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Infection burden in total hip and knee arthroplasties: an international registry-based perspective

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ABSTRACT

Background: Infection remains a leading cause of failure of hip and knee replacements. Infection burden is the ratio of implants revised for infection to the total number of arthroplasties in a specific period, measuring the steady state of infection in a registry. We hypothesized infection burden would be similar among arthroplasty registries.

Methods: We evaluated publicly reported data from 6 arthroplasty registries (Australian Orthopaedic Association National Joint Replacement Registry [AOANJRR], New Zealand Joint Registry, Swedish Hip Arthroplasty Register, Swedish Knee Arthroplasty Register, National Joint Registry of England, Wales, Northern Ireland, and the Isle of Man, and the American Joint Replacement Registry) for revisions performed with an infection diagnosis over the last 6 years.

Results: The 2015 hip infection burden varied between registries from 0.76% (AOANJRR) to 1.24% (Swedish Hip Arthroplasty Register), and the unweighted overall average for hip infection burden was 0.97%. In 2012, 2013, and 2014, average hip infection burden held steady at 0.87%, 0.93%, and 0.94%, respectively, higher than the preceding 2 years. The 2015 knee infection burden varied from 0.88% (AOANJRR) to 1.28% (Swedish Knee Arthroplasty Register), and the unweighted average was 1.03%. In 2012, 2013, and 2014, knee infection burden was 1.04%, 1.11%, and 1.02%, respectively. These numbers were also higher than the preceding 2 years.

Conclusions: Infection burden may be one measure of the overall success in registry populations as well as monitoring the steady state of infection worldwide. Despite global efforts to reduce postoperative infection, infection burden has actually increased in the selected registries over time.

Introduction

Total hip and knee arthroplasties (THA and TKA) are among the most successful procedures in all of medicine with high survivorship and low morbidity and mortality [1,2]. They are associated with dramatic improvement in patient pain, function, and quality of life [3]. As such, the volume for both THA and TKA is currently increasing, and is expected to grow by 174% for THA and 673% for TKA [4]. One of the major endpoints to measure the success of THA and TKA is revision surgery. The etiology of revision surgery has been well documented and includes instability, aseptic loosening, periprosthetic wear, fracture, and infection [5,6].

Revision burden has been defined as the ratio of implant revisions to the total number of arthroplasties performed in a given period within a specific population. First introduced by Malchau et al. [7], revision burden was envisioned as a means for comparing different national total joint registries. It has been used for results reporting, economic analyses, and procedural volume estimates

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[4,7,8]. A recent study by McGrory et al. [9] evaluated the concept of revision burden for THA and TKA across total joint registries worldwide. They found that the revision burden for THA had decreased over a 4-year period, but had remained relatively constant for TKA.

Although there has been a decline in revision surgeries for loosening and wear over time, periprosthetic joint infection (PJI) rates have not improved, resulting in PJI becoming one of the most common modes of failure in THA and TKA [5,6]. Studies project that revision for PJI will dramatically increase over the next two decades compared with other modes of failure, with some anticipating over 60% of all revisions eventually due to infection [10]. As such, there have been numerous studies published over the past decade discussing infection prevention and techniques to reduce the incidence of PJI [11,12]. However, there have been few if any reports that demonstrate that the global rate of PJI is decreasing. The primary purpose of this study was to determine the infection-related revision burden and delineate if the infection burden was similar across 6 nationwide total joint registries : The Australian Orthopaedic Association National Joint Replacement Registry [AOANJRR], New Zealand Joint Registry, Swedish Hip Arthroplasty Register [SHAR], Swedish Knee Arthroplasty Register [SKAR], National Joint Registry of England, Wales, Northern Ireland, and the Isle of Man, and the American Joint Replacement Registry [AJRR]. The secondary purpose of this study was to determine if the burden of revision for infection has changed over time. We hypothesized that the infection burden would be similar across these registries and that the burden of infection would be decreasing over time compared with historical controls.

Material and methods

Infection burden was defined as the ratio of the total number of revisions due to infection to the total number of arthroplasties (primaries and revisions) performed in 1 year. Infection burden was calculated for the last 6 years or since registry inception. Designation as an infection-related revision or removal of components was based on the specific criteria and definitions of revision used by each individual registry. We sought to count a revision or removal of components for infection only once for a given infection episode when multiple subsequent procedures were carried out on the same joint. That is, if a component exchange and debridement failed, or if a patient underwent a 2-stage procedure, these procedures were combined and counted as a single revision/removal of components for infection. We developed the following parameters for acceptable definitions for each variable analyzed.

Hip

- **Primary hip arthroplasty** was defined as a total hip procedure that replaces both the femoral and acetabular sides of the joint, but we excluded hip resurfacing and hemiarthroplasty.
- **Hip component revision** included all procedures, where one or more of the prosthetic components were exchanged or removed as part of either a 1-stage or 2-stage process.
- **Hip revision due to infection** was defined as any repeat or revision surgery on an existing device, where one of the diagnoses for the revision procedure included infection (per the reporting registry criteria).

Knee

- **Primary knee arthroplasty** was defined as a total knee procedure that replaces the femorotibial articulation, and excluded unicompartmental procedures (unicondylar and patellofemoral procedures).
- **Knee component revision** included all procedures, where one or more of the prosthetic components were exchanged or removed as part of either a 1-stage or 2-stage process.
- **Knee revision due to infection** was defined as any repeat or revision surgery on an existing device, where one of the diagnoses for the revision procedure included infection (per the reporting registry criteria).

Table 1
Results of contemporary hip and knee infection burden, in percent

Results of contemporary hip infection burden, in percent						
Registry	2010	2011	2012	2013	2014	2015
AOANJRR	0.80	0.78	0.85	NA[a]	0.82[a]	0.76[a]
NZJR	0.64	0.59	0.56	0.75	0.70	1.00
SHAR	0.88	1.12	1.14	1.18	1.3	1.24
NJR	0.84	0.86	0.91	0.85	0.91	0.94
AJRR	NA	NA	NA	NA	0.99	0.91
Unweighted average	0.79	0.84	0.87	0.93	0.94	0.97
Results of contemporary knee infection burden, in percent						
Registry	2010	2011	2012	2013	2014	2015
AOANJRR	0.87	0.80	0.89	1.08	0.98	0.88
NZJR	0.64	0.71	1.05	1.07	1.10	1.20
SKAR	1.11	1.22	1.27	1.35	1.11	1.28
NJR	0.91	0.94	0.96	0.94	0.97	0.94
AJRR	NA	NA	NA	NA	0.95	0.85
Unweighted average	0.88	0.92	1.04	1.11	1.02	1.03

NJR, National Joint Registry of England, Wales, Northern Ireland, and the Isle of Man; NZJR, New Zealand Joint Registry.
[a] AOANJRR analysis excluded data for metal-on-metal THA with a head greater than 32 mm for 2013, 2014, and 2015, confounding calculation for 2013.

Infection burden for both hip and knee arthroplasties was calculated from publicly reported data (ie, annual reports or other reporting methods) from national hip and knee arthroplasty registries. The comparative review included 6 national registries: AOANJR, New Zealand Joint Registry, SHAR, SKAR, National Joint Registry of England, Wales, Northern Ireland, and the Isle of Man, and AJRR.

Results

The overall results for infection burden for THA and TKA for the 6 surveyed registries are summarized in Table 1.

The 2015 infection burden for THA varied from 0.76% in AOANJRR to 1.24% in the SHAR, and the unweighted average was 0.97%. In 2012, 2013, and 2014, the THA infection burden (unweighted average) held steady at 0.87%, 0.93%, and 0.94%, respectively. This is higher than the preceding 2 years (0.79% and 0.84%). Each registry with 6-year data showed an increase in infection burden for THA over the period of the survey. AOANJRR analysis excluded data for metal-on-metal THA with a head greater than 32 mm for 2013, 2014, and 2015, confounding calculation for 2013.

The 2015 infection burden for TKA varied from 0.88% in AOANJRR to 1.28% in the SKAR. The unweighted average was 1.03%. In 2012, 2013, and 2014, the knee infection burden (unweighted average) was 1.04%, 1.11%, and 1.02%, respectively. These numbers were higher than the preceding 2 years (0.88% and 0.92%). Each of the 5 registries with 6-year data demonstrated an increase in the infection burden reported for TKA over the period of the study.

Discussion

PJI remains a leading cause of failure in THA and TKA [5,6]. The treatment of PJI is associated with substantial morbidity and