

Management of Severe Femoral Bone Loss in Revision Total Hip Arthroplasty



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KEYWORDS

• Revision total hip arthroplasty • Severe femoral bone loss • Preoperative planning • Reconstruction

KEY POINTS

- Femoral bone loss is a complicated problem requiring meticulous preoperative patient evaluation and surgical planning.
- The Paprosky classification system is most commonly used to define femoral bone loss.
- The Paprosky system is based on the location of femoral bone loss, degree of residual proximal femoral bone stock, and the amount of residual isthmus available for diaphyseal fixation.
- More severe bone loss patterns have variable amounts of diaphysis remaining.
- Diaphyseal engaging stems are successful when used with adequate isthmic bone stock. Severe loss of isthmic bone typically requires a cemented option or a megaprosthesis.

BACKGROUND

Total hip arthroplasty (THA) has been shown to be an extremely effective procedure for the treatment of end-stage arthritis of the hip.^{1–5} Long-term follow-up continues to demonstrate favorable clinical outcomes^{5–9} and as a result, younger, more active patients are being considered candidates for surgery.

Based on the current state of affairs, Kurtz and colleagues¹⁰ have extrapolated the need for THA to increase by more than 170% by 2030. Inherent to this increased utilization of THA is an associated burden of revision surgical procedures. As patient life expectancy continues to increase, THA prostheses are being asked to exhibit improved longevity, which may in turn result in more severe bone loss surrounding the femoral component at the time of revision.

The treatment of femoral bone loss in the setting of revision THA is a challenging problem. This article addresses the etiology of femoral bone loss, associated classification systems, clinical and radiographic patient evaluation, components of effective preoperative planning, and clinical results of various treatment options.

ETIOLOGY OF FEMORAL BONE LOSS

Femoral bone loss may result from osteolysis, stress shielding, periprosthetic infection, periprosthetic fracture, aseptic femoral loosening, iatrogenic bone loss during component removal, and metastatic lesions.^{11–13} Regardless of etiology, the pattern of bone loss as well as the degree of residual fixation of the femoral component must be defined preoperatively to determine the appropriate treatment at the time of revision.

The authors have nothing to disclose.

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FEMORAL BONE LOSS CLASSIFICATIONS

The femoral bone loss classification system proposed by the American Academy of Orthopedic Surgeons is based on the presence of segmental, cavitory, or combined bone defects.^{14,15} As has been described previously, the classification system by the American Academy of Orthopedic Surgeons is organized in a simple manner; however, its practical application with regard to the type of treatment that should be used is limited.¹⁵⁻¹⁷

We advocate the use of the classification system described by Paprosky, which is based on the location of femoral bone loss (metaphyseal or diaphyseal), degree of residual proximal femoral bone stock (ie, amount of cancellous bone loss), and the amount of residual isthmus available for diaphyseal fixation.^{15,16} The Paprosky classification system defines 4 different types of femoral bone loss.¹⁸ In type I defects, there is minimal metaphyseal bone loss and the diaphysis is intact. This type of defect is typically not associated with proximal femoral retroversion or varus femoral remodeling (Fig. 1). Type II defects, the most commonly encountered pattern, exhibit extensive metaphyseal bone loss with an intact diaphysis. There is a greater degree of proximal femoral remodeling compared with type I femoral defects (Fig. 2).

This article focuses on the treatment of more severe bone loss patterns about the femur, specifically types III and IV defects. Type III defects



Fig. 1. Type I femoral bone loss. (Courtesy of DePuy Synthes, Warsaw, IN.)



Fig. 2. Type II femoral bone loss. (Courtesy of DePuy Synthes, Warsaw, IN.)

exhibit extensive metaphyseal bone loss with some degree of bone loss within the diaphysis. Type III defects are subdivided into types IIIA and IIIB defects. In IIIA defects, there is greater than 4 cm of diaphyseal isthmus remaining, whereas in IIIB defects, there is less than 4 cm of diaphyseal isthmus remaining for femoral component fixation. These defects are associated typically with significant proximal femoral remodeling (Fig. 3). In type IV defects, there is extensive metadiaphyseal bone loss with complete femoral canal ectasia. The femoral diaphysis is unresponsive and owing to this severe degree of bone loss, there is minimal proximal femoral remodeling (Fig. 4).

RADIOGRAPHIC AND CLINICAL PATIENT EVALUATION

Preoperative Planning: Imaging Options

Plain radiographs, including an anteroposterior view of the pelvis and anteroposterior and frog-leg lateral views of the femur (ensuring that the entire length of the existing femoral stem is visible) are usually sufficient to identify the location and severity of femoral bone loss. If there is any concern for femoral deformity (ie, prior ipsilateral total knee arthroplasty, history of infection or congenital deformity, previous femoral fracture) full-length x-rays of the femur can be helpful. Preoperative CT could be obtained to better define the location and severity of femoral bone loss as an adjunct to plain radiographs.^{14,19,20}

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