

SYNOVIAL FLUID AND TESTS**D.K. Awasthi¹****Archana Dixit²**¹Department of chemistry Sri J.N.M.PG.College Lucknow, U.P, India²Department of chemistry DG PG College Kanpur U.P. India**ABSTRACT**

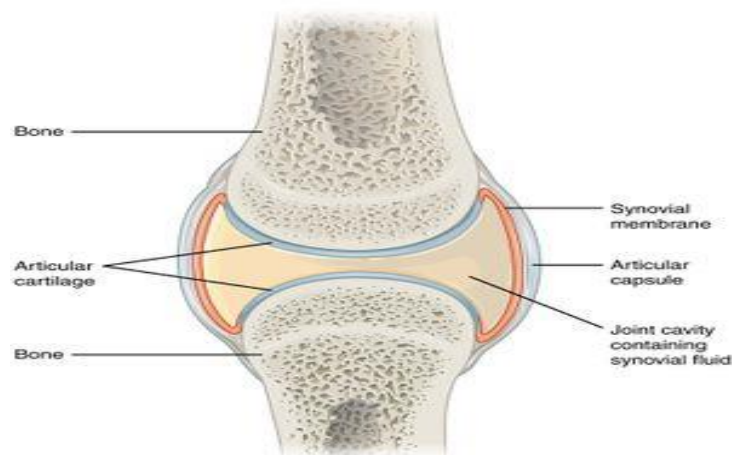
The collection of fluid contained within the joint area is known as synovial fluid. Synovial fluid is physiological and serves as a lubricant for articular cartilage in the joint space as well as a source of nutrients for nearby structures such cartilage, meniscus, labrum, etc. by diffusion. Hyaluronan, lubricin, proteinase, collagenases, and prostaglandins make up the majority of the synovial fluid, which is created as an ultrafiltrate of blood plasma. Type B synovial cells, which resemble fibroblasts, produce synovial fluid.

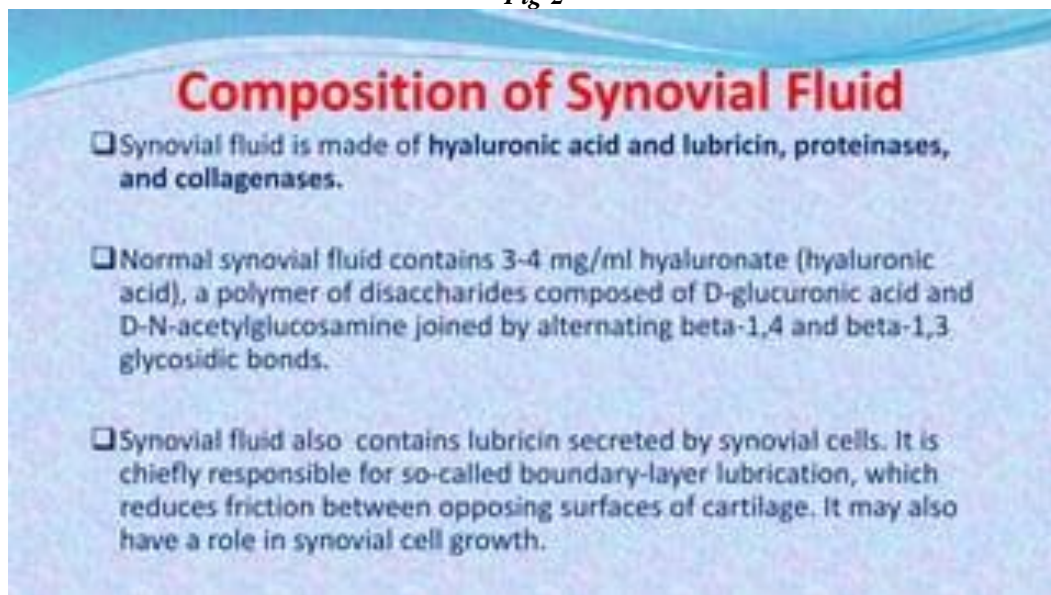
Keywords:

Labrum, cartilage, hyaluronan, lubricin, and synovial cells

INTRODUCTION

The collection of fluid contained within the joint area is known as synovial fluid. Synovial fluid is physiological and serves as a lubricant for articular cartilage in the joint space as well as a source of nutrients for nearby structures such cartilage, meniscus, labrum, etc. by diffusion. Hyaluronan, lubricin, proteinase, collagenases, and prostaglandins make up the majority of the synovial fluid, which is created as an ultrafiltrate of blood plasma. Type B synovial cells, which resemble fibroblasts, produce synovial fluid. Synovial fluid volume and content alter physiologically in response to injury, inflammation, and bacterial, fungal, or viral penetration. Synovial fluid aspiration and analysis are essential to aid in diagnosis and direct treatment when patients arrive with intensely painful joints and suspicion of infection, inflammation, or non-inflammatory causes of effusion. Aspiration and examination of synovial fluid are essential to help with diagnosis and choose the best course of treatment. Arthrocentesis can help with diagnosis if there is a joint effusion, joint pain with no known cause, or a possible infection in the joint area. In settings in which intra-articular injection is a consideration, aspiration should be performed before injection as the aspirated fluid should first undergo inspection for any gross abnormalities or signs of gross infection. Arthrocentesis can also be performed therapeutically for pain relief in a painful joint in which case an effusion or hemarthrosis is preventing a full range of motion of the involved joint. Aspiration should be performed by a trained physician under sterile procedural protocol to prevent the risk of infection and contamination of the aspirate

**Fig-1**

*Fig-2**Fig-3*

A spinal needle may be an option for deeper joints or patients with anatomy complicated by obesity. On obtaining access to the joint, negative pressure should be maintained in the syringe until an adequate amount of synovial fluid is collected. The fluid should then be transferred to a sterile specimen collection cup and sealed for transport to the laboratory for analysis. The syringe may be emptied and reattached to the Arthrocentesis is the procedure by which synovial fluid is collected by aspirating into the joint space. A doctor with in-depth knowledge of the associated anatomy should perform this treatment under sterile procedural settings. In addition to helping to stop the spread of infection, sterility is crucial for reliable fluid analysis. Although it is frequently unnecessary, ultrasound technology may be helpful in assuring proper needle placement. For deeper joints, such as the shoulder and hip, fluoroscopy and CT guided arthrocentesis may be useful. Aspiration site is chosen and indicated when arthrocentesis indications are satisfied. The safe entry portals for the shoulder, elbow, wrist, hip, knee, and ankle are fully described in the literature. After that, the area is prepared and covered in the customary

sterile employing antiseptics such as alcohol, betadine, and/or chlorhexidine alone or in combination in a sterile manner. A cutaneous/subcutaneous wheel can be made using local anaesthetic to reduce local discomfort. Then, a minimum 10-cc syringe with a large gauge, sharp needle, commonly 18 gauge (or smaller if a smaller joint is being aspirated), is introduced into the joint.

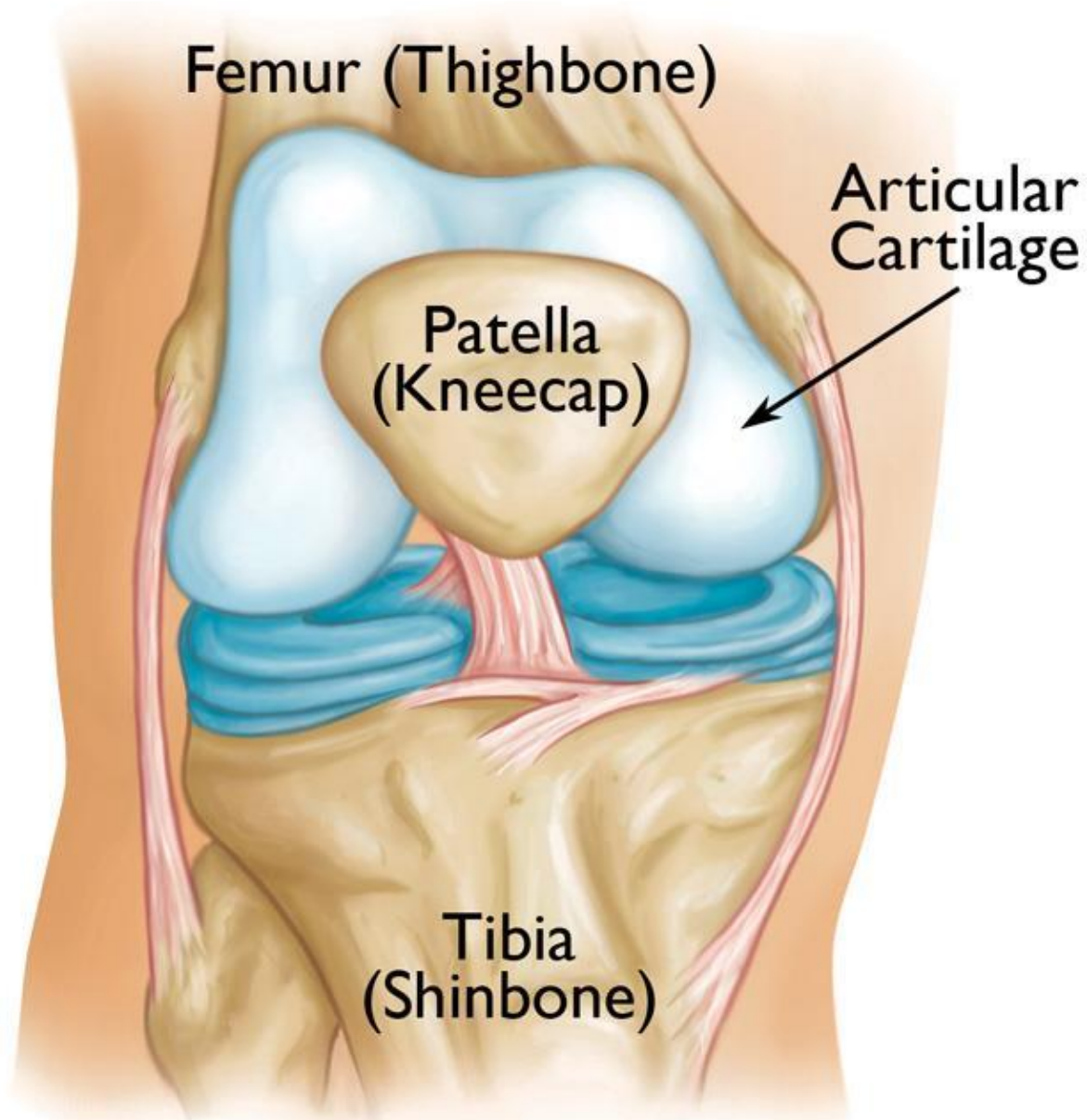


Fig-4 Synovial Chodromatossis

indwelling needle repeatedly, minimizing needle entry points. Once the procedure is complete, the antiseptic should be cleaned off the skin, site dried, and pressure and a soft dressing applied for local hemostasis. No activity modifications or changes in weight-bearing status are necessary following the procedure, in the absence of other pathology. Compressive ace bandage dressings often aid in the prevention of fluid reaccumulation.

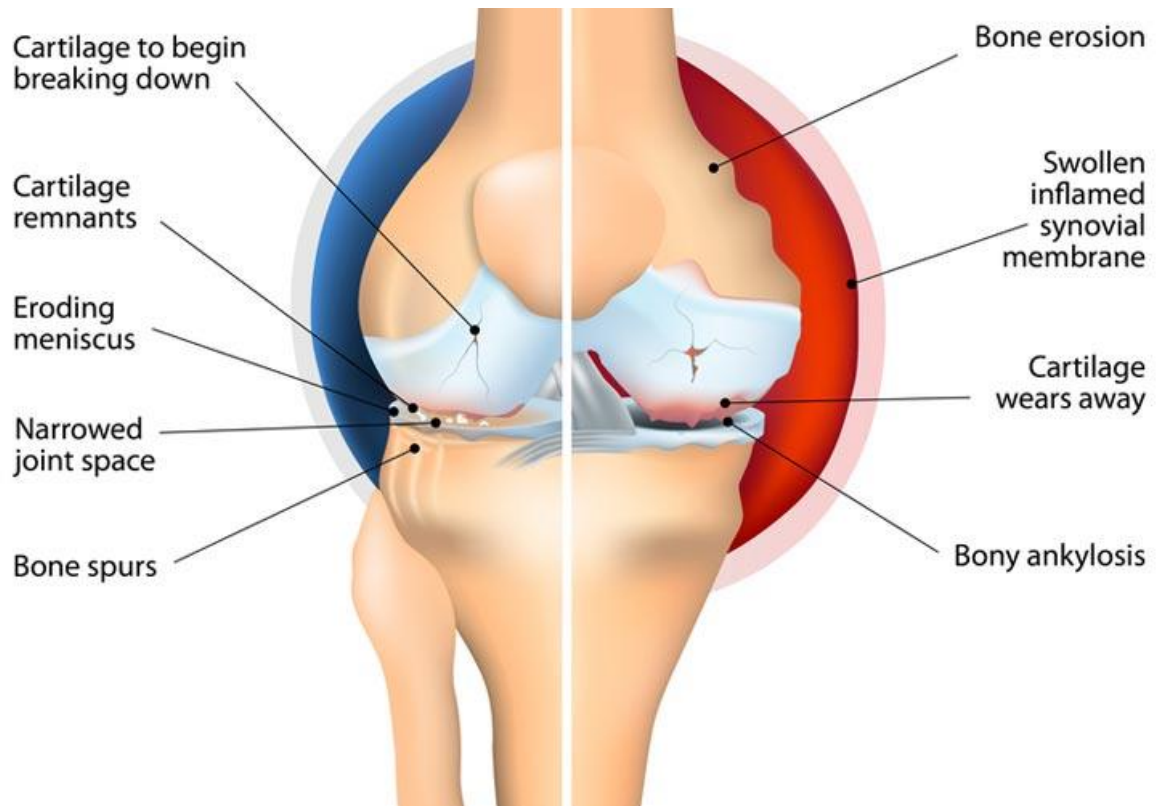


Fig-5 Rheumatoid Arthritis

Indications for synovial fluid aspiration and analysis include the presentation of acute painful joint with surrounding warmth/erythema, suspicion of septic arthritis, suspicion for subacute or chronic periprosthetic joint infection, acute exacerbation of chronic knee pain from osteoarthritis or non-inflammatory arthritis, or acute trauma with painful effusion. In the clinical presentation of acute injury, often arthrocentesis of hemarthrosis can be therapeutic and provide significant pain relief in the acutely traumatic knee. Effusions from chronic inflammatory arthritis can undergo therapeutic aspiration for pain relief. A definitive diagnosis of gout or pseudogout is also an indication for aspiration. It is important to note that infection and gout can co-exist within a joint space. Effusions of unknown etiology warrant aspiration and analysis.

*Fig-6 synovial fluid analysis*

Potential diagnosis from synovial fluid aspiration and analysis include:

- Inflammatory arthritis including gout, pseudogout, infection, or spondylarthritis, or non-inflammatory arthritis which can include effusion from osteoarthritis or meniscal tears
- Septic arthropathy: acute septic arthropathy, subacute or chronic septic arthropathy, or periprosthetic joint infection
- Hemorrhagic: traumatic, often seen with tendon, meniscal, or ligament injury

Below we discuss normal and abnormal findings in native adult joints. It is important to note that cell count thresholds vary in joints with previous hardware such as post-traumatic fixation with hardware or in cases of previous joint replacement.

Native adult joint synovial fluid analysis

According to the American Rheumatologic Association guidelines

- Non-inflammatory <200 to 2000 WBC/mm³
- Inflammatory >2000 to 50,000 WBC/mm³
- Infectious > 50,000 WBC/mm³

Differential with polymorphic nuclear cells (PMNs)

- >75 percent PMNs indicative of bacterial joint infection [2]

Crystal Analysis: Gout and Pseudogout

- Presence of monosodium urate crystals indicates a diagnosis of gout
- Presence of calcium pyrophosphate dihydrate crystals indicates a diagnosis of pseudogout

Gram stain and bacterial culture: synovial fluid aspirate is analyzed for gram stain and both aerobic and anaerobic culture to determine the presence of infection; the presence of any organism indicates abnormal findings.

Several factors can interfere with aspiration and therefore analysis of synovial fluid. Unsuccessful aspiration is common as synovium can clog the needle and interfere with sample collection. Non-sterile technique can contaminate the collected fluid. It is important to remember that multiple etiologies can co-exist, i.e., the presence of gout does not rule out the presence of concomitant infection.

Complications as a direct result of arthrocentesis are rare, and those that do occur are typically not severe. Potential complications include: seeding a cutaneous infection within the joint, cartilage damage from needle

insertion (rare), pain at arthrocentesis site or local ecchymosis, bleeding and iatrogenic hemarthrosis, skin reaction to antiseptics or soft bandage adhesive. The most common complication reported is reaccumulation of the joint effusion.

While arthrocentesis is well tolerated with minimal complications, obtaining informed consent is a must before performing the procedure. Details of the procedure, risks and benefits, potential complications, and alternatives to therapy/diagnosis should be explained. Patients should understand and be able to verbalize the indications for their own procedure as well as be familiar with the previously discussed complications. Patients must have an opportunity to ask questions, and have those questions answered by the performing physician. Keeping patient safety in mind, previously discussed sterile procedural technique should be used every time to minimize potential risks of infection. The patient's chart should undergo a thorough review prior to undergoing arthrocentesis to ensure the patient has no significant allergies to any medication, material, or chemical that may be in use during the procedure. Synovial fluid analysis is also known as joint fluid analysis. It helps diagnose the cause of joint inflammation. Each of the joints in the human body contains synovial fluid. This fluid is a thick liquid that lubricates the joint and allows for ease of movement. In joint diseases like arthritis, the synovium of the joint is the main place where inflammation occurs. Limited mobility in the joint, or pain and stiffness with movement, are often the first signs of joint disorders. Joint inflammation is more common as you age.

A synovial fluid analysis is performed when pain, inflammation, or swelling occurs in a joint, or when there's an accumulation of fluid with an unknown cause. Taking a sample of the fluid can help diagnose the exact problem causing the inflammation. If the cause of the joint swelling is known, a synovial fluid analysis or joint aspiration may not be necessary.

Some potential diagnoses include infection, gout, arthritis and bleeding. In some cases with excess fluid, simply removing some fluid can help relieve pain in the affected joint. Sometimes synovial fluid analysis is used to monitor people with known joint disorders. Once the area has been numbed, your doctor will insert a larger needle into the joint and draw fluid into the syringe. This process of removing fluid from a joint is called arthrocentesis.

- glucose
- proteins
- uric acid
- lactic dehydrogenase (an enzyme that increases in cases of inflammation and tissue damage)

The fluid sample will also be cultured to test for bacteria.

A synovial fluid analysis may be mildly uncomfortable, but the whole process lasts only a few minutes. You might receive a local anesthesia to numb the area. You may feel a prick and burning sensation from the anesthesia at the site of entry. A larger needle will then be inserted into the joint to withdraw the synovial fluid. If you receive anesthesia, you should feel minimal discomfort. If you don't receive anesthesia, the needle may cause slight pain and discomfort. You might feel pain if the tip of the needle touches bone or a nerve.

Following the procedure, apply ice to reduce any pain or swelling. Normal synovial fluid is straw-colored, clear, and slightly sticky or stringy. Abnormal synovial fluid may be cloudy and thicker or thinner than normal fluid. Cloudiness could mean there are crystals, excess white blood cells, or microorganisms in the fluid.

If you have gout, the fluid will contain crystals. Less stringiness in the fluid could signal inflammation. Excess fluid in the joint could be a predictor of osteoarthritis. Reddish-colored fluid could mean blood is present.

Blood in the fluid could point to a bleeding injury in the joint or a more serious bleeding problem throughout the body, such as hemophilia. Absent or ineffective clotting factors cause hemophilia

Cloudy fluid, blood in the fluid, or excess fluid are all signs of a problem in or around the joint, such as:

- gout
- arthritis
- infection
- autoimmune disorders
- injury to the joint

This procedure is highly effective in diagnosing gout by identifying crystals in the fluid.

The most common risks are bleeding or infection in the joint. It's normal to experience soreness or stiffness in the joint. Complications from this procedure are rare.

Uric Acid (Synovial Fluid)

The synovial fluid uric acid test quantifies uric acid concentrations that may build up in joint fluid. A typical bodily waste product is uric acid. It develops when substances called purines decompose. The body naturally contains chemicals called purines. They can also be discovered in a variety of foods, including liver, seafood, and alcohol. When DNA is damaged, they may potentially develop within the body. When purines in the blood break down into uric acid, the body eliminates the acid through urination or bowel movements. However, uric acid can accumulate in the blood if your body produces too much of it or if your kidneys aren't functioning properly. When you consume an excessive amount of high-purine meals or use medications like diuretics, aspirin, or niacin, your uric acid levels may also rise. Uric acid crystals may then develop and gather in the joints. Inflammation is painfully caused by this. Gout is the name of this condition. Kidney stones may also be caused by uric acid.

If you have gout, the fluid that surrounds joints, synovial fluid, may include uric acid crystals. Your joints benefit from this fluid.

as:

- Joint pain or soreness
- Swelling and pain in a joint, such as the big toe, ankle, or knee
- Red skin around a joint
- Joints that are hot to the touch
- Swelling and pain that affects only 1 joint in the body
- Skin that looks shiny and is red or purple

You may also need this test if you have symptoms of kidney stones. Symptoms include:

- Severe pain along your lower back. This may repeatedly get worse and then get better. The pain may also travel to your genitals.
- Nausea
- Vomiting
- Urgent need to urinate
- Blood in your urine

This test needs a sample of synovial fluid. It's collected during a process called joint aspiration. To collect the fluid, your healthcare provider inserts a needle into the skin near an inflamed joint and withdraws some of the fluid into a vial or tube.

Joint aspiration has some minor risks. You may have bleeding in the area around the joint. Although rare, an infection can develop in the joint from the test.

Some medicines may affect your test results. They include:

- Aspirin and other medicines that contain salicylate
- Cyclosporine, a medicine sometimes used for autoimmune diseases
- Levodopa, a medicine used to treat Parkinson disease
- Some diuretic medicines, such as hydrochlorothiazide
- Vitamin B-3 (niacin)

Other things that may affect your test results include:

- Vigorous exercise
- Chemotherapy or radiation therapy to treat cancer
- Foods high in purines, such as organ meats, mushrooms, some types of fish and seafood, and dried peas and beans

Ask your healthcare provider about what to do before having this test. You may need to not eat or drink anything or not take certain medicines on the day of the test. Be sure your provider knows about all the medicines, herbs, vitamins, and supplements you are taking. This includes medicines that don't need a prescription and any illegal drugs you may use.

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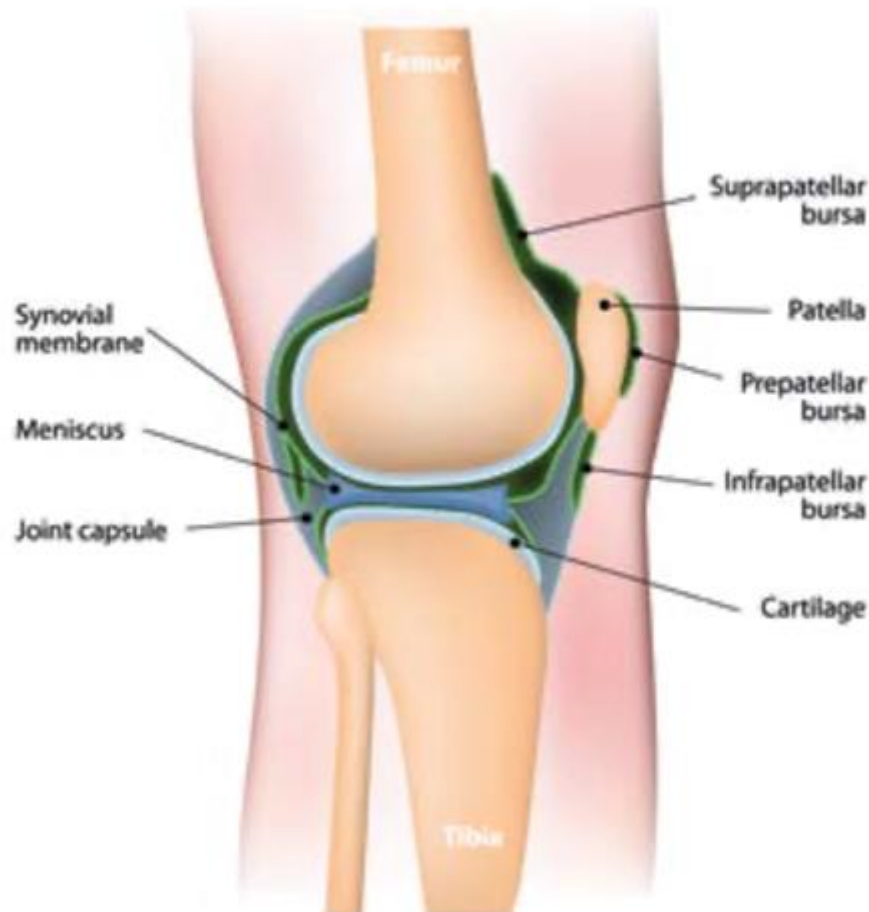


Fig-7

Conclusion:

An essential therapeutic and diagnostic treatment for treating joint effusion discomfort and identifying potentially significant joint diseases is synovial fluid aspiration and examination. It is a low-cost, very effective method of diagnosing and treating pain that may be completed swiftly at the patient's bedside without requiring general anesthesia. Since an expert surgeon is not necessary for arthrocentesis, its usefulness in quick treatment and diagnosis is increased.

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