

ORIGINAL ARTICLE

ROLE OF NEEDLE SYNOVIAL BIOPSY IN JOINT DISEASES

M. Venkataraman¹, Sathyadharan. P²

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ABSTRACT: Joint disease is a common problem affecting all age groups presenting in orthopedic and rheumatology clinics. Diagnostic difficulties are encountered, particularly, in early stages when radiology and blood tests are inconclusive. The role of synovial analysis (Synovium and fluid) using the Parker Pearson technique was studied in 50 patients with various joint afflictions. There were 44 cases of monoarthritis and 6 cases of polyarthritis. Synovial fluid could be completely analyzed in 43 out of 50 cases and based on their physical, biochemical and cytological properties they were grouped as-a) Non inflammatory group b) Mild to moderate inflammation and c) Septic or severe inflammatory group. In this study, there were 6 cases of rheumatoid arthritis, 8 tuberculous arthritis, 16 non-specific synovitis, 4 traumatic arthritis, 4 osteoarthritis, 2 septic arthritis, 6 normal synovium and one each of gout, villo-nodular synovitis, neuropathic joint and AVN femoral head. With Parker Pearson needle and their technique adequate representative synovial tissue could be obtained for histopathology in 41 out of 50 (82%) cases. In the rest 9 cases, it was negative and open biopsy was done to reach a diagnosis. Closed needle synovial biopsy is a simple, cost effective outpatient procedure and a helpful adjuvant for the diagnosis of joint diseases.

KEYWORDS: Synovial biopsy, early arthritis, synovitis, Parker Pearson needle.

INTRODUCTION: Symptoms complex of pain swelling and stiffness of joints labeled as arthritis is a common entity in clinical practice affecting all age groups. Blood test and radiology of involved joint is usually normal in the early stages of many arthritis. Delay in proper diagnosis leads to inability to control the disease process at an early stage usually leading to an irreversible damage to the joints. With detailed clinical examination supported by conventional investigations, diagnosis is often possible. But, a typical clinical presentation with negative routine investigations makes diagnosis of early arthritis difficult. It is in these cases that simple procedures such as synovial fluid examination and biopsy of the synovial tissue can provide an important clue to a possible diagnosis early in the course of the disease and to evaluate response to treatment if analysis is done at frequent intervals during the course of treatment.^[1,2,3] Even though, arthroscopic and open synovial biopsy through open arthrotomy yields adequate tissue for histopathology, it has some disadvantages like hospitalization, anesthesia and fear of infection preventing its routine application.^[4] These could be obviated by closed needle biopsy which can be done under local anesthesia as an outpatient procedure.

MATERIALS AND METHODS: Fifty patients with various joint afflictions presenting in our orthopedic OPD formed materials of the present study. Each patient was thoroughly examined with regard to history and symptomatology. Apart from the routine blood and urine examinations, a special note was made of the ESR, RA factor and serum uric acid level as per the clinical diagnosis in a particular case. After necessary laboratory investigations, radiographs of the affected joints were taken. X-ray of the chest was done in all cases of suspected tuberculosis. The synovial fluid and synovial tissue so obtained were subjected to analysis under the following headings:

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1. Physical characteristics: Volume, color and clarity were observed in a clear glass tube. Viscosity was tested by length of string formation of the synovial aspirate when expressed from a syringe. Mucin clot test was performed with 5% acetic acid. Fibrin clot test was performed by allowing the fluid to stand and graded as 1 to 4 plus.
2. Microscopic examination: Wet mount prepared by placing a drop of synovial fluid previously mixed with EDTA on a glass slide and TLC, DLC and wet smear examination was done.
3. Biochemical analysis: Synovial fluid sugar and proteins were estimated by methods similar to those used for blood estimation.
4. Bacteriological analysis: The synovial fluid was sent for gram stain, AFB stain and culture.

TECHNIQUE OF ARTHROCENTESIS USING PARKER PEARSON NEEDLE: The knee joint was the commonest site biopsied. The knee joint was kept in extension and synovial fluid was displaced from the supra patellar pouch to the medial and lateral aspect of the patella by squeezing downwards from the supra patella pouch. After local anesthetic infiltration of the joint capsule, the needles 'A' and 'B' as shown in Fig. 1 was introduced through a point on the lateral aspect 2 cm above and 2 cm lateral to the midpoint of upper border of patella into the joint cavity. The synovial fluid so aspirated was collected into the empty test tubes and sterile bottles for further analysis.



Fig. 1: Components of Parker Pearson Needle. A –Trocar Needle, B – Cannulated Needle, C – Notched Biopsy Needle



Fig. 2: (a) Synovial Fluid aspiration



Fig. 2: (b) Synovial Biopsy

The needle 'A' was taken out leaving the cannula 'B' in position. Now the notched needle 'C' which had been fitted with a 20 ml syringe was inserted through the lumen of the cannula so that its blunt end with the saw tooth entered the synovial space. Strong suction was then applied to the barrel of the syringe and the toothed needle was slightly withdrawn after aspiration of a few millilitres of synovial fluid. When the notched orifice became occluded by the synovial tissue, further aspiration became impossible. The suction was maintained to hold synovial tissue within the notch.

The syringe and inner needle were then held motionless in the right hand while the left hand slowly advanced the outer trocar using a slight twisting and rotation motion for about 1 cm to ensure that the specimen has been severed and held in the notch. The outer trocar was then left in place and the inner needle with the attached syringe was removed. The piece of synovial tissue was removed from the notched with a needle point and the entire process was repeated several times in different direction and regions of the joint. The specimen so obtained were collected in a vial containing 10% formalin solution and sent for histopathological examination. Figure. 2(a) and 2(b) shows the synovial fluid and synovial biopsy of knee joint respectively.

After the procedure was completed a compression bandage was applied. As a precaution patients were advised to rest for about 12 hours with limb elevation. Compression bandage was removed after 72 hours of biopsy and further treatment was advised in accordance with the result of biopsy reports. The same technique was used for other joints as per their landmarks.

OBSERVATIONS AND RESULTS: There were 34 males and 16 females with an age distribution from 13 years to 63 years. 44 cases were monoarticular and 6 cases were polyarticular. Knee joint was involved more commonly in both monoarticular as well as polyarticular forms of the disease and shown in Fig. 3. The physical properties, the biochemical analysis (Protein and blood synovial fluid sugar difference) and the cytological studies that were carried out in this study are documented in Table 1. It can be further observed from Table 1 that the physical, biochemical and cytological studies show a pattern more or less specific to a particular group of disease. Based on this pattern, joint diseases can be divided under 3 groups as shown in Table 2.

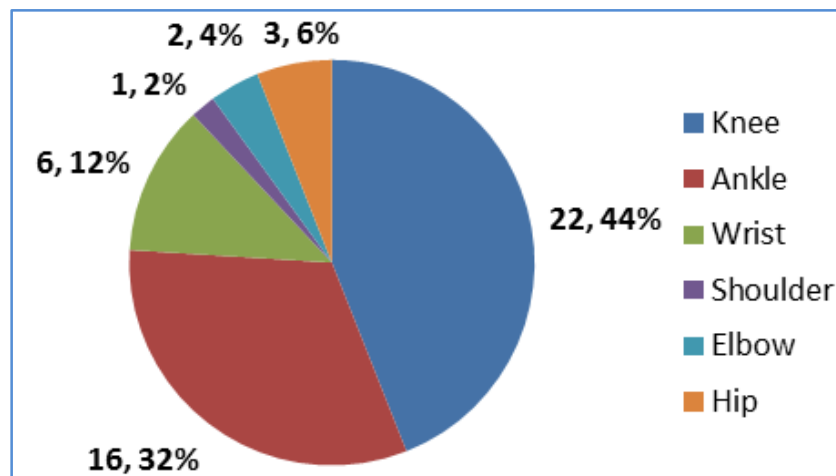


Fig. 3: Chart showing distribution of anatomical sites of biopsies (no. of cases, percentage %)

With Parker Pearson needle and their technique adequate representative synovial tissue for histopathology could be obtained in 41(82%) out of 50 joints. In the rest 9 cases open synovial biopsies were done to reach a definitive diagnosis. Table 3 shows the final histopathological diagnosis (41 closed+9 open) in this study.

DISCUSSION: Affection of the joints, monoarticular or polyarticular by various diseases is a common orthopedic problem. On the basis of clinical examination with conventional radiological and laboratory aids, the diagnosis often can be reasonably made. These findings are sometimes equivocal and therefore necessity of tissue diagnosis arises. Closed needle biopsy is a simple outpatient procedure without complications that aids in establishing the diagnosis after clinical and radiological correlation. Careful review of literature would reveal that the importance of this simple procedure as an aid to diagnosis of joint diseases has been stressed by various authors from time to time.^[1,2,5,6,7,8,9,10,11,12]

Involvement of the knee joint has been found to be the commonest form of joint disease both in the present study and by previous workers also.^[1,10,12,13] On the basis of synovial fluid examination (i.e. physical, biochemical and cytological examination) various arthritis could be grouped into 3 groups as per the nature and severity of inflammation.

Even though literature states very minimal amount of fluid requirement for the studies, it was generally observed that at least 5ml of fluid was required to perform the basic important tests comfortably. In spite of this, in certain percentage of cases clinical, radiological and synovial fluid finding are equivocal or inconclusive. In these cases it is only the synovial biopsy that has usually solved the diagnostic dispute. Closed needle biopsies have been performed using several different types of needles including the Polley Bickel biopsy needle,^[7] Franklin- Silverman liver biopsy needle,^[8] Copes needle,^[11] and the Parker Pearson needle.^[1,2,14,15]

Parker Pearson needle has been the needle of the choice for many workers as it had yielded reasonably good amount of synovial tissue for histological interpretation. By using Parker Pearson technique adequate tissue for HPE could be obtained in 41 out of 50 patients (82%) in this study. The main causes of failure were:

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- a) Involvement of deep-seated joint like hip.
- b) Contracture of the joint.
- c) Biopsy not from a representative site.
- d) Apprehensive patient with poor tolerance under local anaesthesia.

Table 4 and Table 5 show the comparison of synovial fluid analysis and synovial biopsy between this study and other workers respectively. The present series shows a higher incidence of non-specific lesions (32%) compared to other authors like Verma et al and Sakhuja et al.^[1,2,11,13] It can be observed that the total number of cases for the study were also less in three of the workers.^[2,11,13] Two of the authors had considered only monoarthritis cases.^[2,13] In this series, out of the 16 cases (32%) diagnosed by biopsy as nonspecific lesions, 6(12%) cases could not be grouped into any definite pathology clinically also. Two (4%) of these patients had a definite history of trauma but histopathologically did not reveal any extravasated RBC's, fibrin thrombi or haemosiderin laden macrophages. This can be due to sampling error and hence they had to be labelled in the non-specific group. The rest 10(20%) cases were suspected clinically to be either tubercular or rheumatoid arthritis. Five (10%) of these patients were in the younger age group (12-31 yrs) and had a short febrile illness preceding the onset of joint symptoms.

Fever subsided dramatically without any therapeutic intervention there by strongly suggesting that these cases were probably forms of viral arthritis following viral infections. This leaves a proportion of 9 cases (18%) of non-specific synovitis those could not be sub grouped into one of the etiological groups referred in table 3. This is because a fair number amongst these are probably due to conditions like Psoriasis, Behcet's disease, Reiter's arthritis, Enteropathic arthritis or Ankylosing spondylitis that have histological picture indistinguishable from chronic non-specific synovitis in early presentation of the disease. In the present study we encountered normal appearance of synovium in 6 cases out of 50. The clinical diagnosis was non-specific in 3 cases and one each of rheumatoid, tubercular and traumatic arthritis.

Thus it is evident that even after needle biopsy it is difficult to make definitive diagnosis in small group of patients. The limitations of the needle biopsies must be taken into account when interpreting the histological samples. Since the joint surfaces are not seen as in an open or arthroscopic biopsy the findings of direct inspection of the joint are not available and hence the selection of the biopsy site is more of chance. It can also be that the disease process was too early that histopathological changes were yet to occur. Pitkealthly et al^[13] reported normal studies in 16% of their cases even after open biopsies. Long-term follow up and repeat interval biopsy would be required in these cases to detect any change to a particular pathology.

Since needle biopsies yield very minimal amount of representative tissue compared to open biopsies it requires the trained eyes of an experienced pathologist to obtain better results. It is ideal for the specimens to be reviewed by a single pathologist who is a part of the team.

No complications like infection, intra articular hemorrhage or needle fragmentation^[16] were encountered in the present study. From the present study and comparing with the study of other workers it is quite evident that closed needle synovial biopsy is an important useful investigative adjunct to correlate and confirm the diagnosis made after clinico-radiological and synovial fluid evaluation. At times synovial biopsy alone gives the conclusive diagnosis.

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CONCLUSION: To summarize needle synovial biopsy in a simple and easy to perform outpatient procedure which can be reliably done by junior doctors also. It is very cost effective as it does not require hospitalization, anesthesia or costly equipments. Unlike open or arthroscopic biopsies repeated interval biopsies are feasible on the same patient to assess progress of the disease and response to treatment. An attempt at tissue diagnosis by this simple procedure may give conclusive diagnosis where clinical diagnosis and laboratory parameters are equivocal.

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Sl. No.	Diagnosis	No. of cases	Physical			Biochemical		Cytological	
			Appearance colour / clarity	Viscosity	Mucin clot test	Proteins (gm%)	Blood synovial fluid difference (mg%)	Total cell count per mm ³	Predominant cells seen
1	Normal Synovial fluid	6	Straw / clear	High	Good	1.5 – 3	< 10	50 – 200	Poly, lympho & mono with poly < 25 %
2	Osteoarthritis	4	Pale yellow / clear	High	Good	1.2 – 3	< 15	200 – 500	Variable / polymorphs
3	Traumatic arthritis	4	Haemorrhagic / xanthochromic	High	Good	2.5 – 5	10 – 20	680 – 4000	Variable with RBCs
4	Neuropathic	1	Straw / clear	High	Good	2.9	59	9200	Lymphocytes 40 %
5	Villonodular synovitis	1	Straw / clear	High	Good	2	12	900	Lymphocytes
6	Rheumatoid arthritis	6	Yellowish to Greenish / cloudy	Low	Fair to poor	3.5 – 6.4	20 – 30	7600 – 8500	Polymorphs
7	Tuberculous arthritis	8	Yellow / turbid	Low	Poor	3.2 – 6.8	24 – 50	6000 – 12000	Lymphocytes
8	Chronic nonspecific synovitis	16	Yellow / clear	Low to high	Fair to good	2.5 – 5.5	25 – 60	500 – 12000	Variable from poly to lymphocytes
9	Gouty arthritis	1	Yellow / cloudy	Low	Good	2	12	900	Lymphocytes
10	Septic arthritis	2	Yellow, grey / turbid	Low	Very poor	6-8	50-60	26000	Polymorphs 90%
11	AVN femoral head	1	Blood stained	Low	QIS*	QIS*	QIS*	QIS*	QIS*

Table 1: Physical, biochemical and cytological properties of synovial fluid

*QIS – Quantity Insufficient

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	Groups	Number of cases
Group I	Non- Inflammatory group	
	a. Traumatic Arthritis	04
	b. Osteo Arthritis	04
	c. Villonodular Synovitis	01
	d. Neuropathic joint	01
Group II	Mild to Moderate Inflammatory Group	
	a. Rheumatoid Arthritis	06
	b. Tuberculous arthritis	08
	c. Chronic non-specific synovitis	16
	d. Gouty Arthritis	01
Group III	Septic or Severe Inflammatory Group	
	a. Septic Arthritis	02
	Total	43(excluding AVN and normal studies)

Table 2: Table showing the three groups based on synovial fluid analysis

Sl. No.	Diagnosis	Monoarticular No. of cases	Polyarticular No. of cases	Total	Percentage (%)
1	Rheumatoid Arthritis	3	3	6	12
2	Tuberculous Arthritis	8	-	8	16
3	Chronic nonspecific synovitis	15	1	16	32
4	Osteoarthritis	4	-	4	8
5	Villonodular synovitis	1	-	1	2
6	Gouty arthritis	1	-	1	2
7	Septic arthritis	2	-	2	4
8	Traumatic arthritis	4	-	4	8
9	Normal synovium	4	2	6	12
10	Neuropathic joint	1	-	1	2
11	AVN femoral head	1	-	1	2
Total		44	6	50	100

Table 3: Final histo pathological diagnosis (41 closed + 9 open)

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Groups	Present Study		Verma et al ^[2]		Shakhuja et al ^[11]		Vikas Gupta et al ^[12]	
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage
Group – I	10	23.25	5	20	3	8.57	13	25
Group – II	31	72.09	19	76	25	71.43	32	61.54
Group – III	02	4.65	01	4	07	20	02	3.84
Haemorrhagic	-	-	-	-	-	-	5	9.62
Total	43**	100	25	100	35	100	52	100

Table 4: Comparison of synovial fluid analysis

** (Excluding normal synovial biopsy and AVN)

Sl. No.	Diagnosis	Present Study	Verma et al ^[2]	Shakhuja et al ^[11]
		Cases / Percentage	Cases / Percentage	Cases / Percentage
1	Rheumatoid Arthritis	06 / 12	02 / 08	07 / 20
2	Tuberculous Arthritis	08 / 16	11 / 44	15 / 42.86
3	Chronic nonspecific synovitis	16 / 32	06 / 24	01 / 2.86
4	Osteoarthritis	04 / 08	02 / 08	02 / 5.71
5	Villo-nodular synovitis	01 / 02	-	-
6	Gouty arthritis	01 / 02	-	-
7	Septic arthritis	02 / 04	01 / 04	07 / 20
8	Traumatic arthritis	04 / 08	03 / 12	03 / 8.57
9	Normal synovium	06 / 12	-	-
10	Neuropathic joint	01 / 02	-	-
11	AVN femoral head	01 / 02	-	-
Total		50 / 100	25 / 100	35 / 100

Table 5: Comparison of synovial biopsy results

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AUTHORS:

1. M. Venkataraman
2. Sathyadharan P.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, Chettinad Hospital & Research Institute, Kelambakkam.
2. Assistant Professor, Department of Orthopaedics, Chettinad Hospital & Research Institute, Kelambakkam.

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NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. M. Venkataraman,
Door No.11, Plot No. 6,
Kulothungan Street,
Chitlapakkam, Chennai-600064.
E-mail: orthovenkat@yahoo.com

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