

G100: Is the epidemiology of orthopedic implant associated infections changing?

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Response/Recommendation:

Yes. The number and population incidence of periprosthetic joint infections (PJI) is rapidly increasing, driven by an increased number of arthroplasty operations, an increase in cumulative incidence of early infections (particularly in hips) as well as an increased prevalence of people living with joint replacements, who are at risk for late PJI.

Level of Evidence: Low

Delegate Vote:

Rationale:

The incidence of joint replacement procedures is increasing. In OECD countries, the annual incidence of hip and knee replacement operations is 174 and 134/100,000 population, respectively.¹ With aging populations, this is set to increase rapidly in both high- and middle-income countries in the coming decades. In parallel with the increase in total numbers and incidence of joint replacement procedures, and due to improvements in the durability of implants, the prevalence of people living with at least one implant in the population is also increasing. As an example, in Australia, the prevalence of joint replacement is increasing in all age groups, but was highest amongst older Australians, with an overall prevalence of 22.5%, and 13.3% in those aged >85 years and 65-84 years, respectively. The prevalence of people living with multiple joint replacements is increasing more rapidly than patients who have undergone only one joint replacement procedure.²

Understanding the relationship between incidence of new arthroplasty procedures and the prevalence of joint replacements in a population is an important consideration for the epidemiology of periprosthetic joint infection (PJI); the former represents infections acquired during the initial operation and is manifested by PJI occurring early in the post operative period. Most PJI occur within a few months of index surgery, but chronic failures may occur for some years. By contrast, late acute PJI can occur at any time as a consequence of seeding of the prosthesis. In this context, the population at risk is people living with a joint replacement, reflected by the prevalence of arthroplasty.

We performed a systematic review to evaluate if the epidemiology of implant infections is changing. PubMed and Embase databases were searched (Figure 1) from 1990 to December 2024. Studies were limited to humans and in English. After being imported into COVidence and after de-duplication, titles and abstracts were reviewed. Publications were included if they reported hip or knee PJI and any of i) total numbers of PJI over time, ii) incidence (per year) as a denominator of the total population, iii) cumulative incidence as a denominator of procedures or iv) the proportion of confirmed PJI that were early/chronic compared with late-acute or haematogenous PJI. Citations within these papers and the 'grey literature' were also searched. 24 publications were included in the final narrative synthesis (Figure 1). Due to variation in reporting metrics, no quantitative synthesis was performed. One systematic review of incidence of hip PJI was identified, which included 16 studies.³

Interestingly, only one of these studies was identified in our systematic review. Similarly, a systematic review of deep surgical site infections (synonymous with PJI) identified 15, 22 and 24 studies for all, knee and hip arthroplasty operations, respectively, without overlap with the studies identified in the present review.⁴ Taken together, the lack of overlap suggests shortcomings with the search strategy employed here. Studies from the US (7), UK (3), Australia (3), Canada, China, Taiwan, Korea, India, France, Denmark, Sweden and Italy (1 each) were identified.

The total burden of PJIs is rapidly increasing across most settings. There were 8 studies reporting the total numbers of PJI over time, usually presented as proportion of infections as the indication for joint replacement revision. In Taiwan, PJI (both hips and knees) increased rapidly between 2004 and 2013 with projections of a 5-fold increase until 2035.⁵ Similarly in the US, knee and hip PJI have more than doubled between 2003-13 and 2006-14.^{6, 7, 8} Projections suggest ongoing rapid increases in PJI numbers until 2030.⁸ Likewise, Australian data demonstrate a 5-fold increase 2002-2020.⁹

As a proportion of the total population, PJIs are also increasing. Using administrative data from the UK collected between 2006-2019, PJI of knees have increased from 0.9 to 2.7 and hips from 0.8 to 2.3 per 100,000 adults.^{10, 11}

Data reporting cumulative incidence of PJI vary according to the time from the primary arthroplasty, affected joint and study type.³ Systematic under-reporting of the indication for revision to national joint registries may also impact estimates of cumulative incidence compared with administrative data.^{12, 13} Most studies report 12-month cumulative incidence, but 3-month, 2-year and 10-year outcomes were also reported. The systematic review of hip PJI reported an overall incidence of 0.34 to 2.23% with a pooled estimate of 1.05% (CI95 0.75%-1.46%), but with high heterogeneity. Interestingly, the pooled estimate in studies of PJI occurring within 90 days was 1.43 % (0.81-2.52) was higher than 1-year cumulative incidence (0.49% [0.22-1.10%]). In a meta-regression there was no association with publication date (a surrogate for time-period) and PJI incidence.³ In Sweden 2-year incidence of hip PJI appeared to increase between 2005-8 (0.9 [0.8-1.0]%) and 2012-14 (1.2 [1.1-1.3%]) despite implementation of a bundle of interventions to prevent infection.¹⁴ Using administrative and Australian joint registry data, the 90-day revision rates for PJI are increasing over time for hip, but not knee arthroplasty.¹³ By contrast, 1-year incidence (0.53 and 0.57%) of hip PJI in Denmark did not increase over time.¹⁵

Beyond 2 years, the cumulative incidence of PJI continues to increase up to and beyond 10 years, but at a slower annual rate.^{9, 16, 17} The proportion of late-acute infections as a total of all PJI may be increasing, but data supporting this are limited to 3 studies only, with different study designs. Reported estimates of late-acute PJI range from 4% (2006-8),¹⁸ 10% (2011-16)¹⁹ and 45% (2014-17) in a large prospective observational study.²⁰

In conclusion, notwithstanding the limitations of the search strategy and variability in how 'PJI epidemiology' is presented, key themes have emerged from this literature review. First, the total PJI numbers have rapidly increased across most settings and is projected to increase further into the future. A rising incidence at a population level also accords with this. Second, the cumulative incidence of early PJI (within 90 days and up to 1 year) may be increasing over time, particularly following hip arthroplasty. There is no consistent, comparable evidence following knee arthroplasty. Finally, the proportion of late-acute PJI as a total of all

PJI may also be increasing. If confirmed in future studies, this is likely a consequence of a rapidly increasing prevalence of people living with joint replacements who are at risk of haematogenous seeding of their joint replacements during blood stream infections.

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Figure 1. PRISMA diagram



