CASE REPORT

Serum Procalcitonin Guide in a Case of Proteus mirabilis Prosthetic Joint Infection

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ABSTRACT

Infection is a dreaded complication in patients who have underwent arthroplasty and often very challenging to treat. It accounts for lesser than 1% of arthroplasty cases and although low in occurrence, requires appropriate investigations and management to successfully treat the condition. This case demonstrates a case of a rare microorganism with unusual antibiotic susceptibility causing a prosthetic joint infection and the use of serum procalcitonin level as guide in management of the patient.
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INTRODUCTION

Joint replacing surgery is a rewarding procedure for patients with debilitating degenerative joints. However, one of the most feared complications both to the patient and surgeon is a prosthetic joint infection. It is one of the causes of implant failure and may subject the patient to multiple surgeries for debridement and revision of implant, disability and in cases of persistent infection can even lead to sepsis and mortality. Managing a case of prosthetic joint infection requires a thorough investigation with the main aim of identification and eradication of the causative microorganism before proceeding with revision surgery. We present a case of 54 years old male who had a hip prosthetic joint infection with Proteus mirabilis as causative microorganism and discuss the role of procalcitonin in monitoring the response to treatment.

CASE REPORT

A male patient in his fifties who is diabetic and on renal replacement therapy previously had right hip replacement surgery and presented six years later with complaint of right hip pain. On assessment, blood parameters were suggestive of an ongoing infection while plain radiographs revealed implant loosening. He underwent surgery for removal of implant, debridement and antibiotic cement insertion. Subsequently, he developed chronic right hip collection which did not resolve by aspiration. He underwent another surgery for wound debridement and antibiotic cement insertion a year later for persistent infection. Intra operatively, biofilm was seen on the implant with surrounding unhealthy tissue and purulent discharge. Tissue sample from the infected area revealed growth of Proteus mirabilis which was sensitive to Cefuroxime. He was treated with intravenous Cefuroxime for about five weeks followed by oral Trimethoprim-Sulfamethaxazole for another seven weeks. Oral Rifampicin was also added to the entire length of treatment in view of its bone penetration properties and retainment of antimicrobial activities within the cells. His surgical wound healed well with no signs of active infection since the commencement of antibiotics. He was able to ambulate at home using a walking frame with minimal discomfort at the right hip. There was complete resolution of leucocytosis, however the level of C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR) were persistently above normal level with reducing trend in the beginning and thereafter hitting a plateau. Serial procalcitonin level was taken at midcourse of antimicrobial treatment and upon completion of antibiotics for the duration prescribed. The results of serum procalcitonin however shown values below the cut off value to indicate an active infection, therefore concluding that patient has responded well to the treatment. Therefore, antimicrobial therapy was discontinued and he subsequently underwent right hip revision arthroplasty surgery using an endoprosthesis. He remained well with no evidence of infection based on clinical, laboratory and radiological assessment during his latest follow up at one year post operative period and was able to ambulate independently.

Figure 1: Plain radiograph showing the implant migration with surrounding lytic erosion of the bone prior to wound debridement and implant removal

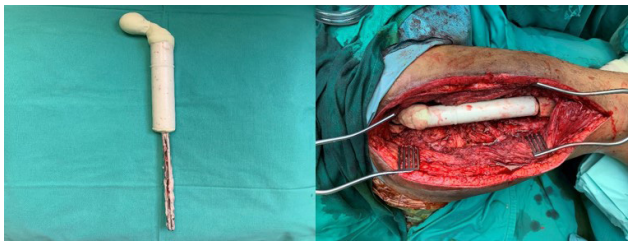

Figure 2: Intra operative images following removal of implant and debridement, followed by insertion of antibiotic bone cement spacer

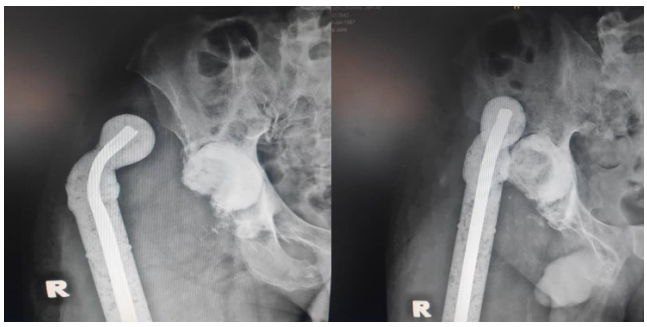

Figure 3: Plain radiographs with antibiotic bone cement spacer.

DISCUSSION

Prosthetic joint infection is a dreaded complication in joint replacement surgery and it accounts for lesser than 1% of arthroplasty cases. Risk factors for prosthetic joint infection include diabetes, obesity, inflammatory arthritis, malignancy and immunosuppressive medications (1).

Surgical debridement and appropriate antimicrobials administration remain the mainstay of treatment for prosthetic joint infection. This condition is commonly associated with biofilm growth which makes elimination of infection impossible with administration of antibiotics

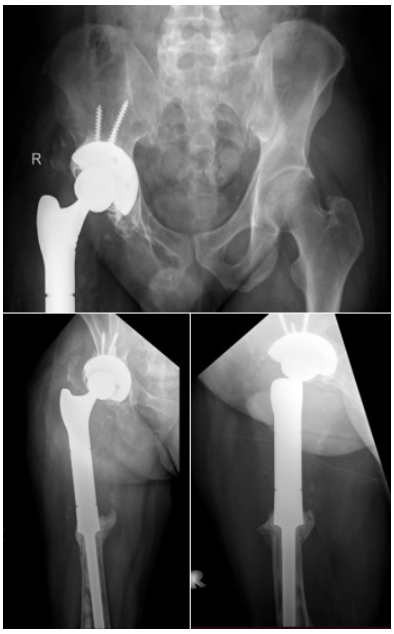

Figure 4: Plain radiographs taken at 1 year post operative period showing no signs of infection or implant loosening

alone. Biofilms as described by one author are "complex formation of microorganisms embedded in an extracellular matrix' that undergoes several stages such as "attachment of microbial to a surface, initial growth on the surface and finally maturation" (1 p. 308). This serves as a protective barrier to the microorganisms.

Staphylococcus aureus and coagulase negative Staphylococcus species are reported as the commonest causative microorganisms in cases of prosthetic joint infections accounting for about 50% of cases (1), followed by streptococcus and enterococcus species. Fungal infections in prosthetic joint infection has been reported to be about 1% of all arthroplasty cases.

Proteus mirabilis which belongs to the Enterobacteriacae group has special features and characteristics which contributes to its virulence and ability to form biofilms which results in resistance to host immunity and antimicrobials. Its ubiquitous property makes it an unpredictable microorganism with variable zone of inhibition. Proteus mirabilis most commonly manifests as urinary tract infections and is almost never reported in prosthetic joint infections (2).

Uncomplicated urinary tract infections caused by Proteus mirabilis are usually treated with oral Trimethoprim-Sulfamethoxazole or oral Ciprofloxacin while in more severe cases, intravenous administration of either Ceftriaxone, Gentamycin or Ciprofloxacin followed by oral Cephalosporins, Ciprofloxacin or Trimethoprim-Sulfamethoxazole is practiced (2). Although Proteus mirabilis is reported to be highly sensitive to antibiotics such as Ciprofloxacin, Cephalaxin and Ampicillin (3), the antibiotic susceptibility of Proteus mirabilis isolated from this case seems to demonstrate otherwise, whereby

it was resistant to Ciprofloxacin, Ampicillin, Amoxicillin-Clavulanate and was instead sensitive to Cefuroxime. The patient also shown improvement clinically, while an improving CRP, ESR and procalcitonin level provided further assurance that the infection was well controlled by a less common choice of antibiotics based on sensitivity.

The decision to proceed with revision surgery is often guided by several factors such as presence of fever, wound healing progress, imaging and laboratory investigations. Commonly, the level of CRP, ESR and white cell count is used as a guide to determine if the patient is responding to treatment. However, it is often noticed that although there was improvement in general condition, the level of CRP and ESR do not normalize although it may demonstrate a reducing trend. This can pose as challenge to the clinician to determine if the patient has completely recovered from infection. Therefore, it can be helpful to use serum procalcitonin which is a precursor of calcitonin as a guide to monitor active infection in cases of prosthetic joint infection (1). Procalcitonin is produced by many types of cells in the body and often found elevated in people with active infection as the process of conversion to calcitonin is inhibited by cytokines and other inflammatory products. High levels of procalcitonin can be used as an indicator to predict progression into sepsis in people with active infection. It has been shown that procalcitonin guided monitoring of patients with active infection has resulted in more judicious use of antibiotics and in fact improve clinical outcomes (4). According to a study by Karthikeyan et al, a cut – off value of 0.4ng/ml can be used to differentiate bones and joints infection from other conditions closely mimicking infections (5). It is also shown that synovial fluid procalcitonin levels could be used to indicate an ongoing infection process, including in prosthetic related infections.

CONCLUSION

Common causative microorganisms of prosthetic joint infection are Staphylococcus aureus and coagulase negative Staphylococcus species, however rare involvement of other microorganisms such as Proteus mirabilis is not impossible. It is also crucial to remember that selection of antibiotics should be determined by tissue culture and sensitivity test. It is also recommended that serum procalcitonin level can be used as an additional tool to monitor response to treatment. Therefore, the duration of antimicrobial therapy can be optimized and delay of revision surgery can be prevented in patients with prosthetic joint infection.

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