swan neck position, but PIP flexion is unrestricted in all positions.

Type II swan neck deformity. PIP motion is partially restricted only when the MCP is placed in extension, as demonstrated with the Bunnell test.

Type III swan neck deformity. PIP flexion is limited in all positions.

Type IV swan neck deformity. The PIP joint is not only fixed in extension with substantial restriction of motion, but radiographically there is evidence of joint damage or destruction.

These deformities are easily identified by measuring PIP motion in the "fist" position versus the Bunnell intrinsic testing position and assessing the integrity of the PIP joint. It is important to characterize the severity of this deformity in order to determine whether it will respond to soft tissue surgical procedures alone or will require arthroplasty or fusion of the PIP joint.

34.11 Boutonniere Deformity

Boutonniere deformity occurs when the central slip of the finger's extensor mechanism ruptures or attenuates, causing a loss of PIP extension. The lateral bands migrate volarly and accentuate the deformity by passing volarly to the PIP joint's axis of rotation. Intrinsic strength at the PIP is diminished or lost, causing hyperextension of the DIP joint with loss of DIP flexion.

Boutonniere deformity may be characterized as mild, moderate, or severe [5]. Mild and moderate deformities involve soft tissue alone and may respond to surgical rebalancing of the extensor mechanism. In a mild deformity voluntary loss of PIP extension is 30° or less, such that when the finger itself is extended, compensatory hyperextension of the MCP joint allows the tip of the finger to clear the plane of the palm. If the PIP flexion deformity is greater than 30°, MCP hyperextension may not be sufficient to allow the extended finger to clear the plane of the hand. A mild deformity may be well tolerated. A moderate deformity may interfere with placing a hand in a pocket or performing fine motor activities, and surgical correction is more often necessary. A moderate deformity where the PIP is supple but postures in 30 to 60 degrees of flexion, may respond to rebalancing of the extensor mechanism. In severe boutonniere deformity, loss of PIP extension and DIP hyperextension is not passively correctable.

With boutonniere deformity, it is also important to assess not only the PIP joint contracture but also the compensatory extension posture of the DIP joint. DIP joint hyperextension may preclude opposition of the fingertip to the tip of the thumb for pinch and fine motor activities. Over time, some patients develop a compensatory but abnormal thumb posture which preserves the ability to oppose the two abnormal digits (thumb and finger). Correcting one or more boutonniere deformities may facilitate voluntary opening and closing of the hand for grasp; however, any repositioning of the digit, even to a more "normal," i.e., anatomic position may alter that digit's contribution to pinch.

34.12 Rheumatoid Thumb

Nalebuff and Millender have described three patterns of thumb deformity seen in the rheumatoid hand [6]. Like the fingers, the thumb may develop an imbalance of flexion and extension forces among its three joints, resulting in deformities which are visually and functionally similar to the boutonniere or swan neck deformities of the fingers.

Type I thumb deformity. The type I deformity has the appearance of the boutonniere deformity with flexion of the MCP joint, dorsal hood attenuation, ulnar subluxation of the extensor pollicis longus, and hyperextension of the IP joint.

Type II thumb deformity. In this deformity, the MP is in extension and the IP joint is hyperextended. The CMC joint may be subluxed.

Tape III deformity. This is essentially a swan neck deformity with radial and dorsal subluxation of the CMC joint due to synovial disease. In this pattern, the metacarpal will be in adduction, the MP hyperextends, and the IP joint is drawn into flexion.

A Type IV deformity has also been described in which the ulnar collateral ligament of the MCP joint is attenuated resulting in a skier's thumb gamekeeper's thumb position. Metacarpal adduction aggravates and accentuates deformity.

34.13 Functional Assessment of the Thumb in Rheumatoid Arthritis

Regardless of the pattern of thumb deformity, a complete examination addresses the thumb's functional contribution to grasp and pinch. In the best of circumstances, the thumb provides a stable post for opposition to the finger for pinch and grasp, contributing to those functions by voluntarily extending its joints and flexing with sufficient power to hold and manipulate. When demonstrating opposition, both thumb rotation and the excursion of its joints are important. With soft tissue imbalance/or joint subluxation, the thumb may roll outward into supination, such that only lateral pinch is feasible and the center of its pulp fails to oppose the center of the tactile pad (distal segment) of the fingers.

34.14 Extensor Tendons

In the rheumatoid hand, extensor tendons are at risk for rupture and for subluxation [7]. Rupture of extensor tendons occurs most commonly at the wrist, and subluxation occurs most commonly at the level of the metacarpal phalangeal joints.

Extensor tendon rupture at the wrist may be immediately evident, or it may be a subtle finding obscured by subluxation and flexion contracture of the metacarpal phalangeal joints. Ruptures may be due to direct synovial invasion, mechanical irritation and abrasion, or medication side effects.

Extensor tendon ruptures commonly occur in association with dorsal subluxation of the distal ulna. Rupture of the TFCC due to synovitis may allow the carpus to rotate into a supinated position, which makes the distal ulna relatively more prominent. The extensor tendons are then subject to risk of attritional rupture as they glide over the prominent ulna.

Tendon rupture may present as the isolated extensor lag of a single digit, but even when only one tendon appears to be ruptured it is common for adjacent tendons to be ruptured a well. Extensor lag of the little finger may signal the rupture of extensor digiti minimi and also the extensor digitorum communis tendon to that finger. In that situation, rupture of the extensor digitorum communis tendon to the ring finger should be suspected as well. The adjacent finger may still extend even if its communis tendon is ruptured because the juncturae tendonae may allow it to do so.

34.14.1 Subluxation of Extensor Tendons

Subluxation of the extensor tendons to the fingers is most common at the metacarpal phalangeal joint level. Frequently, this will be associated with subluxation of the MCP joint. The synovitis which attenuates the joint capsule may attenuate the transverse retinacular fibers as well. This results in a flexion deformity of the MCP joint. Although it is logical to assume that lack of finger extension is due to subluxation of both the extensor tendon and the joint, the extensors should still be examined proximally to ensure that they have not ruptured at the level of the wrist.

34.15 Flexor Tendon Rupture

Flexor tendon rupture may occur at the wrist or in the digit, but rupture at the wrist is more common. Rupture is generally due to attrition and invasive synovial disease in the carpal tunnel but may also be associated with bony spurring formation in the wrist itself. Examination for tendon integrity isolates for testing each of the nine digital flexors—the four profundus tendons, the four sublimis tendons, and the flexor pollicis longus. Flexor rupture may also occur within the digit, but it is less common. A flexor ruptured at the wrist will not contribute to digital flexion at any joint level, but this is difficult to differentiate when the intrinsics or adjacent extrinsic flexors are still functional. Most commonly, the flexor pollicis longus and flexor digitorum profundus are affected [8].

34.15.1 Trigger Fingers and Carpal Tunnel Syndrome

Occasionally, a patient with rheumatoid arthritis will present with triggering of one or more fingers and or carpal tunnel syndrome. In the rheumatoid finger triggering may represent the catching of hypertrophic synovium, possibly with a nodular formation, at the A-1 pulley in the distal palm or at the sublimis decussation more distally within the fingers [9]. Similarly, carpal tunnel syndrome may be associated with aggressive flexor tenosynovitis, with limited active flexion in addition to the findings of carpal tunnel syndrome [10]. Hypertrophy of the flexor tenosynovium will be evident in the distal forearm just proximal to the carpal tunnel. Gliding of tenosynovium will move a mass with active flexion and extension of the fingers.

34.16 Summary

Examination of the rheumatoid hand deformity using a systematic approach which documents motion, identified findings, assesses the functional capacities of pinch and grasp, and anticipates progression of deformities will best contribute to the restoration and/or preservation of function. Correspondingly, the skills developed in examination and assessment of the rheumatoid hand will pay rich dividends in the physician's understanding and assessment of other hand problems.

Acknowledgment The authors wish to acknowledge the concepts of Edward Nalebuff and Lewis Millender, whose teaching and publications have identified timeless principles for evaluation of the rheumatoid hand.

References

1. Shapiro JS. The wrist in rheumatoid arthritis. Hand Clin. 1996;12(3):477–98.
2. Rizio L, Belsky MR. Finger deformities in rheumatoid arthritis. Hand Clin. 1996;12(3):531–40.
3. Stirrat CR. Metacarpophalangeal joints in rheumatoid arthritis of the hand. Hand Clin. 1996;12(3):515–29.
4. Nalebuff EA, Millender LH. Surgical treatment of the swan-neck deformity in rheumatoid arthritis. Orthop Clin North Am. 1973;6(3):733–52.
5. Nalebuff EA, Millender LH. Surgical treatment of the boutonniere deformity in rheumatoid arthritis. Orthop Clin North Am. 1973;6(3):753–63.
6. Stein AB, Terrono AL. The rheumatoid thumb. Hand Clin. 1996;12(3):541–50.
7. Wilson RL, DeVito MC. Extensor tendon problems in rheumatoid arthritis. Hand Clin. 1996;12(3):551–9.
8. Ferlic DC. Rheumatoid flexor tenosynovitis and rupture. Hand Clin. 1996;12(3):561–72.
9. Nalebuff EA. Surgical treatment of rheumatoid tenosynovitis in the hand. Surg Clin North Am. 1969;49(4):799–809.
10. Millender LH, Nalebuff EA. Evaluation and treatment of early rheumatoid hand involvement. Orthop Clin North Am. 1973;6(3):697–708.