METHODS OF RECONSTRUCTION OF ACETABULAR DEFECTS IN TOTAL HIP REPLACEMENT

ESSAY

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بسم الله الرحمن الرحيم

وقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ
ورَسُولُهُ والْمُؤْمِنُونَ

صدق الله العظيم

سورة التوبة آية (105)

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List of Abbreviations

AAOS	:	Academy of Orthopaedic Surgeons
AP	:	Anteroposterior
APC	:	Anti-protrusio cage
CDH	:	Congenital dysplasia of the hip
CT	:	Computerized tomography
IGA	:	Inferior gluteal artery
LT	:	Ligamentum teres
OBT	:	Obturator artery
SGA	:	Superior gluteal artery
THA	:	Total hip arthroplasty
THR	:	Total hip replacement
TM	:	Trabecular metal
UHMWPE	:	Ultrahigh molecular weight polethylene

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Introduction

Total hip arthroplasty has dominated orthopedic surgery for the past 15 years. The demand for hip arthroplasty continues unabated, and with a population that has increasing proportion of older people, it increases further[(1)].

Acetabular bone deficiency can present a challenge during total hip arthroplasty. Bone deficiency in the acetabulum can be encountered in primary and revision acetabular reconstruction. Primary deficiencies result from either an abnormality of growth or a condition that alters the shape of the acetabulum as acetabular dysplasia in congenital dislocation of the hip.

All types of acetabular deficiencies can be divided into segmental or cavitary. A segmental deficiency is a complete loss of bone in the supporting rim of the acetabulum, including medial wall. A cavitary deficiency is a volumetric loss in bony substance of the acetabular cavity [(2)].

Bone deficiencies encountered during revision arthroplasty continue to be the most common and are seen with multiple revisions, aseptic loosening and component migration, infection, osteolysis, and iatrogenic causes [(2)].

Acetabular defects are classified according to the system of the American Academy of Orthopaedic Surgeons (AAOS) Committee into:

- Type I Segmental: medial wall defects, or peripheral rim defects.
- Type II Cavitary: defects contained within ileum, ischium or pubis; may include 50%defect in medial wall.

- Type III Combined: segmental and cavitary defects occurring together.
- Type IV Pelvic discontinuity: complete mechanical discontinuity of the pelvis through the acetabulum due to fracture of anterior and posterior columns, with separation of the superior and inferior portions of the acetabulum [(2)].

Contained (cavitary) defects are more easily dealt with because the skeleton, while weakened, is basically intact. Cavitary defect of the acetabulum is one in which the anterior and posterior columns and the peripheral supporting bone for the a[cetabular component are intact.

Pelvis with a cavitary defect can support an implant with a little help. This help may be biological (in the form of a bone graft) or it may involve modification of the implant. Impaction grafting with use of morseled bone is a biological alternative [(3)].

Large cups and asymmetrical cups that are designed to make contact with host bone, with minimum or no use of morcellized bone, are examples of modified implants that may be used to treat a cavitary defect [(4)].

Uncontained (segmental) defects are more of a challenge. Small and even moderate defects can be dealt with by placing the implant against host bone without structural grafting but perhaps with some compromise of the normal anatomical relationships.

Placement of a cup in a high hip-center position without cement allows the cup to make contact with host bone, thereby facilitating biological fixation by bone ingrowth [(5)].

If the patient has a large segmental defect and there is no possibility of placing the implant against host bone or of restoring nearly normal anatomy, then the use of a structural bone graft may be indicated. This technique, if successful, restores bone stock and anatomical relationships and, if failure occurs, the revision operation may be less challenging[6].

Radiographic features include a visible fracture line through the pelvis or columnar lines, translation or rotation of the inferior hemipelvis relative to the superior hemipelvis, violation of Kohler's line, and superior migration of the center of rotation of the femoral head. Adequate exposure of the acetabulum and verification of columnar integrity before attempting fixation of the acetabular component allows the surgeon to recognize these defects. For cases with more than 50% host bone remaining, rigid plate fixation of the discontinuity, followed by cementless socket fixation. For those cases with less than 50% host bone, rigid plate fixation or antiprotrusio cage placement and cemented socket combination is acceptable [7].

Methods of reconstruction

A- Bone-Grafting:

The spectrum of opinion regarding the treatment of bone defects on the acetabular side of an arthroplasty has ranged from recommendations to avoid the use of bone graft if possible to suggestions that morcellized bone only or complex structural grafts be used[8]

B-Hardware used in Acetabular Reconstruction

1) Press-fitted Porous-coated Implant

It is possible and often preferred to press fit a porous-coated implant in a type III defect with less than 70% of the

host bone left, but it does involve some difficulty. It's recommended to use a structural allograft to reconstruct the deficient rim or column. This aids in maintaining the position and promotes fixation of the acetabular component to the host bone. A structural graft should be used to reconstruct the segmental defects using hemiacetabular or total acetabular allografts with restoration of the hip center of rotation. Reports have shown that if less than 50% of the host acetabulum remains, attempts at obtaining fixation with a porous-coated implant will yield high failure rates[9]

2) Oblong Acetabular Components:

Oblong acetabular component were introduced for management of large superior acetabular defects. Their theoretical advantages include avoiding the high hip center and the use of bulk allograft for support. They are designed to maintain contact with host bone and to restore a more anatomic hip center. Intermediate-term results have been excellent in small series with non custom, oblong porous cups. It's recommended only when the long axis of the socket is smaller than the anteroposterior diameter **[10]**

3) Reconstruction Cages (Antiprotrusio rings) :

The Burch-Schneider acetabular support is cup-shaped with a superior wing and inferior tongue for fixation in the ilium and ischium respectively. It is supplied in the right and left implants. The superior wing designed to rest against the ilium to which it is fixed with cancellous screws. The inferior tongue should be impacted into the ischium**[10]** **.**

4) KerBoull's Plate:

It allows automatic centering of the cup by means of hook placed at the obturator foramen and by stabilizing the lower part of the acetabulum using bone screws connecting

the upper leg to the iliac ring. To achieve its objective certain conditions must be fulfilled[10].

5) Octopus ring:

It is a modular system comprising three component the first is peripheral metallic fram manufactured from pure titanium to ensure malleability. It is supplied in right and left frames. It includes three fixed lugs, a straight superior iliac lug plated at 45 degrees to the ring plane. The second is a T-shaped posterior iliac lug plated at 90 degrees to the ring plane. The third is a hook shaped lug for hooking onto the obturator foramen[10]

6) Ganz reinforcement ring:

It's a titanium ring available in sizes ranging from 38 to 64 mm and is generally combined with a polyethylene cup that is 2 to 4 mm smaller.[11]

Aim of The Work

The aim of this work is to review the literature regarding different modalities used in acetabular reconstruction in both primary and revision hip arthroplasty. This is through reviewing of the surgical anatomy of the acetabulum, preoperative planning, different sources of bone graft, and regimen of the postoperative rehabilitation.