VASCULAR ANATOMY FOR ROTATIONAL ACETABULAR OSTEOTOMY

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Introduction
Rotational acetabular osteotomy which was reported by Ninomiya et al. (1984) is a common surgical procedure for the treatment of acetabular dysplasia. During surgery, there is a danger of intrapelvic vascular injury when the osteotome is inadvertently inserted to perform the osteotomy, and when drilling is overly done for the fixation of the transferred acetabulum. In this study we reported on our anatomical investigation with the purpose of quantifying the relative locations of the circumacetabular bony landmarks and intrapelvic vascular structures, and setting criteria for avoiding vascular injury.

Materials and Methods
Twenty-seven adult cadaveric specimens were used in this study. Seventeen specimens were males and 10 were females. Following intestinal evisceration, each specimen was transected between the 4th and 5th lumbar vertebrae, and the lower part of each body was further dissected longitudinally along the median. The hemilateral lower body of each cadaveric specimen was utilized. After stripping back and removing the muscles peripheral to the hip joint, the specimens were placed in a lateral position.

Sixteen specimens (11 male, 5 female) were from the left side and 11 specimens (6 male, 5 female) were from the right side. A point x was determined as 1 cm postero-lateral to the anterior inferior iliac spine on the anterior superior acetabulum. A K-wire, 2 mm in diameter, was inserted toward the external iliac artery (Fig. 1). The entry point of the K-wire penetrating the external iliac artery was termed point x'. The angle of the held end of the K-wire in the horizontal plane was measured. Dorsal inclinations were allocated positive values and ventral inclinations were allocated negative values. Next, we measured the thickness of the ilium in this region and the distance of the entry portal of the obturator canal through which the obturator artery passes. The K-wire was inserted through point y and directed toward this point. The angle of the held end of the K-wire in the sagittal and horizontal planes was measured. In the sagittal plane, cranial inclinations were allocated positive values. In addition, the distance of yy' was also measured.

The point at the center of the superior pubic ramus base on the anterior inferior acetabulum was determined point z because of the danger of the obturator arterial injury when pubic osteotomy being performed (Fig. 1). The retroperitoneum was stripped, and the internal wall of the pelvis was exposed. The entry portal of the obturator canal was termed point y'. This point y' is the entry portal of the obturator canal through which the obturator artery passes. The K-wire was inserted through point y and directed toward this point. The angle of the held end of the K-wire in the sagittal and horizontal planes was measured. When the K-wire was inserted from point x, in males the minimum value of xx' was 27 mm and the maximum value of the depth of the bone hole was 25 mm. In females the minimum xx' value was 26 mm and the maximum bone hole depth value was 18 mm. If the drill bit is made to stop at a depth of approximately 25 mm for males and 20 mm for females, it is thought to be sufficient to create a hole in the bone.

The results of this study are also thought to reflect the differential pelvic morphologies of males and females. In order to penetrate the external iliac artery from point x, a more dorsal inclination of the handle is necessary in males, as indicated by the average dorsal inclinations in males and females of 8.9 degrees and 4 degrees, respectively. Although there was no statistically significant difference, this is thought to be due to the fact that the wings of the ilium are more open in male pelvises. In order to have the end of the K-wire exit through the entry portal of the obturator canal from point y, a more cranial inclination of the handle in the sagittal plane was necessary for females (mean, 6.3 degrees) than for males (-1.5 degrees) (p < 0.05). In the horizontal plane, the average in males was 18.9 degrees and 26.7 degrees in females, indicating a more ventral inclination of the handle is necessary in females. This is thought to be due to the fact that, in comparison to the male pelvis, the female pelvis is more oblong and cylindrical, and that the entry portal of the obturator canal is located caudoventrally with respect to the base of the superior pubic ramus. For a pubic osteotomy, the levator is inserted from the superior inferior margin of the superior pubic ramus base, protecting the obturator nerve, artery and vein. However, if the point of the osteotome was caudoventrally directed in the same way for males and females, it was thought that females were put at a greater risk of obturator arterial injury. From point z, there was little difference between males and females in the depth of the hole necessary to penetrate the medial wall of the pelvis or in the distance to penetrate the internal obturator muscle. This is thought to be due to the wider spacing of the ischial spines in females.

Conclusion
1. We investigated the location of the external iliac artery and obturator artery in 27 cadaveric specimens in the special reference to the sites of rotational acetabular osteotomy.
2. The average distance from the point ,1 cm postero-lateral to the anterior inferior iliac spine on the anterior superior acetabulum, to the external iliac artery was 38.2 mm in males (range, 27 to 53 mm) and 33.1 mm in females (range, 26 to 41 mm), indicating the distance was shorter in females. The average thickness of the ilium in this region was 16.1 mm in males (range, 11 to 25 mm) and 12.7 mm in females (range, 10 to 18 mm), indicating the female ilium was also thinner.
3. Due to differences in pelvic morphology, the locations of the external iliac artery and obturator artery differed slightly between the sexes. Care should be taken with regard to this point when performing acetabular osteotomies.

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