A New Periacetabular Osteotomy for the Treatment of Hip Dysplasias

Technique and Preliminary Results

REINHOLD GANZ, M.D.,* KAJ KLAUE, M.D.,** THO SON VINH, M.D., PH.D.,† AND JEFFREY W. MAST, M.D.‡

A new periacetabular osteotomy of the pelvis has been used for the treatment of residual hip dysplasias in adolescents and adults. The identification of the joint capsule is performed through a Smith-Petersen approach, which also permits all osteotomies to be performed about the acetabulum. This osteotomy does not change the diameter of the true pelvis, but allows an extensive acetabular reorientation including medial and lateral displacement. Preparations and injections of the vessels of the hip joint on cadavers have shown that the osteotomized fragment perfusion after correction is sufficient. Because the posterior pillar stays mechanically intact the acetabular fragment can be stabilized sufficiently using two screws. This stability allows patients to partially bear weight after osteotomy without immobilization. Since 1984, 75 periacetabular osteotomies of the hip have been performed. The corrections are 31° for the vertical center-edge (VCE) angle of Wiberg and 26° for the corresponding angle of Lequesne and de Seze in the sagittal plane. Complications have included two intraarticular osteotomies, a femoral nerve palsy that resolved, one nonunion, and ectopic bone formation in four patients prior to the prophylactic use of indomethacin. Thirteen patients required screw removal. There was no evidence of vascular impairment of the osteotomized fragment.

* Professor and Chairman, Department of Orthopaedic Surgery, University of Berne, Switzerland.

** Resident, Department of Orthopaedic Surgery, University of Berne, Switzerland.

† Assistant Professor, Laboratory of Anatomy, and staff member, Department of Orthopaedic Surgery, Hopital Cochin, Paris, France.

‡ Associate Clinical Professor, Department of Orthopaedic Surgery, College of Medicine, University of South Florida, Tampa, Florida.

Reprint requests to Reinhold Ganz, M.D., Department of Orthopaedic Surgery, University of Berne, Inselspital, 3010 Bern, Switzerland.

Received: January 20, 1988.

Reorientation of the dysplastic acetabulum can be achieved with a simple innominate osteotomy such as that described by Salter.[19] While this may be beneficial in children, it is usually insufficient in more severe adolescent or adult dysplasias. Several methods have been proposed in order to obtain more complete correction in older age groups.

LeCoeur[13] was the first to publish a technique for triple osteotomy of the pelvis. His method divides the pubis and the ischium close to the symphysis pubis, and thus this osteotomy is not strictly "periacetabular." Improvements in coverage with this osteotomy are limited by the size of the fragment, the attached muscles, and the ligamentous connections to the sacrum. Satisfactory correction results in notable asymmetry of the pelvis.

The technique of Sutherland and Greenfield[22] is similar to LeCoeur's, but differs in that they cut the pelvic bone close to the symphysis pubis. For this reason it is called a double osteotomy. One year after LeCoeur, Hopf[8] published a technique that allowed all three osteotomies to be performed through a

Smith-Petersen approach. For more cephalad dislocations Hopf recommended a double osteotomy variant through the floor of the true acetabulum. Steel's osteotomy[21] differs from Hopf's in that it is somewhat removed from the acetabulum and is performed through three separate incisions.

Correction has been significantly increased by the juxtaarticular triple osteotomy of Tönnis.[23] This technique avoids the sacropelvic ligaments, which usually limit the mobility of the osteotomized fragment. A similar technique was proposed by Carlioz *et al.*[2] These latter osteotomies may result in a defect between the osteotomized fragment and the ischium if major corrections are performed. They require special efforts for stabilization such as plaster.

Wagner,[25,26] Eppright,[6] and Ninomiya and Tagawa[17] described the so-called dial or spherical osteotomy. These osteotomies provide good lateral and anterior coverage, but are not optimal in regard to the correction of anteversion and mediolateral displacement. By leaving the teardrop in its original position, they become intraarticular osteotomies and may deprive the acetabular fragment of its blood supply except for that coming from the capsule.

Faced with the difficulties of the previous techniques, the authors developed a new periacetabular osteotomy in 1983 based on a series of osteotomies on bone models in addition to operations on cadaveric specimens. The advantages are summarized as follows: (1) one approach is used; (2) a large correction can be obtained in all directions including the medial and lateral planes; (3) blood supply to the acetabulum is preserved; (4) the posterior column of the hemipelvis remains mechanically intact, allowing immediate crutch walking with minimal internal fixation and *without* the use of external fixation; and (5) the shape of the true pelvis is unaltered, permitting normal child delivery, a factor of importance in that many patients with these dysplasias are young women.

PREOPERATIVE EVALUATION

Roentgenographic analysis of the hip to be treated includes an anteroposterior (AP) view of the pelvis and a false profile (*faux profil* of Lequesne and deSeze[15]), which is used to determine the anterior coverage of the femoral head. An additional AP view of the hip to be osteotomized, with the leg in abduction, has been found to be useful in demonstrating the optimal relationship between the femoral head and acetabulum. Preoperative planning is much more precise with a three-dimensional imaging technique derived from computed tomography (CT) data.[11] It allows movement of femoral head cartilage relative to the cartilage of the acetabulum, thereby determining the real angular corrections of the acetabulum and, if needed, the proximal femur.

INDICATIONS

Indications for this periacetabular osteotomy are in adolescent or adult dysplastic hips that require correction of congruency and containment. Proximal femoral osteotomies rarely provide comparable corrections and therefore are more often considered as adjuncts to periacetabular osteotomies rather than as an alternatives to them. While the shelf arthroplasty[12,20] and the Chiari osteotomy[3] may be useful for well-reduced hips that lack only coverage, the authors still use this method because it provides a more anatomic reconstruction. The upper age limit is difficult to determine in this type of osteotomy, but the oldest patient in this series was 56 years of age. The patient suddenly started to suffer from severe pain of her dysplastic hip, but roentgenograms showed minimal arthritic changes. An avulsed labrum was identified intraoperatively. Labrum avulsion has also been documented in 16 other dysplastic hips; the significance of such a finding will be discussed later in a separate paper.

The indications for this type of osteotomy expand as the authors gain experience. Early results are encouraging in treatment of coxarthrosis in young adults who have superolateral roentgenographic changes. The advantage of the periacetabular osteotomy over intertrochanteric osteotomy is that it avoids changes in the proximal femur that may have significance if these patients must have future hip arthroplasty.

OPERATIVE TECHNIQUE

The patient is positioned supine on the operating table. The entire lower extremity is prepared so that the leg can be manipulated during the procedure.

EXPOSURE

A Smith-Petersen approach is used. The fascia of the tensor fascia lata is incised laterally to protect the lateral femoral cutaneous nerve. The tensor is detached subperiosteally from the ilium up to the tubercle of the gluteus medius. This exposes the anterosuperior aspect of the joint capsule. Cranially, the capsule is freed from the attachments of the gluteus minimus. The greater sciatic notch, although not visible, can be palpated with a blunt Hohmann retractor. The superior margin of the capsule must be visible. The posterior part of the capsule and the transition to the bony posterior rim should be palpable. This part of the dissection is done with the hip in extension and in slight abduction.

The anteroinferior parts of the capsule and the pubis are exposed with the hip in slight flexion and adduction. The iliacus and sartorius muscles are elevated subperiosteally from the anterosuperior iliac spine and from the iliac wing. The reflected tendon of the rectus femoris is divided, and its direct tendon is detached from the anteroinferior iliac spine. The fibers of the iliacus muscle that insert on the anterior capsule are dissected off the capsule until the tendon of the psoas is exposed and the corpus of the pubis is visible beyond the iliopectineal line. Dissection in the space between the psoas tendon and the distal joint capsule is the last step of the exposure. This permits the tip of the scissors to reach the body of the os ischium distal to the posterior and inferior rim of the acetabulum at the so-called infracotyloid groove. This region can be palpated but is not seen. Dissection on cadavers has shown that the obturator vessels are not in jeopardy medially and that the medial circumflex artery is not compromised posterolaterally if the dissection follows these anatomic guidelines.

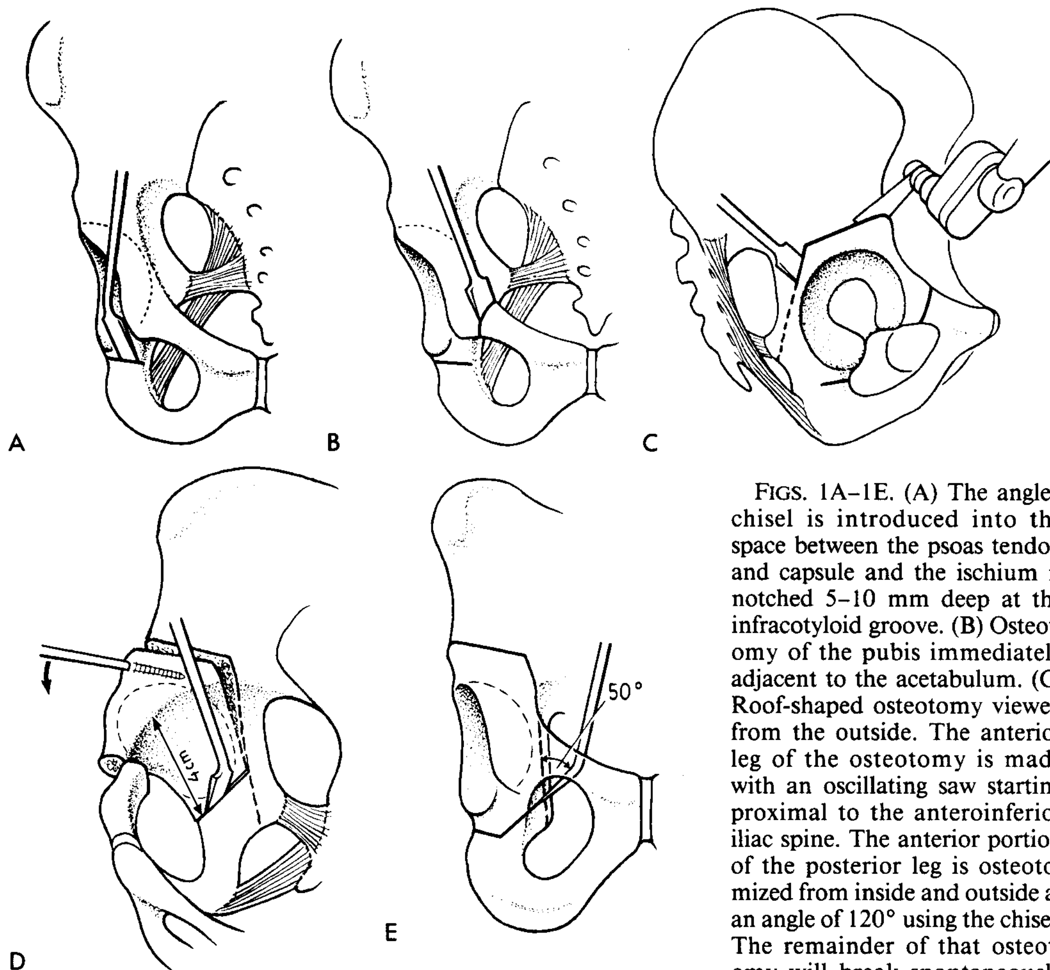
SEQUENCE OF THE OSTEOTOMIES

A special osteotome is needed that has a 15-mm blade that is at a 30° angle to the shaft of the instrument (Fig. 1A). This modification is possible on any standard 15-mm chisel.

The first step of the triple osteotomy is to score the body of the ischium (Fig. 1A). With the hip flexed, the osteotome is introduced into the space between distal joint capsule and psoas tendon. A rasp serves as a guide to slide the chisel into place. The bone is palpated with the rasp immediately adjacent to the posterior border of the acetabulum. The blade is then hammered 5–10 mm into the bone *without* attempting to break it. The correct position of the osteotome can be verified with the image intensifier. This will ensure that the last osteotomy, that of the quadrilateral surface, will not exit into the tuberosity of the ischium, but rather will exit into the infracotyloid groove.

The second step is the division of the pubic ramus from the acetabulum (Fig. 1B). The hip is slightly flexed and adducted and the iliopsoas and femoral neurovascular structures are protected with a retractor that is driven into the pubic ramus. After subperiosteal dissection the soft tissues and the obturator nerve, which lies directly under the bone, are protected by two blunt retractors. A transverse osteotomy of the pubis immediately adjacent to the acetabulum is performed with an osteotome.

The third step is the supraacetabular portion of the osteotomy. It is performed in two steps and is started by scoring the inside as well as the outside of the ilium with a osteotome (Fig. 1C). The leg is extended and slightly abducted for the outside cut and slightly flexed for the inside osteotomy. The anterior leg of the roof-shaped osteotomy is similar to Salter's innominate osteotomy,[19] but extends posteriorly barely beyond the capsular margin and remains about 1 cm away from the pelvic brim on the inside. The osteotomy is started proximal to the anteroinferior iliac spine to allow the solid fixation of a Schanz screw in the acetabular fragment. The actual osteotomy along the scored line is done with an oscillating saw. The first 15 mm of the posterior leg of the osteotomy is also marked with the osteotome on the inner and outer table of the pelvis. It aims at the ischial spine and therefore forms an angle of 110°–120° with the anterior leg of the osteotomy. The cut is performed with an osteotome, and only the first 15 mm needs to be osteotomized. The remaining pelvis (dotted line in Fig. 1C) will break spontaneously toward the ischial spine without breaking into the joint or sciatic notch. The correct position of the osteotome is verified visually but can also

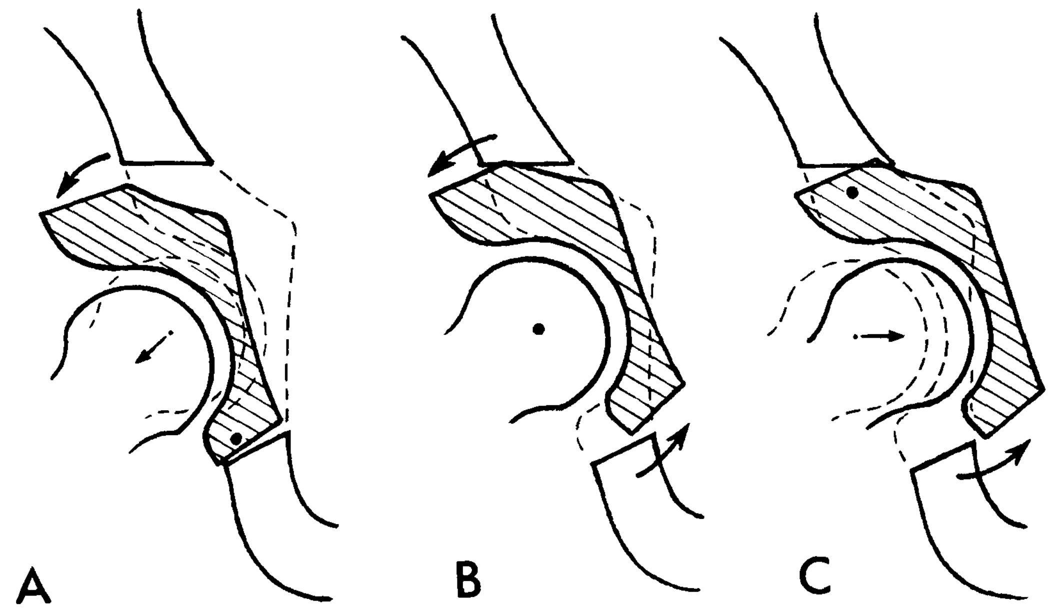


FIGS. 1A–1E. (A) The angled chisel is introduced into the space between the psoas tendon and capsule and the ischium is notched 5–10 mm deep at the infracotyloid groove. (B) Osteotomy of the pubis immediately adjacent to the acetabulum. (C) Roof-shaped osteotomy viewed from the outside. The anterior leg of the osteotomy is made with an oscillating saw starting proximal to the anteroinferior iliac spine. The anterior portion of the posterior leg is osteotomized from inside and outside at an angle of 120° using the chisel. The remainder of that osteotomy will break spontaneously toward the ischial spine (dotted line). (D) Introduction of a Schanz screw into the supraacetabular bone tilts the fragment laterally. Osteotomy of the ischium from the quadrilateral surface is done with the angled chisel 4 cm below the well-visualized pelvic brim. The dorsal pillar and sacropelvic connections remain intact. (E) Using a distance of 4 cm from the pelvic brim, a 50° angle between the blade of the chisel and the quadrilateral surface will result in an osteotomy posterior to the acetabulum.

be checked with the image intensifier. The acetabular fragment is now attached only to the ischium.

Before the fourth osteotomy is performed, a Schanz screw is driven into the supraacetabular bone without entering the hip joint. The Schanz screw is used to lever the acetabulum as in the Salter osteotomy (Fig. 1D). After elevating the tight connective tissue with a rasp, the quadrilateral surface can be visualized to the obturator foramen. The osteotome is applied 4 cm below the well-visualized pelvic brim and oriented 50° to the quadrilateral surface (Fig. 1E). This distance and angular orientation are based on the results of cadaveric experiments in the normal pelvis, but the correct position can be verified by image intensification. The entire length of the osteotomy requires two or three chisel-widths until, under the tension exerted through the Schanz screw, the fracture line extends into the scored infracotyloid groove that was made in the first incomplete cut. Subsequently, the acetabular fragment breaks loose and can be reoriented.

The surgeon positions the acetabular fragment by levering the fragment with a Schanz screw. It is



FIGS. 2A–2C. Effect of the location of the center of adduction–rotation on mediolateral displacement of the acetabular fragment. (A) A distal center of rotation with a proximally easily visible correction results in biomechanically undesirable lateral displacement. (B) If the fragment is rotated around the center of the head, there is neither medial nor lateral displacement. (C) Proximal location of the center of rotation results in a medial displacement of the femoral head and a barely visible displacement of the supraacetabular osteotomy lines. The medial displacement may be beneficial and intentionally desirable intraoperatively.

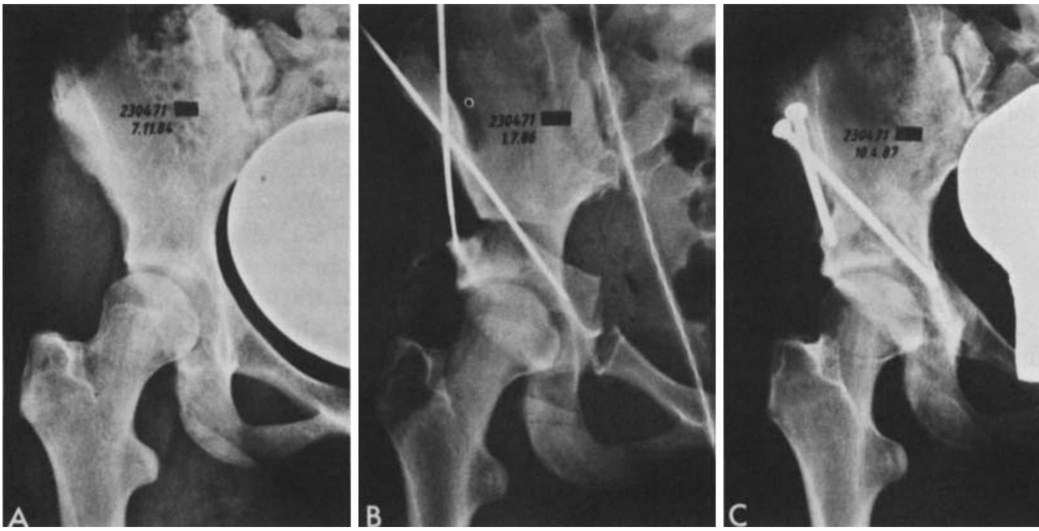
important to avoid lateralizing the acetabular fragment because dysplastic hips have an inherent lateral displacement (Fig. 2A). Rotation around the center of the femoral head is often sufficient (Fig. 2B), but sometimes the fragment must be rotated around a more proximal axis (Fig. 2C) to allow medial displacement of the acetabulum.

After preliminary fixation of the fragment with Kirschner wires, motion of the hip, especially flexion and rotation, is tested and if necessary improved by correction of the position of the acetabulum. An intraoperative roentgenogram of the pelvis is always taken. In severe dysplasias one should not uncover the posterior part of the head. If clinical and roentgenographic intraoperative verification of the correction is satisfactory, the acetabular fragment is fixed with two cortical screws. The acetabular fragment is then trimmed and the resected bone can be interposed at different sites along the osteotomy (Fig. 3). Origins of the rectus, sartorius, and tensor fascia lata muscles are reinserted through bone. Suction drains are placed posterosuperiorly to the capsule, in the true pelvis, and anteroinferiorly to the capsule.

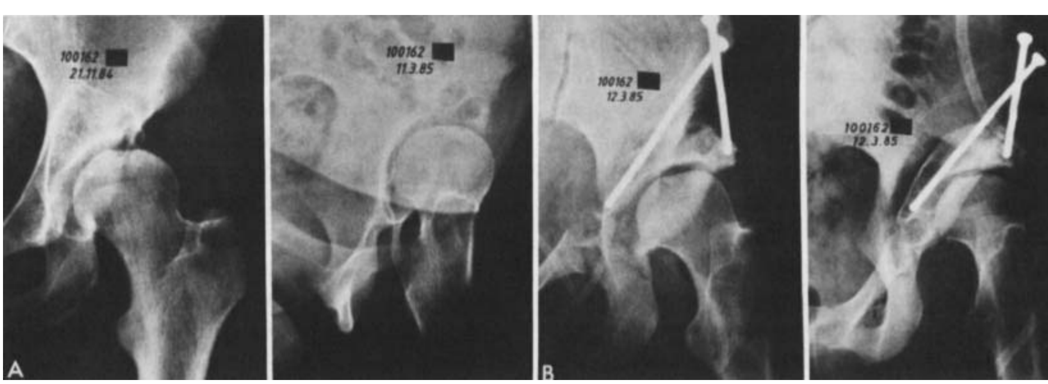
Postoperative roentgenographic documentation consists of an AP roentgenogram of the pelvis with the leg in neutral position and rotation. This allows observation of the superolateral coverage of the femoral head, the horizontal position of the sclerotic acetabular roof, the position of the fossa acetabuli relative to the weight-bearing area, the amount of cranial displacement of the teardrop, and finally, the shape of Shenton's line and hence the correct mediolateral position of the femur. Oblique views show that the posterior column is mechanically intact and that the osteotomies are extraarticular (Fig. 4). A false profile will verify the resultant anterior coverage of the femoral head as soon as the patient can stand.

AFTERCARE

The hip is placed in neutral position in a soft splint. From the first day indomethacin is given at a dosage of 25 mg three times per day to prevent ectopic bone formation. The suction drains are removed after 48 hours. The patient is out of bed on the third postoperative day, when crutch walking with partial weight bearing (10 kg) is begun. Active movements that could jeopardize the rein-



FIGS. 3A–3C. (A) This AP view of a 13-year-old girl with hip pain shows mild dysplasia; Shenton's line is interrupted. Computed tomography (CT) evaluation showed a predominantly anterior deficiency with a total cartilage coverage of 58% (normal, 70%[11]) of the head. (B) Intraoperative verification of the correction hold by threaded Kirschner wires. The teardrop has migrated cranially and the femoral head is slightly medialized. Shenton's line has been restored, the ilioischial line is in continuity, and the dorsal pillar is intact. The K-wires are replaced by cortical screws and trimming of the acetabular fragment. (C) The acetabulum has healed and shows normal bone structure nine months postoperation. Femoral head coverage is 73% on CT.



FIGS. 4A–4C. (A) This 22-year-old woman had marked dysplasia with acetabular cyst and corresponding femoral head defect: VCE angle is 6° (*left*), VCA angle in the false profile (*right*) is 5°. (B) In the postoperative roentgenograms the acetabulum covers the femoral head defect (*left*). In the alar view (*right*) the dorsal pillar with the rotated acetabular fragment is intact. (C) Two years after surgery the VCE angle is 32° (*left*) and the VCA, 40°. Flexion is limited to 90° due to ectopic ossification near the origin of the rectus femoris (*right*).

sertion of the musculature are discouraged for six weeks. After eight to ten weeks, bony healing is verified roentgenographically and is usually sufficient to allow walking with a cane. The cane is used until the abductors are strong enough to stabilize the hip (disappearance of Trendelenburg's sign).

PRELIMINARY CLINICAL EXPERIENCE

Between April 1984 and December 1987 the authors performed 75 periacetabular osteotomies. Twelve patients had bilateral procedures, with an interval between the operations ranging from two weeks to one year. Twenty-three hips had been operated on previously (range, one to four surgeries). Three patients had previous shelf procedures, all of which were unsuccessful. The periacetabular osteotomy was combined with an intertrochanteric osteotomy 16 times during the same operative session (Fig. 5). An intertrochanteric osteotomy was performed at a later date in two cases.

The age of patients averaged 29 years (range, 12–56 years). The ratio of female to male patients was three to one. The majority of the surgeries (n = 52) were performed for classical hip dysplasia. The extent of dysplasia ranged from deficits of anterior coverage with a stable femoral head to severe, chronic subluxation of the hip. A significant secondary osteoarthritis was present in 18 of these cases at the time of operation. Six operations were in patients with spina bifida or cerebral palsy. There were two cases of dysplasia caused by proximal femoral focal deficiency (PFFD). One patient developed dysplastic changes after a posttraumatic, premature closure of the acetabular growth plate. Four patients with superolateral osteoarthritis were treated by this osteotomy.

A detailed analysis of the anatomic and clinical results is beyond the scope of this article: the patient material is heterogeneous, and few comparable cases have an adequate follow-up period. The amount of anatomic correction was related to the degree of preoperative dysplasia and varied considerably from patient to patient. The VCE angle of Wiberg[27] was between −28° and +25° before surgery and was improved from 9° to 53° (average, 31°). The corresponding angle in the sagittal plane (vertical center anterior edge [VCA]) angle of Lequesne and de Seze[15] was between −21° and +18° and was improved by an average of 26° (range, 15°–35°). All patients were followed according to a prospective protocol; clinical correlation with the anatomic correction will be reported at a later date.

It is important to report on the difficulties and complications that have been encountered with this procedure. Operation time has been decreased from five hours in the first case to an average of 2½ hours. Blood loss in the early part of the series was as much as 3000 cc, but the last ten patients lost an average of 800 cc. All clinically significant complications occurred during the first 18 operations. The most serious complication involved two cases of intraarticular osteotomy. In one case, in a cerebral palsy patient, the osteotomy crossed the posteroinferior joint. Despite a pain-free hip, the mobility has been reduced by roughly 50% as compared with the opposite side, which was also treated by pelvic osteotomy. The other case involved a severe subluxation with the femoral head in a false acetabulum. The osteotomy crossed the fossa acetabuli similar to the double osteotomy as described by Hopf.[8] In addition, the excessive adduction of the acetabular fragment resulted in protrusio of the femoral head. This 38-year-old patient ultimately required total hip arthroplasty.

Excessive lateral displacement of the acetabular fragment occurred in one case of severe subluxation: the angular reorientation was correct but excessive lateral displacement impeded the function of the hip abductor muscles. At reoperation the acetabular fragment was relocated correctly. This reoperation was complicated by a transient femoral nerve palsy. Aside from the relatively frequent dysesthesias of the lateral

FIGS. 5A–5C. This 37-year-old woman had marked acetabular dysplasia, three previous operations, and walked with a cane. (A) A shelf procedure done at age 32 years (*left*) had to be revised one year after operation because of severe pain. The false profile (*right*) documents the increase in instability after removal of the shelf. (B) Adduction–extension osteotomy of the proximal femur at age 34 years was done to improve containment. A one-leg stance AP roentgenogram of the pelvis (*upper*) documents the severe insufficiency of the abductors and the subluxation of the femoral head. The intraoperative AP view of the pelvis after periacetabular osteotomy (*middle*) shows the femur adducted and flexed to determine the amount of abduction–extension to be performed with an intertrochanteric osteotomy. The postoperative (*lower*) roentgenogram was taken after one-stage periacetabular and intertrochanteric osteotomy. (C) Thirty months after the last surgery, the patient walks with a mild limp and without a cane. Good coverage and containment is seen in both the AP (*left*) and lateral (*right*) projections.

femoral cutaneous nerve, this was the only significant neurological complication in this series.

Resubluxation occurred twice. The first case involved an initially well-corrected acetabulum in a cerebral palsy patient. Within one year the femoral head resubluxated with the formation of a false acetabulum. The second case involved the correction of a very small acetabulum of a patient with Ehlers–Danlos syndrome who had previously been treated by two open reductions and one intertrochanteric osteotomy. After a satisfactory initial course, the femoral head dislocated posteriorly where acetabular coverage was insufficient. The patient's family refused further surgical intervention. At the time of an unrelated subtrochanteric fracture in this patient two years later, both problems were solved by fixation with one plate achieving union of the fracture and fusion of hip joint.

Noncompliance and early, full weight bearing led to a roentgenographically documented, secondary overcorrection in two cases. This has not been accompanied by clinical symptoms in either case.

Delayed union of osteotomy sites occurred twice, once in the ischium and once in the pubis. The only nonunion at the pubis was observed in an extreme correction; consolidation *did not* occur despite autogeneic bone grafting.

Ectopic bone formation limited flexion to 90° in four patients (Fig. 4). Resection of an ectopic bone fragment restored near-normal function in one of these patients. Because prophylaxis was started with indomethacin,[18] this complication has not been observed. Implant removal has become necessary in 13 cases because of pressure problems at the iliac crest. The screws were removed under local anesthesia on an outpatient basis.

DISCUSSION

This new periacetabular osteotomy is technically demanding and requires careful three-dimensional planning. Practice on models and on cadavers is recommended before undertaking this procedure. The osteotomy of the ischium from the quadrilateral surface requires a precise knowledge of the morphology of the pelvis.

The risk of injury to the sciatic nerve is small because the dorsal pillar remains intact, protecting the nerve. The femoral nerve can also be easily protected because it lies anterior to the iliacus muscle and is retracted at the time of the pubic osteotomy. The only case of transient femoral paresis occurred after a revision and was most likely due to traction on the scarred iliopsoas muscle. The obturator nerve must be carefully protected at the level of its passage through the obturator foramen. It lies just on the inferior aspect of the pubic ramus immediately adjacent to the bone at the level of the osteotomy and cannot be moved out of the way. In this series there has not been an injury to this nerve.

Lesions of major vessels are unlikely if the operative technique is followed carefully. The obturator artery and vein may be in danger if the pubic osteotomy is performed without adequate protection of the soft tissues by the described retractors or if the anatomic space between inferior joint capsule and psoas tendon is dissected too far medially. A more theoretic consideration is the possibility of injury to the medial circumflex femoral artery. This artery lies distal and posterior to the psoas tendon. Bleeding from a relatively large intraosseous artery after the supraacetabular osteotomy has been frequently observed and occasionally has required hemostasis with bone wax.

The vascular supply of the acetabular fragment is sufficient for perfusion following this periacetabular osteotomy. This has been verified in 20 cadaveric specimens using injection studies and preosteotomy and postosteotomy dissection of the respective vessels. Postoperative healing of the osteotomies suggest adequate vascularization because the acetabular fragment is usually incorporated by the eighth postoperative week. Neither conventional roentgenographic studies nor bone scans in 12 cases (not randomly selected) so far have suggested any vascular problems in the acetabular fragment.

Intraoperative roentgenographic control is mandatory because the anatomic landmarks cannot be used as well as with intertrochanteric osteotomies. A perfect AP view of the pelvis is indispensable because a roentgenogram of only the osteotomized hip would not permit verification of optimal abduction, adduction, or medial or lateral position of the acetabulum. The pelvis must not be oblique. The authors' errors with lateral displacement are related to the neglect of these precautions and could have been avoided by a correct intraoperative roentgenogram with the legs well-aligned with respect to rotation, abduction, and adduction.

The authors have been impressed with the number of recently described labrum tears[5] associated with hip dysplasia. This was observed in 20% of the authors' cases; the clinical entity will be reported separately. The authors are not certain whether it is preferable to resect or to reattach such a torn labrum.

The stabilization of the osteotomy with two screws has proven to be adequate fixation. Only in four large corrections was it necessary to add a third, more horizontal screw. The experience with two secondary overcorrections that were due to early, full weight bearing have led the authors to prescribe partial (10 kg) weight bearing. The three delayed unions are not related to imperfect stabilization of the fragments but rather to relatively large gaps between the fragments created by larger corrections.

The analysis of the two most severe complications reveals that these two intraarticular osteotomies occurred in high subluxations. In one case the angled chisel was not yet available, so the ischial osteotomy was started too anteriorly and finished intraarticularly. In the second case the space between the inferior capsule and psoas tendon (and hence, inferior joint border) was inadequately identified. The concomitant overcorrection of the acetabulum led to protrusion of the femoral head.

Ectopic calcification and ossification is a complication especially in the region of the origin of the rectus femoris and between rectus and tensor fascia lata. This results in compromised hip flexion, which was painful in one case of nonunion of the ectopic fragment. Since the authors have started to reinsert the origins of the muscles transosseously with nonabsorbable sutures and routinely administer indomethacin as prophylaxis,[18] no clinically relevant ectopic bone formation has been observed. The incorporation of the acetabular fragment has been unaffected.

There is little doubt that this periacetabular osteotomy can achieve more correction than the additive techniques such as supra-acetabular shelf arthroplasties[12,20] or Chiari osteotomies.[3] In cases of severe dysplasia the theoretically optimal correction can be obtained and in cases of favorable initial morphology, normal anatomic relationships can be restored. However, a long-term follow-up study is required to determine whether the results in dysplastic hips with centered fermoral heads are superior to the favorable results reported for shelf[4,9,16] and Chiari[1,7,10,12] operations, both of which are technically less demanding.

The periacetabular osteotomy offers more advantages than the techniques of triple osteotomies that are performed further from the periacetabular region; a greater correction is achieved, and there is less distortion of the pelvic symmetry. The osteotomies of Tönnis[23] and of Carlioz *et al.*[2] are conceptually comparable with this periacetabular osteotomy and its correction potential. Encouraging results have been published for the former.[24] The disadvantages are the need for a postoperative hip spica and the need to change the position of the patient on the table. They can also be performed when the triradiate cartilage is open, whereas this periacetabular osteotomy would injure this physis in the acetabulum. Excellent results have also been published with the spherical osteotomy,[25] which appears even more technically demanding. There are some concerns regarding the vascularity of the fragment, although vascular compromise has not been observed in this series as it was after Hopf's double osteotomy,[14] which separates the acetabular fragment from the acetabular artery.

The periacetabular osteotomy presented here can, with careful planning and execution, be used to obtain more satisfactory and more anatomic correction of hip dysplasias.

ACKNOWLEDGMENT

The authors gratefully acknowledge the help of Christian Gerber, M.D., Department of Orthopaedic Surgery, University of Berne, Switzerland and L. Scott Levin, M.D., Division of Orthopaedic Surgery, Duke University, Medical Center, Durham, North Carolina in the preparation of the English manuscript.

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