

Synovial fluid analysis one of the basic diagnostic tool for undiagnosed knee synovitis

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Abstract:

Introduction: Synovial fluid analysis being a basic diagnostic tool, will differentiate between inflammatory & non-inflammatory conditions and provide direct proof of crystal arthropathy and infection. The aim of the present study was to find out the etiological diagnosis among patients of undiagnosed knee synovitis by synovial fluid analysis.

Methodology: A descriptive cross-sectional study was done in department of Physical Medicine and Rehabilitation, I.P.G.M.E. & R. Kolkata from March 2009- October 2014 (5 year 06 months). Patients of knee effusion in the age group of 21 to 71 yrs were included in the study. Patients having one or more of the following conditions were excluded from the study: diabetes mellitus, suspected hemarthrosis, suspected sepsis, bleeding diathesis, pregnancy, lactating mother, skin lesion, patients on hypouricemic drug. Complete enumeration was done of all the patients attending PMR OPD within the study period fulfilling inclusion and exclusion criteria. A total of 60 patients were included in the study.

Study Techniques: Clinical presentation of 60 patients of knee effusion of all gender and age group between 21yr to 71yr attending P.M.R. O.P.D. was noted. Arthrocentesis was done aseptically and fluid was sent for cytologic and biochemical analysis.

Results: In this study 60 patients were analysed. Clinical presentation of them (60) were as follows: polyarthritis 10, Oligoarthritis 45, Monoarthritis-5; one patient had high serum uric acid level (8.6mg/dl) (Table 1). Arthrocentesis findings revealed: Crystal arthropathy -12 patients, (monosodium urate crystal-11) Normal cytology & biochemistry- 31 patients, Inflammatory-9 patients, Septic Arthritis-2 patient.

Conclusion: Unless we go for routine synovial fluid analysis, we can miss a reasonable number of crystal arthropathy.

Key words: Synovial fluid, Synovitis, Arthrocentesis, Arthropathy

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I. Introduction:

Synovial fluid analysis being a basic diagnostic tool, will differentiate between inflammatory & non-inflammatory conditions and provide direct proof of crystal arthropathy and infection.

Synovial fluid, often referred as joint fluid, is located in all joints or diarthroses. At the synovial joints, the bones are covered by articular cartilage and are separated from each other by a small cavity that contains the synovial fluid. Together, all these anatomic elements form the joint, which is enclosed in the articular capsule. Inside these capsules are specialized secretory cells termed synoviocytes (types A and B), which produce the components of the synovial fluid (eg, matrix constituents, hyaluronic acid and salts, collagens, fibronectin for the intimal interstitium and synovial fluid).¹

Biochemically, the synovial fluid is an ultrafiltrate of plasma across the synovial membrane enriched with various compounds produced by the synoviocytes. In normal physiological conditions, the biochemical composition of the synovial fluid is similar to that of plasma. In pathological conditions, laboratory evaluation of synovial fluid provides information about the pathology of the condition affecting the joint (eg, arthritis).¹ Similar to other body fluids, common laboratory evaluation of synovial fluid involves the following three steps

- Physical examination of synovial fluid (eg, appearance, to include color, viscosity, other physical characteristics)
- Chemical analysis (eg, glucose, total protein level, uric acid)
- Microscopic evaluation (eg, cell count and differential count, crystal identification)

In addition, synovial fluid can be subjected to microbiologic, serologic, and cytologic laboratory evaluations.

Typical characteristics of synovial fluid

The characteristics of normal synovial fluid are as follows:

- Appearance: Clear
- White blood cell (WBC) count: Less than 200 cells/ μ L
- Polymorphonuclear neutrophils (PMNs): Less than 25%
- Viscosity: High
- Glucose level: Similar to that of the patient's serum glucose level

The following are typical characteristics of synovial fluid in noninflammatory conditions (eg, osteoarthritis, trauma):

- Appearance: Clear, yellow
- WBC count: Less than 2000 cells/ μ L
- PMNs: Less than 25%
- Viscosity: High
- Glucose level: Similar to that of the patient's serum glucose level

Indications and result interpretation

Indications include evaluation of inflammation, infections, trauma and degenerative diseases of the joints.

The aspect, biochemical composition, and microscopic content of synovial fluid change with different diseases, conditions, or medications.

Conditions associated with changes in the appearance of synovial fluid

In normal conditions, synovial fluid is colorless or faint yellow and clear, and it can form viscous strings of 4-6 cm (owing to polymerization of hyaluronic acid). (The word synovial comes from the Latin word for egg/egg white.)²

The color and clarity of synovial fluid can change in different medical conditions, as follows:

- Inflammatory diseases of nonimmunologic origin: Cloudy/turbid, dense yellow with crystals
- Septic conditions: Cloudy, yellow-green, more viscous, positive culture
- Hemorrhagic conditions (eg, trauma, traumatic aspiration): Cloudy, reddish, low viscosity, with WBC count equal to the blood count
- When a high number of crystals are present: Milky/cloudy

Some Important Information:

Failure to initiate appropriate antibiotic therapy within the first 24 to 48 hours of onset can cause subchondral bone loss and permanent joint dysfunction.^{2,3}

Before antibiotics were available, two-thirds of patients died from septic arthritis.^{4,1} Current mortality rates of bacterial arthritis range from 10 to 20 percent, depending on the presence of comorbid conditions, such as older age, coexisting renal or cardiac disease, and concurrent immunosuppression.⁵

There is a link between elevated levels of serum urate and the incidence of gout. Patients with serum urate levels ≤ 7 mg/dL have an annual incidence below 1%; for patients with serum urate levels ≥ 9 mg/dL, the incidence is more than 5%.⁴

Identifying monosodium urate (MSU) and calcium pyrophosphate dehydrate (CPPD) crystals allows a quick and definitive diagnosis of both gout and CPPD arthritis, and remain the accepted gold standard.⁶

The present study was conducted with the objective to find out the etiological diagnosis among patients of undiagnosed knee synovitis by synovial fluid analysis.

II. Methodology

Study design, duration and setting: A descriptive, observational study with a cross-sectional design was conducted in the department of Physical Medicine and Rehabilitation, I.P.G.M.E.& R. Kolkata from March 2009- October 2014 (5 year 06 months).

Sampling: Patients of knee effusion in the age group of 21 to 71 yrs were included in the study. Patients having one or more of the following conditions were excluded from the study: diabetes mellitus, suspected hemarthrosis, suspected sepsis, bleeding diathesis, pregnancy, lactating mother, skin lesion, patients on hypouricemic drug. Complete enumeration was done of all the patients attending PMR OPD within the study period fulfilling inclusion and exclusion criteria. A total of 60 patients were included in the study.

Study Techniques: Clinical presentation of all 60 patients of knee effusion of all gender and age group between 21yr to 71yr attending P.M.R. O.P.D. was noted. Arthrocentesis was done aseptically and fluid was sent for cytologic and biochemical analysis [Cell type, Cell count, culture sensitivity if required, gm staining, AFB stain, Crystal study, Protein, Sugar].

III. Results and Analysis:

In this study 60 (28 males and 32 females) patients were studied with a mean age of 60.81(±14.95). Clinical presentation of them (60) were as follows: polyarthritis 10, Oligoarthritis 45, Monoarthritis-5(Figure 1). One patient had high serum uric acid level (8.6mg/dl). Arthrocentesis finding revealed: Crystal arthropathy 11 patients,(monosodium urate crystal) Normal cytology& biochemistry-38patients, Inflammatory-9 patients, septic arthritis-2 patient (Table-1). Mean BMI among patients of crystal arthropathy, noninflammatory, inflammatory and septic arthropathy were 25.21(±1.42), 25.69(±1.67), 24.37(±1.75) and 25.45(±0.64) kg/m² respectively.

IV. Conclusion:

Unless we go for routine synovial fluid analysis, we can miss a reasonable number of crystal arthropathy. However, our sample size was small and further study with a bigger sample size can be much more helpful.

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Tables and Diagrams:

Figure 1: Distribution of study participants according to their gender and type of arthritis.

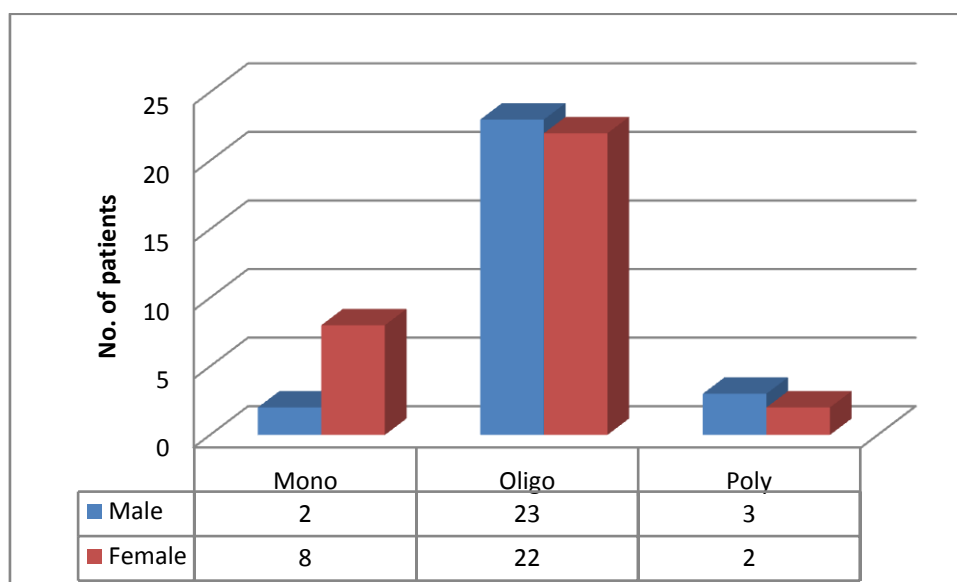


Table 1: Distribution of socio-demographic and anthropometric characters with type of synovitis n=60

Socio-demographic and anthropometric parameters		Synovitis				Total
		Crystal	Non inflammatory	Inflammatory	Septic	
Sex	Male No(%)	6(21.4)	17(60.7)	4(14.3)	1(3.6)	28(100)
	Female No(%)	5(15.6)	21(65.6)	5(15.6)	1(3.1)	
BMI(kg/m ²) Mean(SD)		25.21(1.42)	25.69(1.67)	24.37(1.75)	25.45(0.64)	

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