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Review article

Treatment options for chronic pelvic discontinuity

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ABSTRACT

Chronic pelvic discontinuity is a distinct and unique challenge seen during revision total hip arthroplasty (THA) in which the superior ilium is separated from the inferior ischiopubic segment through the acetabulum, rendering the anterior and posterior columns discontinuous. The operative management of acetabular bone loss in revision THA is one of the most difficult challenges today. Common treatment options include cage reconstruction with bulk acetabular allograft, custom triflange acetabular component, a cup-cage construct, jumbo acetabular cup with porous metal augments, or acetabular distraction with a porous tantalum shell with or without modular porous augments.

1. Introduction

Chronic pelvic discontinuity is an important and difficult complication of total hip arthroplasty (THA), estimated to be the cause of 1–5% of all acetabular revisions.[1,2] The most common reasons for revision THA are instability/dislocation, mechanical loosening, and infection.[3] Revision THA is becoming more common due to an increasing number of primary THA procedures being performed annually. Kurtz et al. demonstrated a projected increase of 137% of total hip revisions by the year 2030.[4,5] The advent of technological advancements in THA have allowed us to address patients with increasing life expectancy and greater demands on the implants. However, the issue of chronic pelvic discontinuity can be expected to become more common.[6]

Pelvic discontinuity occurs most often in patients of female gender, with a history of prior pelvic radiation or rheumatoid arthritis.[1] The two most common classification systems are the AAOS Classification System and the Paprosky Classification,[7,8] with the Paprosky Classification providing treatment recommendations based on the degree and location of bone loss, thus allowing for pre-operative planning.[9] In addition, follow-up studies have demonstrated adequate validity and reliability of this classification system.[10]

There are three important factors in regards to achieving a successful outcome when treating pelvic discontinuity: the amount of bone stock remaining, biologic in-growth potential, and the healing potential of the discontinuity.[11,12] Treatment options include cage reconstruction with bulk acetabular allograft, custom triflange acetabular component (CTAC), a cup-cage construct, jumbo acetabular cup with porous metal augments, or acetabular distraction with a porous tantalum shell with or without modular porous augments. This review article discusses classification, evaluation, reconstruction options and outcomes of chronic pelvic discontinuity.

1.1. Classifying acetabular bone defects

The Paprosky classification is the most commonly utilized system for acetabular bone loss. The system's findings are based on the location of the hip center of rotation in reference to the superior obturator line, the presence of osteolysis at the ischium and at the tear drop, and the relation of the hip center of rotation relative to Köhler's (ilioischial) line.

Three types of bone defects are described. Type I defects have an undistorted acetabulum with intact anterosuperior and posterior columns. Type II defects have acetabular distortion but still have retention of the anterosuperior and posteroinferior columns. These are further broken down into A-C subclassifications. Type IIA defects have anterosuperior bone loss with less than 3 cm of superior migration. Type IIB defects have superolateral bone loss with less than 3 cm of superolateral femoral head migration. In Type IIC defects, there is medial migration of the hip center with disruption of Köhler's line.

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Type III defects are characterized by acetabular distortion and loss of column support such that trial components will be partially or completely unstable upon initial implantation. These defects are divided into Type IIIA and Type IIIB. Type IIIA defects have an 'up and out' pattern with superolateral loss with 30–60% of the columns being disrupted. There is superolateral migration of the hip center >3 cm but Köhler's line is typically intact. Type IIIB defects have an 'up and in' pattern with superomedial hip center migration, >3 cm, >60% compromise of the columns, and with violation of Köhler's line.[8] Pelvic discontinuity can be seen in Type IIC and IIIA defects but are more commonly associated with Type IIIB defects.

1.2. Pre-operative evaluation

Favorable clinical outcomes are based on careful evaluation and pre-operative planning. Patients often present clinically with pain, difficulty with ambulation and leg-length discrepancy due to migration of the cup and hip center. A detailed history should be documented regarding the index procedure as well as pre- and post-operative symptoms. A full series of radiographs should be obtained including an anteroposterior (AP) pelvis, AP and lateral of the hip, and a cross-table lateral of the hip. In some cases, a computed tomography (CT) can be a powerful adjunct to assess the degree and location of bone loss, as it is frequently underestimated on plain radiographs.[13] In cases with severe medial migration, CT angiography should be obtained to understand the relationship of intra-pelvic neurovascular structures to the acetabular component.

Pre-operative laboratory evaluation including white blood cell count, erythrocyte sedimentation rate, and C-reactive protein should be obtained before all revision THAs.[14] Elevated markers should prompt a pre-operative hip aspiration.

1.3. Treatment options

A successful reconstruction is predicated on the ability to achieve stable fixation of a cementless construct, the biology of the remaining bone stock, and the ability to heal the chronic discontinuity. Chronic pelvic discontinuity is typically associated with poor biology and acts similarly to an atrophic or fibrous non-union. In revision THA, cementless acetabular components have demonstrated improved survivorship as compared to cemented components, and newer interventions focus on stable fixation utilizing cementless implants.[15] Treatment options include cage reconstruction with bulk acetabular allograft, custom triflange acetabular component, a cup-cage construct, jumbo acetabular cup with porous metal augments, or acetabular distraction with a porous tantalum shell with or without modular porous augments.

1.4. Cage reconstruction with bulk acetabular allograft

Historically, massive bulk allograft, used in conjunction with a cemented liner in the setting of chronic pelvic discontinuity had a 50% failure rate. [16,17] Additionally, there is concern for this type of reconstruction due to graft resorption and infection risks associated with the allograft.

Another method of fixation was an independent acetabular cage used as a bridging device to span the ilium and the ischium. Again, outcomes were poor with high rates of complication and reported failures of up to 50–60%.[18–20] When there is inadequate bone to support a cage construct, bulk allograft can be used in conjunction with a cage. This will provide stability until the allograft incorporates by creeping substitution. Studies have shown satisfactory outcomes with failure occurring due to lack of biologic ingrowth of the cage, leading to eventual loosening or cage breakage.[20–22] With the advent of trabecular metal implants, bulk allografts were used less frequently, due to improved biologic ingrowth and no concerns for implant resorption.

1.5. Cup-Cage construct

With the availability of porous trabecular metal implants and their increased ability for biologic ingrowth, the cup-cage construct has gained enthusiasm as a useful treatment option. These constructs are protected by a cage while biologic fixation is achieved at the host bone-cup interface. This technique involves the placement of a highly porous jumbo acetabular cup against host bone, with or without porous metal augments, and a cage that spans the defect with fixation into the ilium and ischium.

Early outcomes have been favorable, demonstrating survivorship >85% in series.[2,23,24] A recent long term study by Amenabar et al. demonstrated five- and ten-year survivorship of 93% and 85% with revision for any reason as the end point.[25] Another recent study by Martin et al. demonstrated 100% survivorship of 27 hips treated with a cup cage construct at five years.[26] However, there is concern with this construct as the cup is typically placed too vertical and relatively retroverted to accommodate the cage.

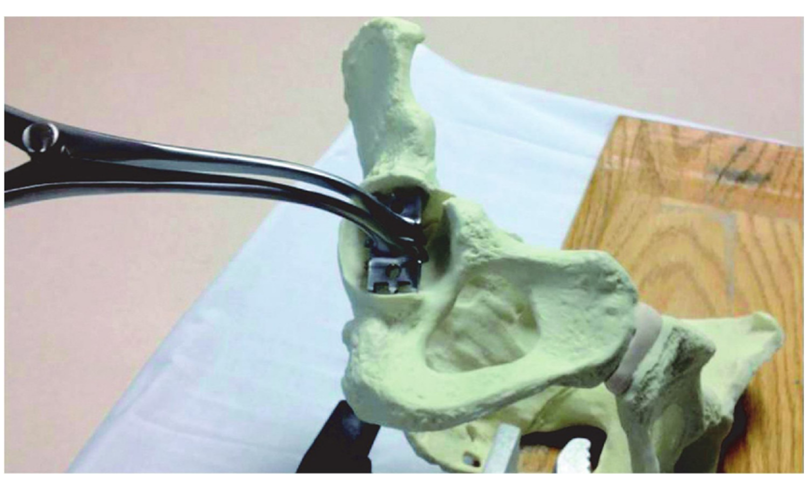

Fig. 1. A distractor is used to assess motion at the fracture site.

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