Original article

The role of trochanteric flip osteotomy in fixation of certain acetabular fractures

Sandeep Gupta a, Jagdeep Singh b, Jagandeep Singh Virk a, * 

a Department of Orthopaedics, Government Medical College and Hospital (GMCH), Chandigarh, India
b Department of Orthopaedics, Guru Gobind Singh Medical College and Hospital (GGSMCH), Faridkot, India

A B S T R A C T

Purpose: Complete visualization of certain acetabular fractures of posterior wall or column with cranial extension involving superior dome from standard surgical exposures is a challenge. Osteotomy of the greater trochanter has been used to enhance fracture visualization, especially the dome, in posterior and lateral exposures of the acetabulum. It also decreases the need for excessive muscle retraction. The purpose of the study was to investigate the outcome associated with trochanteric flip osteotomy in the management of certain acetabulum fractures.

Methods: From January 2011 to December 2013, 25 displaced acetabular fractures were treated by open reduction and internal fixation. The fractures were managed using a Kocher–Langenbeck approach along with trochanteric flip osteotomy. At 3rd, 6th and 24th month follow-up, all patients had radiographic examination and underwent a final clinical evaluation based on the modified Merle d’Aubigne and Postel score. The strength of the abductors was assessed according to the Medical Research Council (MRC) grading system.

Results: Congruent reduction was achieved in all patients and all osteotomies healed within an average period of 3.8 months. All our patients were allowed full weight bearing at the end of 3 months and with no abductor lurch at the end of 6 months follow-up. There were no cases of avascular necrosis of femoral head. None of the patients had any neurovascular complication or infection by the end of the follow-up period.

Conclusion: Trochanteric flip osteotomy is a very effective technique to fix certain acetabular fractures especially those with dome involvement. It is more accurate and associated with no significant complications compared with conventional way.

© 2017 Daping Hospital and the Research Institute of Surgery of the Third Military Medical University. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

The Kocher–Langenbeck approach provides adequate surgical exposure and is recommended in the majority of posterior acetabular injuries and some selected fractures involving both columns. However, in certain posterior wall fractures with significant superior dome involvement, especially in obese patients, visualization of the superior portion of the acetabulum provided by this classical approach is insufficient. In order to visualize such fractures, excessive retraction can damage the abductor muscles and neurovascular structures (superior gluteal neurovascular bundle). In this condition, trochanteric osteotomy can be used to extend the exposure of the Kocher–Langenbeck approach superiorly and anteriorly. In addition, certain transverse, transverse plus posterior wall, T-type and associated posterior column plus posterior wall fracture patterns may be treated using this approach.1

However, the fear of possible complications like non-union of the osteotomy site, abductor weakness as well as extra implants for fixation, constrains the surgeons to avoid using this procedure.2,3 To overcome these problems, trochanteric flip osteotomy is a modified technique which has been described and recommended by many authors.4,5 In contrast to standard procedure, in the trochanteric flip approach, the tendinous attachments of the gluteus muscles are left intact proximally and the tendinous origin of the vastus lateralis is left intact distally, which provides a neutralizing force to that of the gluteal muscles and thereby reduces the tendency of the trochanter to migrate proximally.1,4 This study aims to report our
experience with this technique for the management of acetabular fractures.

**Materials and methods**

This is a retrospective study of prospectively collected data from January 2011 to December 2013. The study was done at the first author’s institute. The inclusion criteria was any patient with (1) posterior fracture dislocation of hip with significant posteri-osuperior wall fractures, (2) posterior column acetabular fractures or combined posterior column and wall fractures and (3) transverse fractures with posterior wall fractures.

We kept a low threshold for performing this digastric osteotomy in posterior and transverse acetabulum fractures with dome or cranial extension, with posterosuperior comminution in which we felt that direct visualization of the fracture lines would be better served.

The patients included in study were those who received operation from January 2011 to December 2013. Out of the 63 total operated acetabular fractures, 25 patients were operated on using this approach. Complete examination of all the patients with such fractures was done both clinically and radiologically including Judet views (Figs. 1 and 2) and CT scan (Fig. 3) after preliminary stabilization of patient and reduction of hip. All surgeries were performed by the single senior author.

Under suitable anesthesia, patient was placed in lateral decubitus position and Kocher—Langenbeck approach was used. In this approach fascia is incised in line with skin incision in the distal part of the incision while gluteus maximus is split in the proximal part. The trochanteric bursa was incised and reflected to expose the surface of the greater trochanter. The leg was internally rotated to view the posterior border of gluteus medius and postero-superior edge of the greater trochanter. The osteotomy site was marked with the cautery, starting proximally from the posterosuperior edge of the greater trochanter to the posterior border of the vastus lateralis ridge distally. Then, with a thin oscillating saw, osteotomy is done, with its plane in line with the direction of external rotators (Fig. 4).

The most important point to keep in mind is that the proximal part of osteotomy should start just anterior approximately 5 mm to the most posterior portion of the gluteus medius muscle. This helps to prevent the injury to the branch of medial circumflex femoral artery (MCFA). The saw should stop at the anterior cortex and the osteotomy was then used to complete the osteotomy. With this, the anterior cortex was fractured, which helps in reduction while re-attaching the trochanter. This osteotomy produces a trochanteric fragment of about 15 mm in thickness. After releasing the remaining fibers of gluteus medius from the trochanter proximally and vastus lateralis fibers from the femur distally, the fragment was then flipped anteriorly with the help of a retractor (Fig. 4). This fragment has gluteus medius attached proximally and vastus lateralis distally. After retraction, the piriformis tendon and gluteus minimus interval was identified and release of piriformis tendon along with superior, inferior gemelli and obturator internus around 1 cm away from their insertion was done. The reflection of short external rotators protects the sciatic nerve during retraction. Intraarticular visualization may be improved by anteriorly based Z-shaped capsulotomy. When a posterior wall fracture is present, the capsular pedicle to the wall fragments must be preserved. The capsulotomy was modified to incorporate the posterior wall at its margin. The wall fragments were then reflected inferiorly to assist in joint visualization. The labrum is typically intact at the anterior aspect of the wall fragment, but is avulsed at the posterior margin. Gluteus minimus is invariably badly damaged in such fractures and needs to be thoroughly debrided to prevent heterotopic ossification. Fracture was reduced by making use of reduction devices such as ball spikes, reduction clamps and provisionally reduction was held by kirschner wires (k-wires). Partially threaded cannulated screws were also used besides holding the final reduction with 3.5 mm reconstruction plates. In fractures involving both posterior column and wall fractures, the column was fixed first, followed by fixation of the wall. The osteotomy of the greater trochanter was then reattached with two or three 3.5 mm cortical screws or 4 mm cancellous screws directed towards the lesser trochanter (Fig. 5). Reduction of the osteotomy the trochanter usually glided back from the retracted position to its original position quite easily with finger manipulation itself and was provisionally held with a 2 mm K-wire before fixing definitively with screws. No drains were used. On the first postoperative day, patients were allowed for sitting, side turning and pelvic lifting exercises. Toe touch weight bearing was allowed in all patients within first week if possible. Deep vein thrombosis prophylaxis involved aspirin till stitch removal and rivaroxaban for further 4 weeks. Suture removal was done on twelfth postoperative day. Follow-up of the patients was done at 6 weeks, 3 months, 6 months, 1 year and thereafter 6 monthly for 2 years.

**Results**

From January 2011 to December 2013, 25 displaced acetabular fractures were treated by open reduction and internal fixation using this approach. The fractures were managed using a Kocher—Langenbeck approach along with trochanteric flip osteotomy. The mean age of the patients was 33.28 years (range 17–63 years) with a mean follow-up of 11.3 months (range 6–15 months).
Fifteen (60%) patients had fracture dislocation with posterosuperior acetabular wall involvement, 6 (24%) patients had posterior column fracture and 4 (16%) patients had transverse fracture associated with posterior wall fracture. Mechanism of injury in all patients was motor vehicle crash. The mean time to surgery was 4.6 days (range 1–26 days). Four (16%) patients out of 25 had marginal impaction in which bone grafting was done. Two patients had preoperative sciatic nerve involvement which fully recovered at the end of 1 year follow-up. Use of tri-cortical graft was done in 2 patients in whom posterosuperior wall was highly comminuted. Congruent reduction was achieved in all patients and all osteotomies healed within an average of 3.8 months (Fig. 6). No special intervention was carried out in cases in which delayed healing of the osteotomy was observed on follow-up radiographs. The maximum period of union was 5 months, seen only in 4 out of 25 cases. The other 21 cases achieved union in 12–16 weeks. All our patients were allowed full weight bearing at the end of 3 months with no abductor lurch at the end of 6 months follow-up. There were no cases of avascular necrosis (AVN) at the end of the follow-up period of 1 year. To specifically observe for any sign of AVN, patients undergoing fixation of acetabular fracture with trochanteric flip osteotomy were further followed up till the end of 2 years. None of the patient had hip pain or radiological features suggestive of AVN at the last follow-up. Clinical evaluation was based on the modified Merle d’Aubigne and Postel score. The hip function and score was assessed using this method which included 3 parameters: pain, mobility and ability to walk. Clinical scoring was excellent in 16 cases, good in 6 cases and fair in 2 cases. The strength of the abductors assessed according to the Medical Research Council (MRC) grading was grade 5/5 in 16 patients, 4/5 in 6 patients and 3/
5 in 2 patients at the end of 1 year follow-up. As for complications, 1 patient had postoperative sciatic nerve palsy which recovered by the end of follow-up. One patient had postoperative infection which was fully controlled by debridement. Only in two patients, Brooker’s class 1 heterotopic ossification was seen. No patient had trochanteric pain or symptoms suggestive of trochanteric bursitis at the end of the follow-up period.

Discussion

Improved visualization is the most important benefit and indication for trochanteric osteotomy. In trochanteric slide approach, the tendinous attachments of the gluteus muscles are left intact proximally and the tendinous origin of the vastus lateralis is left intact distally.1,4,5 This provides an advantage of limiting trochanteric migration to reduce nonunion and creates additional trochanteric stability to enhance osseous union. Our results were generally favorable which is well supported in previous literature.

A rare but major concern in trochanteric flip osteotomy which has been stressed in literature is trochanteric nonunion which leads to migration of trochanter and impaired abductor function.9,10 In a study of 213 cases, only 3 cases of failure of trochanteric fixation were reported.11 Another study showed one case of nonunion and two cases of avulsion of trochanter and migration.1 A study of 10 patients showed no nonunion or upward migration of greater trochanter. Although one study found heterotopic ossification in 6 out of 10 patients, none of them were clinically significant.12 Ebraheim and Wong13 reported satisfactory clinical results with this technique for five cases of acetabular fractures and total hip replacements. In our study all osteotomies healed uneventfully. All trochanters were radiographically and clinically united at 3.8 months after surgery. The rate of nerve palsies in acetabular fractures is about 16% and this incidence increases to 40% when a posterior wall fracture is present.14 Iatrogenic nerve palsy acetabular fracture exposure, it also offers advantages like preservation of abductor strength, reliable healing of the sciatic nerve, and comparing the results with other approaches.

In conclusion, we conclude that the trochanteric osteotomy is a very effective technique to fix certain acetabular fractures especially with dome involvement. It is a precise surgery without associated significant complications. Besides enhanced surgical and fracture exposure, it also offers advantages like preservation of abductor strength, reliable healing of the flip osteotomy and no additional risk of damaging the vascularity of femoral head.

References

1. Siebenrock KA, Gautier E, Ziran BH, et al. Trochanteric flip osteotomy for cranial extension and muscle protection in acetabular fracture fixation using a Kocher-Langenbeck approach. J Orthop Trauma. 2006;20:552–556.
2. Ritter MA, Eizember LE, Keating EM, et al. Trochanteric fixation by cable grip in hip replacement. J Bone Jt Surg Br. 1991;73:580–581.
3. Koyama K, Higuchi F, Kubo M, et al. Reattachment of the greater trochanter using the Dall-Miles cable grip system in revision hip arthroplasty. J Orthop Sci. 2001;6:22–27.
4. Siebenrock KA, Gautier E, Woo AK, et al. Surgical dislocation of the femoral head for joint debridement and accurate reduction of fractures of the acetabulum. J Orthop Trauma. 2002;16:543–552.
5. Ganz R, Gill TJ, Gautier E, et al. Surgical dislocation of the adult hip: a technique with full access to the femoral head and acetabulum without the risk of avascular necrosis. J Bone Jt Surg Br. 2001;83:1119–1124.
6. Brooker AF, Bowerman JW, Robinson RA, et al. Ectopic ossification following total hip replacement: incidence and a method of classification. J Bone Jt Surg Am. 1973;55:1629–1632.
7. Bray TJ, Esser M, Fullerson L. Osteotomy of the trochanter in open reduction and internal fixation of acetabular fractures. J Bone Jt Surg Am. 1987;69:711–717.
8. Ebraheim NA, Patil V, Liu J, et al. Sliding trochanteric osteotomy in acetabular fractures: a review of 30 cases. Injury. 2007;38:1177–1182.
9. Glassman AH. Complications of trochanteric osteotomy. Orthop Clin North Am. 1992;23:321–333.
10. Parker HG,Wieeman HG, Ewald FC, et al. Comparison of preoperative, intraoperative and early postoperative total hip replacement with and without trochanteric osteotomy. Clin Orthop Relat Res. 1976;121:44–49.
11. Hadjicostas PT, Thielemann FW. The use of trochanteric slide osteotomy in the treatment of displaced acetabular fractures. Injury. 2008;39:907–913.
12. Ebraheim N, Wong FY. Sliding osteotomy of the greater trochanter. *Am J Orthop (Belle Mead NJ)*. 1997;26:212–215.

13. Giannoudis PV, Grotz MR, Papakostidis C, et al. Operative treatment of displaced fractures of the acetabulum. A meta-analysis. *J Bone Joint Surg Br*. 2005;87:2–9.

14. Petsatodis G, Antonarakos P, Chalidis B, et al. Surgically treated acetabular fractures via a single posterior approach with a follow-up of 2–10 years. *Injury*. 2007;38:334–343.

15. Kaempffe FA, Bone LB, Border JR. Open reduction and internal fixation of acetabular fractures: heterotopic ossification and other complications of treatment. *J Orthop Trauma*. 1991;5:439–445.

16. Heck BE, Ebraheim NA, Foetisch C. Direct complications of trochanteric osteotomy in open reduction and internal fixation of acetabular fractures. *Am J Orthop (Belle Mead NJ)*. 1997;26:124–128.

17. Triantaphillopoulos PG, Panagiotopoulos EC, Mousafiris C, et al. Long-term results in surgically treated acetabular fractures through the posterior approaches. *J Trauma*. 2007;62:378–382.

18. Naranje S, Shamshery P, Yadav CS, et al. Digastric trochanteric flip osteotomy and surgical dislocation of hip in the management of acetabular fractures. *Arch Orthop Trauma Surg*. 2010;130:93–101.