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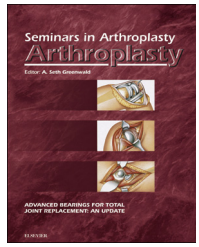

Acetabular bone loss: Accommodating a growing void

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ARTICLE INFO

Keywords:
revision acetabulum
allograft
augments
cages
pelvic discontinuity
cup cage reconstruction

ABSTRACT

The burden of revision total hip arthroplasty continues to rise exponentially, which is a reflection of the increasing number of primary total hip arthroplasty (THA) procedures being performed, lower surgeon thresholds for THA due to excellent mid- to long-term success rates and improved survival of the general population. Acetabular bone loss encountered at the time of revision surgery can present a significant pre- and intra-operative surgical challenge. This review covers the causes, a classification system and surgical options for treatment of acetabular bone loss at revision surgery.

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Acetabular bone loss: Causes

Pre-revision acetabular bone loss may result from osteolysis, infection, metallosis, trunionnosis, periprosthetic fracture or aseptic component loosening. The landscape of acetabular bone loss in revision THA is slowly shifting from classical osteolysis observed with high density polyethylene [1], to increasing rates of periprosthetic fracture, infection [2] and the modern phenomena related to recent implant designs of metallosis [3] and trunionnosis [4].

Potential iatrogenic intraoperative bone loss must be considered pre-operatively, as bone loss during acetabular component removal can be significant, particularly with well-fixed components [5].

Classifying acetabular bone loss

Acetabular bone loss can be classified pre-operatively or intra-operatively. Pre-operative assessment can be made with plain radiographic films, special views and computerized tomography. Intra-operative assessment is, by definition, more accurate but has the significant drawback that it cannot be performed during pre-operative planning. Importantly, defects are significantly larger intra-operatively than they appear on plain radiographic assessment [6]. Therefore, at the pre-operative assessment and planning stage, the classification of the defect and potential for greater bone loss than expected, particularly of the posterior column and ischium must be considered.

Disclosure: Dr Gross has received benefits from Zimmer as part of the design team for the trabecular metal acetabular revision system.

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http://dx.doi.org/10.1053/j.sart.2016.06.029
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Table – Gross Classification of Acetabular Bone Loss

Type	Defect
I	No significant loss of bone stock
II	Contained loss of bone stock (cavitary)
III	Uncontained loss of bone stock involving less than 50% of the acetabulum (minor column defect)
IV	Uncontained loss of bone stock involving more than 50% of the acetabulum (major column defect)
V	Pelvic discontinuity

Radiographic

Several radiographic classification scores have been described [7,8]. The intraoperative reliability and validity [9] of the Gross classification, alongside the guidance it provides in reconstructive options makes it our classification of choice (Table). Acetabular bone loss is defined as follows: (I) no substantial loss of bone, (II) contained (cavitary) loss of bone with intact columns and rim, (III) uncontained (segmental) loss of bone stock involving less than 50% of the acetabulum, (IV) uncontained loss of bone stock involving greater than 50% of the acetabulum and (V) pelvic discontinuity with uncontained loss of bone (Fig. 1).

Additional radiological assessment is often helpful in evaluating acetabular bone stock [10]. In particular, Judet views, chiefly the iliac oblique view, can help assess posterior wall and ischial defects that can be difficult to formally assess on the standard anteroposterior pelvic and lateral hip radiographs. Computerized tomography is a useful adjunct in defining bone loss, but its role is particularly useful for three-dimensional CT reconstruction with contrast, to evaluate the pelvic vessels, ureter and bladder when the acetabular component is medial to Kohler's line or bone loss is profound [11].

Assessment of containment

The acetabular rim is a key component in the decision making process for reconstructive options, primarily whether the defect remains contained, that is, the rim is intact (type I and II), or uncontained where the rim has segmental disruption (type III–V). This distinction is a crucial element of the Gross classification, as achieving containment aids both the stability and survivorship of any implanted acetabular component.

Reconstructive options

The reconstructive options in acetabular bone loss will vary upon the type of defect, patient factors (particularly young patients where subsequent revision is probable) and host bone contact. These options can be broadly defined into four groups: (I) restoration of bone stock, (II) replacement of bone stock, (III) increasing cup size, or (IV) bridging the divide, where pelvic discontinuity has to be addressed.

Restoration bone stock

The ideal scenario when addressing bone loss would be restoration of host bone stock. However, patient factors (both the local host environment and systemic co-morbidities) and weight bearing restriction during bone integration limit the use of these techniques.

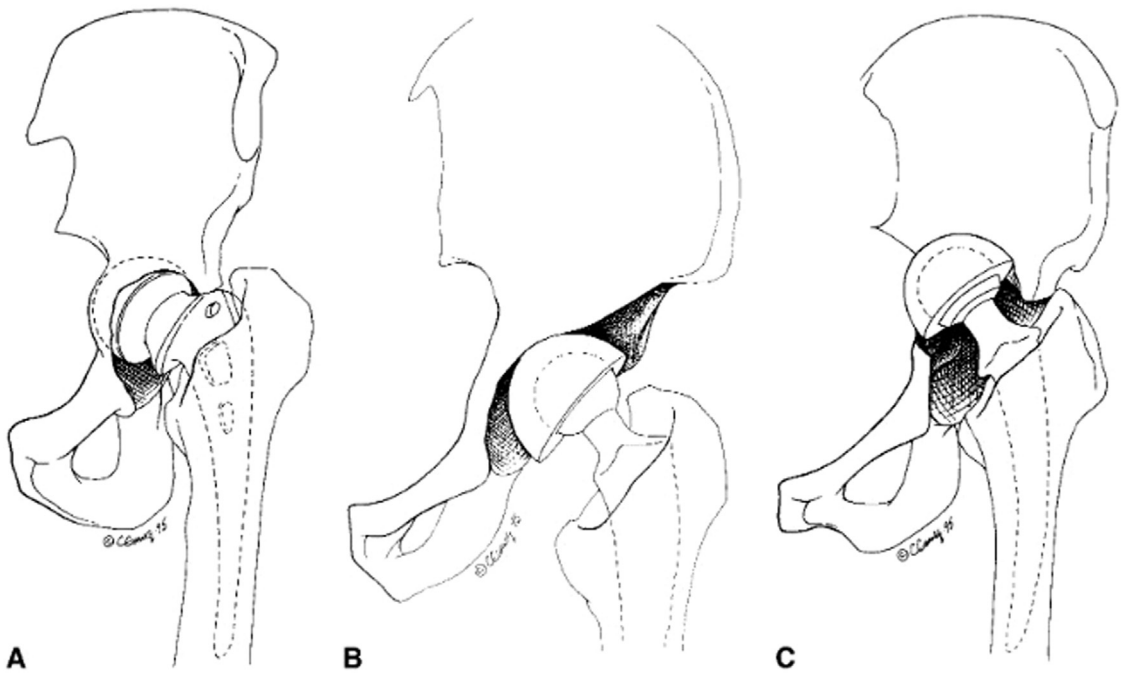

Figure 1 – Classification of bone defects associated with revision arthroplasty of the acetabulum. (A) Type II, contained (cavitary) loss of bone stock. (B) Type III, uncontained (segmental) loss of bone stock involving <50% of the acetabulum. (C) Type IV, uncontained (segmental) loss of bone stock involving >50% of the acetabulum.

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