

Improved detection and treatment of prosthetic joint infection

S Patrick¹ A McDowell¹ J.V. Glenn¹ & MMTunney²

¹ School of Medicine & Dentistry & ² School of Pharmacy, Queen's University of Belfast,
Northern Ireland, UK

INTRODUCTION: Although it is widely considered that aseptic loosening is the most common cause of failure of total hip replacement (THR), studies at Queen's University Belfast indicate that routine microbiological practice underestimates the incidence of infection¹. By sampling directly from prostheses retrieved at the time of revision operation and adhering to strict anaerobic culture techniques the anaerobic bacterium *Propionibacterium acnes* is isolated as frequently as coagulase negative staphylococci. In addition non-culture detection using specific antibodies enables the detection of bacteria in culture negative samples². We now present data relating to the study of prostheses retrieved from a further 125 patients and in addition examine bone samples.

METHODS: Samples were obtained from 125 patients undergoing revision operations for total hip arthroplasty at Musgrave Park Hospital, Belfast. Upon removal from the patient, samples were transferred into an anaerobic jar for transport to the laboratory where they were transferred to an Anaerobic Work Station (Don Whitley) for processing. Samples were placed in pre-reduced quarter strength Ringer's solution containing L-cysteine and then subjected to mild ultrasound treatment to dislodge adherent biofilm. Samples of the Ringer's solution (sonicate) were then spread plated onto blood agars and incubated aerobically and anaerobically. Sonicate samples were also incubated with antibodies that reacted with either *Staphylococcus* spp or *Propionibacterium acnes* and FITC-conjugated secondary antibodies and then viewed using a fluorescence microscope.

RESULTS: Of the 125 patients, 55 were male, 62 female and there was no gender information for 8 patients. The mean age was 70 years (34 to 91); age details were absent in 12 cases. The mean time-span of the implant *in situ* before failure and the need for revision surgery was 12.1 years (range of 1 year to 22 years). The study confirmed our previous data that handling of samples using strict anaerobic practice resulted in the isolation of *Propionibacterium acnes* as frequently as coagulase negative staphylococci. In addition, bacteria could also be cultured from bone samples after mild ultrasound treatment and detected by

immuno-fluorescence microscopy (IFM). IFM revealed characteristic aggregates of bacteria that had been dislodged from adherent biofilm. Ninety-seven percent of the patients in the study had evidence of osteolysis.

DISCUSSION & CONCLUSIONS: Clearly, bacterial infection in THR is not restricted to bacteria growing in biofilm on the prosthesis surface, but may include biofilm colonisation of the adjacent bone. This has important implications for the potential role of bacteria in the osteolysis observed in these patients. These data also highlight the potential importance of the bacterium *Propionibacterium acnes* in the failure of total hip replacements. The potential virulence of this bacterium is becoming increasingly clear, with evidence of variable expression of putative determinants of virulence amongst different types³.

REFERENCES: ¹Tunney MM, Patrick S, Gorman SP, Nixon JR, Anderson N, Davis RI, Hanna D and Ramage G (1998) Improved detection of infection in hip replacements: a currently underestimated problem *J Bone Joint Surg Br* **80**:568-72 ²Tunney MM, Patrick S, Curran MD, et al Ramage G, Hanna D, Nixon JR, Gorman SP, Davis RI and Anderson N (1999) Detection of prosthetic hip Infection at revision arthroplasty by immunofluorescence microscopy and PCR amplification of the bacterial 16S rRNA Gene. *J Clin Microbiol* **37**:3281-90. ³Valanne S, McDowell, A, Ramage G, Tunney MM, Einarsson GG, O'Hagan S, Wisdom GB, Fairley D, Bhatia A, Maisonneuve J-F, Lodes M, Persing DH and Patrick S (2005) CAMP factor homologues in *Propionibacterium acnes*: a new protein family differentially expressed by types I and II. *Microbiol* **151**, 1369-1379.

ACKNOWLEDGEMENTS: AM was funded by the Northern Ireland Health and Personal Social Services Research and Development Office and JVG by the European Social Fund.