Original Article

Surgical hip dislocation for treatment of cam femoroacetabular impingement

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Abstract

Background: Cam femoroacetabular impingement is caused by a misshapen femoral head with a reduced head neck offset, commonly in the anterolateral quadrant. Friction in flexion, adduction and internal rotation causes limitation of the hip movements and pain progressively leading to labral and chondral damage and osteoarthritis. Surgical hip dislocation described by Ganz permits full exposure of the hip without damaging its blood supply. An osteochondroplasty removes the bump at the femoral head neck junction to recreate the offset for impingement free movement.

Materials and Methods: Sixteen patients underwent surgery with surgical hip dislocation for the treatment of cam femoroacetabular impingement by open osteochondroplasty over last 6 years. Eight patients suffered from sequelae of avascular necrosis (AVN). Three had a painful dysplastic hip. Two had sequelae of Perthes disease. Three had combined cam and pincer impingement caused by retroversion of acetabulum. All patients were operated by the trochanteric flip osteotomy with attachments of gluteus medius and vastus lateralis, dissection was between the piriformis and gluteus minimus preserving the external rotators. Z-shaped capsular incision and dislocation of the hip was done in external rotation. Three cases also had subtrochanteric osteotomy. Two cases of AVN also had an intraarticular femoral head reshaping osteotomy.

Results: Goals of treatment were achieved in all patients. No AVN was detected after a 6 month followup. There were no trochanteric nonunions. Hip range of motion improved in all and Harris hip score improved significantly in 15 of 16 cases. Mean alpha angle reduced from 86.13° (range 66°–108°) to 46.35° (range 39°–58°).

Conclusion: Cam femoroacetabular Impingement causing pain and limitation of hip movements was treated by open osteochondroplasty after surgical hip dislocation. This reduced pain, improved hip motion and gave good to excellent results in the short term.

Key words: Cam lesion, femoroacetabular impingement, pincer impingement, surgical hip dislocation
Mesh terms: Impingement syndrome, hip dislocation, surgical technique

Introduction

Femoroacetabular impingement causes pain and limitation of movement in the hip.[1] Cam impingement is caused by a misshapen femoral head with a reduced femoral head neck offset. Surgical Hip Dislocation was described by Ganz[2] to effectively expose the hip without damaging its blood supply[3] Cam impingement is usually in the anterolateral zone and causes excessive pressure against the labrum and chondrolabral junction in flexion adduction and internal rotation.[4-6] It is seen on the anteroposterior (AP) X-ray as a pistol grip deformity of the femoral head or as the sagging rope sign or by the presence of anterolateral extrusion of the femoral head. Special lateral views like the cross table lateral, false profile and modified Dunn view show the loss of the femoral head-neck offset or the presence of a bump at the anterior head-neck junction. We measured the severity of the impingement by the alpha angle.[5] It is the angle between the femoral neck axis and the line connecting the head center with the point of beginning asphericity of head-neck contour. Pincer impingement is caused by acetabular retroversion and anterior over coverage. This is seen on an AP X-ray of the hip as the crossover sign and prominence of the ischial spine.[7] Clinical examination reveals pain on flexion adduction and internal rotation of the hip.[8,9]

Surgical hip dislocation enables 360° visualization of the femoral head and acetabulum. An osteochondroplasty

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removes the bump, deepens the head-neck offset and allows impingement free movement. Surgical dislocation also permits other procedures like relative neck lengthening, head reduction osteotomies, distalization of the trochanter and subtrochanteric osteotomies. All of these help reduce pain and increase hip range of motion and prolong the life of the native young hip.

Materials and Methods

16 consecutive patients who had surgical hip dislocation at our institute over the last 6 years were included in study. There were 11 males and 5 females having 9 left and 7 right hips. The mean age of the patients was 28.3 years (range 12–55 years). 8 patients had residual effects after avascular necrosis (AVN) with cam impingement. 3 had dysplastic hips with cam impingement and proximal migration of the greater trochanter. 2 had residual deformities after Perthes disease. Three female patients had retroversion of the hip with cam and pincer impingement. We treated the cam impingement in all three, but attempted to tackle the pincer impingement only in one of the patients [Table 1].

All the cases presented with pain in the hip, limp and limitation of movements and activities. Cam femoroacetabular impingement was diagnosed in all cases on clinical examination and plain X-rays. Only three patients had a preoperative magnetic resonance imaging (MRI) scan. Magnetic resonance arthrography was not performed for diagnosis.

The patients were symptomatic for a mean of 23.4 months (range 1–48 months) and have been followed-up after surgery for a mean of 24.8 months (range 6–55 months). Mean preoperative Harris hip score (HHS) was 47.86 (range 6.54–85). The preoperative Tonnis grading did not correlate well with the preoperative HHS on Pearson correlation coefficient ($r = –0.090$), the slope being not significantly different from zero ($P = 0.72$). Preoperative alpha angle was a mean of 86.13° (range 66^0–108^0) denoting severe cam impingement.

Operative procedure

Surgical hip dislocation has been described in detail.[2] We followed the technique without creating a step in the trochanter. In 3 of our cases, the trochanteric osteotomy became a thin sliver but did not affect exposure of the hip or its healing. The depth of cut can be difficult to determine in dysplastic hips and those with excess or reduced version.

Osteochondroplasty[10,11] to improve offset of the femoral head neck junction was performed in all 16. A curved osteotome was used to remove excessive bone from the neck as well as the head. Intraoperative bleeding was noted in all cases. In no case was the neck thinned significantly. An impingement test was performed intraoperatively to ensure the adequacy of excision of the bump and ensure smooth movement of the head against the labrum.

Relative neck lengthening[12,13] was performed in 4 cases by a subperiosteal dissection using a thin sharp osteotome to preserve the extended retinacular flap. Bony resection at the inferolateral corner of the neck was performed along with distalization of the trochanter to extent of 15 mm.

Table 1: Clinical details of patients

Name	Age (years)	Sex	Side	Diagnosis	Preoperative HHS surgery	Pain since (months)	Preoperative MRI	Tonnis grade	Surgery	PO HHS	Difference in HHS	Followup (months)
GD	22	Male	Right	Dysplasia	25.2	26	No	1	OCP*	96	70.8	26
DG	25	Male	Left	AVN	39	24	No	3	IAOst†	93.8	54.8	23
DJ	26	Male	Left	AVN	85	13	No	1	OCP	96	11	18
DC	23	Female	Left	Dysplasia	49.6	36	No	2	OCP, DT, RNL	89.3	39.7	20
HB	22	Male	Right	Exostosis	66	20	No	0	Excision	92	26	44
HF	12	Female	Left	Perthes	42.6	16	No	1	OCP*	100	57.4	43
RK	19	Male	Right	AVN	43.09	14	Yes	1	OCP Ost	82.9	39.81	28
MP	28	Male	Right	AVN	57.6	48	No	2	OCP	92.75	35.15	40
RT	40	Female	Right	Retroversion	42.3	46	No	2	OCP Ost	96.8	54.57	26
SA	34	Male	Left	AVN	32.69	38	Yes	1	OCP DT	89	56.31	6
SI	30	Female	Right	Retroversion	57	28	No	3	OCP rim	78	21	10
AS	22	Male	Left	Perthes	85	12	No	0	OCP RNL DT	88.25	3.25	13
SS	37	Male	Right	AVN	34.5	21	No	3	OCN Ost FL	89.1	54.6	22
SM	29	Male	Right	AVN	76.8	15	No	2	IAOst OCP	94.7	17.9	55
VD	34	Female	Left	Retroversion	23.55	36	Yes	2	OCP	87.6	64.05	25
VM	18	Male	Left	Dysplasia	49.5	4	No	1	OCP RNL DT	89.9	40.4	14
ZP	55	Female	Left	Femoral head#	6.54	1	No	0	Internal fixation	94	87.46	18
SJ	33	Male	Left	AVN	45.6	24	No	2	OCP DT RNL	87	41.4	6

*OCP=Ostechondroplasty, †IAOst=Intraarticular osteotomy, ‡DT=Distalization of trochanter, §RNL=Relative neck lengthening, ||ost=Osteotomy, **rim=Rim trimming and labral re-fixation, ††FL=Femur lengthenin, HHS=Harris hip score, AVN=Avascular necrosis, MRI=Magnetic resonance imaging

A subtrochanteric osteotomy[14] was performed in 3 patients with AVN. One was fixed with a locking plate, and two were fixed with an Ilizarov fixator. Medial displacement was performed in all. In the patients fixed with an Ilizarov fixator, a valgus angulation ensured that the lateral affected zone of the femoral head stayed away from the weight bearing zone of the acetabulum. A distal devalgus and lengthening osteotomy[15] was performed in both cases.

Intraarticular osteotomy to reshape the femoral head[16] was performed in two cases of residual effects of AVN. The femoral head had a saddle shaped deformity with a depression under the lip of the acetabulum. The central depressed zone of the femoral head was excised. The extruded lateral portion and medial portion of the femoral head had reasonably good articular cartilage. These were coapted and fixed with two countersunk screws. The resultant contour was reasonably spherical and a distinct improvement from the preoperative status. Bleeding from the cut edges of the osteotomy was noted during surgery.

The three of our patients who had retroversion of the acetabulum had cam as well as pincer impingement. We performed osteochondroplasty in all three. In only one of the patients did we perform an acetabular rim trim with refixation of the labrum[17] with anchor sutures. However, since it was our first case, we could not achieve an adequate resection of the acetabular rim.

Results

The surgical objectives (to recreate femoral head-neck offset and reduce cam impingement) were achieved in all cases. Only 3 of our patients had followup <12 months and only 5 had a followup <18 months. The HHS was significantly improved in 15 of the 16 hips. Mean postoperative HHS was 90.69 (range 78–100). The mean difference in the HHS was 43.09 points (range 3.25–70.8). The paired *t*-test for difference in the means of preoperative and postoperative HHS was significant ($P < 0.001$) There were 7 excellent results (HHS > 90). Eight good results (HHS 80–89) and one fair result (HHS 78).

Mean postoperative alpha angle[18] was 46.75° (range 39^0–58^0) when the mean preoperative angle was 86.13° and the difference was significant (two tailed $P < 0.0001$).

Complications

There were no cases of nonunion of the greater trochanter. There were no wound infections.

Two patients of AVN with a subtrochanteric osteotomy using an Ilizarov fixator had significant complications. One developed a fracture at the midshaft osteotomy for which the fixator was reapplied. Another had pin track infection with a ring sequestrum, which needed debridement. There were 4 cases of class I heterotopic ossification around the tip of the trochanter. None suffered loss of motion.

Discussion

Femoroacetabular impingement is now recognized as a clinical entity causing hip pain in the young. If untreated, it leads to labral and chondro labral damage and eventually to the development of arthritis of the hip.[6] The incidence of femoroacetabular impingement is perhaps under reported and largely unrecognized. Kumar and Aggarwal[19] described radiological changes in 50 symptomatic patients. Malhotra *et al*.[20] have shown the similarity in the measurement of alpha and beta angles and the offset ratio comparable to that in the western literature. However, there are few published reports of treatment of this condition from India. Madhuri *et al*.[21] have reported on eight patients that they operated upon for osteoplasty for various indications with a short followup. They described their technique of assessing femoral head vascularity rather than the exposure or technique of osteoplasty or short-term clinical results. Naranje *et al*.[22] described surgical hip dislocation in 18 patients who had acetabular fractures to determine the accuracy of reduction.

Perthes disease [Figure 1] and Dysplasia [Figure 2] are known to cause secondary osteoarthritis. Joseph[23] has found in a long term study of the natural history of Perthes that 76% of cases end up with a nonspherical femoral head. The treatment of post Perthes femoral head deformities has been described by Leunig and Ganz[12] and Paley.[16] Coxa magna and an elliptical shape were seen in our patients. We performed osteochondroplasty and relative neck lengthening in our patients.

AVN happens to be the commonest indication for performing a total hip replacement in India,[24] the Swedish national registry has clearly shown a failure rate of >25% of total hip replacement at 13 years followup.[25] The prostheses needed for surgery in younger patients are also more expensive. This is perhaps the reason patients in our study sought us for an alternative to hip replacement.

The AVN had healed in all of these patients. Mean duration since onset was 25 months (range 13-48 months). The mean age of these patients was 29 years (range 19-37 years) which is certainly not the best age to perform a Total Hip Replacement. All of these patients had a large cam lesion [Figure 3] with a large extruded portion of femoral head occupying more than one third the femoral head circumference in all cases. Osteochodroplasty was

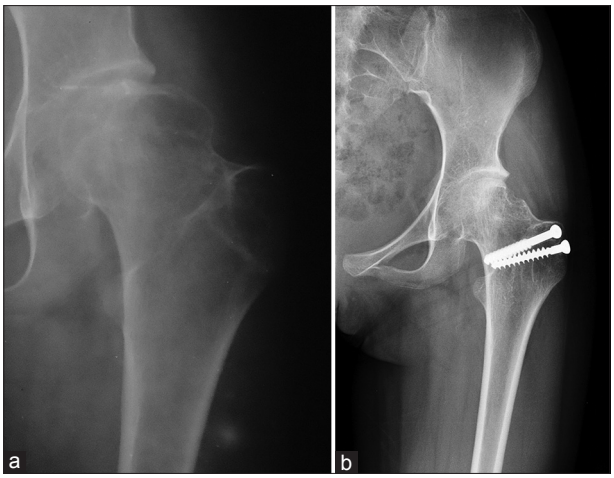

Figure 1: X-ray (L) hip joint anteroposterior view in a 14 year old following Perthes disease 4 years ago showing (a) femoral head is extruded anterolaterally with an irregular shape. There is significant pain on sitting in a low chair and on flexion-adduction-internal rotation. (b) After safe surgical dislocation, the femoral head-neck offset is restored after osteochondroplasty. There is no more impingement and hip movements have become free. Harris hip score has improved from 42 to almost 100

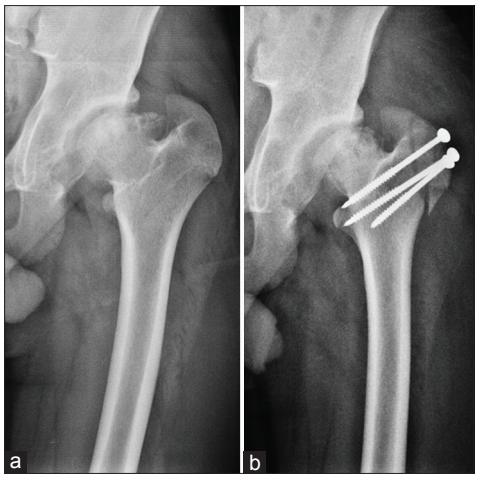

Figure 2: X-ray (L) hip joint anteroposterior view in a (a) dysplatic hip in a 16-year-old showing an extrusion of the femoral head is seen antero-laterally giving rise to pain and restricted abduction-internal rotation. (b) After trochanteric osteotomy, osteochondroplasty is performed to restore almost spherical shape and the femoral head-neck offset. Trochanter fixed with 3 screws. Minimum relative neck lengthening has been performed. Harris hip score has improved from 49 to 89

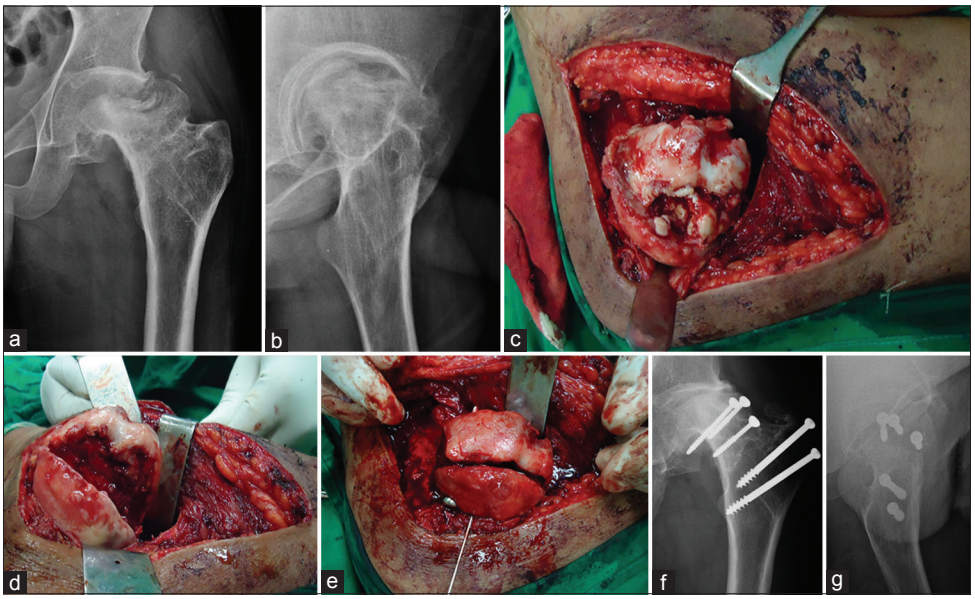

Figure 3: X-ray left hip joint anteroposterior view showing (a) severe avascular necrosis with a saddle shaped head with a large extruded chunk anterolaterally after 2 years fracture neck femur. Range of motion only 60° of flexion. Severe pain. Harris hip score is 39. (b) Lateral X-ray showing loss of sphericity and extrusion of head anteriorly. Saddle shaped depression is also seen in the centre. (c) After the safe surgical exposure, the head is dislocated with the hip in external rotation. The central depression area with severe damage is seen. The medial portion of the head and the lateral extruded portion have reasonably good cartilage cover. (d) The central depressed portion is resected as a trapezoidal wedge. Part on left is extruded portion. The inner cut edges reveal bleeding signifying intact vascularity and efficacy of the safe surgical approach in preserving blood circulation. (e) The two portions of the head are coapted, fixed with screws. Reasonable sphericity is achieved. (f) A reasonably spherical profile of the head is created. Trochanter healed without problems. Hip range of motion has increased to 90° flexion and 25° adduction and abduction each. Rotations were restored minimally after 12 months. At 2 years after surgery, Harris hip score is more than 95. No pain at all and limp is minimal. (g) Postoperative lateral X-ray shows loss of the anterior bump and a reasonably spherical shape which permits flexion to almost 110° and no impingement in adduction-internal rotation.

sufficient to restore some sphericity in 6 of the 8 patients. Two of these patients had intraarticular wedge resection osteotomies. We found that the extruded portion of the femoral head was covered with reasonably good articular cartilage as was the medial portion of the femoral head. The portion under the lateral acetabular lip was depressed with the loss of cartilage. This central portion was excised in a wedge shaped manner, and the lateral and medial ends were brought together and coapted to restore some sphericity. The two cases in our series have produced an

excellent result with HHS more than 90 after a followup of 26 and 59 months.

The improvement in the pain parameters of patients with AVN has been significant. The mean followup of patients in this subgroup has been 23.1 months (range 6–55 months). The mean difference in the HHS has been 36.88 (range 11–56.1). Only 2 of the 8 had a difference in HHS of <20. While these are certainly very early results, they are certainly promising.

We did not have access to sophisticated instrumentation like laser Doppler flowmetry[26] to check intact vascularity of the femoral head during the surgery in the dislocated state. There was active bleeding from the raw surfaces of the femoral head/neck in all of our patients. None has had any increase in pain signifying onset of secondary AVN. There have been no adverse X-ray changes at last followup. The treatment of the acetabular rim trimming and labral debridement and reattachment[17] has been done in only one of our cases and that too inadequately. We submit that the osteochondroplasty has an easier learning curve, the acetabular procedures will need more expertise to prove successful. Hence, this study has focused on our experience treating the cam impingement.

In comparison to arthroscopy[28] of the hip, surgical dislocation does not require any expensive or special instruments or operation table at all. It also allows a more comprehensive assessment of dynamic impingement conflict. It is also useful when any subtrochanteric osteotomy is contemplated, when impingement of the hip is located posterior to the retinacular vessels or when the entire acetabulum rim needs to be addressed.

The limitations of this study are the small number of patients and lesser duration of followup. However, the early results show promise and considering the mean age of patients in this group is only 28.8 years; any surgery that postpones joint replacement should be considered worth trying. Unfortunately, none of our patients has agreed to have an MRI scan postoperatively due to cost constraints as this could confirm the presence or absence of an iatrogenic loss of vascularity.[27] Peters *et al*.[29] described early results of open treatment of femoroacetabular impingement in their patients, in which 9 of their patients had a followup of <18 months.

Surgical hip dislocation offers possibility of performing intraarticular surgeries to overcome impingement and prolong the life of these hips.

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