INTRODUCTION

Auto antibodies are thought to be the major tools of investigating Rheumatological disorders. Beside auto-antibodies, Medical arthroscopy and Musculo-skeletal ultrasound (MSK USS) in the hands of Rheumatologist are newer developments in the diagnostic techniques.

Author was fortunate to have a dedicated joint ultrasound machine with high frequency probe since last 5-6 years. Author could also establish medical arthroscopy programme in the country.

Medical arthroscopy and MSK Ultrasound both have been proved to be important diagnostic tools in the hands of Rheumatologist.

Arthroscopy is an accurate, reliable method for examining the interior structure of joints while there are very few Rheumatologists who are using the technique. The decision to learn arthroscopy is thus individual based.

Flexible scopes for office arthroscopies are being developed that can be used with local anesthesia. It seems entirely possible that all diagnostics arthroscopy will one day be done in an office setting which may overcome most of current reservations that Rheumatologist have about doing this Procedure. A new term medical arthroscopy can be coined for diagnostic arthroscopy used exclusively for arthritis research. This term may differentiate arthroscopy performed by surgeon.

It has become clear in recent past that the synovium is the primary site of inflammation & a major effector organ in a variety of joint diseases including Rheumatoid Arthritis (RA) as a result there had been increased interest in studies of pathological changes of the synovium.

INSTRUMENTS

Arthroscope

An arthroscope is an optical system. Three basic optical systems are used in rigid arthroscopies:

1. The classic thin lens system.
2. Rod lens system
3. The graded index lens system.

The fiber optic arthroscopies generally consist of a rod lens system surrounded by multiple light conducting glass fibrils; enclosed in a specially treated rigid metal sheet. Most important optical characteristics of arthroscope are direction of view of an arthroscope & a line connecting the tip of arthroscope & the center of its field of view. The viewing angle refers to the field encompassed by the lens. Arthroscope consist of an optical lens system, light conducting fibreoptics and surrounding sheath; they vary in diameter.

Fiber Light sources

The fiber optic cable consists of a bundle of specially prepared glass fibers encased in a protective sheath for routine general diagnostics inspection in patient. 150 watt tungston bulbs are usually sufficient.

Other instruments

All instruments should be approximately the same length as the arthroscope. The basic instrument list consists of following:

Arthroscope 0 & 30 degree
Probe
Scissors
Basket forceps
Grasping clamps

Irrigation systems

In recent past, irrigation & distention of joint are essential to all arthroscopic procedures. Joint distention is maintained by normal saline or RL. Either continuous flow or intermittent distension may be used. The two factors that determine the hydrostatic pressure within the joint are the height of the fluid bag & diameter of tubing. Distension is an important aid in the arthroscope viewing of any joint expanding its internal capacity to allow a greater viewing.

Tourniquet

In diagnostic arthroscope procedure usually tourniquet is not required.
Newer Tools in Rheumatology Practice

Anesthesia

1. Local – xylocaine (Short acting) & Bupevacain (Long acting) used in a cooperative patient for synovial biopsies.
2. General- indicated where pain is an important factor and also in non cooperative patients, or allergy to local anesthesia.
3. Spinal- rarely used.

Indications

1. When a thorough history, physical examination & suitable non invasive & radiographic studies have failed to establish a diagnosis.
2. When treatment of a specific problem has failed and there is need for additional information that other studies cannot provide.
3. When specific additional diagnostic information can be obtained in a less traumatic way (biopsy).

Contraindications

1. A minimally deranged patient that will respond to the usual method of treatment.
2. Local skin infections.
3. Partial or complete ankylosis – difficult maneuverability of instruments.

Pathologic Findings in Arthritis. Rheumatoid synovial villi are larger than normal, club shaped, pale, edematous, and numerous; in the knee they proliferate in the suprapatellar roof, along the edges of the femoral condyles, beneath the menisci, and in the intercondylar notch. Early, the creeping pannus can be pulled from articular edges with a probe, demonstrating the erosion of underlying hyaline cartilage. Later stages may show extensive fibrillation, ulcers, or craters, often in an irregular, pattern over the femoral condyles and patellofemoral groove. The joint often contains thick, yellowish synovial fluid with numerous, small, opaque white fragments, so-called rice bodies.

Osteoarthritic synovium is less fibrillated and not nearly as proliferative as that seen in rheumatoid arthritis. Fronts may be hyperemic or yellowish. Free-floating debris also seen but is finer and more irregular in size. Articular changes include fibrillation, fissuring, and loss of normal thickness. The patella, central femoral condyles, and tibia plateaus are common sites of wear. There may be craters revealing bare bone, and the articular edges of the joint may show osteophytic spurring, especially in the knee, shoulder, and ankle. Knee menisci are often softened and shaggy, with frank tears and mobile fragments protruding and catching in the joint and producing erosion of articular cartilage.

Pigmented villonodular synovitis is extremely prolific and dense, having a reddish-brown or even orange color. Its nodular character is unique. Articular erosion and meniscal pathology are less common but do occur. Hemophiliac arthropathy can show extensive articular destruction and a florid, hemosiderin-stained synovium that proliferates into every recess of the joint. The synovium is friable on probing and easily peels away from sub synovial layers. In later stages, one sees osteophytic spurring, joint flattening, and subchondral cysts that visibly open into the joint. Gouty arthritis can erode the articular edges in much the same way as does rheumatoid arthritis. Crystalline deposits in synovium are seen in both gout and pseudogout, but those in the latter more often coat otherwise normal-appearing articular cartilage. Calcium pyrophosphate dehydrate deposits can completely cover the menisci or fill the intercondylar notch extensively.

Synovial chondromatosis is characterized by multiple cartilaginous bodies that are free within the joint. These may be small and resemble the rice bodies of rheumatoid arthritis, but usually there is an extraordinary arthroscopic picture of large, irregular loose bodies so numerous that they nearly fill the suprapatellar pouch. There may be an associated villous that resembles that seen in osteoarthritis.

Mild forms of synovial inflammation can not be differentiated arthroscopically. The early stages of rheumatoid arthritis may mimic post-traumatic synovitis. Hypertrophy and hyperemia, in moderate degree, are common in most acute and chronic trauma; thus, biopsies are routinely taken for accurate synovial diagnosis by microscopic sections.

ULTRASOUND IN RHEUMATOLOGY PRACTICE

Conventional Radiography has long been the mainstay of the radiological assessment of joint disorders. However, early periarticular soft tissue abnormalities and synovitis are also not very well seen by X-rays. Although the gold standard for the assessment of soft tissue abnormalities is MRI, in the last few years, musculoskeletal USG has made its niche as an important radiological investigation in the initial assessment of rheumatoid disease and during follow-up. This has been possible due to the availability of better USG equipment, higher frequency transducers and state-of-the-art software. USG is often called the “rheumatologist’s extended finger”. However, many rheumatologists are still reluctant to introduce routine USG in their clinical practices. This is partly due to the fact that USG is a largely operator dependent modality and there is inadequate reproducibility of USG findings and also maybe to some degree due to the inherent resistance towards accepting a ‘new’ modality – “the fear of the unknown”.

IMAGING REQUIREMENTS

Since most of the joints and periarticular structure to be imaged are superficial, high-resolution and high-definition USG, with 7.5-15 MHz linear probes, is required for adequate resolution. However, lower frequency probes upto 5 MHz are often used for larger joints that require more penetration, such as the shoulders and hips. “Extended field-of-view” is very useful, as it allows a larger area to be visualized and measured. The size of the probe footprint
is very important. Transducers with a large footprint are a bad choice for visualizing small joints such as the metacarpophalangeal joints due to poor maneuverability in these areas. Power and color Doppler are extremely useful for identifying the degree of inflammation and help in increasing the confidence for diagnosing subtle changes. USG is an operator dependent modality and it is imperative to have a sound knowledge of its principles and the musculo-skeletal anatomy.

**INDICATIONS**

- Early detection of erosive disease
- Assessment of synovial tissue
- Assessment of effusions
- Detection of enthesitis in seronegative spondyloarthritis
- Assessment of treatment response
- Assessment of crystal arthropathy

**COMMON PATHOLOGIES ENCOUNTERED**

**Synovitis**

Most articular diseases affect the synovium. The presence of excess intra-articular fluid suggests the presence of synovitis. USG is actually more sensitive than physical examination for the diagnosis of synovial effusion. USG is however limited in its ability to assess the nature of the joint fluid. The synovial effusion may be due to inflammation, infection or bleed. Since joint effusion usually occurs in an arthropathy and is better seen on uSG, more and more sub-clinical disease are being picked up.

In early disease, USG primarily helps in deciding the presence/absence of synovitis, its location and the number of joints involved along with any associated synovial proliferation, cartilaginous changes or erosions.

Synovial proliferation presents with thickening of the synovium. If the “fluid” in the joint cannot be compressed, that usually implies the presence of thickened synovium, which may also show increased flow on Doppler. Severe synovial proliferation shows an irregular contour of the synovial membrane with synechiae between the walls of the articular recesses. Areas of active disease show increased flow on Doppler. This is due to neo-vascularization in the pannus. The degree of increased flow on Doppler may be a rough indicator of the degree of active disease. Several studies comparing the pre- and post-treatment findings of color and spectral Doppler and have successfully shown that reduced vascularity correlates well with symptomatic improvement.

**Tendon disease**

In the last decade, USG has become the gold standard for tendon examination. Tenosynovial effusion, tenosynovial proliferation and tendon tears are routinely detected by USG. Clinical examination of tendon involvement is highly inaccurate. USG is even superior to MRI in the detection of longitudinal split tendon tears. It is the only modality which allows real-time, dynamic assessment, which is extremely useful for identifying subluxed and snapping tendons. USG also demonstrates focal or diffuse tendonitis, calcified tendonitis and tendon xanthomas.

Peri-articular soft tissue swelling may be due to effusion or due to tenosynovitis and USG helps to differentiate between these causes. Areas of active disease show increased flow on Doppler evaluation. It must however be kept in mind that though USG is sensitive in identifying tendon disease, it is non-specific. Correlation with biochemical parameters and history is important to achieve a diagnosis.

**Cartilage Changes**

Normal weight-bearing cartilage ranges from 1.2 - 1.9 mm in thickness. The cartilage in the wrists and hands is thinner. The earliest radiological finding is usually thinning of the cartilage, though rarely, USG may show thickening due to edema, in very early stages of arthritis. However, non-visualization of the cartilage is not necessarily an ominous sign, as the cartilage may not always be seen, depending on the site. Irregular thinning or thickening of the cartilage is usually abnormal.

**Erosions**

Although MRI is the gold standard for the assessment of erosions, USG has of late shown to be useful in the early diagnosis of erosions. The multiplanar capabilities of USG, allow a careful assessment of the bone surfaces on more views than those allowed by standard radiographs. This improves the sensitivity of USG in detecting small erosions, especially in areas not well seen on standard views. Marginal erosions are seen as crater-like defects, along the edges of the articular cartilage, affecting the so-called “bare” areas. In RA, pannus is seen as hypoechoic soft tissue filling these erosions. Color and power Doppler usually show an intense increase in flow at these sites especially in active disease.

Small erosions of the carpal bones are difficult to interpret on USG as the normal carpal bones have irregular margins; MRI is therefore superior in the carpal bones. Bone marrow edema and cartilaginous changes are also better seen on MRI. Subarticular cysts are often completely missed on USG.

**Crystal Deposition Disease**

A few papers have described the USG appearance of articular and periarticular changes caused by calcium pyrophosphate dihydrate (CPPD) disease. In some cases, calcification detected by USG may not be found on radiographs, either because of the location of the calcium deposit or the technique used. MRI is also not a good modality for the evaluation of calcium.

**Bursitis**

Bursitis is a common disease entity in joint diseases. Subacromial-subdeltoid bursitis is a common USG finding in RA. A Baker’s cyst is often seen in chronic cases. It may be anechoic or may show calcified or non-calcified loose bodies. A ruptured Baker's cyst can be readily diagnosed on USG and can be differentiated from deep
vein thrombosis. Differentiation of joint effusion from bursitis, for example in the popliteal fossa, can be easily accomplished by USG.

**Enthesitis**

Enthesitis is the inflammation at the origin and insertion of ligaments and tendons and is commonly seen in seronegative spondyloarthritis (SpA). It may be the first sign of an SpA in some cases. Acute enthesitis on USG is seen as a tender area with increased thickness of the tendon and ligament insertion with hypoechogenicity and loss of normal echopattern. The adjoining bone may be normal or may show irregularity at the site of tendon insertion. In chronic cases, there is evidence of intratendinous and interligamentous calcification adjacent to the entheseal insertion.

**Nerves:**

The median nerve at the wrist is the most involved nerve in rheumatology practice, as part of the carpal tunnel syndrome (CTS). CTS is primarily a clinical diagnosis and imaging is used mainly to identify a secondary cause such as wrist joint effusion, tenosynovitis, amyloid deposition, hypertrophied accessory muscle, increased fatty tissue, ganglion cyst or a variant median artery. Many investigators have attempted to define USG criteria for the diagnosis of CTS. Abnormalities found on these studies include volar bulging and thickening of the flexor retinaculum and focal or diffuse swelling or flattening of the nerve.

**CONCLUSION**

Globally medical arthroscopy & MSK ultrasound are emerging field and may evolve into a more serious relationship between rheumatologist and these tools. Both the techniques has been shown to be capable of substantially changing the traditional approach to most clinical problems in daily rheumatological practice. Author have used both the techniques extensively for last six-seven years.

**REFERENCES**