

# Normal Anatomic Variant: Scintigraphy of the Ischiopubic Synchrondrosis

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**Radionuclide bone imaging in pediatric patients occasionally shows a focus of distinct localized increase of radiotracer uptake at the ischiopubic synchrondrosis. Correlation of radionuclide bone images and conventional radiographs of this area in a group of pediatric patients demonstrates the positive bone scans to correlate with the period of beginning but incomplete fusion of the synchrondrosis. This represents a normal phase of skeletal development that radiographically and scintigraphically may mimic disease and should not be confused with a focus of pathologic activity.**

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The ischiopubic synchrondrosis (IPS) is a well-known and extensively described normal structure with variations that can cause some confusing radiographic patterns. Although such findings have been exhaustively studied, to our knowledge the scintigraphic appearance has not been reported.

The IPS is a fixed joint involving the distal end of the inferior pubic ramus and the distal end of the inferior ischial ramus; it is composed of a cartilaginous mass that is eventually replaced by bone as the joint fuses between the ages of 4 and 12 (1).

Before fusion there may be some mild demineralization and swelling at the IPS, and this could be mistaken for osteomyelitis, eosinophilic granuloma, tuberculous osteitis, or a neoplastic destructive lesion. Bony swelling may precede fusion by several years. Closure can be asymmetric, which indicates that fusion does not occur simultaneously on both sides (2,3).

The object of this report is to correlate the radiographic findings previously described with the scintigraphic findings of increased radioactive uptake well localized to the IPS.

## METHODS

Bone scintigraphy with technetium-99m methylene

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diphosphonate was performed three hours after injection and with the patient in a well-hydrated state. Images were obtained over the complete skeletal system. The radiotracer dosage for pediatric patients is calculated from a nomogram based on surface area and kilogram weight.

A 15-inch gamma camera with an ultrafine collimator was used in imaging. The pulse-height analyzer was calibrated to a 140-keV photo peak using a 20% window. Radiographs of the pelvis in the frontal projection were obtained using routine KVP and MAS techniques.

Bone scans were reviewed over the past 3 yr (1979-82). During that period a total of 31 bone scans, limited to the age range 6 mo to 17 yr, were performed. Correlation with radiographs was possible in only 15 instances, which represents our total population in this study. Of these 15 patients, eight females and seven males, the age range remained 6 mo to 17 yr.

## RESULTS

It was found that of the 15 patients three had positive scans correlated with radiographs. The uptake was well-localized to the IPS, with intensity similar to that in the growth plates throughout the remainder of the skeleton. Radiographs in two patients (Cases 1 and 2) showed marked swelling at the ischiopubic synchrondrosis, with uneven mineralization. Case 3 showed incomplete fusion of the IPS, with mild irregularity between the cortical walls of the ischial and pubic rami. The other 12 patients showed either normal uptake on

bone scan, with complete fusion of the IPS on radiographs, or no uptake in the region of the IPS, with radiographs that reveal wide separation of the ends of the ischial and pubic rami, with smooth tapered ends pointing toward the synchondrosis.

**Case 1.** A 12-year-old black male with a history of right hip pain following a sledding accident was admitted for possible hip fracture. The pain was well localized to the medial aspect of the right hip, with mild decrease in range of motion. No tenderness of the ischium was noted. Radiographs show an expansile lytic lesion at the junction of the ischium and inferior pubic ramus on the right (Fig. 1, left). Three-phase bone scanning showed normal perfusion and blood-pool images. The delayed static image reveals a well-localized area of increased radiotracer in the right inferior pubic bone (Fig. 1, right).

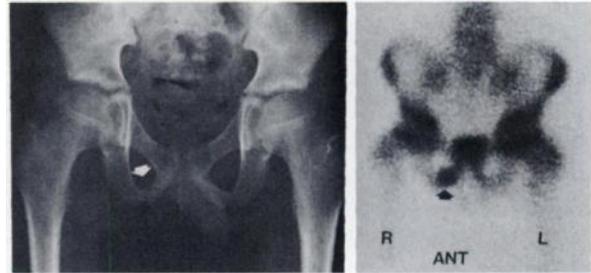
**Case 2.** An 11-year-old white male with a long history of Legg-Calvé-Perthes disease of the left hip was evaluated on a followup basis for increasing pain after prolonged walking. Radiographs, including tomographs, revealed irregularity and sclerosis in the ossification center of the left femoral head. The femoral neck shows widening with varus angulation. An expansile lytic lesion is also seen at the junction of the ischium and inferior pubic ramus on the right (Fig. 2, left). This correlates well with increased radioactivity on the scintigraphic study (Fig. 2, right) corresponding to the region of the right IPS.

**Case 3.** An 8-year-old white female with a history of Legg-Calvé-Perthes disease was admitted to the hospital with stiffness and limp involving the right leg. Radiographs showed irregularity and sclerosis of the right femoral head. Mild cortical disruption of the ischiopubic synchondrosis on the left correlated well with the increased radiotracer accumulation, similar to that in the previous case.

#### DISCUSSION

The IPS is described as a normal variant that commonly presents in an asymmetrical fashion with swelling and uneven mineralization at the synchondrosis. It is followed by fusion at all ages between 4 and 12 yr. The synchondrosis has been mistaken in the past for a neoplastic process. In the symptomatic child with clinical signs of localized pain, tenderness, or limp, the findings have been attributed to juvenile osteochondrosis (Van Nech's ischemic necrosis) (4). Murray and Jacobson (5) described one instance in which a patient had an expanding osteolytic lesion in the ischiopubic junction with persistent pain. It was eventually resected; the histologic findings were entirely normal and it was simply a developmental variation.

In our Case 1, the possibility of injury to the synchondrosis is a real one and differentiation between injury and normal synchondrosis activity is difficult. No followup films were available in this case, but clinical



**FIG. 1.** (left) Expansile lytic appearing lesion at junction of ischium and inferior pubic ramus (arrow). (right) Increased radiotracer at corresponding site on delayed bone imaging (arrow).

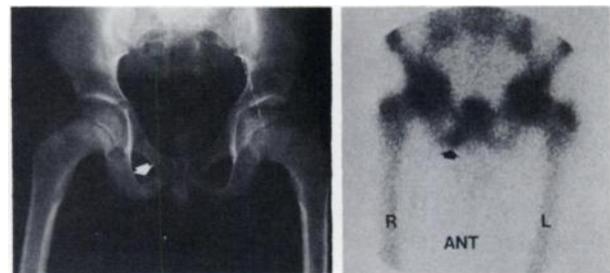
followup continued to show no evidence of ischial tenderness. Range of motion increased and pain in the right hip decreased.

Caffey (6) has reported one case in which the IPS completely closed, developed some demineralization and swelling, and fused completely a second time, without clinical evidence of disease at the synchondrosis.

Kohler (7) has shown that the IPS closes before closure of the synostoses of the acetabular region, which occurs near puberty. In addition they have postulated that during the development stages of a diseased hip, the IPS gaps wider on the affected side. It is interesting that two of our cases had avascular necrosis of the femoral head, with unilateral unfused synchondrosis occurring on the opposite side. It appears from this that the IPS is not related to the diseased hip.

Radionuclide reaction mechanisms in bone scanning have been well worked out by Jones, Francis, and Davis. (8). Uptake of methylene disphosphonate is enhanced where there is increased blood flow, increased osteoblastic activity, immature osteoid with numerous potential binding sites, and developing hydroxyapatite crystals in young bone. These conditions are present in healing fractures, avascular necrosis, and closing of growth plates, as well as the synchondrosis.

Uptake in the area of the IPS is most intense at the time of fusion. Before and after fusion, no uptake is detected in the IPS area. The intensity of the radionuclide accumulation is similar to that seen in the area of the



**FIG. 2.** (left) Avascular necrosis involving left femoral head. Expansile lesion of right IPS (arrow). (right) Bone scintigraphy shows increased radiotracer accumulation at junction of right ischium and inferior pubic ramus (arrow).

growth plate.

It is our contention that focal increase in radionuclide activity at the IPS is a normal physiologic finding in most instances and correlates radiographically with incomplete fusion prior to closure. In patients with symptoms directly referable to the region of the IPS, it is impossible to exclude completely a pathologic cause such as trauma, osteomyelitis, or neoplasm for a focus of increased activity. However, more invasive means of diagnosis might initially be deferred in favor of followup radiographs and clinical re-evaluation.

In pediatric patients, a localized focus of increased activity may be seen at the IPS. The differential diagnosis has been discussed. In our cases correlation with radiographs suggests that this is a normal physiologic process in most cases, unrelated to any pathologic state.

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The Scientific Program Committee of the Mideastern Chapter of the Society of Nuclear Medicine solicits the submission of abstracts from members and nonmembers of the Society of Nuclear Medicine for the 13th Annual Meeting to be held April 21-23, 1983, in Gettysburg, Pennsylvania. The program will include submitted papers, invited speakers, teaching sessions, and exhibits.

Abstracts should not exceed 300 words and should contain a statement of purpose, the method used, results, and conclusions. The name of the author presenting the paper must be underlined.

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