RESEARCH BRIEF

Association of Partial Hip Replacement With Higher Risk of Infection and Mortality in France

Surgical site infection (SSI) after hip replacement is a major complication[1] targeted for epidemiologic surveillance.[1–4] Measuring and reducing the risk of SSI through surveillance improvement is a key target of the French program for prevention of healthcare-associated infection.[5,6]

Hip arthroplasty after fracture or trauma is associated with an increased SSI incidence, especially when practicing partial hip replacement (PHR). Moreover, this surgery has been reported to have higher crude in-hospital mortality compared with patients undergoing a total hip replacement (THR).[1] However, case fatality could vary according to several patient underlying conditions often associated with such fracture. In the scope of epidemiologic surveillance aiming for hospital benchmarks, it is essential to account for differentiating patient characteristics that might affect the probability of infection. Recent studies worldwide reported numerous patient risk factors for SSI, including obesity, malnutrition, diabetes mellitus, and blood transfusion.[7] Recent studies have demonstrated the usefulness of a hospital information system for SSI surveillance, especially improvement of postdischarge surveillance.[2,3,8] Using the French hospital discharge database, this study aimed to determine SSI outcome and mortality after primary THR compared with PHR after adjusting for confounding factors.

The national hospital discharge database provides computerized SSI detection in an affordable data-reporting system allowing robust analyses.[2,3,8] A previous study demonstrated the potential of hospital discharge algorithms for SSI detection after hip arthroplasty with an acceptable performance (positive predictive value, 87%, without difference between PHR or THR).[8] Data on French public and private hospitals were extracted from the hospital discharge database during the 2008–2012 period (Appendix). Overall 476,778 patients undergoing hip replacement were selected and followed up, including 371,889 (78%) receiving THR. Comorbidities, used as confounding factors, were extracted using *International Classification of Disease, Tenth Revision*, coding algorithms (ie, the specifications to identify each condition) from significant associated diagnoses (Appendix). A time-dependent model was calculated using the Kaplan-Meier method and Cox regression to determine the effects of different confounding factors on the SSI and mortality risk comparing THR and PHR, first evaluated in a bivariate analysis and included in the multivariate model if $P < .2$. We checked proportionality of hazards and log-rank test by SAS, version 9.1 (SAS Institute).

During the study period, primary hip replacement was performed mainly in private hospitals (60%). Patients were mainly female (74.9%), aged more than 65 years. The median (interquartile range) age at replacement was 84 (10) years. The main reasons for hip replacement were degenerative osteoarthritis (85.9%) and fracture (8.8%). THR was mostly performed for osteoarthritis (89%), whereas 90% of PHR occurred after hip fracture. PHR was mostly performed in older women after hip fracture. Over the period, the number of arthroplasties per year was stable. Most patients were readmitted to the hospital after the arthroplasty stay, 24.4% once and 40.8% at least twice (mean follow-up, 381 days). A total of 30,846 (8%) of the 371,889 patients had another primary arthroplasty during their follow-up, corresponding to the contralateral hip replacement in more than 80% of these cases. In-hospital case fatality during follow-up after hip replacement was 3.7%.

One-year SSI incidence was 1.2% after THR vs 2.2% after PHR. The median age at infection was significantly higher in PHR than THR (82 vs 71 years, $P < .001$).

The Kaplan-Meier curves for SSI occurrence showed a higher and early risk of SSI after PHR over time, and the same result was found for mortality after hip replacement (Figure 1).

In multivariate analysis, PHR was associated with a higher risk of SSI than THR (hazard ratio, 1.29 [95% CI, 1.22–1.36]) after adjusting for risk factors of age greater than 65 years (1.17 [1.09–1.21]), body mass index (calculated as weight in kilograms divided by height in meters squared) greater than 40 (1.20 [1.08–1.32]), urinary disorders (1.30 [1.23–1.39]), renal failure (1.17 [1.09–1.25]), malnutrition (1.17 [1.09–1.29]), and decubitus ulcer (1.11 [1.03–1.19]), whereas gender, diabetes mellitus, and heart diseases were not associated with SSI.

Overall crude mortality rate was 7% and was significantly lower in THR than PHR (4% vs 7%, $P < .01$). In the multivariate analysis, PHR was associated with a higher risk of mortality (hazard ratio, 2.13 [95% CI, 2.08–2.19]) as well as SSI (1.22 [1.15–1.29]).

As recently checked in Canada, medical chart review for cases identified through administrative data is an efficient supplemental SSI surveillance strategy.[9] It improves case-finding by increasing SSI identification, and it identifies SSIs presenting at nonprocedure facilities.[9]

At first, on the basis of a nationwide hospital information system of more than 400,000 procedures, our study confirmed the significant increase of crude SSI incidence previously reported in a regional subset during the same study period.[3] An association of SSI coding with new hospital financial incentives has been suspected since the labeling of French medical centers in 2009 for rates of complicated bone and joint infection,[2] but this trend does exist in other countries, making this argument insufficient to explain such an increase.[10] Hence, the hospital discharge database model has limitations, particularly

https://doi.org/10.1017/ice.2016.234 Published online by Cambridge University Press

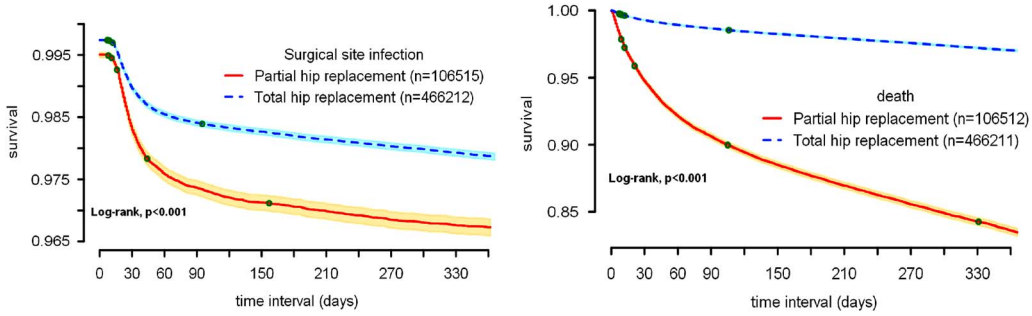

FIGURE 1. Annual risk of surgical site infection and death after hip arthroplasty in French 5-year cohort of hip prosthesis.

regarding the quality of the data coded. However, the routine definition of SSI cases after hip arthroplasty has been assessed with reliable performance parameters. The strength of this work is the use of a national database, avoiding underestimation of SSI incidence by limiting postdischarge surveillance to the operating hospital.

We demonstrated that infection and mortality risk were higher after PHR compared with THR and after adjusting for confounders. In-hospital mortality associated with PHR was also higher in SSI than non-SSI patients. As recently exposed,[1] patients needing hip fracture surgery mainly underwent PHR, favoring SSI and death. However, even if patient conditions represent important independent factors of SSI and death, PHR remains an important independent factor of SSI and mortality.

ACKNOWLEDGMENTS

We thank Guillaume Gras, MD, and Jerome Druon, MD, for their contribution in the creation of hospital discharge algorithms and discussion of the results; Fei Gao, for database extraction; and all the contributors to the validation algorithms: Philippe Acquier, MD, Yves Guimard, MD, and all the technicians of medical information.

Financial support. None reported.

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article.

Leslie Grammatico-Guillon, MD, PhD;[1]
Caroline Perreau, MD;[2]
Katiuska Miliani, MD, PhD;[2]
Francois L'Heriteau, MD;[2]
Philippe Rosset, MD, PhD;[3]
Louis Bernard, MD, PhD;[4]
Didier Lepelletier, MD, PhD;[5]
Emmanuel Rusch, MD, PhD;[1]
Pascal Astagneau, MD, PhD[6]

Affiliations: 1. Department of Medical Information and Public Health, University Hospital, Tours, France; 2. Center for Control of Healthcare-Associated Infections, Paris, France; 3. Service of Orthopedic Surgery, University Hospital, Tours, France; 4. Service of Infectious Diseases, University Hospital, Tours, France; 5. Bacteriology and Infection Control Department, University Hospital, Nantes, France; 6. Pierre and Marie Curie University, Paris, France

Address correspondence to Leslie Grammatico-Guillon, MD, PhD, Department of Medical Information and Public Health, EE1 EES, University Hospital, Tours, France (leslie.guillon@univ-tours.fr).

Received May 24, 2016; accepted September 7, 2016; electronically published November 7, 2016

Infect Control Hosp Epidemiol 2016;38(1):123–125

 0899-823X/2017/3801-0021. DOI: 10.1017/ice.2016.234

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit http://dx.doi.org/doi:10.1017/ice.2016.234.

REFERENCES

1. Le Manach Y, Collins G, Bhandari M, et al. Outcomes after hip fracture surgery compared with elective total hip replacement. *JAMA* 2015;314:1159–1166.
2. Grammatico-Guillon L, Baron S, Gettner S, et al. Bone and joint infections in hospitalized patients in France, 2008: clinical and economic outcomes. *J Hosp Infect* 2012;82:40–48.
3. Grammatico-Guillon L, Baron S, Rosset P, et al. Surgical site infection after primary hip and knee arthroplasty: a cohort study using a hospital database. *Infect Control Hosp Epidemiol* 2015;36:1198–1207.
4. Zimmerli W. Infection and musculoskeletal conditions: prosthetic-joint-associated infections. *Best Pract Res Clin Rheumatol* 2006;20:1045–1063.
5. Carlet J, Astagneau P, Brun-Buisson C, et al. French National Program for Prevention of Healthcare-Associated Infections and Antimicrobial Resistance, 1992-2008: positive trends, but perseverance needed. *Infect Control Hosp Epidemiol* 2009;30:737–745.
6. Astagneau P, L'Hériteau F, Daniel F, et al. Reducing surgical site infection incidence through a network: results from the French ISO-RAISIN surveillance system. *J Hosp Infect* 2009;72:127–134.
7. Zhu Y, Zhang F, Chen W, Liu S, Zhang Q, Zhang Y. Risk factors for periprosthetic joint infection after total joint arthroplasty: a systematic review and meta-analysis. *J Hosp Infect* 2015;89:82–89.
8. Grammatico-Guillon L, Baron S, Gaborit C, Rusch E, Astagneau P. Quality assessment of hospital discharge database for routine surveillance of hip and knee

arthroplasty-related infections. *Infect Control Hosp Epidemiol* 2014;35:646–651.
9. Rusk A, Bush K, Brandt M, et al. Improving surveillance for surgical site infections following total hip and knee arthroplasty using diagnosis and procedure codes in a provincial surveillance network. *Infect Control Hosp Epidemiol* 2016;37:699–703.
10. Dale H, Fenstad AM, Hallan G, et al. Increasing risk of prosthetic joint infection after total hip arthroplasty. *Acta Orthop* 2012;83:449–458.

https://doi.org/10.1017/ice.2016.234 Published online by Cambridge University Press