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**Topic 8: Investigations, Diagnostic and Therapeutic Procedures**

*Diagnostic and Therapeutic Procedures in MSSDs*

**1.0 Arthroscopy**

**1.1 Introduction**

- Arthroscopy is a procedure in which a small fiber-optic scope is inserted into a joint space, allowing the doctor to look inside the joint and to project the image onto a video monitor
- The skin incision is very small
- Local, spinal, or general anaesthesia or a combination can be used
- During arthroscopy a biopsy can be taken for analysis or surgery done to correct the condition
- There is a very small risk of joint infection with this procedure.
- Knee Arthroscopy is a common surgical procedure performed using an arthroscope, a viewing instrument, to look into the knee joint to diagnose or treat a knee problem. It is a relatively safe procedure and a majority of the patient's discharge from the hospital on the same day of surgery.

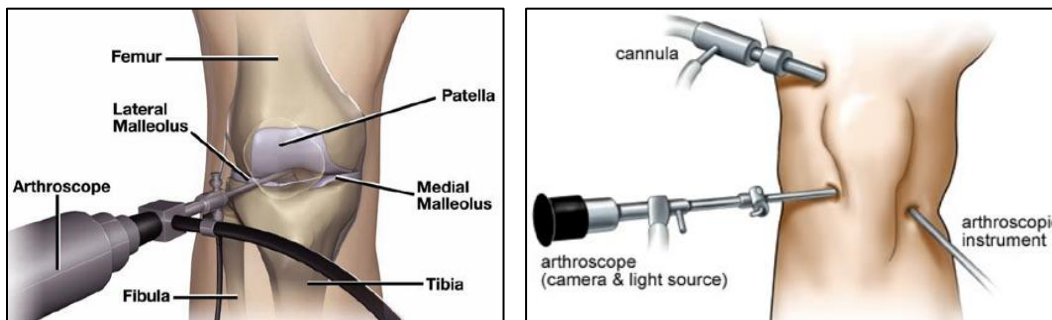


Figure 8.1: Arthroscopy Procedure

- Depending on the underlying causes, knee arthroscopy may be effective in:
  1. Relieving pain
  2. Improving stability
  3. Removing loose bodies (cartilage or bone spurs)
  4. Repairing tissue tears and damage
  5. Improving function and range of motion



*Figure 8.2: Arthroscopy procedure*

## 1.2 Indications

- The knee joint is vulnerable to a variety of injuries
- Indications - inflammation of the synovium lining the joint (synovitis); ligament, tendon, or cartilage tears; and loose pieces of bone or cartilage
- The most common indications
  1. Torn meniscus
  2. Torn or damaged cruciate ligament
  3. Torn pieces of articular cartilage
  4. Inflamed synovial tissue
  5. Misalignment of the patella
  6. Baker's cyst (common in knee conditions - meniscal tear, knee arthritis, rheumatoid arthritis)
  7. Certain fractures of the knee bones

## 1.3 Contraindications

## 1.4 Procedure

- Knee arthroscopy is performed under local, spinal, or general anesthesia
- Two or three small incisions are made around the knee
- A sterile saline solution is injected into the knee to push apart the various internal structures (this provides a clear view and more room for work)
- An arthroscope is inserted through one of the incisions to view the knee joint (structures inside the knee are visible on a video monitor)
- The structures inside the knee joint are examined
- A diagnosis is made
- Surgical instruments such as scissors, motorized shavers, or lasers are inserted through another small incision, and the repair is performed based on the diagnosis.
- The repair procedure may include any of the following:
  1. Removal or repair of a torn meniscus
  2. Reconstruction or repair of a torn cruciate ligament
  3. Removal of small torn pieces of articular cartilage
  4. Removal of loose fragments of bones
  5. Removal of inflamed synovial tissue
  6. Removal of baker's cyst
  7. Realignment of the patella
  8. Making small holes or microfractures near the damaged cartilage to stimulate cartilage growth
- After the repair, the knee joint is carefully examined for bleeding or any other damage.
- The saline is then drained from the knee joint.

- The incisions are closed with sutures or steri-strips
- Knee is covered with a sterile dressing

## 1.5 Complications

- Knee arthroscopy is a safe procedure
- Complications are very rare
- Complications specific to knee arthroscopy include
  1. Bleeding in the knee joint
  2. Infection
  3. Knee stiffness
  4. Blood clots
  5. Continuing knee problems

## 2.0 Joint Aspiration (Arthrocentesis)

### 2.1 Introduction

- The aspiration of a joint and subsequent analysis of the synovial fluid is a critical component in diagnosing arthritis
- Analysis of the joint fluid can differentiate an inflammatory arthritis from a non-inflammatory arthritis
- Joint aspiration is usually performed on the knee. However, fluid can also be removed from other joints, such as the hip, ankle, shoulder, elbow, or wrist.

### 2.2 Indications

- i) Diagnostic
  - Unexplained joint effusion to differentiate a septic from an inflammatory or bloody mono-arthritis
  - Remove joint fluid for cytology, microbiology and biochemical testing.
- ii) Therapeutic
  - Remove excess fluid or blood from joint to provide symptomatic relief, increase mobility and decrease pain in large effusions, crystal-induced arthropathy or haemarthrosis
  - Intra-articular steroid injections

### 2.3 Contraindications

- i) Local skin cellulitis/infection
- ii) Acute fracture
- iii) Joint prosthesis
- iv) Uncontrolled bleeding diathesis
- v) Anatomically inaccessible joints
- vi) Uncooperative patient

### 2.4 Risks of the procedure

- i) Discomfort at the aspiration site
- ii) Bruising at the aspiration site
- iii) Swelling at the aspiration site
- iv) Infection at the aspiration site

## 2.5 The Procedure

### a) Equipment

- Sterile gloves, sterile fenestrated drape, 2 10-mL syringes, 2 21-gauge, 1-inch needles, 1 inch of 4 × 4 gauze soaked with povidone-iodine solution (Betadine), Haemostat (for stabilizing the needle when exchanging the medication syringe for the aspiration syringe) and sterile bandage

### b) Before the procedure

- Explain the procedure to you and offer you the opportunity to ask any questions that you might have about the procedure.
- Obtain a consent

### c) During the procedure

- Remove clothing and wear a gown
- Cleansed with an antiseptic solution the skin
- Administer local anaesthetic
- Insert the needle through the skin into the joint. The needle is directed at a 45-degree angle distally and 45 degrees into the knee, tilted below the patella
- Once the needle has been inserted 1 to ¼ inches, aspiration is performed, and the syringe should fill with fluid. Using the non-dominant hand to compress the opposite side of the joint or the patella may aid in arthrocentesis.
- Once the syringe has filled, a haemostat can be placed on the hub of the needle. With the needle stabilized with the haemostat, the syringe can be disconnected and the fluid sent for studies. Care should be taken not to touch the needle tip against the joint surfaces when removing the syringe. A syringe filled with corticosteroid medication can then be attached to the needle.
- Remove the needle and apply a sterile bandage or dressing
- Send the fluid sample to the lab for examination

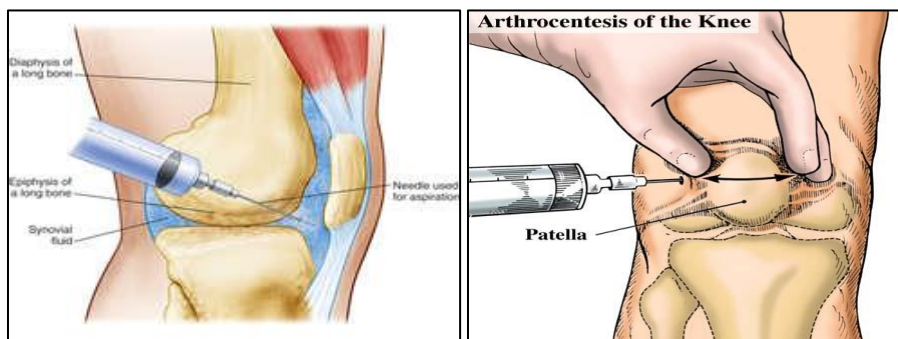


Figure 8.3: Arthrocentesis



Figure 8.4: Guided Arthrocentesis

- d) After the procedure
- ❑ Keep the joint aspiration site clean and dry, bandage left in place for one week and analgesics

### 3.0 Nerve and Muscle Tests

- ❑ Nerve conduction studies (electromyography and nerve conduction studies) help determine whether the nerves supplying the muscles are functioning normally.

a) Electromyography (EMG)

- ❑ Usually done at the same time as nerve conduction studies
- ❑ Electrical impulses in the muscles are recorded to help determine how well the impulses from the nerves are reaching the connection between nerves and muscles (neuromuscular junction)



Figure 8.5: EMG

b) Nerve Conduction Tests (NCT)

- ❑ Help indicate whether there is a problem primarily in the
  - Muscles e.g. myositis or muscular dystrophy
  - Nervous system e.g. stroke, spinal cord problem, polyneuropathy
  - Neuromuscular junction e.g. myasthenia gravis
- ❑ Useful for the diagnosis of peripheral nerve disorders, such as carpal tunnel syndrome and ulnar nerve palsy



Figure 8.6: NCT

### 4.0 Bone Scanning

- ❑ Is an imaging procedure that is occasionally used to diagnose a fracture, particularly if other tests, such as plain x-rays and CT or MRI, do not reveal the fracture
- ❑ Involves use of a radioactive substance that is absorbed by any healing bone
- ❑ The radioactive substance is given IV and is detected by a bone-scanning device, which creates an image of the bone that can be viewed on a computer screen
- ❑ Can also be used when a bone infection or a tumour that has spread from a cancer



Figure 8.7: Bone Scan

## *Investigations in MSSDs*

Table 8.1: Investigations in Neurological Disorders

Investigation		Indication	Findings and Interpretation
Group	Investigation		
1.	Radiological or Imaging Investigations	Plain radiography including (X-rays)	<ul style="list-style-type: none"> <li><input type="checkbox"/> Detecting abnormalities in bone</li> <li><input type="checkbox"/> Diagnose fractures, tumours, injuries, infections, and deformities (such as congenital hip dysplasia)</li> <li><input type="checkbox"/> Show changes in arthritis (for example, rheumatoid arthritis or osteoarthritis)</li> <li><input type="checkbox"/> Do not show soft tissues</li> </ul>
		Ultrasonography (U/S)	<ul style="list-style-type: none"> <li><input type="checkbox"/> Joints, soft tissues, injuries</li> <li><input type="checkbox"/> Identify inflammation in and around joints and tears or inflammation of tendons</li> <li><input type="checkbox"/> A guide when a needle needs to be put into a joint (for example, to inject drugs or to remove joint fluid)</li> </ul>
		CT scan	<ul style="list-style-type: none"> <li><input type="checkbox"/> Trauma/injury</li> <li><input type="checkbox"/> Tumours</li> <li><input type="checkbox"/> Primary diagnosis of benign and malignant pathology, staging of tumours and detection of spread, rheumatological disorders, trauma and sports injuries</li> </ul>
		MRI	<ul style="list-style-type: none"> <li><input type="checkbox"/> Trauma/injury</li> <li><input type="checkbox"/> Tumours</li> <li><input type="checkbox"/> Primary diagnosis of benign and malignant pathology, staging of tumours and detection of spread, rheumatological disorders, trauma and sports injuries</li> <li><input type="checkbox"/> Demonstration of spinal and joint anatomy and pathology</li> </ul>
		Dual-Energy X-Ray Absorptiometry (DXA)	<ul style="list-style-type: none"> <li><input type="checkbox"/> Trauma/injury</li> <li><input type="checkbox"/> Tumours</li> <li><input type="checkbox"/> Most accurate way to evaluate bone density (screening or diagnosing osteopenia or osteoporosis is with dual-energy x-ray absorptiometry)</li> <li><input type="checkbox"/> DXA is also used to predict a person's risk of fracture and can be useful for monitoring the response to treatment as well</li> <li><input type="checkbox"/> X-rays examine bone density at the lower spine, hip, wrist, or entire body</li> </ul>
		Arthrography	<ul style="list-style-type: none"> <li><input type="checkbox"/> Torn joint ligaments &amp; fragmented cartilage</li> <li><input type="checkbox"/> An x-ray procedure in which a radiopaque dye is injected into a joint space to outline the structures, such as ligaments inside the joint</li> </ul>
2.	Blood Tests	Full blood count	<ul style="list-style-type: none"> <li><input type="checkbox"/> Infections</li> <li><input type="checkbox"/> Tumours</li> <li><input type="checkbox"/> Hemogram – Anaemia; Neutrophilia; Leucopenia</li> <li><input type="checkbox"/> Erythrocyte sedimentation rate</li> </ul>
		Biochemical	<ul style="list-style-type: none"> <li><input type="checkbox"/> Infections</li> <li><input type="checkbox"/> Tumours</li> <li><input type="checkbox"/> Level of creatine kinase<sup>1</sup>, Urea and creatinine, Uric acid, Calcium</li> <li><input type="checkbox"/> Urinary albumin-creatinine ration</li> </ul>
		Serological	<ul style="list-style-type: none"> <li><input type="checkbox"/> Rheumatoid arthritis</li> <li><input type="checkbox"/> Autoimmune diseases</li> <li><input type="checkbox"/> Rheumatoid factor - In rheumatoid arthritis; Anti-cyclic citrullinated peptide (anti-CCP) antibody - in SLE; Autoimmune antibodies (autoantibodies), e.g. antinuclear antibodies and antibodies to the DNA</li> </ul>
3.	Urinalysis	Protein, Blood	<ul style="list-style-type: none"> <li><input type="checkbox"/></li> </ul>
4.	Joint Aspirate	Bacteriology Biopsy/Histology	<ul style="list-style-type: none"> <li><input type="checkbox"/></li> </ul>

<sup>1</sup> a normal muscle enzyme that leaks out and is released into the bloodstream when muscle is damaged), increased when there is widespread ongoing destruction of muscle



*TASK: Identify the various fractures*

## Common MSS Disorders

- ❑ Musculoskeletal disorders (MSDs) are conditions that can affect muscles, bones, and joints
- ❑ Include tendinitis, carpal tunnel syndrome, arthritis (osteoarthritis, septic arthritis) rheumatoid arthritis (RA), gouty arthritis, fibromyalgia and bone fractures
- ❑ MSDs are common and the risk of developing them increases with age
- ❑ Symptoms of MSDs can include recurrent pain, stiff joints, swelling, and dull ache
- ❑ They can affect any major area of the musculoskeletal system, including the neck, shoulders, wrists, back, hips, legs, knees and feet

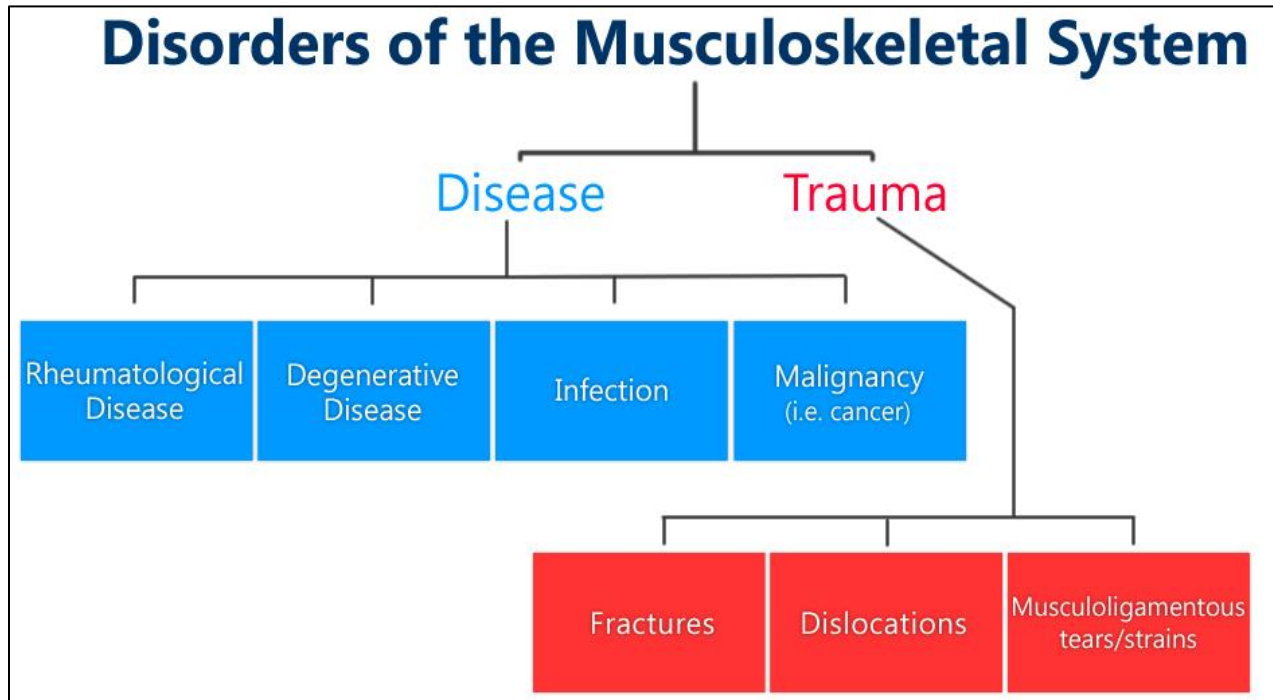


Figure 1.8: Disorders of the MSS

Table 8.2: Common MSS Diagnoses

	Location/ Diagnosis	Diagnosis	Clinical History	Physical examination Findings				
				General	Inspection	Palpation	Percussion	Auscultation
1.	Gait							
2.	Hand and Wrist							
3.	Elbow joint							
4.	Shoulder Joint							
5.	Neck							
6.	Spine							

	Location/ Diagnosis	Diagnosis	Clinical History	Physical examination Findings				
				General	Inspection	Palpation	Percussion	Auscultation
7.	Hip Joint							
8.	Knee joint							
9.	Ankle and foot							