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P Lakshmi Narayana Reddy
Consultant Orthopedician, Orthopedic Speciality Hospital, Pogathota, Nellore, Andhra Pradesh, India

Correspondence
P Lakshmi Narayana Reddy
Consultant Orthopedician, Orthopedic Speciality Hospital, Pogathota, Nellore, Andhra Pradesh, India

Joint flid analysis-A study to early diagnose different arthopathies

P Lakshmi Narayana Reddy

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Abstract
Introduction: Arthritis is the initial manifestation of many joint disorders. An analysis of synovial fluid has long been recommended as a routine procedure to assist in the diagnosis of arthritis.
Objective: The present study was undertaken to correlate the clinical presentation and the results of synovial fluid analysis in arthritic conditions.
Materials and Methods: In the present study, A total of 78 joint cases were studied. The joints aspirated were the knee (75 cases), ankle (2 cases) and elbow (1 case). Based on the physical, cytological, bio-chemical and bacteriological studies, the synovial fluids were divided into distinct group, which confirmed to the clinical diagnostics.
Results: In our study of 78 specimens of synovial fluid of various arthritis (synovitis), 24 (30.76%) were osteoarthriitis, 4 (5.12%) were Rheumatoid arthritis, 7 (8.97%) were tuberculous arthritis, 3 (3.84%) were septic arthritis, 1 (1.28%) were neuropathic joint, 10 (12.82%) were Traumatic Joint, 1 (1.28%) was Gouty arthritis, 1 (1.28%) was Rheumatic Fever and 27 (34.61 %) were non-specific synovitis. The synovial glucose values ranged from 35 to 110 mgldl. The total protein content varied from 4 to 6 mgldl. The cytology showed total inflammatory cells varying between 15 cells to 2000 cells / cu.mm. There are predominance of polymorphs, lymphocytes and monocytes. Other cells present were synovial cells. The next most common diagnosis was osteoarthritis (24 cases). Seven cases were diagnosed as tuberculous arthritis. In that four cases were confirmed with synovial biopsy after the synovial analysis. Three cases were diagnosed as septic arthritis. Total four cases diagnosed as rheumatoid arthritis. The series also included one case of rheumatic fever.
One case was diagnosed as neuropathic joint involving left elbow the patient presented with gross swelling, pain free joint movement, deformity, thickenings of the synovium and crepitations were present. One case was diagnosed as gouty arthritis. Ten cases were diagnosed as traumatic arthritis.
Conclusion: Biochemical analysis and cytology assessment of synovial fluid for proteins and sugar contributes in diagnosis of different types of arthritis.

Keywords: Synovial fluid, Mucin clot test, Osteoarthritis, Rheumatoid arthritis, C-reactive protein

Introduction
One of the major health problems is arthritis, though the mortality is very less, the morbidity is very much. Arthritis is the general term used when the joints themselves are the major seats of either inflammatory or degenerative or other lesions and manifest clinically as pain, swelling, restriction of movements, deformity of the affected joints. Arthritis is one of the oldest diseases. There are over a hundred causes for arthritis identified and described. It is impossible to recall all these types, when a patient is in front of us. Instead, a simple logical approach needs to be worked out based on clinical examination and investigations.
Apart from other investigations like ESR; c-reactive protein; rheumatoid factor test; ASO titre, L.E. Cell; anti-DNA antibody, complement studies, immnoglobulin profile, complement studies, serum uric acid, the "Analysis of synovial fluid" plays an important role. Synovial analysis is utmost essential factor in the diagnosis of the joint diseases and can be compared to urine analysis of the renal disease.
Analysis of synovial fluid is indicated whenever there is an accumulation of fluid in a joint. Synovial fluid unlike blood or urine is not always easy to get. At-least a few drops of fluid is usually obtainable from joints accessible to needle puncture especially if they are inflamed.
When the test for Rheumatoid factor in the serum is positive, it is helpful in establishing the

diagnosis of rheumatoid arthritis but they are often negative in early cases, when the diagnosis is more desirable. Similar problems occur with serum uric acid determination in gout. These may be normal in the early stages of the disease and may be elevated in a variety of other conditions. As a rule definitive roentgenograpthic changes in all the arthritis becomes diagnostic only in late stage of the disease Routine synovial biopsy is not a common procedure in most ofthe institutions primarily because it is not always a conclusive diagnostic tool, as the representative tissue may not always be the diseased one.

Since the underlying synovial tissue reaction is often reflected in the joint fluid, its analysis may provide much information about the disorders at this primary site of activity itself. Numerous studies on viscosity, protein, polysaccharide chemistry, cytology, presence of crystals and other elements and even tissue culture of synovial fluid examination has added new entities like pyrophosphate crystal arthropathy, immunopathology, immune histology and crystalography is recent years.

The purpose of analysis of synovial fluid by aspiration is to get acquainted with the diagnostic values of synovial fluid examination. Synovial fluid has presented a virtually unexplored frontier in the investigation of arthritis.

A simple bed-side procedure in the experienced hands, the test can yield valuable results. With the availability of disposable syringes and needles and with sterile precautions, the procedure is very much acceptable and useful to diagnose and correlate the different arthritis.

The present study was undertaken to correlate the clinical presentation and the results of synovial fluid analysis in arthritic conditions.

Materials and method

Joint fluid aspirations is diagnostically indicated in any patient with an effusion who has an undiagnosed arthritic disorder or who has a new event relating to the joint with the effusion. Aspiration of inflamed, localised, periarticular soft tissue also is indicated. Even asymptomatic metatarsophalangeal joints with no evidence of active arthritis can be aspirated to found MSUM and CPPD crystals. In skilled hands, the discomfort and risk are minimal. Therefore, in the view of the valuable diagnostic information to be obtained," Do Not Wait; Aspirate."

The synovial fluid samples were obtained from the patients with aseptic methods. Each specimen of the fluid was subjected to tests viz., physical characteristics (with respect to color, clarity, pH, viscosity), much clot test the biochemical examination (sugar, total proteins, A: G ratio and electrolytes), the cytological study and the bacteriological study (culture & Grams strain).

The specimens are col1ected in sterile bottles and sent appropriately to the laboratories of Biochemistry, pathology an microbiology for biochemical, cytological and bacteriological examination respectively. In most of the patients blood samples were collected simultaneously preferably by fasting for atleast 6 hours for the estimation of sugar. The technique of the joint fluid aspiration is known as "Arthrocentesis".

Arthrocentesis tray-contains

Syringes of choice
Needles - 25 gauge for small joints.
21 gauge for other joints.
15-18 gauge for thick effusions (pus, rice bodies)
Iodine disinfectants
Alcohol
2% xylocaine! Ethyl chloride spray.
Sterile sponges.
Forceps (hemostat)
Adhesive bandages (Band-Aid)
Clear glass stoppered text tube with anticoagulant (sodium heparin or EDTA)
Screw top sterile culture tube
Special items of choice - Chemistry tubes
Culture medium
Intra articular corticosteroids.

Method of arthrocentesis

Hench *et al*. 1954 [1] considered human joint as a "sacred cow, not to be violated even by pathologist doing an autopsy on a dead rheumatoid patient". In the past putting a needle in a joint was looked upon with a frown by the orthopedic surgeons except as preliminary to drainage of the pus in the strongly suspected cases of septic arthritis.

But there is no absolute contraindication to joint aspiration for the diagnostic purposes. The possibility of iatrogenic septic arthritis is remote when aseptic techniques are practiced. Hollander *et al*. [2] has reported and infection rate of 1:7000 procedures after recording nearly 100,000 joint aspirations and drug injections.

The site for arthrocentesis is selected avoiding the area of abrasion or cellulitis. Proper cleaning of the skin performed by swabbing with alcohol to remove the natural oils and debris followed by an iodinebased antiseptic, such as povidone-iodine (Betadine), followed by alcohol swabbing.

Sterile technique as described is essential not only to avoid introduction of organisms into the joint but also to have sterile specimens for cultures, Gloves and drapes are not required if one is certain not to touch the needle or the area to be aspirated. However, we have always used gloves, drapes, syringe, 18-20-gauge needle and bottles all autoc1aved.

We have not used local infiltration of the xylocaine for the fear of entering the joint and causing dilution of synovial fluid and possible confusion in the interpretation of synovialysis. Sprayings the designated area with ethylchloride, which is sterile, decreases the superficial pain. Do not swiri the spray, hold it steady and stop spraying as soon as the first sign of freezing occurs; skin damage can occur in patients with atrophic skin. A quick, decisive thrust through the skin with the disposable needle and attached syringe produces the least discomfort. Once into the subcutaneous tissue, where the nerve endings are less prevalent, angles and landmarks can be briefly re-evaluated so that a second penetration may be made through the capsule, the other area of increased pain fibres. This second thrust is made more cautiously because of the subjacent bone and articular cartilage. If the periosteum is struck, pain is considerable. If the articular cartilage is entered, a gouge may occur that does not readily heal Therefore it is important to pierce the capsule and enter the joint spaces cleanly without gracing off other structures.

Small effusions may be withdrawn more easily if gentle pressure is applied to the opposite side of the joint cavity, bringing the needle towards the needle tip. Once sufficient fluid has been drawn into the syringe, tension on the plunger should be released and the needle quickly withdrawn. If during arthrocentesis, extraneous blood brings to invade the synovia in the syringe, it is usually wise to terminate the procedure to avoid excessive contamination of fluid with blood.

At times it is difficult to aspirate the fluid inspite of its presence. In case of chronic inflammatory arthritis, small bits (biopsies) are often aspirated if the needle touches the synovium; likewise free-floating "rice-bodies", made up of synovial tissue and/or fibrin, can clog the needle. The choices are;

1. To withdraw the needle with tissue worthy of examination in the bore, if sufficient fluid for the examination is in the synnge.
2. To leave the needle in place express some of the aspirated synovia back through the needle to unplug it, and continue with further aspiration.
3. If neither approach has been productive, to with draw and reenter the joint with a large-gauge needle.

Caution: - It is wise to have a small surgical forceps (hemostat) with you during all aspirations. Rarely the needle may break or separate from its plastic adapter, requiring immediate retrieval from the injection site. Commonly the forceps is useful for removing the needle from the syringe smoothly when switching syringes with the needle in the joint cavity, for example upon aspiration and subsequent injection.
The specimens are collected in three sterile bottles. The bottle added with fluoride (to avoid the glucose metabolism by leukocytes) was sent for chemical examination, the bottle added with anticoagulant, EDT A (to prevent cell clotting) was sent for cytology, and fluid in sterile bottle without additive was sent for culture. The synovial fluid examination starts from the time of aspiration.
The physical characteristics like colour, clarity and the viscocity by string test or syringe drop test and mucin clot tests were done immediately.
The presence of blood streaks in the synovial fluid during aspiration is usually due to puncture of blood vessels during the procedure of arthrocentesis.

Mucin clot test
This test is performed on the fluid collected without additive. The clot formed in the test tube was graded as GOOD, when it is tight, ropy and suspended in clear solution, FAIR when it is softer in a slightly cloudy solution and POOR when it consists of numerous small flecks of mucin in a turbid solution.

Glucose
It was measured by Folin-Wu macromethod (as used for serum glucose) and expressed as mgldl.

Proteins
Total proteins and A:G ratio were measured by Biuret method and expressed as *gml* d I.

Cytology
The white cell counting technique was used for counting total cell count except that isotonic saline was substituted for the usual acetic acid WBC diluting fluid since the latter precipitates the hyaluronic acid - protein complex. Saline 0.3% was used as diluting fluid whenever the effusion was bloody in order to lyse the red cells. The differential WBC count and cellular morphology were done with a pap stain or cytopin preparation.

Bacteriology
The specimen without additive was inoculated in the appropriate media for the culture of Neisseria, Tubercle bacilli, Anaerobes and Aerobes. The sediment was stained with Grams's stain and Ziehl-Neelson stain to examine morphology of the organisms.

Aspiration of individual joints
(1) Hip joint: The hip may be aspirated by inserting needle above the trochanter, *allowing* for *femoral neck* anteversion. *Alternatively*, a needle *may* be passed into *the joint* from in front, a JittJe below the inguinal ligament and lateral to the femoral artery.

(2) Knee joint: F or a large effusion, a lateral approach directly into the center of the ballooned- out suprapatellar pouch is shift and hence less uncomfortable. The ballooning of the suprapatellar pouch can be accentuated by the pressure laterally on the medial aspect of this area. Mark the target area, which will be approximately at the level of cephalad border of the patella. This will leave a small round skin indentation sufficiently visible to allow time for cleaning anaesthesia and arthrocentesis. A medial approach under the midpoint of the patella is preferable for a small effusions. Be sure to the medial edge of the patella so as not to strike its "v-shaped" gliding surface.

(3) Ankle joint: The ankle joint is entered form the front, between the lateral boarder of the peronius tertius and lateral malleolus, or between the medial boarder of the tibialis anterior and medial malleolus. The needle is thrust backwards and slightly backwards and slightly downwards should gain the interval between the tibia and the talus which has been previously identified by palpation. The joint may also be aspirated from the back, between the tendo calcaneus and peroneal muscles.

(4) Shoulder joint: With the patient in supine position, find the coracoid by following the clavicle laterally; it lies about 5 ems obliquely below the acromio-clavicular joint. Now rotate the arm, when we should be able to feel the head of the humerus. After local infiltration, pass the needle directly backwards into the joint (usually just below and lateral to the corocoid)

(5) Elbow joint: Most direct and safest approach is from the lateral side. Flex the elbow at 90degrees to locate the radial head, pronate & supinate the arm, and feel with thumb for its rotation. After infiltration of the area with local anesthetic, interduce the aspirating needle depression between proximal part of the radial head and capitulum.

(6) Wrist joint: With the thumb, feel for the depression of the back of the wrist which lies between the distal end of radius and scaphoid in the vertical plane, and between the extensor digitroum communis and extensor carpi radialis brevis in the plane at right angles to it. After infiltration of the skin with local anaesthetic, incline the aspirating needle at 60degrees, with the tip directed cranially.

Systematic Examination & Investigation.
1. Blood (Hb Percent, TC, DC, ESR, Grouping, Bleeding Time, Clotting Time, Prothrombin Time, Sugar, Urea, Uric Acid)
2. Urine (Albumin, Sugar, Microscopic)
3. X- Ray Chest
4. X- Ray of Joints - Findings, Articular Ends, Joint Space, Bony Components, Abnormal Bone Shadows

5. Special Investigations - Rheumatiod Factor, Diagnostic BCGl Montoux, VDRL.

1. Synovial Fluid Test - Volume, Color, Clarity, Turbidity, Viscosity (Syringe Drip Test), Specific Gravity, Total WBC, Mucin Clot Test, Sugar, Total Proteins, Organisms.
K.Biopsy - Lymph Node, Synovial Membrane.
L.Diagnosis

Results

A total of 78 joint cases were studied. The joints aspirated were the knee (75 cases), ankle (2 cases) and elbow (1 case). Based on the physical, cytological, bio-chemical and bacteriological studies, the synovial fluids were divided into distinct group, which confirmed to the clinical diagnostics. Those, which are not, confirmed with clinical diagnosis and the results of which not fitting into any group were grouped as non-specific synovitis.

In our study of 78 specimens of synovial fluid of various arthritis (synovitis), 24 (30.76%) were osteoarthriitis, 4 (5.12%) were Rheumatoid arthritis, 7 (8.97%) were tuberculous arthritis, 3 (3.84%) were septic arthritis, 1 (1.28%) were neuropathic joint, 10 (12.82%) were Traumatic Joint, 1 (1.28%) was Gouty arthritis, 1 (1.28%) was Rheumatic Fever and 27 (34.61 %) were non-specific synovitis.

The age range of the patient is varied from 10-72 years with 1 patient in 0-10 range, 5 patients in 11-20 years, 14 patients in 21-30 range, 13 patients in 31-40 years, 17 patients in 41-50 range, 19 patients in 51-60 range, 8 patients in 61- 70 range and 3 patients in 71-80 age group.

Table 1: Findings of synovial fluid analysis

Diagnosis	Colour	viscosity	Glucose *mgldl*	Proteins gms/dl	Total W.B.C cells/cu. mm.)	Differencial count %
Normal	clear	good	equal to Serum	1.72	63	P-7, L-25 M-63
Traumatic Arthritis	Red!Orange	good	57	5	0-1000	P-25
Osteoarthritis	Pale Yellow	good	69	4	20-600	L,H
Septic arturitis	Turbid! Purulent	reduced	35	5.75	28000-100000	P-70-90
Non-Sepcefic Synovitis	Variable	Variable	64	4.2	15-2000	P-40, L-30 E-40
Rheumataid arthritis	Orange	reduced	52	6.26	4000-30000	P-30 L-60
Gouty arturitis	Thick Yellow	reduced	51.5	5.6	4500-50423	P-73
Rhuematic fever	Yellow	reduced	70	4.5	1750	L-60
Pigmented villonodular synovitis	Reddish Brown	reduced	75	5.0	530	P-90
Tuberculous Arthritis	Turbid	reduced	53.7	6.17	7240-27620	P-30 L-10

(P-Polymorphs, L-lymphocytes, E-Eosinophils, H-Histocytes, M-Monocytes)

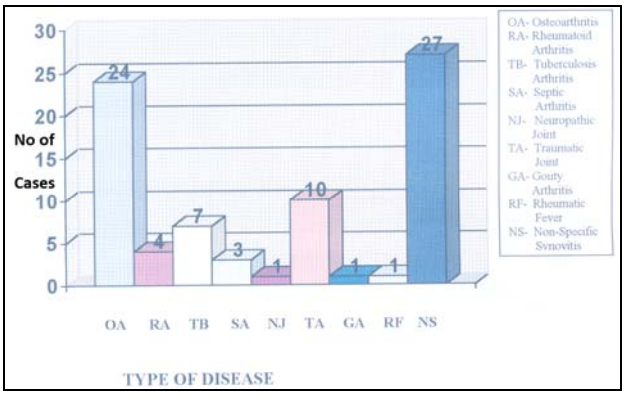


Fig 1: Simple bar graph of distrubution of cases

Table 2: Sex distribution

Arthritis type	Male	Female
Ostearthritis arthritis	18	6
Rheumatoid arthritis	2	2
Tuberculaus Arthritis	2	5
Septic arthritis	2	1
Neuropathic joint	0	1
Gouty arthritis	1	0
Traumatic joint	8	2
Rueumatic fever	1	0
Non-specific synovittis	14	13

Table 3: Distribution of cases according to age

Arithritis type	Age Group in Years							
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
Osteo arthritis	0	0	0	0	7	9	5	3
Rheumatic arthritis	0	0	0	1	2	1	0	0
Tuberculous arthritis	0	0	0	1	3	2	1	0
Septic arturitis	0	0	1	1	0	1	0	0
Neuropatuic joint	0	0	0	1	0	0	0	0
Traumatic arthritis	1	2	3	0	1	2	1	0
Gouty arturitis	0	0	0	1	0	0	0	0
Rheumatic fever	0	1	0	0	0	0	0	0
Non-specific synovitis	3	9	7	3	4	1	0	0

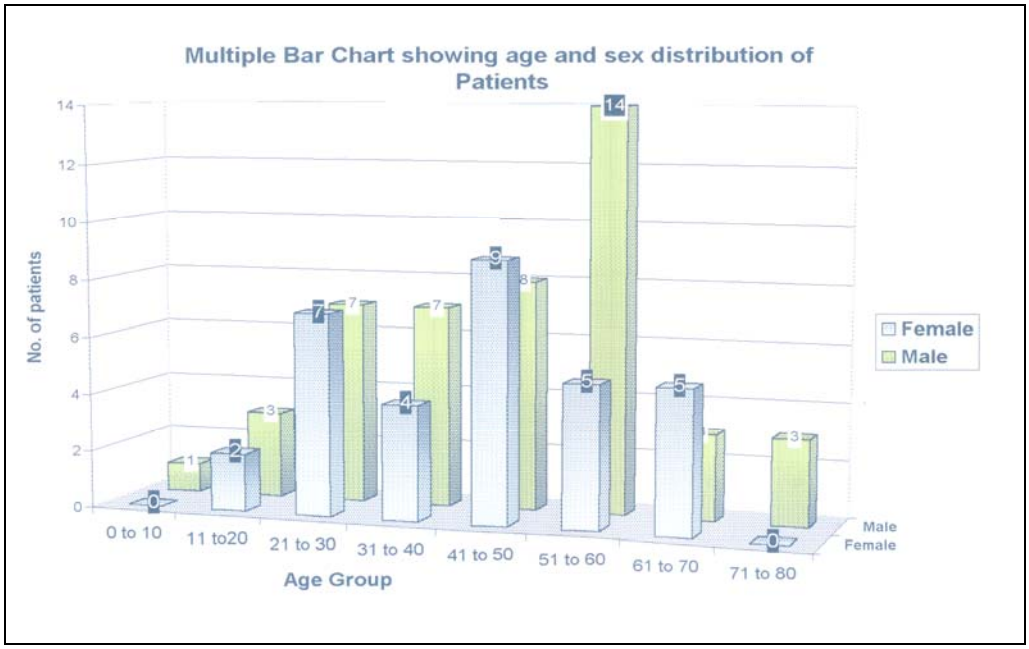


Fig 2: Bar chart showing age and sex distribution of patients.

Table 4: Clarity of fluid

Arthritis	Clarityip ale	Turbid	Very turbid
Osteoarthritis	18	6	0
Rheumatoid arthritis	0	4	0
Tuberculosis arthritis	3	4	0
Septic arthrits	0	0	3
Neuropathic Joint	1	0	0
Traumatic arthritis	6	4	0
Gouty arthritis	0	1	0
Rheumatic fever	1	0	0
Non-specific synovitis	20	7	0

The disease wise age range in osteoarthiritis was from 44-72 years, in Rheumatoid arthritis from 40-51 years, in Tuberculous arthritis from 43-67 years, in septic arthritis from 30-60 years, in neutropathic joint 40 years, in Traumatic arthritis from 10-64 years, in Gouty arthritis 45 years, in Rheumatic Fever 30 years and in non-specific synovitis from 18-63 years.

The sex involved are 48 male patients and 30 female patients (M:F - 61.53:38.46) with osteoarthritis - 18:6, Rheumatoid arthritis - 1:1, Tuberculous arthritis 2:5, septic arthritis - 2: 1, Traumatic arthritis 8:2, and non-specific 14: 13. The most common diagnosis was non-specific synovitis (27 case) they were categorized into the group because of a typical presentation with insidious onset and mild inflammatory nature and the synovial analysis not characteristic of other diseases. The specimens were pale yellow, clear to thick with viscosity being normal, low.

The synovial glucose values ranged from 35 to 110 mgldl. The total protein content varied from 4 to 6 mgldl. The cytology showed total inflammatory cells varying between 15 cells to 2000 cells / cu.mm. There are predominance of polymorphs, lymphocytes and monocytes. Other cells present were synovial cells. The next most common diagnosis was osteoarthritis (24 cases). The specimens were pale yellow in color, clear and viscosity was normal. The synovial glucose values ranged from 35-118 rng/dl. The total proteins varied from 0.6 - 6.02 gms/dl. The total cell count varied from 20cells to 600 cells pet cu.mm. the striking finding cytologically was the presence of numerous well preserved normal appearing cartilage cells. The other cells were synovial cells, lymphocytes and few polymorphs. Relationship of inflammatory cells was maintained as in normal fluid.

Seven cases were diagnosed as tuberculous arthritis. In that four cases were confirmed with synovial biopsy after the synovial analysis. The specimens were ye1lowish, cloudy and viscosity was reduced. The synovia glucose content ranged between 40 to 93 ms/dl and protein content was 5.0 to 7.8 gms/dl. Cytology of specimens showed total leucocyte count ranging from 6240 to 28,760 cells/cu.mm with polymorphs predominating in almost a1l cases.

Three cases were diagnosed as septic arthritis. The specimens are grossly purulent in a1l the three cases. The viscosity was generally low. The synovial fluid glucose ranged from 15 to 64 mg/dl. The range of total proteins varied from 4.5 to 7.8 gms/dl. The total cell count showed 28000 cells/cu.mm to 100000 cells/cu.mm with po\ymorphs being 70%-90% and other cells were mainly lymphocytes with few synovial cells, marcrophases and RBcs in few cases.

Total four cases diagnosed as rheumatoid arthritis. All cases were monoarticular. ln the 2 cases latex fixation test for rheumatoid factor was positive and ESR was high in all the cases. The colour of the specimens varied from yellow to Grey and viscosity in all the fluids was reduced. The synovial glucose values ranged from 40-70 rng/dl. The total proteins were between 5.1 to 7.5 gms/dl. The cytology showed total leucocyte count with considerable variations ranging from 4000 to 30000 cells/cu.mm. In all the cases polymorphs were predominant.

The series also included one case of rheumatic fever. The patients history was typical of fleeting nature joint pains and ASO titre was positive. The synovial fluid findings were yel1ow, thick fluid with low viscosity. The synovial fluid glucose was 70 mg/dl. The protein content was 4.5 gms/dl the cytology showed 1750 total leucocytes/curnm the cells were predominantly lymphocytes with few neutrophils. Other cells being plenty of mesothelial cells, macrophages andRBCs.

One case was diagnosed as neuropathic joint involving left elbow the patient presented with gross swelling, pain free joint movement, deformity, thickenings of the synovium and

crepitations were present, VDRL test was negative. Volume aspirated about 50m], reddish tinged in colour: Total cell count 900 cells/cu.mm with polymorphs and lymphocytes (35% and 65%, respectively). RBCs were seen. Protein content 3.8 gms/dl and sugar 64 mg/dl.

One case was diagnosed as gouty arthritis. The synovial fluid is yellow and cloudy. Viscosity is low the cell count is similar to rheumatoid arthritis with 75% of neutrophils. The diagnosis of gouty arthritis rests on identifying the specific crystals under polarized microscope.

Ten cases were diagnosed as traumatic arthritis. These fluids were generally haemorragic and orange colour. The viscosity was normal. The cytology showed plenty of RBCs in clumps, sheets and inflammatory cells varied between none to 1000 cells/cu.mm. the majority of cells were polymorphs with few lymphocytes, macrophages and histocytes.

Discussions

Synovial fluid is a dialysate of blood plasma plus mucin. It is a nutrient and lubricant of artiucular cartilage. Changes in amount, physical, biochemical and histopathological characteristics of synovial fluid occur rapidly as a result of injury or disease of the joint (Ropes and Bauer, 1953) [3] and so, it is an aid in the diagnosis and treatment of arthritis. In the literature, the datas of synovial fluid analysis are available for almost all types of arthritis with effusion (Kling, 1938 [4], Ropes and Bauer 1953 [3], Furey *et al* 1959 [5], PH CURTISS 1964 [6].

A swollen joint particularly monoarticular arthritis of knee joint is a common orthopaedic condition and there is always a problem in diagnosing it. Occasionally on the basis of clinical and radiological findings, and other haemotological investigations it is possible to make a definitive diagnosis. But more often these findings are equivocal and therefore need arises for further investigation of the large number of tests available for the diagnosis of arthritis, none seems to be specific or totally reliable, moreover, the bacteriological studies, serological investigation and other special tests are usually not performed in small routine laboratories. Therefore, the need for some simple procedures possible to conduct with routine laboratory facilities cannot be over-emphasized. This particularly relevant in respect of the presently emerging pattern of specialist services in provincial hospital of our country.

The present study was therefore undertaken to find the usefulness of routine synovial fluid analysis as a diagnostic aid in arthritis, to evolve a diagnostic pattern of synovial fluids analysis, and to compare the results of this study with other series. Careful screening of the literature would reveal that lately there has been a revival of interest in the examination of synovial fluid from the joint. In the past, it was most often limited to the bacteriological examination for the diagnosis and management of purulent arthritis. However, it has recently been realized that a more ielaborate physicochemical, cytological analysis could be profitable in diagnosis of many other types of arthritis too. Much of the interest attracted by synovianalysis has been because it is relatively simple procedure, can be carried out in the out patient department when compared with other conventional methods such as synovial biopsy and serological tests. Hollander [2, 7] suggested the synovial fluid analysis as the most definite differential diagnostic test for various arthritis. Despite these wide ranging implications, reports are scanty in India.

When one develops the habit of aspirating synovial fluid from involved joints in which the cause of disease is not known, a significant number of unsuspected diagnoses will be made and made early in the course of the disease. The technique can eliminate unnecessary treatment and possibility, the necessity of an arthrotomy. It is not to give an impression that the synovianalysis will suffice in the diagnosis in all cases arthritis. The need for open synovial biopsy still exist in some instances. This especially true where tuberculous arthritis is strongly suspected and a 6-10 week delay for culture is not advisable and in rheumatoid arthritis, sometimes, as the synovial fluid values are markedly variable depending on the severity of inflammation. It would be emphasized that, as with other laboratory procedures, synovial fluid analysis cannot supplant a through history and physical examination, although it can provide invaluable additional information.

In spite of overlapping of the findings the grouping of various joint diseases according to synovial fluid findings is helpful in understanding the pathogenesis of the effusion. Sehmid, Ogata, 1965 [8], Hollander 1966 [7] ---

Group I - Non-inflammatory joint diseases

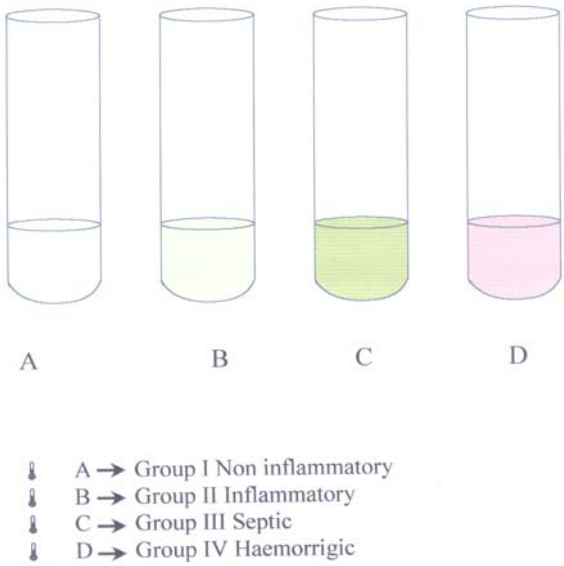
Group II - Inflammatory

Group III - Septic

Group IV - Haemorrhagic.

Haemorrhagic synovial fluids are grouped in a separate category chiefly for convenience. Except for the presence of blood or xanthochronic fluid, the results of synovianalysis are usually similar to those of Group I fluid.

As it is seen with the results of synovial fluid changes in our study there was no difficulty in diagnosing the traumatic, degenerative (Osteoarthritis) and septic arthritis. The former 2 fall into group not inflammatory type or I. The physical characteristics (Viscosity, mucin clot), glucose content, protein content with normal A:G and the total leukocyte count were similar in both the traumatic and degenerative types. But the cytology had shown the majority of cells as polymorphs (75%) with occasional hemosiderin pigment cells and plenty of RBCs in traumatic synovitis and the cartilage cells with occasional multinucleated cells and monocyte predominance in degenerative arthritis. Our findings were conformity with other series (Naib 1973) [9], arthritis which may be misleading, little difficulty in encountered in separating the more severe inflammatory reactions seen in the Group II patients from the traumatic or degenerative reactions seen in group I patients.



The septic arthritis cases fall into Group III type with no difficulty in diagnosis. In our study serum synovial fluid glucose difference was more than 50mg% polymorphs constituting 10% - 90%. The gram stain showed positive for bacteria in 43% of cases and the culture was positive in 75% of cases. The viscosity was decreased and the mucin clot was poor to very poor. Our studies were conformity with the findings of Ropes, Bauer and other series.

In our study the main diagnostic difficulty was in differentiating monoarticular arthritis with effusion of rheumatoid arthritis and tuberculous arthritis. The viscosity was reduced and synovial fluid glucose was 35 mg/100 cc.

There was no difference in the total protein content which has increased in both and the total leukocyte count was also similar. There are polymorph predominance in 80% of cases in Rheumatoid arthritis and in 75% of cases in T.B arthritis.

However, the ultimate diagnosis was based on the synovial biopsy. There was considerable overlap in the synovial fluids findings of Rheumatoid and Tuberculous arthritis. No single test was exclusively diagnostic of either Rheumatoid or Tuberculous arthritis. Our findings were in consistent with the remarks of other studies.

The results of non-specific synovitis have shown findings of Group I / II nature.

When one develops the habit of aspirating synovial fluid from involved joints in which the cause of disease is not known, a significant number of unsuspected diagnosis will be made and made early in the course of the disease. The technique can eliminate unnecessary treatment and possibly, the necessity, of an arthrotomy. It is not to give the impression that this series of tests will suffice in the diagnosis in all cases of arthritis. The need for open biopsy will still exist in some instance (especially in T.B) Also by repeated examination of the synovial fluid at regular interval one can establish whether the patient is responding to the treatment or not.

Summary and conclusions

Study of the joint fluid is an important in arthritis as urinalysis in renal disease. Careful examination of joint fluid is the most definitive diagnostic laboratory test for differentiation of the various forms of arthritis. It is also the diagnostic aid least frequently utilized by physicians. The separation of cases of severe inflammatory response from those of basic traumatic and degenerative etiology can be readily accomplished. Proper interpretation of synovianalysis will not only aid in diagnosis but also offer some insight as to prognosis, provide a measure of therapeutic response and add to one's understanding of the pathogenesis of synovial tissue inflammation. Synovial fluid is actually a "Liquid Biopsy" from the site of inflammation.

A rather complete examination of synovial fluid is possible with a minimum of equipment and within a reasonable time. The significance of the fluid findings outweigh the effort of the analysis. In the past putting a needle in a joint was looked upon with a frown by the orthopedic surgeons expect as preliminary to drainage of the pus in strongly suspected cases of septic arthritis. But if strict aseptic ritual is adhered to for collecting the synovial fluid there is hardly any chance of contaminating the joint as is evident from the present series. Another plus point for this procedure is that it lessens the burden of the patients in the orthopaedic wards waiting for their turn for the open biopsy in the operation room. Although cytology has been considered the most definite diagnostic laboratory test for the diagnosis of various forms of arthritis it is still the most neglected of the tests available. Exfoliative cytology has found wide application in the diagnosis of disease in effusions from many organs and from many secretions. It is a valuable technique not only because of reliability in experienced hands but also because of the rapidity with which smears can be screened. Not insignificantly, it also has the advantage of being inexpensive. There is no reason why synovial effusions, when easily aspirated, should not be subjected to this type of examination.

Inspite of the limitations of this procedure (synovianalysis), it is a simple and useful addition to the armamentarium of investigations to reach a conclusive diagnosis in monoarticular joint pathology. It is therefore concluded that a careful history, physical examinations and roentgenographic evaluation supplemented by different combination of tests in synovial fluid analysis will allow greater diagnostic accuracy in evaluating diseased or traumatized joints.

Our study shows:

1. The clarity, viscosity, mucin clot and electrolytes do not have independent diagnostics significance. Exfoliative cytology found to be the most useful of all the tests. The measurement of total glucose was most useful additive in the diagnosis of septic arthritis.
2. The total proteins increased in all the inflammatory conditions, more so in rheumatoid and tuberculous arthritis. The bacteriology was helpful in infective arthritis but absence of bacteria do not rule out infective nature.
3. The findings in traumatic arthritis and osteoarthritis are similar to that of normal synovial fluid except that cytology shows hemosiderin cells, RBCs in T.A. and cartilage cells, giant cells in O.A.
4. In septic arthritis the diagnostic findings were turbid to purulent fluid, reduced viscosity, highly reduced glucose (35 mg/dl), cytology - 68000 *WBCs/cu.mm.* with 70%-90% of polymorphs, and positive Gram's Stain, culture.
5. The most diagnostic difficulty was in differentiating Rheumatoid and Tuberculous arthritis as the findings were more or less similar and it is here the combination of different tests than individual test stressed and also itshere the scope for synovial biopsy exists more than others.
6. Histopathological examination is diagnostic and specific most of the times leaves us in dark in case of non specific synovitis.
7. Advantage in analyzing synovial Fluid was Firstly the patients with huge effusion were relieved by aspiration especially the patient suffering from septic arthritis. Secondly it lessened the burden of the patients in the orthopaedic wards waiting for their tum for open biopsy in operation theatre.
8. Synovial Fluid examination is a reliable "liquid biopsy" Short of HPE, but has an advantage of being less invasive than an open biopsy This study Suggest that synovial fluid aspiration and analysis is simple, practical and effective diagnostic tapping which yields to several investigation, including the investigation not done in our study like crystal, immunological and electrophoretic study.

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