

GRAM STAINING IN THE DIAGNOSIS OF ACUTE SEPTIC ARTHRITIS

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This study aimed at determining the sensitivity and specificity of Gram staining of synovial fluid as a diagnostic tool in acute septic arthritis.

A retrospective study was made of 22 patients who had arthroscopic lavage following a provisional diagnosis of acute septic arthritis of the knee joint. Gram stains and cultures of the knee aspirates were compared with the clinical and laboratory parameters, to evaluate their usefulness in diagnosing acute arthritis.

All patients who had septic arthritis had pain, swelling and limitation of movement. CRP was elevated in 90% of patients. The incidence of elevated white blood cell count was higher in the group of patients with a positive Gram stain study (60%) as compared to patients with a negative Gram stain study (33%). Gram staining sensitivity was 45%. Its specificity was however 100%.

Gram staining is an unreliable tool in early decision making in patients requiring urgent surgical drainage and washout.

Keywords : septic arthritis ; Gram stain ; specificity ; sensitivity.

Mots-clés : arthrite septique ; coloration de Gram ; spécificité ; sensibilité.

INTRODUCTION

Accurate diagnosis of acute septic arthritis can sometimes pose a challenging clinical problem. The need to institute early management, particularly in children, cannot be overemphasized. A number of clinical and laboratory parameters, including Gram staining, are used in making a diagnosis. Analysis of the synovial fluid in patients with infected arthritides is said to universally show more

than 80,000 white blood cells, with more than 75% polymorphonuclear cells. Other features include low glucose levels (< 25 mg/dl) and increased synovial lactate (6).

Some hospitals place high emphasis on Gram staining of synovial fluid in making a diagnosis and Gram-staining results are awaited before arthroscopic lavage is instituted. To our knowledge, there is no published data on the sensitivity and specificity of Gram stain studies of synovial aspirates of infected joints. The current study was pursued in order to find out the specificity and sensitivity of Gram staining of synovial fluid and the benefit of the Gram stain result in decision making for emergency knee washout when septic arthritis is suspected.

PATIENTS AND METHODS

Between March 1996 and January 2001, 22 patients underwent urgent arthroscopic lavage of the knee (within 24 hours). These patients presented with an acute, warm, swollen and stiff knee with the provisional diagnosis of septic arthritis. The decision for surgical intervention was based on clinical and laboratory parameters (table I, II). The culture of synovial fluid specimens was positive in all cases and provided the diagnosis of septic arthritis.

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Table I. — Patients with positive Gram stain on direct smear and subsequent positive blood culture

Variables	Incidence
Male : Female	6:4
Mean & range of age	73 (43-83yrs)
Side : R/L	5/5
Predisposing factors	50%
Pain, limitation of movement, swelling	90%
Fever	40%
Turbid synovial fluid	100%
High CRP, plasma viscosity	90%
Elevated WBC	60%
Positive blood culture	0%
Micro-organism grown	<i>S aureus</i> (7), <i>E coli</i> (2), <i>Strep.</i> <i>pyogenes</i> (1)

Table II. — Showing patients with negative Gram stain on direct smear and subsequent positive blood culture

Variables	Incidence
Male : Female	10:2
Mean age & range	40 (8-77yrs)
Side R/L	5/7
Predisposing factors	58%
Pain, limitation of movement, swelling	91%
Fever	50%
Turbid synovial fluid	91%
High CRP, plasma viscosity	91%
Elevated WBC	33%
Positive blood culture	16%
Micro-organism grown	<i>S aureus</i> (9), <i>Pseud.</i> <i>Aeruginosa</i> (1), <i>Group B</i> <i>Streptococcus</i> (2)

Patients who had joint replacement surgery were excluded from the study. The clinical assessment was performed by a senior orthopaedic surgeon. Fever, pain, limited movement of the knee joint and knee effusion were recorded. Pyrexia was represented as temperature greater than 37.2 C°. Predisposing factors and associated medical conditions were recorded.

Samples for estimation of white blood cell count, C-reactive protein and/or plasma viscosity, and blood culture were obtained. Gram staining and culture of knee aspirates were taken prior to arthroscopic lavage. Using aspirate culture as our gold standard, we then

retrospectively compared the diagnostic relevance of the clinical features, laboratory parameters and results of Gram stain studies.

RESULTS

The patients were divided into 2 groups ; Group I had Gram stain studies showing organisms, Group II had Gram stain studies not showing organisms.

Ten patients (45%) had a positive Gram stain i.e. demonstrated organisms, indicating a low sensitivity. The predominant organism was *S.aureus* (72%).

In both groups of patients, males were affected more often. The mean age was higher in group 1 patients (73 years). The age range in both groups was 8-83 years. High C-reactive protein and plasma viscosity was noted in 90% of patients in both groups. In group I, high white blood cell count was noted in 60% of patients, however only 33% of patients in group 2 had high white blood cells. In both groups the body temperature was elevated in 40-50% of cases only, the average being 37.4°. All patients had clinical features of joint stiffness, moderate-severe effusion and pain.

Ten percent of patients in group I demonstrated the organisms in blood culture, compared with 16% in group II.

The following predisposing factors were noted :

1. Leukaemia (1 patient)
2. Diabetes (2 patients)
3. Previous recent knee injury (1), previous patellectomy (1)
4. Previous knee arthroscopy (4 patients)
5. Lymphoma (1 patient)

DISCUSSION

The decision on the operative intervention in septic arthritis of the knee is not uncommonly difficult to make. Pain, limitation of movement and knee effusion were constantly seen in both groups of septic arthritis of the knee in our patients ; these clinical manifestations, however are not specific to septic arthritis and can be seen in other diseases of the knee joint. Fever was not a constant feature in our patients either. Blood investigations are also

unreliable (7). Although CRP and /or plasma viscosity was high in the majority of our cases, WBC count was elevated in less than half of the cases.

In clinical practice the decision to carry out arthroscopic lavage in patients with features of septic arthritis sometimes hinges on the result of Gram stains of synovial aspirates. Gram staining is a rapid diagnostic test for detecting micro-organisms in most body fluids (1-8). Gram stain study, however, sometimes delays the institution of appropriate management with dire consequences.

To be useful, Gram stain study must be both sensitive (able to detect infection) and specific (able to rule out infection). Various rates of sensitivity and specificity have been reported for different samples obtained in the body. Sensitivity of over 90% and specificity of 73% have been documented for bronchoalveolar lavage fluid and intraocular samples (1, 2). Gram stain study of specimens taken from artificial joints in orthopaedic surgery, however, has been found to be not reliable for determining the presence of infection in patients who are having revision surgery of the arthroplasty (7). While Gram stain may be specific, it lacks any acceptable level of sensitivity (range 0 to 23%) (3, 5).

In our 22 cases of culture proven septic arthritis of the knee, less than half had positive Gram stain study of synovial fluid prior to surgery, no micro-organisms was seen in the remaining cases despite the turbidity of the aspirated fluid. The Gram staining study was predominantly positive in the elderly and the immunocompromised.

CONCLUSION

When the clinical features suggest septic arthritis, a clinical decision needs to be made urgently to drain and lavage the knee joint. Blood investigations and knee aspiration for both Gram stain study and culture and sensitivity, however have to be done. A negative Gram stain study should not be taken as evidence against septic arthritis of the knee joint and should not delay surgical treatment. On the other hand, when the Gram stain study shows a particular micro-organism, the culture comes back positive in 100% of cases.

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SAMENVATTING

A. A. FARAJ, O. D. OMONBUDE, P. GODWIN. *Gram kleuring bij acute septische arthritis.*

De waarde van gram kleuring van synoviaal vocht als diagnostisch middel bij acute septische arthritis werd bestudeerd.

22 patiënten die een arthroscopische lavage ondergingen met het vermoeden van een acute septische arthritis van de knie werden retrospectief nagekeken. Gram kleuring en cultuur van het knie aspiraats werden geëvalueerd naar hun diagnostische waarde en vergeleken met klinische en laboratorium parameters.

Alle patiënten met septische arthritis hadden bewegingsbeperking, pijn, en zwelling. Bij 90% was de bezinking versneld. De leucocytosis was hoger bij gram positieve (60%) dan bij gram negatieve invasie (33%). De gevoeligheid van gram kleuring bedroeg slechts 45%, maar de specificiteit haalde 100%.

Gram kleuring is dus niet bruikbaar bij de beslissing tot dringende spoeling bij de behandeling van acute septiche arthritis.

RÉSUMÉ

A. A. FARAJ, O. D. OMONBUDE, P. GODWIN. La coloration de Gram dans le diagnostic de l'arthrite septique aiguë du genou.

Ce travail a cherché à déterminer la sensibilité et la spécificité de la coloration de Gram réalisée sur le liquide synovial, dans le cadre du diagnostic des arthrites septiques du genou.

Les auteurs ont fait une étude rétrospective portant sur 22 patients qui ont subi un lavage arthroscopique du genou sur base d'un diagnostic provisoire d'arthrite sep-

tique aiguë du genou. Les résultats de la coloration de Gram et de la mise en culture du liquide articulaire ont été étudiés en regard des autres paramètres cliniques et paracliniques, dans le but d'évaluer leur intérêt pour la mise au point diagnostique de l'arthrite aiguë.

Tous les patients présentant une arthrite septique présentaient douleurs, gonflement et limitation de la mobilité articulaire. La CRP était élevée chez 90% d'entre eux. L'incidence de l'hyperleucocytose était plus élevée dans le groupe où la coloration de Gram était positive (60%) que dans le groupe où elle était négative (33%). La sensibilité de la coloration de Gram était de 45% ; sa spécificité était de 100%.

La coloration de Gram apparaît comme un outil diagnostique non fiable lorsqu'il s'agit de prendre une décision thérapeutique rapide chez des patients chez qui un drainage chirurgical avec lavage articulaire peut s'imposer.