

Efficacy of Synovial Fluid Analysis in Diagnosing Various Types of Arthritis, with Special Reference to Percutaneous Synovial Biopsy as a Diagnostic Tool

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ABSTRACT

Introduction: Arthritis, a common clinical occurrence of joints, is a very prevalent chronic disease in India and various parts of the world. It is estimated to affect 1% of world's adult population. Biopsies of Synovial fluid are being done as an adjuvant technique to assist in the diagnosis of arthritis. It offers a non-invasive method to diagnose any condition of the joint like traumatic, inflammatory or non-inflammatory. The aim of present study is to estimate the efficacy of percutaneous synovial membrane biopsy in diagnosing of various types of arthritis with synovial biopsy as a diagnostic tool.

Material and methods: Percutaneous synovial biopsy along with synovial fluid analysis was studied in 50 enrolled cases of arthritis. The fluid was subjected to physical, biochemical and cytological analysis.

Results: In this study, total of 50 cases were studied. Knee joint was the most commonly involved. It was seen in 65.8% of the cases. In this study males were predominant; the male to female ratio was 2.3:1. The mean age of males were 54.2±1.8 years and females were 54.7±1.5 years. There were 14 cases (28%) of rheumatoid arthritis, 13 cases of tubercular arthritis. There were 20% cases (n=10) which constituted non-specific synovitis. Clinicopathological correlation was seen in 34 out of 50 cases. As a diagnostic tool, synovial fluid biopsy offers a sensitivity of 85%, 100% specificity with positive predictive value of 100% and negative predictive value of 62%.

Conclusion: Biopsy of synovial membrane helps in establishing the exact aetiology of arthritis. It is a useful adjunct for establishing diagnosis and hence can prevent indiscriminate use of NSAIDs. Levels of Rheumatoid factor and C-reactive protein can be accurately estimated. In our study Synovial fluid biopsy showed a sensitivity of 85%.

Keywords: Arthritis, Biopsy, Rheumatoid, Synovial

INTRODUCTION

Arthritis, a common condition involving joints, is a prevalent chronic disease in India and various other parts of the world. It is estimated to affect 1% of world's adult population. It is the inflammatory condition of the synovium that affects the joints of hands and wrists leading to pain and stiffness which further leads to loss of function.¹ It acts as a threat to socioeconomic and health burden of the society.² Detection of Arthritis is based on radiographs, MRI and ultrasounds but 70% of the radiographs show no detectable change. MRI and ultrasounds have higher sensitivity.³ It is responsible for morbidity amongst both sexes of older age group. Joints aid in providing movement and support to the skeleton. They consist of two bony surfaces which are enclosed by

a joint capsule. This membrane encloses synovial fluid, whose function is to provide lubrication and nutrition. It also reduces friction while movement. Anatomy of Joint influences its function directly.⁴

Biopsies of Synovial membrane are being done as an adjuvant technique to assist in the diagnosis of arthritis. It was first done by Ropes and Baver who pointed out the differences in the inflammatory and non-inflammatory conditions of the joint via synovial fluid.⁵ There have been a variety of advancements and developments after its discovery like the use of biochemical markers⁶, synovial fluid cytology⁷ which aided in better diagnosis of the conditions. It offers a non-invasive method to diagnose any condition of the joint like traumatic, inflammatory or non-inflammatory.^{8,9} The aim of present study was to estimate the efficacy and accuracy of percutaneous synovial membrane biopsy in diagnosing of various types of arthritis with synovial biopsy as a diagnostic tool.

MATERIALS AND METHODS

A prospective cross-sectional study was done in the Career Institute of medical sciences and hospital Lucknow Uttar Pradesh, during a period of 6 months i.e. December, 2016 – June, 2017. In this study all the patients reporting to the OPD of orthopaedic department were enrolled. The study was approved by the Institute's ethical board and all the subjects were informed about the study and a written informed consent was obtained from all. A detailed history was obtained from all the patients with special emphasis on the frequency and location of pain.

After a complete clinical evaluation of the patients synovial fluid study and percutaneous needle biopsy was performed. Aspiration of synovial fluid was done before arthroscopy physical, biochemical and cytological analysis of the fluid was performed. Amongst physical examination, volume, clarity and viscosity were noted. Under biochemical

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evaluation protein and sugar level were estimated. Cytology was done to evaluate the TLC and DLC.

Procedure for arthrocentesis-Under complete aseptic condition synovial fluid aspiration was performed. Patient was kept nil per oral at least 6 hours before the procedure. Scrubbing and draping of the patient was done. Local anaesthesia was infiltrated in skin and subcutaneous tissue. The knee was kept in extended position such that the fluid was displaced into suprapatellar space. Needle was inserted 2cm above and 2 cm lateral to the upper border of patella and aspiration was performed. Volume, viscosity and cloudiness of the synovial fluid were assessed. The fluid was then divided into two halves. One was sent for biochemical analysis and other for cytological evaluation. Patients of septicaemia or soft tissue infection were excluded from the study. Needle was removed leaving the cannula inside. Later strong suction was applied to the barrel of the syringe which later become occluded with the synovial membrane and this was removed for biopsy. After biopsy intravenous cefuroxime was given and a compression bandage was applied to the joint.

Staining was done by H&E stain, Ziehl Nielson stain, Gram stains were done whenever required. The smears were checked for the presence of hyperplasia or hypertrophy of synovium, types of inflammatory cells, presence of bone or cartilage or any sign of haemorrhage. In case where synovial biopsy confirmed the clinical diagnosis were known as true positive cases and in cases where clinical diagnosis confirmed non specific arthritis were known as True negatives. False

negative were considered when clinical non specific arthritis was confirmed into definitive aetiology by biopsy.

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

In this study, total of 50 cases were studied. The joints included ankle, knee, wrist, sacroiliac and hip. Knee joint was the most commonly involved. It was seen in 65.8% of the cases. In this study males were predominant; the male to female ratio was 2.3:1. The mean age of males were 54.2+/-1.8 years and females were 54.7+/-1.5 years.

Table 1 shows the most common joint aetiologies in our study. There were 14 cases (28%) of rheumatoid arthritis, 13 cases of tubercular arthritis. There were 20% cases (n=10) which constituted non specific synovitis. The least number of cases were of traumatic arthritis (8%). Osteoarthritis constituted to 12% of the total cases.

Percutaneous synovial membrane biopsy was performed in all the cases. Table 2 illustrates the physical findings that were obtained on biopsy. 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. We detected 4 cases of traumatic arthritis.

Table 3 shows the biochemical and microscopic findings of our study. 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. The TLC range in patients of non specific synovitis was 65000-85000/mm³. Sugar levels were 4.3-6.8gm/dl. 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 sugar

S. No	Disease	Cases	Percentage
1	Rheumatoid arthritis	14	28
2	Tubercular arthritis	13	26
3	Chronic non specific synovitis	10	20
4	Traumatic arthritis	4	8
5	Osteoarthritis	6	12
6	Septic arthritis	3	6

Table-1: Cases of Joint effusion

Synovial fluid		Rheumatoid arthritis	Tubercular Arthritis	Septic arthritis	Traumatic arthritis	Osteoarthritis
Volume		2-8	4-8	2-6	2-8	4-10
Clarity	Clear	3	3	1	0	4
	Opaque	11	10	2	4	2
Viscosity	Normal	1	0	1	4	4
	Low	13	15	2	0	2

Table-2: Physical examination of synovial fluid amongst cases

		Rheumatoid arthritis	Tubercular arthritis	Septic arthritis	Traumatic arthritis	Osteoarthritis
TLC (cells/mm ³)		3500-20000	8000-12000	65000-85000	2000-3500	160 to 1700
DLC	Neutrophils	85	78	96	68	23
	Lymphocytes	12	17	3	21	69
	Macrophages	3	5	1	11	8
Sugar (mg/dl)		20-55	30-45	19-36	20-30	75-85
Protein (gm/dl)		4.3-6.8	4.1-4.7	4.2-6.4	4.6-6.3	1.3-2.6

Table-3: Biochemical and microscopic analysis

levels respectively.

Out of 50 cases of joint arthritis, there were 34 cases which were confirmed by biopsy. These were labelled as 11 cases of Rheumatoid arthritis, 10 cases of tubercular arthritis, 5 cases of traumatic arthritis and 4 cases of osteoarthritis and 2 cases of septic arthritis. Rest 10 cases diagnosis were made and hence labelled as non specific synovitis. Clinicopathological correlation was seen in 34 out of 50 cases. As a diagnostic tool, percutaneous synovial fluid biopsy offers a sensitivity of 85%, 100% specificity with positive predictive value of 100% and negative predictive value of 62%.

DISCUSSION

Fluid accumulation within the joint is a common joint problem. Joint affection whether monoarticular or polyarticular are a common reason for the visit to orthopaedic doctor. Monoarticular lesions are generally because of trauma or infection and polyarticular lesions are rheumatoid in nature. Arthritis is a common clinical entity and an important reason for morbidity. Its high frequency of occurrence has led to indiscriminate use of NSAIDs by the doctors without even reaching at the exact etiological diagnosis. Therefore it is necessary that proper clinical examination along with radiographic and laboratory examination is done to arrive at the exact aetiology. Synovial fluid biopsy is a useful and a vital adjuvant to aid in diagnosis. Features of inflammation seen macroscopically do not always match the microscopic features. Therefore it is necessary to perform a closed needle biopsy.¹⁰⁴

In our present study, knee was the most commonly involved joint. In a study by Vijay M et al¹⁵ and Venkataraman M et al¹⁶, they also found that knee was the commonly involved joint in monoarticular and polyarticular arthritis. In our study, the most common etiology was rheumatoid and tubercular which was followed by non specific Synovitis. This finding was consistent with the study by M. Ganesh et al¹⁷ and Singhal et al.¹⁸ In a study done by Abhyankar et al¹⁹ tubercular and rheumatoid arthritis together constituted to 68% of the cases with predominance of tubercular arthritis. In our study clinicopathological correlation was seen in 68% of cases. In a study by Schumacher HR et al¹⁴, it was 65% and in an equivalent study by Singhal et al¹⁸ it was 68%. The results were also similar to those of M. Ganesh et al.¹⁷ Studies conducted by Naib and Broderick et al^{20,21}, synovial biopsy shows good clinical correlation. In rheumatoid arthritis, the levels of TLC noted in our study were 3500-20,000/mm³. According to a study by Qazi Najeeb et al²² it was found to be between 3000-20,000/mm³. In our present study synovial fluid was opaque in color with low viscosity. The sample size of study was small, larger sample needs to be studied to estimate the exact specificity and sensitivity.

CONCLUSION

Biopsy of synovial membrane helps in establishing the exact aetiology of arthritis. It is a useful adjunct for establishing diagnosis and hence can prevent indiscriminate use of NSAIDs. Levels of Rheumatoid factor and C-reactive

protein can be accurately estimated. In our study Synovial membrane biopsy showed a sensitivity of 85%.

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