

# FOCUS ON RESEARCH

## MOLECULAR METHODS FOR IMPROVING THE DIAGNOSIS OF JOINT REPLACEMENT INFECTIONS

### Researchers

Professor AHRW Simpson, Mr P Gaston, Dr. D Salter, Mrs C Ritchie.

### Aims

Total Joint Replacement (TJR) is a very common treatment for arthritis. Over time a proportion of TJRs fail by becoming loose, giving pain. Sometimes this loosening is due to infection. It is very important to diagnose infection in a loose TJR as it greatly affects the subsequent treatment, but current diagnostic tests are not always accurate. In this study we examined the use of molecular biology (specifically the polymerase chain reaction (PCR), which detects DNA) to help improve diagnostic accuracy. Our questions were:

1. Is PCR based detection of bacterial DNA a better test than those that already exist for the diagnosis of infection in loose TJRs in patients with non-inflammatory joint disease (e.g. Osteoarthritis)?
2. Could PCR improve diagnostic accuracy in loose TJRs in patients with inflammatory joint disease (e.g. Rheumatoid Arthritis)?

### Project Outline/Methodology

We recruited 204 patients who were due to have a re-operation for a loose TJR (a revision). Before revision they had: blood tests for the Inflammatory Markers – C-Reactive Protein and the Erythrocyte Sedimentation Rate (CRP/ESR); a sample of fluid taken from the joint for microbiology culture of bacteria; and fluid/tissue specimens collected for PCR. We used internationally agreed criteria as the gold standard for infection, which we applied after the revision surgery. The patient was deemed to be infected if any of the following were found: pus coming from the joint; bacterial growth; inflammatory cells at microscopy (histology).

### Key Results

There were 152 Osteoarthritis type patients. 35 were infected according to the gold standard. All tests, including PCR, were useful if negative – it was unlikely the TJR was infected. However, a positive PCR indicated an underlying infection only 43% of the time, compared to 57% for the ESR and 71% for aspiration Microbiology.

There were 52 Rheumatoid Arthritis type patients. Histology may be inaccurate in these patients and was omitted from the gold standard. This allowed us to compare histology with the other tests. 9 were infected according to the modified gold standard. Again all negative test results were useful. Positive results of PCR, ESR and histology were all inaccurate.

### Conclusions

PCR based detection of bacterial DNA is no better for the diagnosis of infection in loose TJRs in patients with non-inflammatory joint disease than already existing simpler tests. PCR does not improve accuracy in patients with inflammatory joint disease.

### What does this study add to the field?

We now know that PCR is not a useful tool for the diagnosis of infection in a loose TJR. It has allowed us to examine critically all tests used to diagnose infection in this setting, and to produce guidelines for the use of these tests.

### Implications for Practice or Policy

We recommend that all patients with loose TJRs have inflammatory markers checked as a screening test - if negative then the clinician can be relatively reassured that the implant is not infected. If positive, further investigation should be undertaken. Taking a sample of fluid from the joint for microbiology is currently the best available second line test.

### Where to next?

Microbiology with growth of the actual bacteria causing the infection is the best test in this situation. Positive microbiology also provides guidance on future treatment of the patient. We are currently collaborating with our microbiology colleagues to improve the accuracy of this test. PCR may be useful for localisation of bacteria in the tissues around TJRs.

### Further details from:

Mr Paul Gaston  
Department of Orthopaedic Surgery  
New Royal Infirmary of Edinburgh  
Little France  
Edinburgh. EH16 4SU

