Enhanced specificity of polymerase chain reaction in periprosthetic joint infection diagnosis

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Abstract

Background: False negative culture results in Periprosthetic Joint Infection (PJI) are not uncommon particularly when patients have received long term antibiotics. Polymerase Chain Reaction (PCR) has a lower specificity partly due to detection of residual DNA from dead bacteria. Propidium monoazide (PMA) prevents DNA from dead bacteria from being amplified during the Polymerase Chain Reaction (PCR).

Questions/purpose: Determination of role of PMA in PCR for diagnosis of PJI.

Patients and Methods: Clinical samples were tested with and without prior treatment with PMA and compared to conventional microbiological culture. 208 periprosthetic tissues and explanted prostheses from 62 episodes in 60 patients undergoing revision arthroplasties for either PJI or non-infective causes were tested, by culture, PCR, and PMA-PCR.

Results: 16 of the 62 episodes satisfied the Musculoskeletal Infection Society (MSIS) criteria for PJI and 46 did not. Sensitivity of culture, PCR, and PMA-PCR were 50%, 71%, and 79% respectively. Specificities were 98%, 72%, and 89% respectively. PMA-PCR enhanced both the specificity and the sensitivity of PCR.

Conclusions: PMA-PCR has the potential to be used to detect residual bacterial viability to confirm eradication of infection prior to reimplantation in the two-stage revision for PJI. It therefore helps to ensure that prompt, appropriate treatment is given where residual live bacteria remain when the new prosthesis is inserted.

Clinical Relevance: In two-stage revision for PJI, after a course of antibiotics it is crucial to ensure that the original infection has been eradicated. PCR methods cannot distinguish between DNA from live and dead bacteria. Using PMA, the DNA from residual dead bacteria remains undetected and does not confuse the diagnosis. Also, the use of PMA increases the sensitivity of the method in detecting live bacteria. The use of PMA-PCR promises to improve detection of residual infection and lead to treatment, so improving outcomes in two-stage revision.

Biography

Mohamed Askar is an academic and clinical orthopaedic fellow at Nottingham University Hospital. His research interests are in surgical infection, and particularly that involving implantable devices.

Publications

1. Small-colony variant of Staphylococcus lugdunensis in prosthetic joint infection
2. Comparison of different human tissue processing methods for maximization of bacterial recovery
3. Propidium monoazide–polymerase chain reaction for detection of residual periprosthetic joint infection in two-stage revision
4. Improved laboratory methods for diagnosis of infection in spinal instrumentation
5. Comparison of different tissue processing methods for maximization of bacterial recovery

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