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Original Research Article

Characteristics of Synovial Fluid in Various Types of Arthritis

V. Sowjanya Lakshmi[1], T.C.S. Suman Kumar[2], B.H. Poorna Chandra Sekhar[3], B. Chaitanya[4]

[1]Assistant Professor, Department of Pulmonary Medicine, Government Medical College, Anantapuramu
[2]Assistant Professor, Department of Pathology, Government Medical College, Anantapuramu
[3]Associate Professor, Department of Pathology, Government Medical College, Anantapuramu
[4]Assistant Professor, Department of Pathology, Government Medical College, Anantapuramu

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Corresponding Author: Dr. B. Chaitanya
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Abstract:

Introduction: Synovial fluid is a valuable tool that helps in the diagnosis and treatment of arthropathies. Currently macroscopic screening and cell counts are being done as preliminary diagnostic tests for evaluation of arthropathies. It stands as an area of research given the raising number of cases of articular inflammation.

Objectives: The purpose of this study was to assess the basic laboratory profile of synovial fluid in mono articular arthritis patients in a medical college hospital.

Material And Methods: A cross sectional study was done on synovial fluid samples aspirated from knee joint over a period of one year at the Department of Clinical Pathology, Government Medical College, Anantapuramu.

Results: 50% of the patients were in the age group of 31 – 50 years. Rheumatoid arthritis was the most common cause for joint effusion. Gross parameters, biochemical analysis and cell counts were compared with other causes of arthritis.

Conclusion: Investigation of synovial fluid changes can provide insights into joint related pathology and help the clinician in management of arthropathies.

Keywords: Synovial fluid analysis, Rheumatoid arthritis, Gross features, Cell count.

Introduction

Joint fluid is called synovial fluid because of its resemblance to egg white. Synovial fluid is an ultra-filtrate of plasma with biochemical constituents like hyaluronic acid, glucose, proteins and uric acid. Normal synovial fluid contains small numbers of lymphocytes and only a few neutrophils. Changes to normal joint chemistry and cell counts can occur as a result of joint injury. Synovial fluid analysis helps to distinguish between inflammatory and non-inflammatory causes of arthritis.

Ropes and Bauer were the first to point the differences between inflammatory and non-inflammatory joint disorders via synovial fluid analysis.[1] The term "Synovioanalysis" was advocated by Hollander JL et al. [2] With time, synovial fluid analysis evolved into a vital diagnostic tool for evaluation of arthritis, joint effusions and crystalline arthropathies. Rheumatologists consider synovial fluid examination as "Liquid biopsy of the joint". Guidelines for examination of synovial fluid in patients presenting with joint effusions were laid down by The British Society of Rheumatology (BSR) and American College of Rheumatology (ACR).[3,4] Arthrocentesis will be performed after finding positive results with a " Bulge Test ". Examination of the synovial fluid thus obtained includes:

- Gross analysis (volume, colour and viscosity)
- Biochemical assay of parameters like proteins, glucose, enzymes like Lactate Dehydrogenase etc.
- Microscopy and culture
- Cell counts
- Polarized light microscopy for identification of crystals

Of these, gross parameters along with cell counts were considered to be more effective in diagnosis of joint disorders.[3,4] The present study was carried out to examine and compare the various parameters of synovial fluid among patients with different types of arthritis affecting the knee joint.

Materials and Methods: A cross sectional study was done on synovial fluid samples over a period of one year at the Department of Clinical Pathology, Government Medical College, Anantapuramu.

The study was approved by the institute's ethical board. All patients with one or more joint effusions were included in this study. Patients with uncontrolled diabetes mellitus and with percutaneous soft tissue infections mimicking acute arthritis were excluded.

Arthrocentesis was performed by Orthopaedic Surgeons on the knee joints under strict aseptic conditions following a detailed history taking and clinical examination. Samples for routine chemistry and microbiological testing were collected in plain sterile vacutainers. Samples for cell counts were separately collected in Ethylene Diamine Tetra acetic Acid (EDTA) vacutainers. Processing was done within one hour of collection.

Gross examination for volume, colour and appearance was done. String test was performed to evaluate the viscosity of the samples.

Total Leucocyte count was done using Neubauer's counting chamber after diluting the fluid with hypotonic saline. Differential cell counting was performed on Leishman's stained smears.

Under biochemical evaluation, proteins were assayed by modified Biuret method and glucose by Trinder's method. Adenosine Deaminase (ADA) levels were assessed in cases with high lymphocyte counts.

Gram stain and Ziehl Nielson stain were done as part of microbiological examination. Results were recorded in the Microsoft Excel worksheet and analyzed.

Results

A total of 70 patients with knee joint effusions were studied. In this study, males were commonly seen affected; the male to female ratio was 1.92:1.

Table 1: shows age and sex wise distribution of cases

Age (Years)	Males No. of cases	%	Females No. of cases	%	Total No. of cases	%
11 - 30	04	5.71	06	8.57	10	14.29
31 - 50	21	30	14	20	35	50
>50	21	30	04	5.71	25	35.71
Total	46	65.71%	24	34.28%	70	100%

Majority of the patients belonged to the age group between 31 – 50 years followed by age group more than 50 years. Males were equally affected in both these age groups. Among females, higher number of cases was noted in 31 – 50 years age group. Table 2 shows the most common etiologies in our study. There were 30 cases (42.86%) of rheumatoid arthritis, 14 cases (20%) of Osteoarthritis and 10 cases (14.28%) of septic arthritis. The least number of cases were of traumatic arthritis (4 cases, 5.71%).

Table 2:

S.No.	Disease	Total Cases (M: F)	Percentage
1.	Rheumatoid Arthritis (RA)	30 (12 : 18)	42.86 %
2.	Osteoarthritis (OA)	14 (12 : 2)	20 %
3.	Septic Arthritis (SA)	10 (7 : 3)	14.28 %
4.	Tubercular Arthritis (TbA)	06 (6 : 0)	8.57 %
5.	Chronic Nonspecific Arthritis (CNSA)	06 (5 : 1)	8.57 %
6.	Traumatic Arthritis (TA)	04 (4 : 0)	5.71 %

Details of gross analysis of synovial fluid are given in table 3.

Table 3:

Gross Parameter	RA (30)	OA (14)	SA (10)	TbA (06)	CNSA (06)	TA (04)
Appearance						
Clear (24)	06	12	00	0	06	0
Turbid (35)	24	02	00	05	00	04
Purulent (11)	00	00	10	01	00	00
Colour						
Straw Yellow (27)	10	12	00	00	05	00
Cloudy (38)	20	02	10	06	00	00
Red (05)	00	00	00	00	01	04
Viscosity						
Normal (26)	04	14	00	00	04	04
Low (44)	26	00	10	06	02	00

Table 4: shows Biochemical analysis and Cell counts in various types of arthritis

Arthritis	Proteins (gm%)	Glucose (mg/dl)	Total WBC Count cells/cumm	% of Neutrophils	% of Lymphocytes	% of mononuclear cells
RA (30)	3.5 – 6	25 - 60	3600 – 14,800	72	26	02
OA (14)	1.2 – 2.6	75 - 90	280 - 1600	16	80	04
SA (10)	4.5 – 6.8	15 - 30	40,000 – 62,000	92	05	03
TbA (06)	4.2 – 7.2	20 - 32	7200 – 24,000	24	70	06
CNSA(06)	2.6 – 3.8	45 - 60	400 - 1400	12	82	06
TA (04)	1.6 – 2.8	25 - 40	600 - 2100	60	30	10

Discussion

Synovial fluid analysis is a frequently used laboratory investigation in management of arthropathies. The complete study of the synovial fluid includes macroscopic and microscopic analyses with subsequent specialized staining and microscopy techniques. Characteristics of each test provides information of the joint's state and helps the clinician to determine the course of treatment.[5]

Clear, colorless to slightly yellow synovial fluids on naked eye examination usually are associated with non-inflammatory conditions. Amount of turbidity, cloudiness increases with increase in joint inflammation. Similar findings were observed in the present study akin to the studies of Percy et al and Praveen Garg et al.[6,7] Purulent fluids with low viscosity usually occur in septic/infective arthritis.[8] In our study, synovial fluids from 10 cases of septic arthritis and one case of tuberculous arthritis showed purulent appearance with low viscosity. In the studies of Tauro et al and Praveen Garg et al , synovial fluid in traumatic arthritis was hemorrhagic with normal viscosity.[7,9] We found similar features in our 4 cases of traumatic arthritis.

Literature review shows that with increasing joint inflammation, the volume, turbidity, cell counts of synovial fluid increase with polymorphs being the common cell type on microscopy. Viscosity reduces with increasing inflammation.[10]

Comparison of cases of Rheumatoid arthritis in our study was done with the studies of Yu MX et al, Praveen Garg et al and Hollander et al.[2, 7,11] The lower limit of cell counts was higher and the upper limit of total leucocyte count was slightly lower in our study population. Neutrophil predominance coincides with the rest of the other studies.

Table 5:

Study	Total WBC Count cells/cumm	% of Neutrophils
Current study	3600 – 14,800	72%
Yu MX	330 – 72,600	9 – 97 %
Praveen Garg	2660 – 30,000	>50%
Hollander	1200 – 18,500	Predominant

Synovial fluid in cases of Osteoarthritis showed lower protein values and cell counts compared to other inflammatory arthropathies. Total cell count was between 280 – 1600 cells/cumm. This finding was similar to the studies of Praveen Garg et al and Percy et al.

Septic arthritis has to be diagnosed early to prevent irreversible joint damage. Usually on synovial fluid examination, features of total cell counts of greater than 50,000 cells/cumm with polymorphs greater than 90% are seen overlapping in septic and crystalline arthritis.[12,13] In our study, total counts between 40,000 – 62,000 cells/cumm with 92% polymorphs are noted in septic arthritis. Only 2 out of 10 cases showed organisms on Gram stain. We excluded crystalline arthritis based on absence of crystals on light microscopy.

Highest protein content in synovial fluid was found in tuberculous arthritis. ADA (Adenosine deaminase) was significantly higher in these cases compared to other arthropathies. This finding correlates with study of Foocharoen et al and disagrees with that of Zamani et al. [14,15] One case where purulent effusion was noted showed positivity for acid fast organisms on ZN staining.

Limitations:

1. Assessment for crystalline arthritis was not possible due to absence of polarized light microscopy.
2. Larger sample size followed by workup is required to ascertain and correlate the parameters of synovial fluid to various inflammatory etiologies of arthritis.

Conclusion

The physical, chemical and microscopic characteristics of synovial fluid often mirror the pathology of arthropathies. Evaluation of these features can be further supplemented by serological testing and synovial biopsy in scenarios like rheumatoid arthritis and chronic nonspecific synovitis. Overlap of certain features can be minimized by further re-

search in these areas. Detection of new biomarkers may aid the clinicians with diagnosis and assessment of degree of inflammation.

References

1. Ropes M W, Bauer W. Synovial fluid changes in joint disease. Cambridge, MA: Harvard University Press, 1953. 1–150.
2. Hollander JL, Reginato A, Torralba TP. Examination of synovial fluid as a diagnostic aid in arthritis. Med Clin North Am. 1966; 50(5): 1281-1293.
3. BSR Guidelines and a proposed audit protocol for the initial management of an acute hot joint. Report of a joint working group of the British Society for Rheumatology and the Research Unit of the Royal College of Physicians. J. R Coll Physicians Lon. 1992; 26(1): 83–85.
4. Gatter RA, Andrews RP, Cooley DA, Fiechtner JJ, Minna DA, Phelps P, Wasner C. American college of rheumatology guidelines for performing office synovial fluid examinations. J Clin Rheumatol. 1995; 1(3):194-196.
5. Martínez-Castillo A, Nunez C, Cabiedes J. Analisis de líquido sinovial [Synovial fluid analysis]. Reumatol Clin.2010; 6(6):316-321.
6. Percy JS, Russell AS. Laboratory diagnosis and monitoring of rheumatologic diseases. Can Med Assoc J. 1975; 112(11):1320-1328.
7. Praveen Garg, Vibhuti Goyal. Role of Synovial Fluid Examination in Diagnosis of Joint Diseases. Journal of Clinical and Diagnostic Research.2018; 12(7):EC06-EC09
8. Pascual E, Jovani V. synovial fluid analysis Best Pract Res Clin Rheumatol 2005; 19(3):371-386.
9. Tauro B. Eosinophilic Synovitis: a new entity? J Bone Joint Surg Br. 1995; 77(4):654-656.
10. Courtney P, Doherty M. Joint aspiration and injection and synovial fluid analysis Best Practice & Research clinical Rheumatology. 2009; 23(2):161-192.
11. Yu MX. The clinical significance of synovial fluid examination Zhong guo Yi Xue Ke Xue Yuam Xue Bao.1989; 11(4):274-277.
12. Margaretten ME, Kohlwes J, Moore D, Bent S. Does this adult patient have septic arthritis? JAMA.2007; 297(13):1478-1488.
13. Mathews CJ, Weston VC, Jones A, Field M, Coakley G. Bacterial septic arthritis in adults. Lancet.2010; 375(9717):846-855.
14. Foocharoen C, Sarntipipattana C, Foocharoen T, Mahakkanukrauh A, Paupairoj A, Teerajetgul Y, Nanagara R. Synovial fluid adenosine deaminase activity to diagnose tuberculous septic arthritis. Southeast Asian J Trop Med Public Health. 2011; 42(2):331-337.
15. Zamani B, Jamali R, Ehteram H. Synovial fluid adenosine deaminase and high-sensitivity C-reactive protein activity in differentiating monoarthritis. Rheumatol Int 2012; 32(1):183-188.