In Situ Pinning of Hip for Stable Slipped Capital Femoral Epiphysis on a Radiolucent Operating Table

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Summary: Patients with stable slipped capital femoral epiphysis (SCFE) usually can ambulate at the time of diagnosis. Satisfactory results have been reported after percutaneous in situ pinning using a fracture table. The authors describe a technique to determine the skin-pin entry point for percutaneous pinning of the hip on a regular radiolucent operating table. The pin entry point determined by this modified method was reliable in 15 SCFEs in 13 patients. Pinning on a regular radiolucent table was much easier, without the need to transfer obese patients to a fracture table. It was also useful when a bilateral pinning procedure was performed using single draping. Obtaining modified frog-leg lateral radiographs in patients with a stable SCFE was not associated with avascular necrosis or chondrolysis.

Key Words: Percutaneous pinning technique—Radiolucent table—Slipped capital femoral epiphysis.

In situ pinning has been a preferred treatment of slipped capital femoral epiphysis (SCFE) (1–5). Loder et al. (3) proposed a concept of stable and unstable SCFE that had a direct correlation with clinical outcome after similar treatments were administered. Patients with a stable SCFE are usually able to ambulate, and the risks for avascular necrosis or chondrolysis developing are lower than in patients with an unstable SCFE. The severity of slip usually does not change while the patient is positioned on the fracture table and during the pinning procedure. However, patients with unstable SCFE usually cannot ambulate because of severe pain and instability. The rates of avascular necrosis of the femoral epiphysis developing or the potential for chondrolysis are higher in unstable types. Because of the unstable nature of the SCFE, spontaneous reduction sometimes occurs, even during positioning on the fracture table (3).

Most of the studies have recommended the use of a fracture table for percutaneous in situ pinning (1–5), but this technique may be easier to perform on a regular radiolucent table. When patients present with bilateral SCFE, it is often necessary to drape the surgical field twice and to change the fracture table setting twice. In some cases the patient was either too obese for easy transfer from a stretcher to a fracture table or too small to use a fracture table. Given this experience, we found it necessary to develop a modified technique of determining the pin entry point without using a fracture table.

We are certain that regular radiolucent tables have been used commonly for in situ pinning among experienced pediatric orthopaedic surgeons. Therefore, our description may not be new. However, the procedure using a radiolucent operating table has not been well described in the literature.

The purpose of this study is to describe a modified technique of determining the skin-pin entry point on a regular radiolucent operating table and to analyze the reliability of this new technique in 13 patients with 15 SCFEs who underwent in situ pinning.

MATERIALS AND METHODS

Thirteen patients with 15 SCFEs underwent in situ pinning on a radiolucent operating table. There were nine boys and four girls. The mean age was 10.5 years (range 10–15 years). The average weight was 81.7 kg (range 60–159 kg). All patients were over the 95th percentile weight for age. There were 10 patients with unilateral SCFE and 3 with bilateral SCFE. One patient with bilateral SCFE had had SCFE on one side 6 months before presentation; it had been treated with in situ pinning. This patient then presented with SCFE on the contralateral side. The remaining two patients with bilateral SCFE presented with bilateral hip pain and SCFE. All patients had a stable SCFE. There were no other bone or joint abnormalities. Follow-up physical examination and radiographs were obtained 2 weeks, 6 weeks, 3 months, 6 months, 9 months, 1 year, and then every 6 months until
the physis was closed on the operated and contralateral sides. The patients were followed-up for at least 1 year. Preoperative anteroposterior and frog-leg lateral radiographs were carefully reviewed before the procedure was performed. A small bump was placed under the buttoc. The skin–drape junctures were sealed off with strips of adhesive plastic drape to avoid possible contamination during positioning of the limb for radiographs. The involved extremity was slightly internally rotated, allowing the patella to face upward toward the ceiling and parallel with the floor. Biplane radiographs were obtained using a C-arm image intensifier. An anteroposterior radiograph was obtained using a C-arm image intensifier with the patella facing toward the flat surface of the C-arm table (Fig. 1). A modified frog-leg lateral or easy lateral view was obtained with the patella at a right angle to the flat surface of the C-arm table, and slight flexion, external rotation, and abduction of the hip joint (Fig. 2). The posterior slip angle was determined on the modified frog-leg lateral view (Fig. 3).

The center of the capital femoral epiphysis (C1) was marked on the skin on the anteroposterior view in the above position. The line (L1) starting from the previously determined mark (C1) was extended distally in a perpendicular angle to the physis along the surface of the proximal thigh. A second line (L2) was drawn from the center of the lateral malleolus toward the fibular head, the center of the lateral femoral condyle, and then toward the center of the trochanteric region on the lateral aspect of the thigh. This line (L2) was drawn in the caudal-cephalic direction because it is often difficult to palpate the greater trochanter in obese patients (Fig. 4).

A transverse line (L3) was then projected from the center of the capital femoral epiphysis on the anteroposterior view perpendicular to the line L2. This line is parallel to the line connecting the anterior superior iliac spines. The intersection of L2 and L3 is marked as C2. This point (C2) represents the location of the femoral head, which is projected on the surface of the proximal lateral thigh. On the modified frog-leg lateral view, the degree of slip is measured as previously described in the studies by others (1). The pin entry point will be on line L1. For instance, if the slip angle is 90°, the entry point will be C1. If the slip angle is 0°, then the pin entry point will be at the intersection of L1 and L2. Based on the slippage angle (s°) on the frog-leg lateral view or on the easy lateral view, a fourth line is drawn from the point C2 in an angle (s°) measured on the easy lateral view toward L1. The intersecting point (C3) will be the skin entry point for pinning.
A guidewire for the 7.3-mm AO cannulated screw is placed freehand until the pin makes contact with the anterolateral aspect of the proximal femur. The guidewire is then advanced by gentle tapping with a hammer or by drilling. The position of the guide wire is confirmed with a C-arm image intensifier on anteroposterior and modified frog-leg lateral views. The guidewire for the 7.3-mm screw usually stays intact during examination with C-arm image intensifier. We usually do not drill over the guidewire because the 7.3-mm AO screw has a self-tapping tip. The rest of the procedure is identical to that described by others (2).

RESULTS

All patients underwent in situ pinning of the hip using a small puncture wound based on the technique described here. None of the patients required any additional skin incisions due to an inaccurate entry point. All pins were positioned correctly. There were no cases of avascular necrosis or chondrolysis from obtaining frog-leg lateral radiographs or after the pinning on the radiolucent table. The two patients with bilateral SCFE were surgically treated after draping both lower extremities. No further slippage was noted during the follow-up period. No patients with a unilateral SCFE had contralateral slip during follow-up. All patients returned to their preoperative level of activities.

DISCUSSION

By using a regular radiolucent operating table, it was much easier to prepare for the procedure. This technique was especially useful for treatment of bilateral SCFE, because only one draping is required. This technique was not used in unstable SCFE because there was a concern for avascular necrosis or chondrolysis in the presence of physeal instability (3).

There are limitations of our technique. We were not able to provide a rationale for our assumption using a mathematical model because the contour of the proximal thigh becomes irregular in the supine position. Also, it may be difficult to palpate the lateral aspect of the greater trochanter in obese patients. We assumed that the greater trochanter is in line with the lateral malleous, proximal fibula, and lateral femoral condyle, which are always palpable. The greater trochanter lies slightly posterior to the femoral head due to anteversion of the femoral neck and the fibula lies slightly posterior with reference to the tibia in the coronal plane. By using the patella of the involved limb as a landmark, we were able to obtain biplane radiographs. Despite our lack of full mathematical correlation, the skin entry point determined by our technique using a radiolucent table was very reliable in this group of obese children with SCFE.

REFERENCES