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PICTORIAL REVIEW /*Musculoskeletal imaging*

Imaging of benign complications of exostoses of the shoulder, pelvic girdles and appendicular skeleton

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Abstract Exostoses are the most common benign bone tumors, accounting for 10 to 15% of all bone tumors. They develop at the bone surface by enchondral ossification and stop growing when skeletal maturity has been reached. At first, exostoses are covered by a smooth cartilage cap that progressively ossifies with skeleton maturity. Then they may regress, partly or even completely. Osteochondromas may be solitary or multiple, with the latter associated with hereditary multiple exostoses (HME). Exostoses develop during childhood and become symptomatic during the third decade of life in the case of solitary exostoses, or earlier, in case of HME. They stop growing after puberty, when the epiphyseal plates close. Most exostoses remain asymptomatic. Local complications, usually benign, may occur, such as fractures or mechanical impingements upon nearby structures. In rare cases, sarcomatous degeneration occurs. Most of these complications have been described in case reports. This article describes the imaging features of benign complications of exostoses of the shoulder, pelvic girdles and appendicular.

Exostoses are the most common benign bone tumors accounting for 10 to 15% of all bone tumors. They develop at the bone surface by enchondral ossification and stop growing after skeletal maturity has been reached. At first, exostoses are covered by a smooth cartilage cap that progressively ossifies with skeleton maturity. Then they may partly regress, even completely [1]. Osteochondromas may be solitary or multiple, with the latter associated with hereditary multiple exostoses (HME) [2], a rare hereditary autosomal dominant syndrome. Exostoses develop during childhood and become symptomatic during the third decade of life in the case of solitary exostoses, or earlier, in case of HME. They stop growing after puberty, when the epiphyseal plates close [1]. Most exostoses remain asymptomatic.

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The goal of this review is to illustrate benign complications of exostoses of the shoulder, pelvic girdles and appendicular skeleton as observed on computed tomography (CT) and magnetic resonance imaging (MRI).

Imaging features of osteochondromas

Typical features of osteochondroma include cortical and medullary continuity, metaphyso-diaphyseal location, pedunculated or sessile base. Osteochondromas raise parallel to the long bones. MRI shows a hyaline cartilage cap [3]. After intravenous administration of gadolinium chelate, a thin rim of enhancement corresponding to the fibrovascular tissue that covers the cartilage can be observed.

Complications of exostoses

Fractures

Fractures are unusual complications of exostoses that result from trauma. They occur through the neck of a pedunculated exostosis, because the pedicle is the weakest part [1].

Radiographs often are adequate to show fractures. CT and MRI are useful in case of doubtful diagnosis (Fig. 1) [4]. Cases of spontaneous osteochondroma regression and even resolution have been reported [5].

Figure 1. Volume rendered reformations show a large pedunculated exostosis at the medial border of the inferior metaphysis of the femur, fractured at the base (arrow).

Osseous deformities

Osseous deformities are the most frequent complications that affect growth and cause local side effects such as misalignment and bone inclination. These abnormalities are almost exclusively encountered in patients with HME. In very young patients, undertubulation of bone in the metaphyseal region of the hip and knees may be the first sign seen at radiography. Radiographs reveal metaphyseal widening with an Erlenmeyer flask deformity in the distal tibia.

Osseous deformities are often located in the forearm or wrist (30 to 60% of HME). They include: disproportionate ulnar shortening, ulnar deviation of the wrist, deformed radial articular surface with distal radio-ulnar joint disruption or dislocation of the radial head. Other parts may be affected: coxa valga, genu valgum, ankle valgus by talocrural disjunction, leg length discrepancy and short stature [2]. These deformities result in asymmetric growth, functional impairment and unsightly deformities (Fig. 2).

When exostosis develops in contact with another bone surface, such as in the interosseous space between the tibia and the fibula, deformities of the adjacent bone may be observed, resulting in erosion or scalloping of the bone surface (Fig. 3). Surgery aims to prevent (or limit) and correct deformities [6].

Impingement

On joints, exostosis may cause impingement and repeated friction during movement. Mechanical effects of impingement are limited range of motion, friction and trigger tendons or ligaments and early osteoarthritis. The scapula is involved in 3.0 to 4.6% of complications [7,8]. Usually located at the anterior surface of the scapula, they are often symptomatic. Two consequences may follow. One is the impingement upon the posterior thoracic wall, with or without bursitis, resulting in a snapping scapula with typical crackling when the scapulothoracic joint moves. The other is a posteriorly displaced scapula with limited range of motion. These positional disorders generally imply a winged scapula. Positional disorders mainly concern young patients and are usually painless [7,9].

Radiography, unlike CT or MRI, cannot always identify osteochondromas. MRI can also detect bursae. Dynamic sequences help detect positional disorders [10] (Fig. 4). Several cases of ischiofemoral impingement caused by exostosis have been reported. The syndrome results from impingement upon the quadratus femoris muscle in a small space located between ischial tuberosity and lesser trochanter. The most common radiographic features are edema and hemorrhage in the quadratus femoris muscle or at its myotendinous junction (Fig. 5). Bilateral ischiofemoral impingement is frequent in case of HME [11].

Bursa formation

Bursal formation overlying exostosis has a prevalence of approximately 1.5% [12]. The main areas affected are scapulothoracic joint, hip and shoulder. Clinically, a palpable lump is observed near an osteochondroma that may occasionally grow rapidly. Often painful, bursae may simulate malignant