Original Article

# The Value of Joint Aspirations in the Diagnosis and Management of Arthritis in a Hospital-based Rheumatology Service

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## Abstract

**Introduction: Although joint aspiration with synovial fluid analysis is useful in the diagnosis of crystal or septic arthritis, the frequency with which it provides a diagnosis or aids subsequent management of patients with arthritis has not been well quantified. We therefore evaluated the usefulness of joint aspiration in the diagnosis and management of patients with arthritis in a hospital-based rheumatology service. Materials and Methods: We reviewed records of all patients with joint aspiration performed by an inpatient rheumatology service in a tertiary referral hospital from November 2003 to December 2004. Data were extracted on the frequency with which joint aspiration provided a diagnosis or aided management. Results: Among 76 patients [mean ± standard deviation (SD), 60.9 ± 15.9 years; 41 males, 35 females, Chinese (50), Malay (20), Indian (4) and others (2)] with 86 joint aspirations, a definitive diagnosis was obtained in 44% of procedures which showed gout (n = 28), septic arthritis (n = 8) or pseudogout (n = 2). In another 47% of procedures, joint aspiration aided diagnosis by allowing categorisation of synovial fluid as inflammatory (n = 25), non-inflammatory (n = 16) or blood-stained (n = 2). Joint(s) aspirated were knees (71%), ankles (15%), elbows (8%), shoulders (2%) and wrists, metacarpo-phalangeal and metatarso-phalageal (approximately 1% each). Conclusion: Joint aspiration provides a definitive diagnosis or information that aids diagnosis in a significant number of patients in a hospital-based rheumatology service.**

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**Key words: Arthritis, Aspiration biopsy, Diagnosis, Rheumatology, Synovial fluid**

## Introduction

Joint aspiration with synovial fluid analysis can provide information which complements that which is available from the history and physical examination of the patient, and can help to differentiate various causes of arthritis. It is most useful in monoarthritis, where septic arthritis as a medical emergency needs to be established and treated urgently.[1] It is also important in establishing a definitive diagnosis of crystal arthropathy.[2] However, the usefulness of joint aspiration has been called into question because of limitations in quality control and poor inter-laboratory reliability of synovial fluid analysis.[3] In a 2001 survey of rheumatologists and orthopaedic surgeons in the United Kingdom, synovial fluid cytology was used regularly by only 10% of survey respondents.[4] Despite recommendations by textbooks that joint aspiration is an important diagnostic tool, there has been a trend towards performing less arthrocentesis.[5-7] The postulated reasons for this decline are the availability of newer diagnostic techniques such as magnetic resonance imaging (MRI), the risks of joint aspiration as an invasive procedure and the lack of quality control for synovial fluid analysis.[3]

Interestingly, there has been a relative paucity of literature to show the extent to which joint aspiration with synovial fluid analysis impacts on physicians' diagnoses and treatment. In 1984, Eisenberg et al[8] showed that synovial fluid analysis was most useful for patients likely to have gout, pseudogout or infectious disease, by using threshold analysis and likelihood ratios. In a more recent review, rheumatologists in Switzerland showed that fine-needle aspiration of digit joints diagnosed crystal arthropathy (gout and pseudogout) in 29% of patients and aided diagnosis in two-thirds of patients by differentiating inflammatory from non-inflammatory causes of arthritis.[9]

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These few available studies attest to the value of joint aspiration with synovial fluid analysis in making a clinical diagnosis and influencing management in patients with arthritis in clinical practice. However, there is a need for additional studies to further support the value of joint aspiration. We therefore studied the diagnostic value of joint aspiration in a hospital-based rheumatology service over a 14-month period in a tertiary referral hospital in Singapore, which has a multi-ethnic Asian population of Chinese, Malays and Indians.

## Materials and Methods

Over a 14-month period from November 2003 to December 2004 (inclusive), we identified all joint aspirations performed on patients admitted or referred to the Department of Rheumatology and Immunology, Singapore General Hospital – a 1600-bed tertiary referral centre in Singapore. All procedures were performed at the bedside without ultrasound guidance and were recorded by department staff at the time of the procedure. Synovial fluid was sent to our hospital's accredited laboratories (Biochemistry, Microbiology and Histopathology) for assessment of cell counts, gram stain and pyogenic culture as well as crystal identification respectively. If clinically indicated, specimens were sent for tuberculous and fungal smears and cultures. Departmental staff also examined synovial fluid under polarised light microscopy for crystals. The lag time was kept to a minimum as specimens were sent to the laboratories immediately and our staff usually examined the fluid within 1 hour of the procedure. We used synovial fluid cell count of more than 2000/mm$^3$ to differentiate inflammatory arthritis from non-inflammatory arthritis.[5] We retrospectively reviewed patients' medical records using a pretested, standardised data extraction form to obtain information on demographics, diagnosis, indication(s) for joint aspiration and the development of septic arthritis up to 2 months after the procedure.

## Results

### *Patient Demographics*

Over a 14-month period, 86 joint aspirations were performed in 76 patients [ mean ± standard deviation (SD), 60.9 ± 15.9 years; 41 males and 35 females, Chinese (n = 50), Malay (n = 20), Indian (n = 4) and others (n = 2)]. Synovial fluid of varying volumes was obtained from all aspirated joints. Seven patients had 2 joint aspirations, while 1 patient had 4 procedures over a 2-month period for recurrent effusions in multiple joints.

### *Joint Aspiration*

The joint(s) aspirated were: knees (72%), ankles (14%), elbows (8%), wrists, shoulders, metacarpo-phalangeal and metatarso-phalangeal joints (approximately 1% each).

Joint aspiration yielded a diagnosis in 44% (38 out of 86) of procedures, which showed septic arthritis (n = 8, 9.3%), gout (n = 28, 32%) or pseudogout (n = 2, 2.3%). Table 1 shows the outcomes categorised by diagnosis and joints involved, and organisms isolated in patients with septic arthritis. Notably, there were no patients with both septic arthritis and crystal arthropathy in this series. Among patients where a definitive diagnosis was obtained from joint aspiration, the most common joints aspirated to obtain this diagnosis were the knees, elbows and ankles (Table 2). Septic arthritis and gout were diagnosed mainly from aspirating knee joints.

In 47% of procedures where there was no evidence of septic arthritis or crystal arthropathy, synovial fluid white cell counts proved to be useful in classifying synovial fluid as inflammatory (n = 25) or non-inflammatory (n = 16) using a white count of 2000/mm$^3$ to differentiate these categories. There were 2 patients with heavily blood-stained fluid, one of whom was subsequently diagnosed as having a spontaneous chronic anterior cruciate ligament tear on MRI.

Table 1. Outcomes of Joint Aspirations Categorised by Diagnosis and Joint

| Diagnosis | Joints |
|---|---|
| Septic arthritis (n = 8) | Knee (n = 5, 62.5%)<br>Shoulder (n = 1, 12.5%)<br>Ankle (n = 2, 25%)<br>Organism:<br>Group G Streptococci (n = 2, 25%) *(shoulder n = 1, ankle n = 1)*<br>*Neisseria gonorrhoea* (n = 4, 50%) *(Knee n = 3, ankle n = 1)*<br>*Staphylococcus aureus* (n = 2, 50%) *(Knee n = 2)* |
| Gout (n = 28) | Knee (n = 18, 64%)<br>Elbow (n = 6, 21%)<br>Ankle (n = 2, 7%)<br>MTPJ (n = 1, 3.6%)<br>Shoulder (n = 1, 3.6%) |
| Pseudogout (n =2) | Knee (n = 2, 100%) |
| Inflammatory yield (WBC >2000 cells/mm$^3$) (n = 25) | Knee (n = 19, 76%)<br>Elbow (n = 3, 12%)<br>Ankle (n = 2, 8%)<br>MCPJ (n = 1, 4%) |
| Non-Inflammatory yield (WBC <2000 cells/mm$^3$) (n = 16) | Knee (n = 12, 75%)<br>Ankle (n = 4, 25%) |
| Blood-stained aspirate (packed with RBC) (n = 2) | Knee (n = 2, 100%) |

MCPJ: metacarpo-phalangeal joint; MTPJ: metatarso-phalangeal joint; RBC: red blood count; WBC: white blood count

In 5 out of 86 joint aspirations, a very small amount of synovial fluid was obtained which was insufficient to obtain a cell count or determine the presence of crystals.

Table 2. Diagnostic Yield by Categorised by Joint Aspirated

| Joint aspirated | Diagnostic yield (by category) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Septic arthritis | Gout | Pseudogout | Inflammatory yield (WBC >2000/mm$^3$) | Non-inflammatory yield (WBC <2000/mm$^3$) | Blood-stained aspirate | Non-diagnostic |
| Knee (n = 62 ,72%) | 5 | 18 | 2 | 21 | 12 | 2 | 2 |
| Ankle (n = 12, 14%) | 2 | 2 | - | 2 | 4 | - | 2 |
| Elbow (n = 7, 8%) | - | 6 | - | 1 | - | - | - |
| Wrist (n = 1, 1%) | - | - | - | - | - | - | 1 |
| Shoulder (n = 2, 1%) | 1 | 1 | - | - | - | - | - |
| MCPJ (n = 1, 1%) | - | - | - | 1 | - | - | - |
| MTPJ (n = 1, 1%) | - | 1 | - | - | - | - | - |

MCPJ: metacarpo-phalangeal joint; MTPJ: metatarso-phalangeal joint; WBC: white blood count
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*Changes in Management*

Among the 8 patients with septic arthritis, 3 patients underwent arthrotomy and joint washout. One patient with *Staphylococcus aureus* septic arthritis was treated conservatively. The patient with chronic anterior cruciate ligament (ACL) tear underwent ACL reconstruction 6 months later.

*Complications*

Bleeding or septic arthritis did not occur in any of the aspirated joints in this series.

## Discussion

In this study of patients in a hospital-based rheumatology service, we found that joint aspiration led to a definite diagnosis in 44% (38 out of 86) of procedures, and categorised patients into those with inflammatory or non-inflammatory arthritis in an additional 47% (41 out of 86) of procedures. Joint aspiration, by establishing a diagnosis, often led to major changes in management, especially in patients with septic arthritis where surgical intervention was required. To the best of our knowledge, this is one of the few papers quantifying the usefulness of joint aspiration in the diagnosis of patients with arthritis, and is one of the first from the Asia-Pacific region.

Despite the usefulness of joint aspiration in the diagnosis of patients with arthritis, there are several potential concerns that remain regarding this issue. Septic arthritis as a complication of joint aspiration is a rare but potentially serious complication; however, if proper aseptic technique for arthrocentesis is used, the risk of introducing infection into a joint is negligible (often quoted to be 1 in 10,000).[10] Another concern is the need for better quality control in analysis of synovial fluid to reduce the discrepancies between laboratories; this has prompted efforts to improve sensitivity and specificity of synovial analysis such as formal training of observers to ensure a consistent outcome as well as repeat examination of the same synovial fluid 24 hours later.[11,12]

We recognise several limitations of this paper. First, this is a retrospective study; however, we were able to ensure complete identification of all patients with joint aspiration because each procedure was prospectively documented. Second, the generalisability of our results to other clinical contexts is unclear; however, our data are encouraging and do support the need for such studies to further evaluate the usefulness of joint aspiration in other clinical contexts.

In conclusion, we found in this study that joint aspiration provides a definitive diagnosis or information that aids diagnosis in a significant number of patients in a hospital-based rheumatology service.

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