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Office Tip

The Value of the Direct Lateral Hip Radiograph in an Adult Reconstruction Practice

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ABSTRACT

The specialty evaluation of hip pain, stiffness, and/or dysfunction usually includes patient history, physical examination, and radiographic evaluation. Radiographic views of the hip are not standardized, and basic studies may include an anteroposterior pelvis, anteroposterior hip, frog lateral, and direct lateral of the hip. In this article, we discuss the importance of obtaining a direct lateral radiograph of the hip in all patients being evaluated by a specialist for hip pain and its value in hip arthroplasty care.

Introduction

Hip pain, stiffness, and dysfunction are common maladies that require specialty evaluation. Thorough assessment of the problem includes patient history, physical examination, and radiographic appraisal. Of the 3, radiographic evaluation is often the most variable, and even in textbooks and primers detailing the diagnostic evaluation of the symptomatic hip, there is not a standardized approach for choosing plain films [1-3].

Based on technical availability, surgeon training, experience, or even institutional tradition, initial plain film studies may include an anteroposterior (AP) pelvis radiograph, AP hip radiograph, and frog lateral and direct lateral views of the hip, among other views for specific indications (Table 1). These may or may not have a magnification marker included.

In this article, we present an office tip article that will be helpful for the newly certified and seasoned arthroplasty surgeons alike. Examples of patient evaluations that were enhanced with this approach are given. All patient radiographs are deidentified; general informed consent for usage of radiographs for teaching purposes is collected form patients at our institution at their first visit.

Office tip

The surgeon can achieve the most efficient and complete radiographic examination by obtaining an AP pelvis and direct lateral hip radiograph on the symptomatic side (with magnification marker) at the first patient visit.

Further imaging studies of the affected hip, such as lumbar spine evaluation, frog lateral or Lowenstein lateral radiographs, [4] Judet pelvis views, [8] false profile radiographs, [9,10] and even advanced imaging, may, of course, augment this initial set of films based on the visit. However, these additional studies will be necessary in only a fraction of cases.

The exact method (supine, sitting, or standing) and type of pelvis film (eg, “high pelvis” to include the lower spine or “low pelvis” to focus on the hip joints and proximal femurs) may be debated; therefore, we will focus on the value of the direct lateral hip radiograph in this office tip article.

Technique

With the patient supine, the unaffected hip is abducted and flexed to >80°. The affected limb is then internally rotated 15°, and the x-ray machine is positioned so as to direct the beams parallel to the table, shooting through the groin without dorsal angulation. The beams course horizontally through the femoral head and neck at a 45° angle to the affected hip, with the flat-plate placed

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Table 1
Common hip radiographs used for the evaluation of osteoarthritis and the symptomatic hip.

Name	Synonyms
Anteroposterior pelvis [4]	AP pelvis
Anteroposterior hip [4]	AP hip
Direct lateral [5,6]	Cross-table lateral, shoot-through lateral
Frog lateral [4,7]	Frog-leg lateral
Lowenstein lateral [4]	-
Judet [8]	Obturator oblique, iliac oblique
False profile [9]	faux profil

orthogonal to the beams (Fig. 1). The direct lateral view, therefore, displays the proximal femur and acetabulum images at 90° from the AP pelvis (Fig. 2). One indication of correct positioning is visualization of the prolife of the lesser trochanter [5,11,12].

Standard practice for precise preoperative templating calibration incorporates a magnification marker placed in the same plane as the bone. Using a magnification marker for both the AP and direct lateral hip images allows preoperative digital templating of the cup and stem in both the planes.

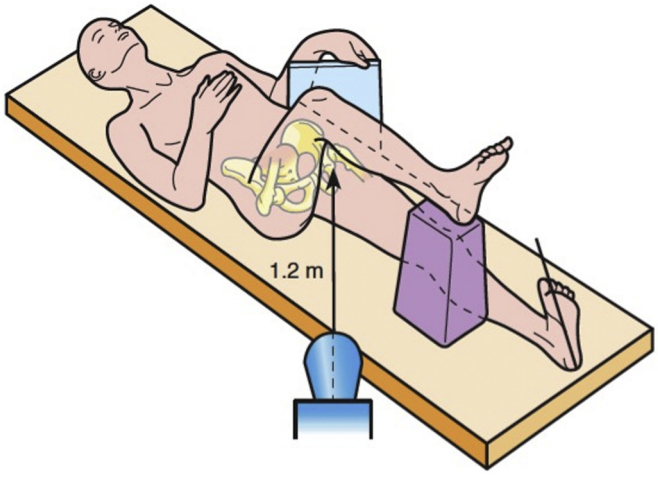

Figure 1. Positioning for the cross-table direct-lateral radiograph.
Image reprinted from Imaging: Plain Radiographs, Tannast M, Siebenrock KA in Techniques in Hip Arthroscopy and Joint Preservation Surgery, page 25, 2011, with permission from Elsevier.

Case histories

Case 1

Anteroposterior radiograph is not concordant with patient symptoms

For this patient (Fig. 3), the direct lateral view was invaluable in demonstrating a more accurate picture of the joint degeneration that corresponded with the patient's presenting clinical symptoms and examination. Of note, a frog lateral radiograph did not demonstrate the anterior joint space narrowing noted on the direct lateral.

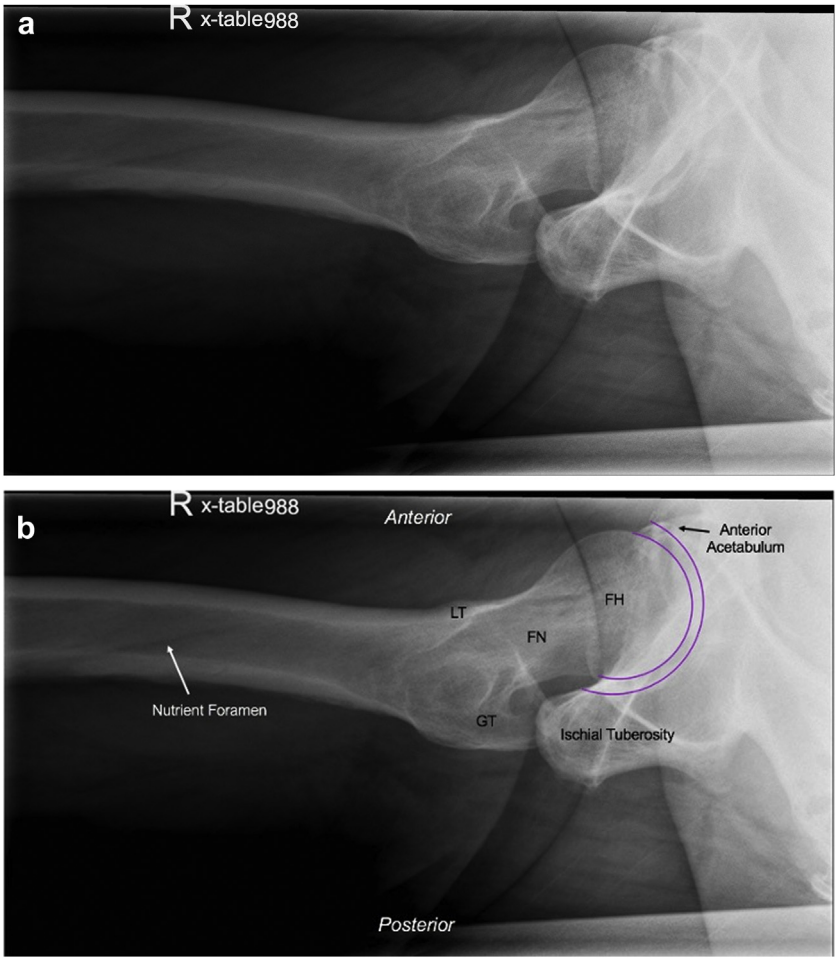

Figure 2. Direct lateral radiograph. Unlabeled (a) and labeled (b). FH, femoral head; FN, femoral neck; LT, lesser trochanter; GT, greater trochanter; purple lines denote the hip joint space.

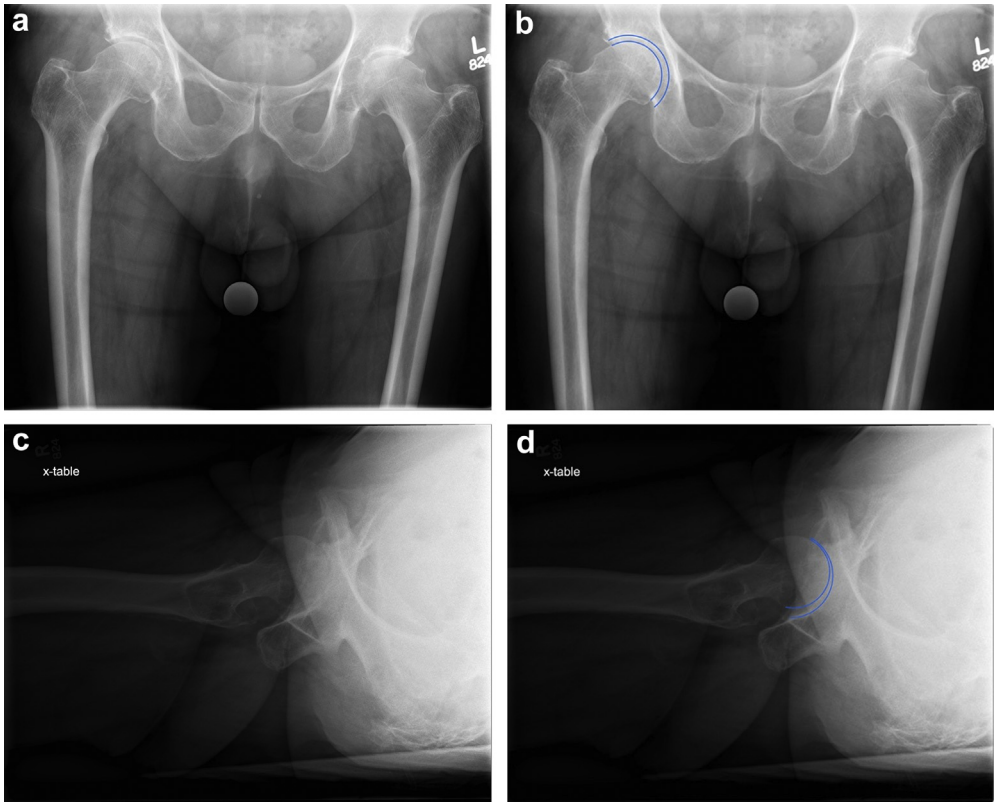

Figure 3. Anteroposterior (AP) low pelvis (a, unmarked; b, marked) and direct lateral (c, unmarked; d, marked) radiographs of a patient with hip osteoarthritis, demonstrating the significant anterior joint space narrowing apparent on the direct lateral, whereas not seen on the AP low pelvis. Blue lines denote the hip joint space.

Case 2

Assessment of acetabular bony morphology before joint replacement

Figure 4 shows preoperative evaluation radiographs of a patient before the right total hip replacement. The direct lateral radiograph demonstrates a significant anterior acetabular osteophyte. This is potentially a very important piece of information for surgical success: removal of the osteophyte will be appropriate for both the correct acetabular anteversion positioning and also to avoid postoperative iliopsoas impingement and pain.

Case 3

Evaluation of joint replacement position

Figure 5 shows presentation radiographs of a patient after bilateral total hip arthroplasties (THAs), who complains of pain and instability of the left THA. The direct lateral radiograph demonstrates that the acetabular component is in retroversion, with prominent overhang of the anterior shell. This underscores that what could be interpreted as an anteversion on the AP radiograph is actually retroversion. The malpositioned acetabular component is

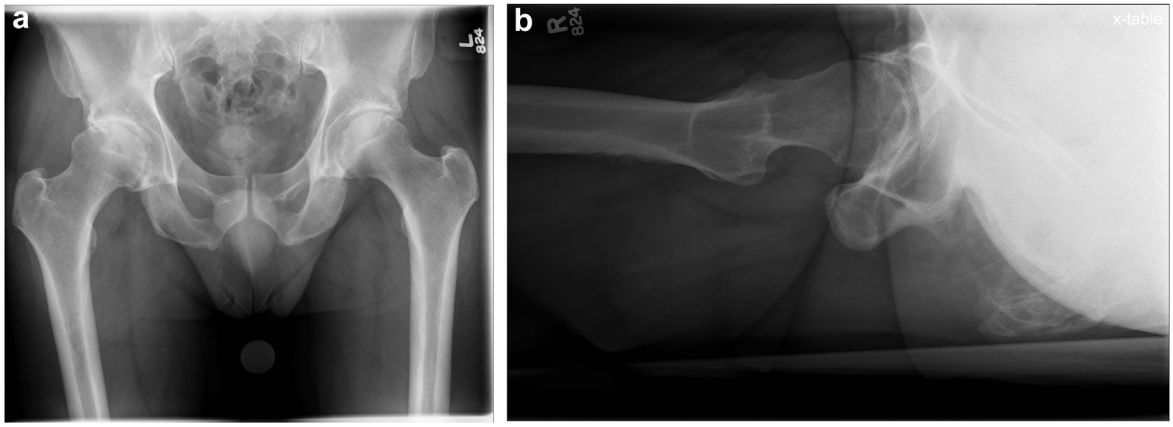

Figure 4. Anteroposterior (AP) low pelvis (a) and direct lateral (b) radiographs of a patient undergoing anterior muscle sparing total hip replacement. Note the large anterior acetabular osteophyte on a lateral radiograph. Assuming that this was normal, bony anatomy would lead to a poor acetabular component positioning (inappropriate anteversion). Not removing osteophyte could contribute to iliopsoas impingement and possible postoperative groin pain.

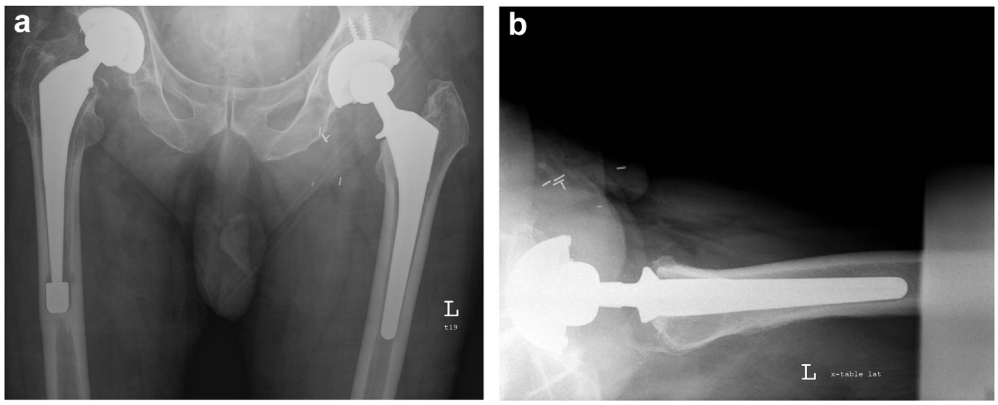

Figure 5. Anteroposterior (AP) low pelvis (a) and direct lateral (b) radiographs of a patient being evaluated for the left hip pain and instability. The AP pelvis is consistent with the right femoral loosening and generalized forward-flexion of the pelvis itself (note the so-called "closed down" obturator foramina). The acetabular components appear symmetrically anteverted bilaterally, but the direct lateral view of the left hip (b) contradicts this assessment. The direct lateral radiograph demonstrates that the acetabular component is in retroversion, with a prominent overhang of the anterior shell.

the underlying cause not only for posterior instability but also for groin pain associated with iliopsoas tendinopathy.

Case 4

Evaluation of dislocated total hip replacement

Figure 6 demonstrates the position of the femoral head after a posterior dislocation of a THA, whereas Figure 7 shows an anterior dislocation. In conjunction with the patient history and examination, the direct lateral radiograph allows the surgeon to plan for the appropriate reduction technique and postoperative care. Reduction technique and postoperative precautions differ depending on whether the dislocation is posterior or anterior.

Discussion

Standardized radiographic evaluation of the patient with a symptomatic hip presentation has not, to date, been codified [1,2,11]. The logic that we currently follow in our practice is that a pelvis rather than a unilateral hip radiograph makes the most sense, so as to allow for comparison through symmetry and permit basic leg length measurement. In addition, an orthogonal or perpendicular view of the acetabulum (ie, direct lateral) and the proximal femur offers valuable information for the initial examination [1].

The direct lateral view provides an unobscured picture of the anterior and posterior contours of the femoral head-neck junction, a view that cannot be seen on the AP pelvis and may be compromised by the greater trochanter on the frog lateral radiograph [12]. In addition, the direct lateral excels in its ability to demonstrate the spherical or aspherical nature of the femoral head; any out-of-anterior plane joint space narrowing; and also the anterior proximal femoral neck deformities such as a cam deformity [11,13]. It is also important to point out that the direct lateral requires less manipulation of a potentially painful limb. The direct or shoot-through lateral view is therefore useful not only as a way to evaluate a severely painful hip due to osteonecrosis or arthritis but also as a confirmatory tool following the AP view in the evaluation of a seemingly undisplaced intracapsular femur fracture [14,15].

In the context of hip arthroplasty care, a true or direct lateral view serves as a useful tool for orthopedic surgeons in preoperative planning and postoperative evaluation.

Preoperatively, anterior osteophytes and cysts, acetabular deficiency, and true acetabular version may be evaluated. The ischio–lateral method [2] can be used to plan for appropriate acetabular anteversion, despite pelvis flexion issues secondary to lumbar spine motion abnormalities [16] and hip flexion contractures. The direct lateral x-ray may also be used to template the size of the acetabular component. This requires a magnification marker, but it is an accurate way to template the implant size because it

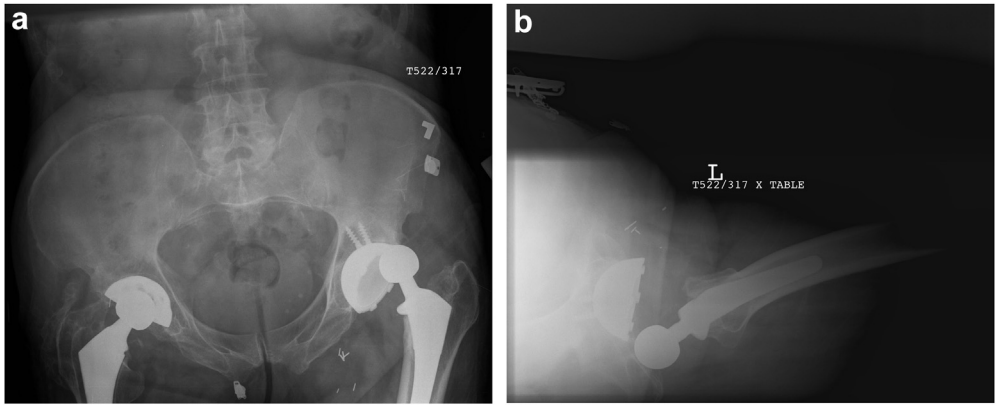

Figure 6. Anteroposterior (AP) pelvis (a) and direct lateral (b) radiographs of a patient with a dislocated left THA. The posterior direction of dislocation is only visible on the direct lateral view. This is the same patient described in Figure 5.

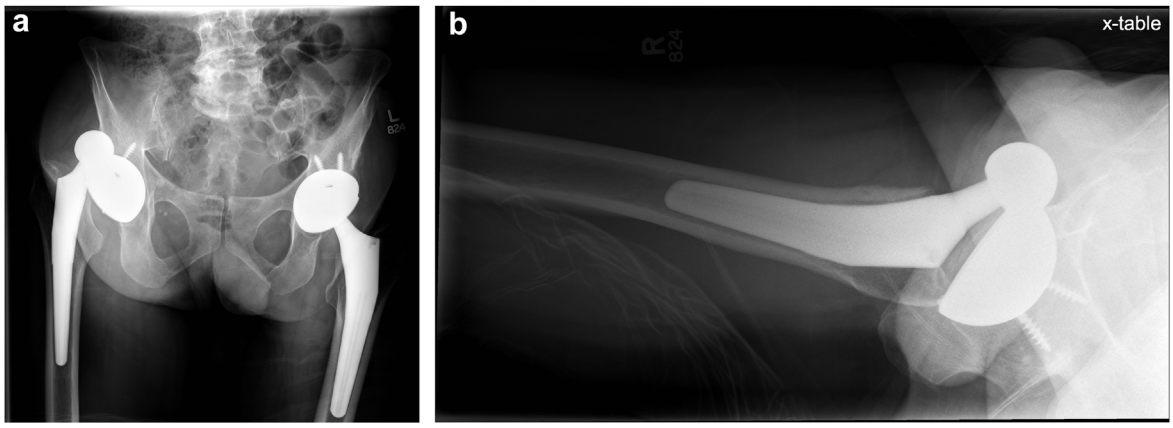

Figure 7. Anteroposterior (AP) pelvis (a) and direct lateral (b) radiographs of a patient with a dislocated right THA. Again, the anterior direction of dislocation is only visible on the direct lateral view.

gives the anterior-posterior dimension of the native acetabulum. Postoperatively, acetabular orientation can be precisely evaluated using this methodology. The ischio-lateral method relies on an internal reference (the ischial tuberosity) and has been shown to have good reproducibility, reliability, and less variation when performed on the direct lateral radiograph as compared with other methods of analyzing acetabular component position following arthroplasty. [2] Finally, anterior or posterior bearing surface subluxation or dislocation can be easily evaluated with the direct lateral x-ray [17,18].

There are a few drawbacks of the direct lateral view. These include 1) the clarity of the radiograph may be decreased in patients with excess soft tissue [11]; 2) it is not the preferred hip view to detect cam-type deformities (in studies comparing lateral x-ray views such as the frog-leg, direct, and 45° Dunn [19] to the gold standard, MRI, the 45° Dunn was the most sensitive and highly correlated with radial MRI of all lateral x-ray views) [20-22]; 3) it is not the preferred view to evaluate osteonecrosis of the femoral head [23]; and 4) the direct lateral may result in an increased radiation exposure due to multiple attempts necessary to achieve correct positioning during the x-ray study, particularly in younger patients [24]. In addition, our experience shows that the variation in a subject's leg position makes interpretation of the native or postoperative femoral anteversion difficult to interpret on the direct lateral view (even if the technician requests 15° of internal rotation of the leg, as is described in the technique). This may be rectified by using a modified Budin view [25]. Furthermore, the appearance of acetabular version may be affected by both spino-pelvic interaction [16,26,27] and also the degree of flexion of the contralateral hip [28]. The ischio-lateral method [2], as previously described, may be used to accommodate for these difficulties. We also recommend computed tomography for precise measurement of a native or prosthetic femoral and acetabular anteversion, when indicated.

Summary

In summary, the proper technique for obtaining a direct lateral radiograph should be a part of the patient evaluation with a symptomatic hip and all hip arthroplasty preoperative preparation and postoperative evaluation. The image provides clinical usage and accurate evaluation of both native anatomy and acetabular component position.

Conflict of interests

The authors declare there are no conflicts of interest.

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