The teardrop shadow of the pelvis is poorly understood and as a result its clinical significance is not appreciated. The structure responsible for this shadow was pinpointed by removing sections from the hemipelvis of an anatomic specimen with an electric saw. This structure is located in the anteroinferior portion of the acetabular fossa at the acetabular notch and consists of cortical and medullary bone contributed primarily from the ischium with a much smaller contribution from the superior pubic ramus. The normal and abnormal appearances of the teardrop shadow of the acetabulum of three patients were demonstrated on both plain radiographs and computed tomographic (CT) scans.

Index terms: Pelvis, anatomy 4(4).920 • Pelvis, computed tomography 4(4).1211
Radiology 143: 659-662, June 1982

RESULTS

Abnormalities of the teardrop shadow of the hip often go undetected as a radiographic sign even by experienced radiologists. This shadow is “U”-shaped and appears on the medial aspect of the hip joint in the acetabulum; it can be seen on anteroposterior radiographs of the pelvis. Previous descriptions of the structure of the pelvis responsible for the teardrop shadow have been imprecise or inaccurate (1, 5, 6). The purpose of this paper is to describe in anatomic specimens and in three patients the precise part of the pelvis that produces the teardrop shadow. The disappearance or deformity of the teardrop is a significant indication of bone disease, especially when hip pain is involved.

MATERIALS AND METHODS

An innominate bone was radiographed in the anteroposterior position. Initially, metal markers were placed at the edge of the pelvic margins in an effort to define the teardrop. Radiographs were obtained, and the metal markers adjusted to coincide with part of the teardrop. The markers, when lying either anterior or posterior to the structure causing the teardrop shadow, still appeared to overlap the shadow. The use of the markers, strips of solder, and sheets of tin, however, did not prove adequate for pinpointing the cortical edges of the bony section causing the teardrop shadow. Subsequently, we removed small sections of bone with an electric saw and radiographed the pelvis after each cut. For each radiograph, the innominate bone was secured in the same position to avoid changes in pelvic rotation. In this way, we determined the effects of removal of each bony section.

The Teardrop Shadow of the Pelvis: Anatomy and Clinical Significance

1 From the Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins Medical Institutions, Baltimore, MD. Received Oct. 17, 1980; accepted and revision requested Jan. 6, 1981; revision received Nov. 12, 1981.

Jack W. Bowerman, M.D.
Joseph M. Sena, B.S.
Richard Chang, M.D.
CASE STUDIES

The causes of pelvic or hip pain have been diagnosed in several patients by the detection of abnormalities of the teardrop shadow. Three illustrative cases are presented here.  

**CASE I:** A 47-year-old man with squamous-cell cancer of the right lung that had been diagnosed 11 months earlier presented with progressive right hip pain of seven months' duration. The pain was made worse by weight bearing and gradually became constant and kept the patient awake at night. Radiographs of the pelvis showed loss of the teardrop on the right side (Fig. 3a). Anterior tomographic sections through both hips confirmed the absence of the teardrop on the right side and a normal thin teardrop on the left side (Fig. 3b). Subsequently, the right hip of the patient was irradiated (1,500 rad [15 Gy]), resulting in prompt relief of symptoms. The destructive lesion was presumed to be a metastatic focus. A biopsy was not performed.

**CASE II:** Cancer of the prostate was diagnosed in December 1978 in an 83-year-old man who subsequently underwent a bilateral orchietomy. The patient was readmitted in October 1979 because of pain in the right thigh and was found to have cutaneous and lymph node metastases from the prostatic cancer in the right groin. Excretory urography at that time showed loss of the right teardrop structure (Fig. 4a). The patient received radiation therapy to the groin, obtained prompt relief from the pain, and soft-tissue swelling decreased. A follow-up CT scan obtained on February 1, 1980 (Fig. 4b) showed that the cortical margins of the acetabulum at the level of the teardrop had been partially destroyed by a permeative lytic lesion.

**CASE III:** A 27-year-old woman had pain in the left hip in July 1979 after waterskiing. The pain persisted and progressed from simple pain when running to severe pain when walking and, finally, to severe pain when bearing weight only. A radiograph obtained in the summer of 1979 showed a destructive lesion on the left pubic ramus, the crushed area and adjacent bone in the right hip (Fig. 5a). Anterior tomographic sections through both hips confirmed the presence of the destructive lesion on the right hip (Fig. 5b). After irradiation (2,000 rad [20 Gy]), the patient received radiation therapy to the groin, obtained prompt relief from the pain, and soft-tissue swelling decreased. A follow-up CT scan obtained on February 1, 1980 (Fig. 5b) showed that the cortical margins of the acetabulum at the level of the teardrop had been partially destroyed by a permeative lytic lesion.
and the patient was admitted for evaluation. A radiograph of the pelvis and hips (Fig. 5a) showed a destructive lesion of the left pubic ramus and destruction of the left teardrop shadow. This destruction indicated an extensive lesion of the left acetabulum as confirmed by a CT scan (Fig. 5b). The scan showed destruction of the anterior half of the acetabulum and the extent of the soft-tissue mass. A biopsy indicated a malignant fibrous histiocytoma, and following intraarterial Adriamycin (doxorubicin hydrochloride, Adria Laboratories, Inc.) therapy, a left hemipelvectomy was performed because of the extensive destruction of the acetabulum.

**DISCUSSION**

The extent of the lesion in Case III could have been predicted by observation of the loss of the teardrop shadow on the plain radiograph. Note also, that because the posterior part of the acetabulum and the quadrilateral surface of the ischium were unaffected by this large lytic lesion, the ilioischial line of the left hip was preserved and can be seen on the plain radiograph. The teardrop shadow is produced by an anterior part of the acetabulum, whereas the ilioischial line is produced by a posterior cortical surface (*i.e.*, the quadrilateral surface of the innominate bone).

The teardrop shadow has been described by others. Koehler (6) states that it is bounded medially by the inner surface of the lesser pelvis, laterally by the floor of the acetabulum, superiorly by the epiphyseal cartilage, and inferiorly by the foremost margin of the acetabular limbus or acetabular rim. Hooper and Jones (5) have stated that the teardrop is formed by the acetabular floor laterally and the pelvic floor medially. Others have defined the structure as being bounded by the wall of the acetabular fossa in the region of the quadrilateral surface (1).

Our radiographic studies indicate that the margins of the teardrop shadow are produced by cortical surfaces of struts of bone contributed by the ischium and the pubic bone to form the anteroinferior portion of the acetabular fossa at the acetabular notch. Removal of this section of the acetabulum causes the teardrop to disappear on the radiograph. The appearance of the margins of the teardrop is not affected by removing either the cancellous or medullary bone.

Others have shown that the position of the teardrop is useful in the diagnosis of protrusio acetabuli (5, 8). If the teardrop shadow is altered in protrusio acetabuli, the anterior location of this part of the ischium must be considered. The femoral head will lie predominantly posterior to the anterior edge of the acetabular notch that produces the teardrop. Similarly, if the teardrop is used as a reference point for measuring the femoral head-teardrop distance as an indicator of synovial effusion or...
synovial thickening in synovitis or Legg-Calve-Perthes disease (2, 4, 7, 9), then the anterior position of the teardrop must be considered. Small effusions will shift the femoral head very little or not at all, and slight rotations of the pelvis will influence the teardrop-femoral head distance.

Loss of the teardrop shadow is analogous to loss of a pedicle shadow in the anteroposterior view of the spine, although each may have different causes. In addition to loss of the teardrop shadow with metastatic disease, such loss has also been associated with primary chondrosarcoma, aneurysmal bone cyst, histiocytosis X, and with nonneoplastic diseases such as neurofibromatosis, tuberculosis, Paget disease, trauma, and Legg-Calve-Perthes disease.

Acknowledgments: We would like to express our appreciation to Dr. Stanley S. Siegelman for his advice on CT scanning, to our typist Mrs. Liz Novak, and to our orthopedic radiographer, Mrs. Debbie Wilkins.

Department of Radiology
The Johns Hopkins Hospital
600 N. Wolfe St.
Baltimore, MD 21205

References