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The role of arthroplasty registry in detecting early failure of a modern uncemented total knee

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Introduction

The National Arthroplasty Registry of Slovenia (NARS) is fully operational since 2019. A higher revision rate was detected after primary uncemented total knee arthroplasty (TKA) compared to the similar model of cemented TKA. This study aimed to analyse possible causes for unexpected tibia bone loss resulting in modular porous tantalum (PT) component failures necessitating early revision.

Materials and Methods

A total of 7301 TKAs were performed from 2019 to 2021 and 121 (1.66%) were revised. In the same time period, 262 uncemented fixed-bearing TKAs were implanted and 6 (2.29%) were revised, 5 were retrieved at the authors' institution. The tissue samples collected underneath the tibia baseplate (TB) were histologically analysed and scanned for Proton-Induced X-ray Emission (micro-PIXE) elemental analysis. Fractographic and microstructural analysis were performed by stereomicroscopy. A full 3D finite-element model was made for numerical analysis of stress-strain conditions of the TB.

Results

There were 3 males and 2 females in the series. The mean age of the patients was 61.8 years (range, 58 – 65), the mean BMI was 32 kg/m² (range 27.8 – 37.1), and the mean time from index surgery to revision procedure was 18.6 months (range 5 – 43). The knee radiographs depicted pronounced osteolysis of the proximal tibia bone and displacement of the TB which fractured in 2 patients. Histological examination of tissue underneath the TB revealed dark stained metal debris, which was confirmed by micro-PIXE to consist of tantalum and titanium. Fractographic analysis and tensile testing showed that the failure of the TB fulfilled the criteria of a typical fatigue fracture.

Discussion

This study stresses the importance of an arthroplasty register for patients' safety and details modes of failures of TKA components. Further studies are needed to confirm the responsibility of metal debris for an increased bone absorption ultimately leading to early revisions.

Notes