VOLUME - 10, ISSUE - 12, DECEMBER - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Pathology

STUDY OF SYNOVIAL FLUID IN DIAGNOSIS OF JOINT DISEASES IN A TEACHING HOSPITAL

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ABSTRACT

Background: Analysis of synovial fluid has been recommended as a routine procedure to assist in the diagnosis of arthritis. Arthritis can be either a monoarticular or polyarticular lesion leading to morbidity, affecting all ages .

Aim of the study: To study synovial fluid analysis in the diagnosis of joint diseases in a teaching hospital.

Materials and methods: Prospective study was done on synovial fluid samples over a period of two years at the Department of Pathology. ACS medical college ,Chennai for duration of 6 months ie, from February 2021 to August 2021.

Results: Majority of the cases were osteoarthritis constituting 33.3 % .Rheumatoid arthritis constituted 20%..Chronic nonspecific synovitis were noted in 30% cases .01 case of Traumatic arthritis and 02 cases of Tubercular arthritis were noted.

Conclusion: Synovial fluid analysis will give us an idea about the differential diagnosis of joint diseases. Synovial fluid aspiration should be done for the analysis and also used as a treatment procedure of synovial inflammation.

KEYWORDS : Synovial fluid, Osteoarthritis, Nonspecific arthritis, Rheumatoid arthritis.

INTRODUCTION

Synovial fluid (SF) analysis is one of the most useful laboratory tests in the diagnosis of joint diseases. It allows us to determine the degree of synovial inflammation and, through the identification of pathogenic crystals and microorganisms, to diagnose crystal-induced arthritis and septic arthritis, respectively [1]. Ropes and Bauer were among the first to point out that differences in the appearance and cell content of abnormal SF could be related to different disease categories, in particular distinguishing inflammatory and noninflammatory forms of arthritis.(2).Hollander et al promulgated the routine use of SF analysis as an aid to diagnosis, documenting in detail the main findings of SF in different forms of arthritis and introducing the term "synovianalysis".(3-5) The recommended procedure included evaluation of the gross appearance of SF, cell counts, microbiology, and biochemical tests such as glucose levels,It was subsequently shown that detection of crystals in SF may change clinical diagnosis and treatment.(6)

Aim of the study:

To study synovial fluid analysis in the diagnosis of joint diseases in a teaching hospital

MATERIALS AND METHODS

After obtaining ethical committee clearance, a prospective study was done on synovial fluid samples in the Department of Pathology at ACS medical college, Chennai for duration of 6 months from February 2021 to August 2021

Inclusion Criteria

Age 20 – 70 years
Patients with one or more joint effusions.

Exclusion Criteria

Cutaneous soft tissue infections mimicking acute arthritis
Patients of septicaemia.

Methodology

After taking an informed consent from the patients, synovial fluid samples were aspirated by orthopaedic surgeons under all aseptic precautions. Processing and analysis of the synovial fluid specimens was done in the department of pathology with detailed clinical history obtained through proforma.

After synovial fluid aspiration fluid was sent for the

- Physical analysis
- Biochemical analysis
- Clinical pathology and Cytology

The physical analysis includes color, appearance and volume, viscosity. Using WBC pipette synovial fluid was drawn up to 0.5 mark and diluted with RBC diluting fluid by drawing up to 11 mark. Total and differential leucocyte counts were performed using Neubauer's counting chamber. Viscosity of the fluid was evaluated by performing a "string test" in which a long string (4-6 cm) forms when a drop is expressed from the end of the needle.

Microscopic examination for total and differential leukocyte count was done. Total leukocyte count was done using Neubauer's counting chamber after diluting the fluid with normal saline. Dilution was also done by Turk fluid in case of haemorrhagic aspirate. Differential leukocyte count was done by staining a dried smear of the fluid with Leishman stain.

Biochemical analysis included glucose levels and protein levels in synovial fluid.

Cytology includes the total leukocyte count and differential count from the centrifuged deposit to see the predominant white blood cells(WBCs)

Statistical Analysis

The data was analyzed using SPSS software. All the results

are expressed in tabulated form. Sensitivity and Specificity of the synovial fluid biopsy was established.

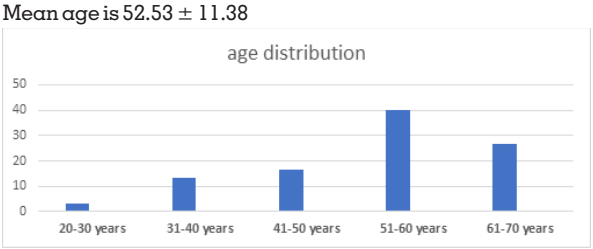
RESULTS

Table 1 :Age distribution

Age distribution	No. of cases	Percentage %	Mean Age
20-30 years	01	3.3	52.53 ± 11.38
31-40 years	04	13.3	
41-50 years	05	16.6	
51-60 years	12	40	
61-70 years	08	26.6	
Total	30	99.8%	

In our study, total of 30 cases were studied with a mean age of 52.53 ± 11.38 . Age distribution varied from 20 years to 70 Majority were noted among 51-60 years constituting 40% (12/30) followed by 26.6 %(08/30) among 61-70 years .

Mean age is 52.53 ± 11.38



In our study males were predominant constituting 63.3% (19/30) ; The male to female ratio was 1.7:1.The mean age of males were 54.2+/- 1.8 years and females were 54.7+/-1.5 years.

In our study the joints included were ankle, knee, wrist, sacroiliac. Knee joint was the most commonly involved. It was seen in 66.6% (20/30) of the cases.

Table 2: Cases of joint effusion

Joint effusion	No. of cases	%
Traumatic arthritis	01	3.3
Rheumatoid arthritis	06	20
Tubercular arthritis	02	6.6
Chronic non specific synovitis	09	30
Osteoarthritis	10	33.3
Septic arthritis	02	6.6
Total	30	99.8%

In our study majority of the cases were osteoarthritis constituting 33.3 % (10/30) and mostly seen among 51- 70 years. Rheumatoid arthritis constituted 20% (06/30) and cases were seen in 30-45 years age group. Two cases of Tubercular arthritis were noted in 33 year old female and 45 year old male .Chronic non specific synovitis were noted among 50-55 years and constituted 30% (09/30) One case of Traumatic arthritis was noted in 24 years old male .

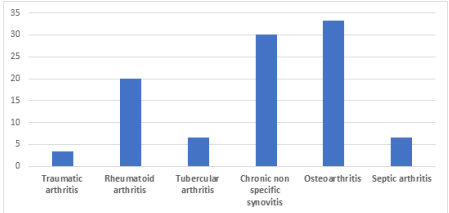


Table 3 : Physical examination

Physical examination	Rheumatoid arthritis (n=06)	Tubercular arthritis (n=02)	Chronic non specific synovitis (n=09)	Traumatic arthritis (n=01)	Osteoarthritis (n=10)	Septic arthritis (n=02)
Volume	2-6	3-7	2-7	2-6	4-10	2-5
Appearance						
Clear	03	-	05	-	05	-
Opaque	03	02	04	-	05	02
Bloody	-	-	-	01	-	-
Viscosity						
Normal	03	-	05	-	05	-
Low	03	02	04	01	05	02

In Rheumatoid arthritis 03 cases showed the presence of opaque fluid and low viscosity.

03 cases showed clear fluid with normal viscosity .02 cases of tubercular arthritis showed opaque fluid with low viscosity. 2 cases of septic arthritis showed opaque fluid with low viscosity. Among 10 cases of osteoarthritis, 05 cases showed clear fluid with normal viscosity. We detected one cases of traumatic arthritis with bloody appearance.

Table 4: Microscopic analysis

Biochemical and microscopic analysis	Rheumatoid arthritis	Tubercular arthritis	Chronic non specific synovitis	Traumatic arthritis	Osteoarthritis	Septic arthritis
TLC (cummm)	4500-22000	13000-15000	35000-50000	3500	1700 -3000	65000-85000

In cases of Rheumatoid arthritis, the level of TLC was 4500-22000/mm3 with predominance of Neutrophils.

Tubercular arthritis patients showed TLC of 13000-15000/ mm3 with predominance of neutrophils.

The TLC range in patients of non-specific synovitis was 35000-50000/mm3 with predominance of neutrophils.

Patients with septic arthritis showed TLC between 65000-85000/mm3 with predominance of neutrophils.

Patients with Osteoarthritis showed TLC between 1700 - 3000/mm3 with predominance of lymphocytes .

In Traumatic arthritis , TLC was low ie, about 3500/cumm with normal DC .

Table 5: Biochemical analysis

Biochemical and microscopic analysis	Rheumatoid arthritis	Tubercular arthritis	Chronic non specific synovitis	Traumatic arthritis	Osteoarthritis	Septic arthritis
Sugars (mg/dl)	20-55	30-45	20-30	20-30	75-85	19-36
Proteins (gm/dl)	4.3-6.8	4.3-6.8	2.0-3.0	4.6-6.3	1.3-2.6	4.2-6.

In cases of Rheumatoid arthritis, sugars were between 20-55 mg/dl and proteins between 4.3-6.8 gm/dl

Tubercular arthritis patients showed sugars were between 30-45 mg/dl and proteins between 4.3-6.8 gm/dl

The TLC range in patients of non specific synovitis sugars were between 20-30 mg/dl and proteins between 2.0-3.0 gm/dl.

Patients with Osteoarthritis showed sugars were between 75-85 mg/dl and proteins between 1.3-2.6 gm/dl

In Traumatic arthritis , sugars were between 20-30 mg/dl and proteins between 4.6-6.3 gm/dl

Patients with septic arthritis showed sugars were between 19-36 mg/dl and proteins between 4.2-6.4 gm/dl.

Table 6: Statistical evaluation of the cases

Test	Fisher's exact test	
P value	<0.0001	
P value summary	****	
One- or two-sided	Two-sided	
Statistically significant (P < 0.05)	Yes	
Effect size	Value	95% CI
Sensitivity	1	0.8241 to 1.000
Specificity	0.75	0.4677 to 0.9111
Positive Predictive Value	0.8571	0.6536 to 0.9502
Negative Predictive Value	1	0.7009 to 1.000
Likelihood Ratio	4	
Methods used to compute CIs Sensitivity specificity etc.		Wilson-Brown

Clinicopathological correlation was seen 30 cases. As a diagnostic tool, synovial fluid aspiration offers a sensitivity of 100%, 75% specificity with positive predictive value of 85% and negative predictive value of 100%

DISCUSSION

Comparative studies related to age distribution

In our study Mean age is 52.53 ± 11.38 .Osteoarthritis mostly seen among 51- 70 years. Rheumatoid arthritis were seen in 30-45 years age group. Chronic non specific synovitis were noted among 50-55 years .One case of Traumatic arthritis was noted in 24 years old male. In a study conducted by Mamatha SV et al [7] Osteoarthritis and tuberculous arthritis was seen in the elderly with the age range between 40- 70 years. Rheumatoid arthritis was seen in the age group of 25-65 years. Post traumatic arthritis was seen all ages. In Praveen garg et al study[8] osteoarthritis in elderly patients at 40-70 years of age with a median age of 58 years. Rheumatoid arthritis was more prevalent in the age group of 30-50 years with a median age of 41 years and tuberculous arthritis in the age group of 20-35 years with a median age of 30 years. In Karthikeyan et al study[9] Rheumatoid arthritis was found between the age group of 31-50 years and above 50 years predominantly. Tubercular arthritis was found mainly in the younger age group between 11-30 years. Septic arthritis, Osteoarthritis and Gout were more common in age group between 31-50 years.

Comparative studies related to sex distribution

In our study Joint effusion was seen predominantly in males constituting about 63.3%; The male to female ratio was 1.7:1. Similar findings were observed in Praveen garg et al [8] Susheel Kumar Pathak et al [10] and in Karthikeyan et al study [9] where males were predominant over females. Hence our study was in collobration with other respective studies.

Where as Mamatha SV et al[7] observed female predominance (51) when compared to males(51).

Comparative studies related to various diseases distribution

Joint effusion	Mamatha SV et al [7]	Susheel Kumar Pathak[10]	Praveen garg[8] et al study	Karthikeyan et al study[9]	Present study
Traumatic arthritis	09	04	03	03	01
Rheumatoid arthritis	15	14	16	13	06
Tubercular arthritis	05	13	06	08	02
Chronic non specific synovitis	-	10	-	09	09
Osteoarthritis	20	06	22	08	10
Gouty arthritis	01	-	03	07	-
Septic arthritis	05	03	04	10	02

osteoarthritis was most commonly reported in our study where as Rheumatoid arthritis was commonly reported in other respective studies.

Comparative studies related to Site of arthritis

In our study Knee joint was the most commonly involved. It was seen in 66.6% of the cases .similar findings were observed in Susheel Kumar Pathak et al study [10] and Praveen garg et al study [9] where both noted knee joint as commonly involved joint and seen in 65.8% and in 90% patients respectively .

Comparative studies related to Physical appearance distribution

In our study in Rheumatoid arthritis ,septic and tubercular arthritis cases showed the presence of opaque fluid and low viscosity. Among 10 cases of osteoarthritis, 05 cases showed clear fluid with normal viscosity. We detected one case of traumatic arthritis with bloody appearance. In Mamatha SV et al [7] in osteoarthritis Synovial fluid was clear in 19 cases and opaque in 1. Viscosity was normal in 19 cases and low in 1.Mucin clot test showed firm clot in 19 cases and friable clot in 1. On wet mount examination cartilage fibrils were seen in all the cases. In Susheel Kumar Pathak et al study [10] there were 11 cases of Rheumatoid arthritis which showed the presence of opaque fluid and low viscosity. There were 10 cases of tubercular arthritis which showed opaque fluid with low viscosity. 2 cases of septic arthritis showed this consistency. Amongst osteoarthritis, 4 cases showed clear fluid with normal viscosity. In Karthikeyan et al study [9] Pale yellow and yellowish colour was the most predominant colour of the synovial fluid in most of the diseases whereas reddish colour was seen in cases of traumatic and rheumatoid arthritis.

Comparative studies related to differential count distribution

In our study increased WBC count was noted in Rheumatoid arthritis and septic arthritis with predominance of neutrophils . Patients with Osteoarthritis showed predominance of lymphocytes. In Praveen garg et al study [8] total leukocyte count was found to be highest in septic arthritis and lowest I n osteoarthritis. Polymorphs were highest in septic arthritis (95%) and lowest in osteoarthritis (23%). In Karthikeyan et al study [9] there is increased count of WBC cells in rheumatoid arthritis and gout .Polymorphs were more predominantly seen in rheumatoid arthritis, traumatic arthritis, Septic arthritis, osteoarthritis, whereas lymphocytes were predominantly seen in tuberculous arthritis .In Susheel Kumar Pathak et al study [10] in cases of Rheumatoid arthritis, the level of TLC was 3500-20000/mm3 with predominance of Neutrophils. Tubercular arthritis patients showed TLC of 8000-12000/ mm3 with predominance of neutrophils.

Comparative studies related to sugars and protein

In our study tubercular arthritis patients showed sugars were between 30-45 mg/dl and proteins between 4.3-6.8 gm/dl .Patients with septic arthritis showed sugars were between 19-36 mg/dl and proteins between 4.2-6.4 gm/dl. In Susheel Kumar Pathak et al study [10] In tubercular arthritis, the sugar levels were 4.1-4.7 gm/dl. Patients with septic arthritis showed 4.2-6.4 gm/dl and 19-36 mg/dl as protein and sugars levels respectively.

CONCLUSION

Synovial fluid analysis will give us an idea about the differential diagnosis of joint diseases. Synovial fluid aspiration should be done for the analysis and also used as a treatment procedure of synovial inflammation. In our study majority of the cases were osteoarthritis constituting followed by Chronic non specific synovitis and Rheumatoid arthritis Cytology reveals the predominant cells involved in the inflammatory disorders .

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