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Project: Aseptic loosening following hip and knee replacement - are there different mechanisms of failure?

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Introduction:
Aging populations in New Zealand, as with other developed countries, are responsible for significant increases in the demand for joint replacements such as total hip (THR) and total knee replacements (TKR).

Over 90% of these joint replacements are due to osteoarthritis, a degenerative joint condition that can cause severe pain and disability.

These procedures are commonly performed to reduce pain and increase quality of life and are performed most commonly on the hip and knee joints.

Research from the Christchurch Orthopaedic Department in 2014 has predicted increases in THR and TKR by 84% and 183% respectively by 2026. Thus, with the drastic increases in demand for THR and TKR due to osteoarthritis and ageing in New Zealand, there will be subsequent increases in numbers of procedures that need to be revised due to failure.

Currently, 15% and 8% of hip and knee surgeries per year in New Zealand are revision of previous surgical procedures, which has a large burden for patients and the healthcare system. Reliable information on the causes of revision of hip and knee replacements, including the trends over time, is thus needed to help recommend changes in clinical practice.

Aim:
The primary objective of this study is to examine the 15-year report of the New Zealand Joint Registry (NZJR) to determine if there are changing patterns in the cause of revision of hip and knee replacements.

We hypothesise that in the past 15 years there are different trends in the mechanisms of failure of hip and knee replacements. Analysis of this will enable us to see if developments in arthroplasty are improving and make recommendations to influence clinical practice so that the longevity of these implants can be extended. This may help to reduce the burden of revision surgeries for both the patients and the healthcare system.

Method:
Data on the causes of revision of hip and knee replacements was extracted from the NZJR for the period of January 1999 to December 2013. The results were grouped into three periods of 5 years (Period 1=1999-2003, Period 2=2004-2008 and Period 3 = 2009-2013).

Yearly revision rates for hip and knee replacements were calculated, to allow analysis of changing trends. For those revisions that had their primary joint replacement recorded by the registry, we calculated the absolute revision rate per year for each cause.

This was done by dividing the yearly number of revisions for each cause by the total number of primary hip or knee replacements for each year. Emphasis was placed on early revisions, those that occurred within 1 year of the date of the primary replacement. Data was stratified to enable comparison of revision rates for gender, ASA class (a measure of the presence of additional health conditions) and age.

Results:
For the period of January 1999 to December 2013, early revisions of hip and knee replacements rose from 0.86% and 0.49% to 1.30% and 0.66% of total hip and knee replacements per year respectively. For early revision of hip replacements, most notably femoral fracture has increased from 0.27% to 1.18% of total yearly hip replacements for period 1 to period 3. Deep infection has also recently dramatically increased, rising from 0.66% in period 2 to 1.22% in period 3. Dislocation has also decreased from period 2 to period 3, where it dropped from 2.52% to 2.13%. However, a rise from 0.33% to 0.48% occurred from 2009-2013. For early revision of knee replacements, deep infection has again dramatically increased, from 1.07% of yearly total knee replacements in period 1 to 1.57% in period 3. Early revision due to loosening of the tibia and femur (bones of the thigh and lower leg), decreased throughout the 15year period from 0.30% and 0.18% to 0.15% and 0.064% for periods 1 to 3 respectively.

Conclusion:
With the recent large increase in the risk of early revision of both hip and knee replacements due to deep infection, we recommend following further clinical research on artificial joints which are coated in silver or nanoparticles.

This research has been promising, showing reductions in the adherence of bacteria to artificial joints and in exerting anti-bacterial activity.

This exciting technology has the potential to help prevent infections of artificial joints before they occur. We should also pay attention to the results of the PRISS (Prosthetic Related Infections Shall be Stopped) project in Sweden. This project aims to cut the actual frequency of joint replacement infections in half. Monitoring this will enable us to see how increased awareness and highly scrutinised preventative measures of this project can impact the risk of revision due to deep infection.

Following this, there is the possibility of implementing such a project within New Zealand. We also recommend continuing the trend of increased use of cross-linked polyethylene (a highly dense plastic material) joint implants, which is associated with a reduction in the risk of revision due to loosening.
Continuing to use larger femoral head sizes may also help reduce the risk of revision due to dislocation.

Finally, where appropriate, we recommend increases in the cementation rate for fixation of hip replacements, which has decreased in recent years. This is likely contributing to the recent increase in early revision due to femoral fracture. Continuing to monitor the trends in the causes of revision by use of the NZJR is paramount to providing further recommendations on changing clinical best practices for hip and knee replacements. In doing so, we may help to reduce the burden of revision surgeries for both the patients and the healthcare system.