Editorial

The rate of prosthetic joint infection is underestimated in the arthroplasty registers

In the present issue of *Acta Orthopaedica*, 2 studies have contributed results on different aspects of the rate of prosthetic joint infection (PJI). The studies have in common that they combined different patient registries, i.e. different data sources, to identify patients who had been reoperated due to PJI. In a study from Finland by Kaisa Huotari et al., the authors' rationale for this approach was that incidence studies solely based on the Finnish Arthroplasty Register (FAR) had a tendency to underestimate the number of PJIs (Jämsen et al. 2009, Huotari et al. 2010). Thus, the authors combined data from FAR with data from the (Finnish) Hospital Discharge Register to study the rate of late PJI.

The other study on PJI presented in this issue of *Acta* is from Denmark, by Per Hviid Gundtoft et al. The aim of that study was to estimate "the true incidence of surgically treated deep prosthetic joint infection". By combining several data sources, including data on microbiology and blood tests, the authors have concluded that 40% of surgically treated PJIs were not reported to the Danish Hip Arthroplasty Register (DHR).

Completeness of data when it comes to registration of primary hip and knee prostheses in the registers has been impressively high, in fact close to 100 percent. The failure endpoint in the registers has been any revision/reoperation of the prosthesis, and the completeness of revision data in general has also been considered to be high (Södermann et al. 2000, Pedersen et al. 2004, Espehaug et al. 2006). It might therefore come as a surprise to the readers of this journal that only 60% of the surgically treated PJIs were reported to Danish Hip Arthroplasty Register. However, in its annual report in 2011 the Swedish Hip Arthroplasty Register (SHAR) presented the results of a study that showed that only 67% of surgically treated PJIs were reported to the SHAR (Lindgren et al. 2014).

There could be different ways of explaining this under-registration of PJIs in the registers. In the report from the SHAR in 2011, it was stated that the degree to which the various hospitals reported their PJIs to the SHAR varied considerably. Many hospitals reported all their PJIs, whereas some hospitals reported less than 20%. As already mentioned, the failure endpoints in the arethroplasty registers have been revision/reoperation of the prosthesis. The register data are based on a notification form filled in by the operating surgeon immediately after the operation. As a means of registering all the PJIs that are treated operatively, the design of the notification form used in different countries has changed over time. In all the Nordic countries, minor prosthetic revision—which includes exchange of loose prosthetic parts, such as caput and liners—should be reported to the register, and also soft tissue debridement in cases of hip PJI. In Finland, the last revision of the notification form was done in 2014, while in Denmark minor revisions and soft tissue debridement have been options in the notification form for several years. This means that in the study period 2005–2011, all PJIs that were reoperated should have been registered in the Danish Arthroplasty Register (perhaps with the exception of reoperation due to a superficial infection). One could speculate on the degree to which the current practice of reporting to the register has been implemented by the different hospitals, and to what degree this has been followed up by the individual orthopedic surgeons. It should be remembered that during the first decade(s) after the arthroplasty registers were established, it took several years before it was well known in the orthopedic community that a procedure like a Girdlestone operation should be reported to the register. The Norwegian Arthroplasty Register (NAR) was established in 1987. 12–15 years later (1999–2002), one-third of hospitals (17/50) reported less than 50% of their "removal revisions" to the NAR (Espehaug et al. 2006).

An important weakness of the arthroplasty registers is that they are not designed for registration of infections. In Finland, Denmark, and Norway, the surgeon fills in a form and—based on a subjective assessment—the surgeon decides whether or not the revision/reoperation is due to an infection. This is done immediately after the operation. In most cases (80%), the proof of an infection is culture of the causative microbe in tissue biopsies taken peroperatively. A conclusive microbiological result will usually not be available until 2–7 days after surgery, i.e. 2–7 days after the notification form has been sent to the register. Positive (or negative) culture results might come as a surprise, but once the revision diagnosis is reported to the to the register, it is (probably) never changed. It is even the policy of the Nordic Arthroplasty Register Association that a priority should be made not to change the primary revision diagnosis (personal communication).

The Swedish Knee Arthroplasty Register submits medical records together with the notification form in cases of prosthetic revision, and the revision diagnosis is validated by personnel at the registry. To my knowledge, whether or not this policy has improved the completeness of registry data in general—and registration of PJIs in particular—has not been evaluated.

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In some cases, diagnosis of a PJI is difficult. There is an ongoing international collaboration to reach an agreement on objective criteria for the diagnosis of a PJI (Zmistowski et al. 2014). Viewing a PJI as something to be assessed by the orthopedic surgeon at the operating theater is an outdated diagnostic approach. In the study from Denmark, it is interesting to notice that visible joint purulence was not a very reliable criterion of infection. The diagnosis of a PJI should be based on objective criteria. Amongst these objective criteria, bacterial growth is most important. In some cases it is difficult to make a definite diagnosis, and the diagnosis should, if possible, be based on a multidisciplinary approach where specialists in infectious diseases and medical microbiology are included.

For our readers, it is self-evident that infection is the most devastating complication to prosthetic surgery. If the trends continue with increasing rates of multiresistant bacteria and less effective antibiotics, infection would become a limiting factor for further development of prosthetic surgery. Each hospital should be part of a national surveillance program to ensure continuous survey of the rate of PJI. The diagnosis of PJI should be based on internationally accepted criteria, and if possible, diagnosis and treatment should be the result of a multidisciplinary approach.

A spin-off product of such an approach and strategy would probably also be an improvement in the validity and completeness of the registration of PJI in the arthroplasty register. How the procedures for reporting of PJIs to the register should be revised to achieve such an improvement is beyond the scope of this editorial comment.

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