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Structures at Risk from Medially Placed Acetabular Screws*

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ABSTRACT: The anatomical structures adjacent to fourteen acetabula were studied to identify structures that are at risk from acetabular screws. There were six embalmed acetabula, four acetabula from two fresh autopsy specimens, and four acetabula that were studied during two gynecological operations. Models were constructed to show where these screws can penetrate. Medially placed screws either penetrated or came dangerously close to the external iliac vein; the obturator artery, nerve, and vein; and tributaries of the internal iliac vein.

To avoid injury to the medial vascular structures, screws should not be placed in the anterosuperior quadrant of the acetabulum.

Substantial interest has developed in the use of porous-coated acetabular components that are fixed with cancellous screws; many manufacturers now sell such components. The vascular complications that have been reported usually have been related to intrapelvic extrusion of cement or to damage to the common iliac vein during reaming. Little attention has been paid, however, to the risk to anatomical structures when a drill-bit or screw penetrates the second cortex.

Although orthopaedic surgeons are very familiar with the structures that are anterior, superior, and posterior to the acetabulum, many are not as well acquainted with those that lie medial to it. Our interest was piqued by a consultation in 1986. After a revision hip arthroplasty, this patient had a retroperitoneal hematoma, anuria, and a secondary infection about the implant; the patient eventually died from penetration of a branch of an internal iliac artery, as determined by selective arteriography. The case of this patient prompted us to study the structures that lie adjacent to the acetabulum to determine the danger of penetration by a drill-bit or screw.

Materials and Methods

Three types of anatomical subjects were studied; six embalmed acetabula and four fresh autopsy specimens were...
RESULTS

In our dissections, the internal obturator muscle was only two to four millimeters thick and provided minimum protection for the adjacent vascular structures. The obturator artery, vein, and nerve coursed medially just below the rim of the pelvis on the way to the obturator foramen. Just inferior to the obturator foramen was a large plexus of veins that included the superior and inferior vesicular veins, the internal pudendal vein, and other branches of the internal iliac vein² (Fig. 1). The tributaries of the internal iliac vein were found two to three millimeters from the osseous medial wall of the pelvis, with no strong protecting fascial barrier, since the arcus tendineus was inferior (the arcus tendineus is the lateral origin of the levator ani muscle, which forms the abdominal floor).

The intra-abdominal tributaries of the internal iliac vein, especially the superior and inferior vesicular veins and the uterine plexus, were extremely variable; they really were a plexus of veins rather than a single vein. These vessels usually formed a plexus that lay on the levator ani muscle and on the inferior portion of the exposed part of the internal obturator muscle.

In two of the specimens, the obturator vein and artery were replaced by an enlarged pubic vein and artery that joined the external iliac vein as it entered the pelvis and thus did not course along the surface of the internal obturator muscle with the obturator nerve. The sciatic nerve, as it left the pelvis, lay directly against the osseous surface of the sciatic notch adjacent to the internal iliac vein. In the acetabula that were studied during the gynecological operations, the external iliac vein lay directly on the osseous surface of the arcuate line, and thus it was not protected by the iliopsoas and iliacus muscles as it appeared to be in the cadaver. The external iliac artery, however, coursed along the iliopsoas muscle and tendon and thus was relatively protected by the thickness of the muscle.

In the models and the cadaver specimens, screws that were inserted into the anterior part of the rim and the depths of the acetabular cup either penetrated or came dangerously close to the external iliac vein; the obturator artery, nerve, and vein; and tributaries of the internal iliac vein (Figs. 2 and 3). Any screws that were placed in the superior portion of the acetabulum and penetrated the medial wall were close to the external iliac vein and the internal iliac venous plexus. The bladder and rectum were relatively safe. Neither the screws that were placed posterior to the midline of the acetabulum nor those placed distal to the anterior border of the transverse acetabular ligament penetrated the pelvis in a dangerous position (Fig. 4).

DISCUSSION

The sciatic nerve lies against the posterior wall of the acetabulum as it leaves the pelvis at the greater sciatic notch. This nerve may be identified and protected by palpation of the posterior part of the wall of the acetabulum during drilling and the insertion of screws; thus, screws that are placed
in the posterior part of the wall are relatively safe. The inferior portion of the acetabulum, posterior and distal to the anterior attachment of the transverse acetabular ligament, is relatively safe, since the abdominal cavity is no longer near the medial wall of the pelvis. The femoral nerve, artery, and vein are protected laterally, as they leave the pelvis, by the iliopectineus and ilipectineus muscles and tendons.

The variability that we found in the intra-abdominal tributaries of the internal iliac vein has been reported previously; this is the most variable arterial and venous system in the body. In two of our dissections, as already noted, the obturator vein and artery were replaced by an enlarged pubic vein and artery; it has been stated that the obturator artery is replaced by an enlarged pubic branch from the inferior epigastric artery in 30 per cent of the population.

In view of the small number of dissections in our study, it is possible that anatomical variations other than the ones that we have described are present in the area medial to the acetabulum.

Screws that are inserted in the anterosuperior quadrant of the acetabulum, a pie-shaped area that is bounded by an arc drawn from the mid-portion of the superior dome to the anterior border of the transverse acetabular ligament, are in the most dangerous area because of the thinness of the acetabulum and the intra-abdominal vascular structures medially.

References