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ORIGINAL ARTICLE

When and how do prosthetic hips fail after total hip arthroplasties?—A retrospective study

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Background/Purpose: Understanding failure modes, time to revision, and vulnerable components in revision hips could help reduce the risk of revision surgeries. Our aim was to investigate the association between the index diagnosis and the failure mode in patients undergoing revision surgeries.

Methods: A total of 402 patients who underwent a first revision surgery in a single hospital between 2000 and 2012 were recruited in a retrospective study. Multiple logistic regression analysis was used to evaluate the association of the index diagnosis of the primary total hip arthroplasty and short-term failure, as well as specific failure mode that occurred early, while controlling for sex, age, and the type of prosthesis.

Results: The mean time to revision due to all failure modes was 9.48 (standard deviation = 6.08) years. Defining short-term failure as a time to revision <5 years after total hip arthroplasty, the primary failure mode was infection (32.4%), followed by loosening (25.7%) and instability (17.1%). In multivariate analysis, as compared to osteonecrosis, patients with index diagnosis as infection was significantly associated with revision due to infection (odds ratio = 9.69, $p = 0.013$). In addition, osteoarthritis increased the odds of loosening (odds ratio = 4.18, $p = 0.012$). In contrast to studies in the United States and Europe, acetabular component revisions were the most common type found in our study.

Conflicts of interest: The authors have no conflicts of interest relevant to this article.

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Conclusion: This study demonstrates that, compared with patients with osteonecrosis, patients with infection and osteoarthritis had higher odds of revision due to infection and loosening, respectively. Further studies are needed to examine the cause—effect relationship between index diagnosis and mode of failure.

Introduction

Total hip arthroplasty (THA) is one of the most successful orthopedic surgical procedures in recent years. The success rate of THA at 10 years is ~80—93%.[1,2] Despite its high success rate, the proportion of revision THAs continues to grow steadily over the years.[3] The increasing life expectancy in an aging population is associated with an increasing incidence of THAs, leading—as would be expected—to a rising trend in revision surgeries. Identifying the factors that influence the need for revision surgery is challenging and difficult, because revision THA usually occurs years or a decade after the primary THA. The common causes of revision THA are wear, loosening, dislocation or instability, and infection. The patient-related factors that have been shown to be associated with the causes of revision THA include sex, age, activity, high body mass index, the index diagnosis of the primary THA, poor bone quality, and other reasons related to infection or dislocation.[4—6]

From previous studies, we have observed that the index diagnosis of THA differs between the Caucasian and Asian populations.[7—10] Whereas osteoarthritis (OA) is the main diagnosis for patients in the West, osteonecrosis (ON) has been a major cause for Asian patients (e.g., Taiwanese) undergoing primary THA. Compared with Caucasian countries, the main differences in Taiwan are that the most common index diagnosis is ON (43—47%), the majority of patients are male (~60%), and the patients are relatively young (mean age 55 years).[7,8,10] Thus, it is of interest to know how differences in patient characteristics contribute to different distributions of failure modes requiring revision surgery. The purpose of this study was to explore the relationship between the failure modes of the prosthesis and patient-related factors, the time of revision after primary THA, and the type of revision, including the components exchanged. In addition, a better understanding of the short-term failure of prosthetic hips would benefit attempts to reduce the risk of revision THA.

Methods

Patients and measurements

A retrospective chart review was conducted for all patients who underwent revision surgery of a primary THA performed between 2000 and 2012 at the Department of Orthopedics, Hualien Tzu Chi Medical Center, Eastern Taiwan. The study protocol was approved by the hospital's Institutional Review Board. Revision surgeries included revision THA, partial revision, Girdlestone procedure, synovectomy or debridement of the hip, and fracture fixation. Patients who had undergone hemiarthroplasty revision and rerevision were excluded. We ultimately recruited a total of 402 patients for whom information about their primary THA was available. Two experienced surgeons (T.C.Y. and I.H.C.) performed the majority of the revision surgeries (>90%). Most patients (>90%) were operated with a posterolateral incision and a posterior arthrotomy with cementless implant fixation. Detailed demographic and clinical data were collected, including age at primary and revision surgeries, sex, index diagnosis of primary THA, brand and type of prosthesis, failure modes for revision surgeries, time to revision surgeries, and components exchanged. Data were derived from a retrospective review of clinic notes, operative notes, and radiographs recorded by the surgeons. The index diagnoses were classified into the following categories: primary OA, ON, developmental dysplasia of hip, inflammatory arthritis (including ankylosing spondylitis arthritis and rheumatoid arthritis), posttraumatic arthritis, and others, including acetabular fracture. During the study period, a total of 23 different brands of prosthesis were used. The top five brands were Secur-Fit Osteonics (37.5%) (Howedica Osteonics Corp, Mahwah, New Jersey, USA), PCA E-series Howmedica (13.4%) (Howmedica, Rutherford, New Jersey, USA), Omnifit Osteonics (9.4%) (Osteonics, Allendale, New Jersey, USA), Harris-Galante Zimmer (7.3%) (Zimmer Inc, Warsaw, Indiana, USA), and ABG Howmedica (7.1%) (Benoist Girardh, Boulevard de la Grande Delle, Hérouville-Saint-Clair, France), which accounted for 75% of all prostheses. For the purpose of analysis, we further grouped these prosthesis brands into two types, cemented and cementless, based on the method of fixation of the components.[11,12]

To determine the cause of the revision surgeries, three surgeons identified and grouped those diagnoses that were mainly related to the implant failure, based on the radiographic evaluation and intraoperative findings recorded on operative notes. Radiological evaluation was performed using standing anteroposterior and lateral views. Definitive loosening was defined as gross mechanical instability or a progressive radiolucent line wider than 2 mm on an image study. Polyethylene (PE) wear was considered when there was gross asymmetry in the radiographic views or a change in thickness noted in the intraoperative findings. Loosening was further divided into two subgroups: (1) loosening associated with PE liner wear (wear + loosening) and (2) loosening not associated with PE liner wear (loosening). All other failure modes were included, such as periprosthetic fracture, instability, and infection.

The time to revision was defined as the time interval (in years) from the index date of the primary THA to the revision date. We further divided patients into three