

Management Of Acetabular Deficiency In Total Hip Arthroplasty: A Series Of 15 Cases

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Citation

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Abstract

OBJECTIVE: Deficiency of the acetabular bone stock is one of the major problems in revision total hip arthroplasty and certain primary total hip arthroplasty. This study was done to find a new method of fixation of such fractures.

METHODS: 15 Patients in whom an aseptic acetabular deficiency has been surgically reconstructed during THR between 2003-2008 were included. There were ten primary arthroplasties and five revision cases. Mean duration of follow-up is 3.2yrs (range 6months- 5yrs). All patients underwent surgery in the lateral position, and all were treated through a posterolateral approach. **RESULTS:** The postoperative radiographs were used as a reference to determine the initial position of the implant with the use of the criteria of Johnston et al. The clinical evaluations were made on the basis of Merle d' Aubigne score. Of the patients evaluated at the most recent follow-up evaluation, six (75%) were free of pain and Two (13.3%) had occasional mild pain with normal activity. **CONCLUSION:** We conclude that stable fixation by uncemented primary replacement with bone graft augmentation and screw fixation of bone graft was more commonly obtained in Type II and Type III defects in which the medial wall of the acetabulum was not disrupted. These cases have shown good clinical and radiological results. Cases with acetabular medial wall defect Type III and Type IV in fixation with reinforcement ring had been achieved with bone grafting at the time of the surgery have shown significantly good clinical and radiological results.

Deficiency of the acetabular bone stock is one of the major problems in revision total hip arthroplasty and certain primary total hip arthroplasty. It may result from numerous factors, including the following: (1) osteolysis caused by wear, loosening, or infection; (2) excessive bone resection at the time of previous surgery, especially if the patient has had a resurfacing procedure or previous acetabular revision; (3) preexisting bone deficit from acetabular fracture or dysplasia that was not corrected at the time of previous surgery; and (4) inadvertent destruction of bone during removal of a previous component or cement.

The goals of acetabular reconstruction are to establish: the center of rotation of the hip to its anatomical location for normal joint mechanics; and to reestablish the structural integrity of the acetabulum by rigid fixation of bone graft, adequate containment of the new prosthesis.

MATERIAL AND METHODS

15 Patients in whom an aseptic acetabular deficiency has been surgically reconstructed during THR between 2003-2008 were included. The criteria used to select the study population included:

Aseptic loosening acetabular component with a stable or unstable femoral component.

A bone defect requiring the use of allograft bone or augmentation with a reinforcement ring or cage both in primary and revision arthroplasty.

Primary Arthroplasty requiring Reverse Hybrid.

There were ten primary arthroplasties and five revision cases. The indication for primary surgery were protrusion in Five patients, secondary arthritis post-trauma or post inflammatory with medial wall defect in three hips, dysplasia in two hips. The indication for revision was acetabular aseptic loosening in four hips and discontinuity of medial wall in one hip. Mean duration of follow-up is 3.2yrs (range 6months- 5yrs). Nine patients were females and six were men with mean age of fifty nine years (range, 47-72 years). As per AAOS I classification six patients were of type II, eight patients were type III and one patient with pelvic discontinuity i.e. type IV.

Table 1

AAOS Classification of Acetabular Deficiencies

Type I	Segmental deficiencies
	Peripheral
	Superior
	Anterior
	Posterior
	Central (medial wall absent)
Type II	Cavitary deficiencies
	Peripheral
	Superior
	Anterior
	Posterior
	Central (medial wall intact)
Type III	Combined deficiencies
Type IV	Pelvic discontinuity
Type V	Arthrodesis.

SURGICAL TECHNIQUE

All patients underwent surgery in the lateral position, and all were treated through a posterolateral approach. Trochanteric osteotomy was done in one case for exposure of hip. After resection of the posterior capsule, joint was dislocated posteriorly. In cases with severe protrusion neck osteotomy close to head done and then head was removed with cork screw. All cement, debris, membranes, and scar tissue were resected in revision cases. The sclerotic acetabular bone was debrided with use of an acetabular reamer. The teardrop was exposed with a blunt retractor placed at the medial border of the incisura acetabuli. Segmental defects were bridged with wafer shaped pieces of allograft bone. The graft was impacted with a hemispherical trial acetabular component. Cavitary defects were filled with morselized autograft. In bone defects requiring augmentation with ring, appropriately sized ring was chosen by placing the hook of the trial device under the teardrop and impacting the ring into the acetabulum until contact was reached between the flange of the prosthesis and the iliac bone. The size of the ring was

considered adequate if the primary stability was achieved. The orientation of the implant was defined by the area of the best bone stock. The ring was positioned and was fixed in with cancellous screws against the area of best bone stock. It allowed the optimal positioning, coverage and cement fixation of the polyethylene cup. Post-operatively, all the patients received prophylaxis against deep vein thrombosis with LMW Heparin until mobilization was achieved. Patients were allowed to begin partial weight bearing after second post-operative day. Full weight bearing was allowed three months following the procedure.

Figure 1



RESULTS AND COMPLICATIONS

Radiographic Evaluation: An anteroposterior radiograph of the pelvis and true lateral view of the involved hip were made immediate after surgery, at six weeks, and subsequent follow-up visit. The postoperative radiographs were used as a reference to determine the initial position of the implant with the use of the criteria of Johnston et al 2. Loosening was defined as:

- >2mm of movement of the center of rotation vertically or horizontally,
- >3 degree of rotation of the polyethylene cup,
- Progressive radiolucency around the ring and screws, and
- Implant failure in combination with one or more of the previous criteria.

The position of the anatomical center of rotation could be measured in the normal contralateral hips and was compared with the involved side before and after the reconstruction. The teardrop was used as a reference. The horizontal and vertical distances between the reference point and the Centre of prosthetic head were measured. There were no cases of dissociation between the polyethylene socket and the reinforcement ring/cage. Remodeling of the graft was apparent on the plain X- rays of all hips three months after the procedure. In all cases, the quality of the fixation was deemed to be adequate at follow up. At the most recent follow up examination, there were no patients which had migration of the implant post operatively and resorption of

the graft. The clinical evaluations were made on the basis of Merle d' Aubigne score 3. At the intermediate follow-up evaluation (at three months), the score for pain, walking ability, and mobility were significantly increased relative to the preoperative baseline values ($p < 0.001$).

Of the patients evaluated at the most recent follow-up evaluation, six (75%) were free of pain and Two (13.3%) had occasional mild pain with normal activity. The median scores for pain and walking ability and the median composite score at the recent follow-up evaluation were significantly different from the scores at the preoperative evaluation and from the score at the intermediate follow-up. (Table).

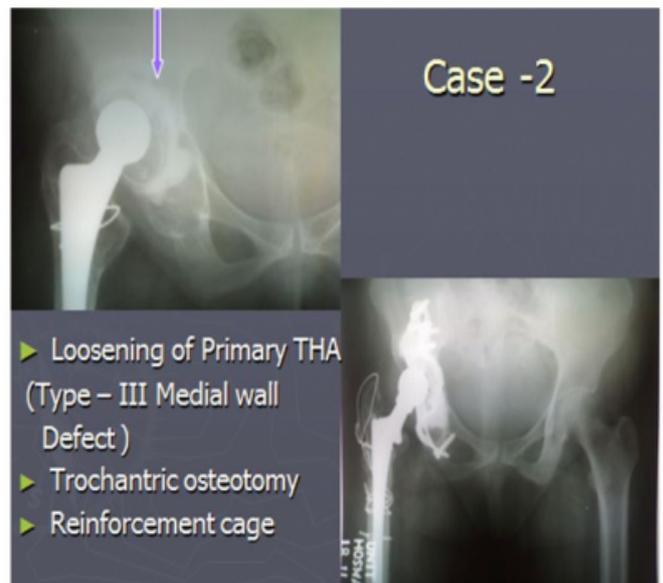
Table 2

Merle d' Aubigne score	Pre op		Post op follow up		P value
	Median	Min- Max	Median	Min-Max	
Pain (0-6) points	3	1-5	5	3-6	< .0001
Walking ability (0-6 points)	2	1-6	5	3-6	< .0001
Mobility ability (0-6 points)	2	1-6	5	2-6	< .0001
Composite score (0-18 points)	7	6-16	15	10-18	< .0001

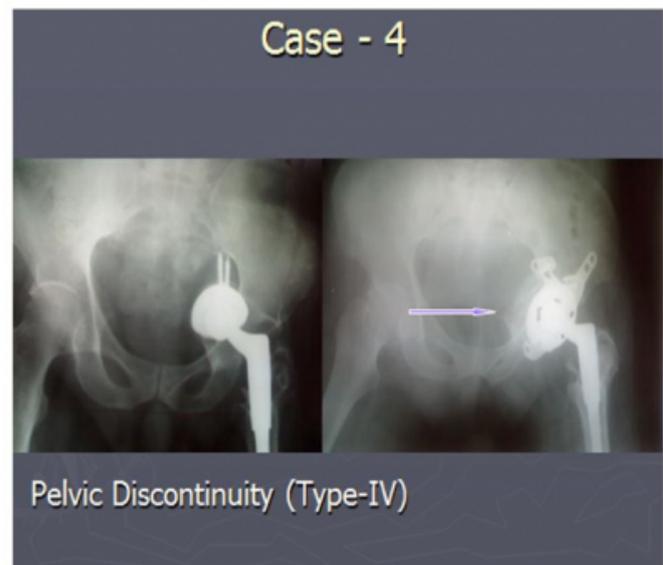
Case 1



Case 2



Case 4



COMPLICATONS:

One patient had a dislocation within one month after revision and was treated with closed reduction and immobilization but repeat dislocation occurred then open reduction done with change in version of femoral prosthesis, then after patient had no dislocation. This patient developed paraesthesia on ipsilateral side after surgical correction which was recovered completely after eight weeks. Limb length discrepancy (1.5 cm) in one patient with dysplastic hip managed with shoe heel raise. No wound dehiscence in any case. No infection in any case.

DISCUSSION

The reconstruction of the uncontained acetabular defects in revision hip surgery is a complex and controversial problem. Satisfactory results have been reported after treatment of the massive uncontained defects with bridging antiprotrusio cages fixed in ilium and ischium in combination with morselized and/ or structural grafts^{4, 5, 6,7,8,9}. A major disadvantage of the reinforcement cages is that implantation necessitates wide exposure of the supra-acetabular region with partial detachment of the abductor muscles to achieve correct positioning and fixation of the large superior flange. We have shown that nonstructural autografting combined with use of the reinforcement ring is an effective technique for the reconstruction of the large acetabular defects. Furthermore, our study demonstrated that use of the reinforcement ring, combined with nonstructural bone graft, led to good, stable long stable long-term clinical results, as measured with the Merle d' Aubigne grading system. The classification that we used included, in the addition to the description of contact of the implant with the host bone¹⁰.

The primary stability of the implant (without screw fixation and before bone-grafting) is an essential factor. We believe that the primary stability of the implant, enhanced by adequate screw purchase in the ilium and proper placement of the hook below the teardrop, provides pretensioning of the ring, similar to plate osteosynthesis performed with a tension device or blade-plate¹¹ provided that the implant demonstrated primary stability with in the acetabulum before the defect was a filled with graft and screw fixation was performed.

Osteointegration of the bone graft took place during the first twelve months and the structural properties of the reconstructed bone remained stable. Our study demonstrated that stable fixation by uncemented or cemented primary replacement with bone graft augmentation with screw fixation was more commonly obtained in Type II and Type III defects in which the medial wall of the acetabulum was not disrupted. Furthermore, with the failed cases with acetabular medial wall defect in which fixation with reinforcement cage had been achieved with bone grafting at the time of surgery stable hip has been achieved. With this small study it was observed that the ganz ring was not appropriate for the reconstruction of large defect type IV or segmental defects of the medial wall. Under these circumstances, it is difficult to secure the ring safely; therefore, a larger reinforcement cage (octupussy cage) was more secure and should be preferable.

CONCLUSION AND SUMMARY

This study of fifteen patients with acetabular defects demonstrate that stable fixation by uncemented primary replacement with bone graft augmentation and screw fixation of bone graft was more commonly obtained in Type II and Type III defects in which the medial wall of the acetabulum was not disrupted. These cases have shown good clinical and radiological results.

Cases with acetabular medial wall defect Type III and Type IV in fixation with reinforcement ring had been achieved with bone grafting at the time of the surgery have shown significantly good clinical and radiological results. We have shown that nonstructural autograft combined with use of the reinforcement cage is an effective technique for reconstruction of the large acetabular defects. Furthermore, our study demonstrated that use of the reinforcement ring, combined with nonstructural bone graft, led to good, stable clinical results.

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