Curved periacetabular osteotomy for the dysplastic hip: cadaveric and radiological analyses of safe procedures

Abstract Curved periacetabular osteotomy is a modified Ganz’s procedure and requires an intrapelvic osteotomy. In order to establish the osteotomy line and the chisel inserting angles during the procedure, 32 cadavers and 28 three-dimensional computed tomosgraphs were utilized. The guide-points for the osteotomy line were obtained from the cadaveric analysis and the inserting angles of the chisel were measured from the radiological analysis. On the supra-acetabular portion, the C-shaped osteotomy line, starting from the proximal end of the anteroinferior iliac spine, should pass above the intersection point of the arcuate line and the line passing from the proximal end of the anteroinferior iliac spine to that of the ischial spine, and the chisel inserting angle should be 17° to the anterior surface of the ilium. On the quadrilateral surface, the C-shaped line should locate one finger width anterior to the greater sciatic notch, and the chisel inserting angle should be 25° to the quadrilateral surface. On the anterior aspect of the ischium, the chisel should advance with an inserting angle of 60° to the ground at the level of one finger width below the distal joint edge.

Key words Cadaveric analysis • Curved periacetabular osteotomy • Radiological analysis

Introduction

Curved periacetabular osteotomy, a modified Bernese periacetabular osteotomy described by Ganz et al. [1], has been performed on over 200 patients in our institution since 1997 [2–5]. There are several advantages to this particular pelvic osteotomy. First, the cut line is curved, enabling smooth acetabular reorientation. Second, the gluteus muscles are not stripped from the iliac bone, thus preserving the blood supply to the acetabular fragment. Furthermore, the skin incision of this osteotomy is relatively small, and can be concealed by ordinary underwear, which is advantageous because almost all the patients are young females.

Surgical technique

The direct anterior approach is used with the patient supine. The triple-osteotomy procedure is performed with a specially curved chisel, designed to approximately correspond to the circumferential curvature of the acetabulum (Figs. 1, 2). The first step of osteotomy of the ilium is to score the inner surface of the pelvis with an airtome. The C-shaped osteotomy line starts proximal to the anteroinferior iliac spine and ends in the distal part of the quadrilateral surface. The actual osteotomy along the scored line is performed with the chisel being directed proximally in the supra-acetabular portion, posteriorly in the proximal part of the quadrilateral surface, and distally in the distal part of the quadrilateral surface.
Fig. 1a-c Curved periacetabular osteotomy. a Osteotomy of the iliac bone. b Osteotomy of the pubis. c Osteotomy of the ischium. All of these osteotomies are performed through one incision using the direct anterior approach. Only the ischium osteotomy requires the image intensifier.

Fig. 2 Lateral view of the curved chisel. The shaft angle is 45° and curved part of the chisel is 30 mm. The radius of the curvature is 50 mm and is designed to approximate the curvature of the acetabulum.

Except for the use of the osteotome, an incomplete cut of the ischium and a complete cut of the pubis are performed in the similar manner to those of Bernese periacetabular osteotomy. The acetabular fragment can be then redirected and fixed with two or three screws.

Due to the anatomical complexity of the pelvis and the three-dimensional advancement of the chisel in this procedure, it is sometimes difficult to determine the exact placement of the tip of the chisel under the image intensifier. Furthermore, concrete guidepoints for scoring the C-shaped osteotomy line and inserting the chisel have not been established. Up until now, successful performance of the procedure has depended to a certain extent on the operator’s experience. The purpose of this study was to establish the osteotomy line and the chisel inserting angles during a curved periacetabular osteotomy in order to enable safer and more precise execution.