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Systematic Review of Proximal Femoral Arthroplasty for Non-Neoplastic Conditions

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ABSTRACT

Proximal femoral arthroplasty (PFA) is an established treatment modality following oncological resection. Increasingly, these prostheses are being used for non-neoplastic conditions such as fractures and bone loss associated with septic or aseptic loosening. We performed a systematic review of the literature to determine the failure rates, mortality rates and hip outcome scores when PFAs were used in non-neoplastic conditions. There were 14 studies with an average follow-up of 3.8 years (range 0–14 years) describing 356 PFAs. Re-operation for any reason occurred in 23.8% (85/356) of cases. The most common complications were dislocation (15.7%) and infection (7.6%). The mortality rate ranged from 0% to 40%. PFA provides an acceptable surgical solution when confronted with massive bone loss, but it has a high re-operation rate for dislocation and infection.

Revision of total hip arthroplasties can be challenging on both the femoral or acetabular side, especially as primary THAs are being implanted in younger and more active patients. Numerous factors can contribute to the eventual loss of femoral bone stock, including septic and aseptic osteolysis, periprosthetic fractures, stress shielding and multiple previous revision procedures [1–8]. Treatment options available for the management of massive bone loss around the proximal femur include the use of structural allograft-prosthesis composite, impaction allografting, long cemented or press-fit revision stems, resection arthroplasty and proximal femoral arthroplasty (PFA) [1,4].

A PFA has the advantages of no allograft to host bone interfaces to heal, no problems of graft resorption, fracture or disease transmission, relative ease of reconstruction and the implant is not adversely affected by chemotherapy or irradiation [2]. The disadvantages include an inability of the prosthesis to heal to the abductor apparatus and an increased risk of complications such as dislocation and infection [2,3,6]. A typical pre-operative and post-operative radiograph of a proximal femoral replacement is shown in Fig. 1.

There are very few studies on the use of PFAs in non-neoplastic conditions with massive bone loss such as fractures, aseptic loosening and septic loosening. We performed a systematic review of the literature to determine the failure rates, mortality rates and hip scores when a PFA was used in non-neoplastic conditions.

Methods

Search Strategy

MEDLINE and EMBASE were searched on 01/10/2013 to identify relevant studies pertaining to the use of PFAs in non-neoplastic conditions. The database search was restricted to studies in humans from 1950 till January 2013 for papers in the English literature.

Keyword searches used were 'proximal femoral replacement' and 'hip megaprosthesis'. The reference lists of the relevant papers were explored to find additional papers. The authors of some papers were contacted to clarify key information such component fixation [9,10] or surgical approach used [8,9].

Eligibility Criteria

Inclusion criteria included all articles which described the use of a PFA in non-neoplastic conditions published in the English language. Exclusion criteria were studies which used long revision hip stems or PFAs following oncological resection. Total femoral arthroplasties were also excluded in the analysis. Isolated case series/reports with less than 5 patients were also excluded.

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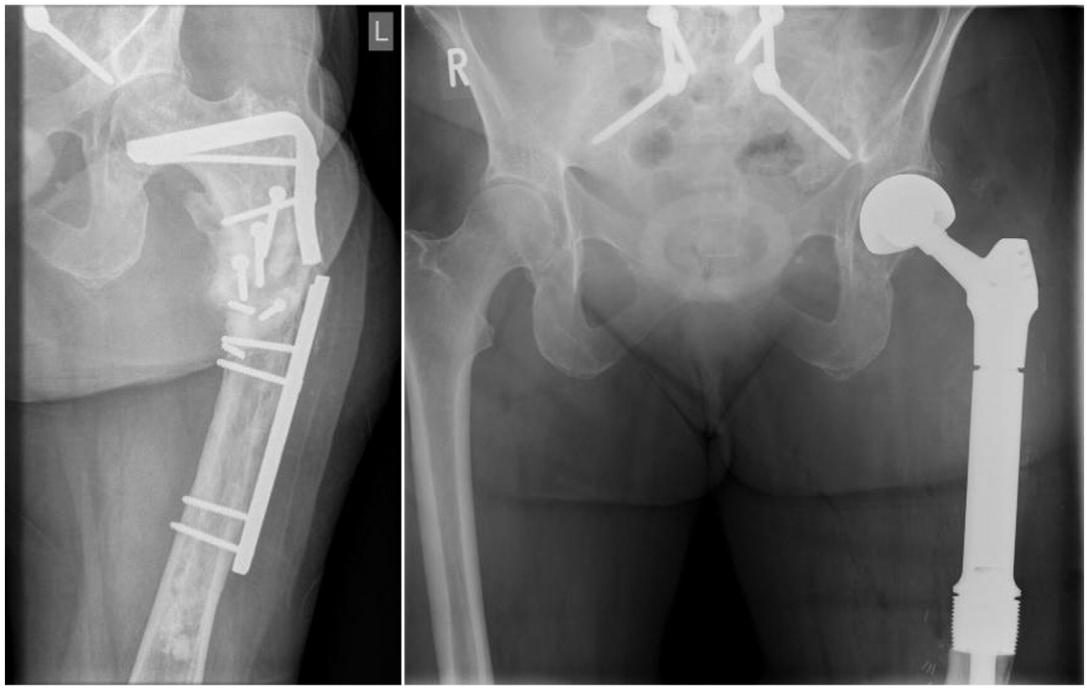

Fig. 1. Pre and post operative radiographs of proximal femoral bone loss associated with persistent subtrochanteric fracture nonunion treated with a proximal femoral arthroplasty.

Data Extraction

Two authors independently reviewed the titles and abstracts of the identified articles. If both observers agreed that a study did not meet the eligibility criteria, it was excluded. After screening of titles and abstracts, the full text of the remaining articles was obtained and reviewed by the same two observers independently.

Data on the type of implant, number of patients, indications for PFA, follow-up period, infection, soft tissue problems, hematoma, aseptic loosening, dislocation, surgical approach, type of fixation, use of constrained liners, implant fractures, periprosthetic fractures, re-operations, hip scores and mortality were extracted and entered in a spreadsheet.

Outcome Measures

The primary outcome measures were failure and mortality. Failure was defined as the need for revision or reoperation. The modes of failure were classified into two types, including mechanical failure (ie, structural failures [which included aseptic loosening and component fracture], periprosthetic fractures, and soft tissue failures [wound dehiscence, abductor mechanism failures]) or non-mechanical failure (i.e, septic joint infections requiring washout hematoma requiring incision and drainage with irrigation), following classifications described by Henderson et al [11].

Secondary outcome measures were validated hip scores to assess improvements in pain and function.

Subgroup analysis of failure for the main non-neoplastic indications (fractures, infection, aseptic loosening) was also performed.

Results

Search Results

A total of 2287 article titles were reviewed. The abstracts pertaining to complex hip arthroplasties were reviewed to determine if they met the inclusion criteria on the use of a PFA for a non-neoplastic condition. A total of 14 studies [1,4,8–10,12–20] satisfied the eligibility criteria and the search strategy is illustrated in Fig. 2.

Quality Assessment

All the studies were small to medium sized retrospective case series (N = 5–50) describing the outcome of a PFA in non-neoplastic conditions. The range of follow up was 0–14 years. Only 3 of the 6 studies which included patient reported outcome measures (PROMS) had a pre-operative score to be able to quantify any improvements that the patients experienced.

Cohort Characteristics

The studies included 356 PFAs performed in patients with a mean age of 69.6 years who were followed up for a mean of 3.8 years (range 4 days–14 years). There were 8 heterogeneous studies with a variety of reasons for PFA [1,8,10,12–15,19] and 6 homogeneous studies [9,10,16–19]. The most common reason for a PFA was for fractures (43.5% – 155/356 primary, secondary or periprosthetic fractures), followed by aseptic loosening (36% – 128/356) and re-implantation following infection (17.1% – 61/356) and other (3.3% – 12/356).

The PFA was fixed using cement in 75.6% (269/356) and uncemented fixation was used in 24.4% (87/356). The posterior approach was used in 32% (114/356), transfemoral approach was used in 23.6% (84/356), lateral approach was used in 33.1% (118/356) and indeterminate in 14% (50/356) of cases. A constrained liner was used primarily in 15.7% (56/356) of cases. The demographics of the patients in the studies are summarized in Table 1.

Primary and Secondary Outcome Analysis

There were 85 re-operations for any reason giving a failure rate of 23.9% over a mean of 3.8 years. The most common reason for failure was dislocation at 15.7% (56/356) followed by infection at 7.6% (27/356). Mechanical complications including aseptic loosening (2.5%) and