Avulsion Injury

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63.1 Definition

- Avulsion injury is considered a special type of fracture.
- Radiographically and histologically, the lesion may have a pseudosarcomatous appearance.

63.2 Synonyms

- Cortical avulsion
- Avulsion fracture

63.3 Etiology

- Repetitive muscle contraction or a violent muscle contraction may pull off a fragment of cortical and medullary bone across the tendon insertion, which has a stronger tensile strength than the bone.

63.4 Epidemiology

- Occurs more frequently in active young adolescents.

63.5 Sites of Involvement

- Most commonly in the tibial tuberosity, at the insertion of the quadriceps (*Osgood-Schlatter disease*), and in the medial distal metaphysis of the femur, at the insertion of the adductor magnus tendon (*distal femoral cortical syndrome or periosteal desmoid*)
- Around the pelvis:
  - Ischial tuberosity (ischial apophyseolysis), at the insertion of the hamstring muscles
  - Inferior pubic ramus, at the insertion of the adductor muscles
  - Iliac spine, at the insertion of the rectus femoris
  - Femoral greater trochanter, at the insertion of the gluteus
  - Femoral lesser trochanter, at the insertion of the psoas
  - Humerus, at the insertion of the pectoralis major or the subscapularis muscle

63.6 Clinical Symptoms and Signs

- Usually sudden and severe pain.
- Slight swelling in bones near the skin.

63.7 Imaging Features

63.7.1 Radiographic and CT Features

- The radiographic picture commonly shows extensive reactive bone proliferation and may suggest malignant neoplasms.

Eduardo Santini-Araujo was deceased at the time of publication.

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- In the ischium, iliac spine, and femoral greater trochanter, a portion of the cortex is pulled off by a violent muscle contraction or repetitive muscle contractions, and radiographs frequently show the apophysis loose in the soft tissue (Figs. 63.1 and 63.2).
- Later, reactive bone formation appears, which in some patients may be exuberant.

63.7.2 Bone Scan Features

- Intense uptake of technetium.

63.8 Imaging Differential Diagnosis

63.8.1 Bone-Forming Benign and Malignant Neoplasms (e.g., Surface Osteosarcoma)

- Avulsion injury has a limited growth potential and mineralizes early over time.

63.9 Pathology

63.9.1 Gross Features

- Frequently the material is obtained by core needle biopsy (Fig. 63.3).

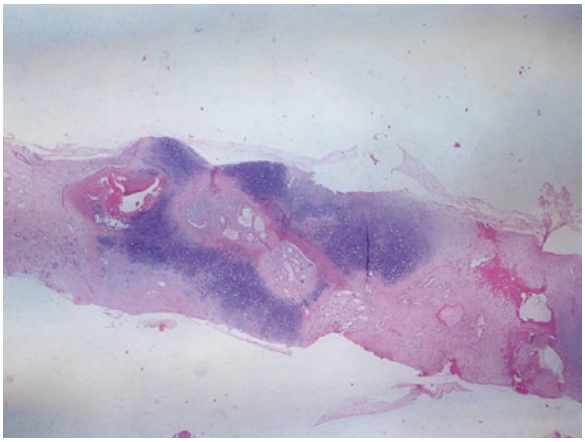

Fig. 63.3 Microphotograph at low magnification of a core needle biopsy specimen from an avulsion injury

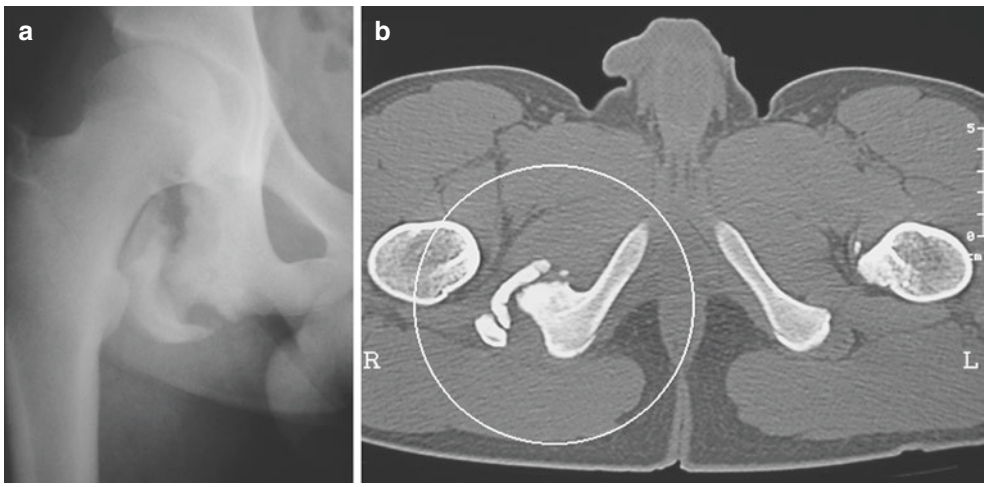

Fig. 63.1 Avulsion injury. (**a**, **b**) X-ray and CT scan showing an avulsion injury in the ischial tuberosity (ischial apophyseolysis), at the insertion of the hamstring muscles. Muscle contraction pulled off a portion of the cortex, and radiographs show the loose ischial apophysis in the soft tissue

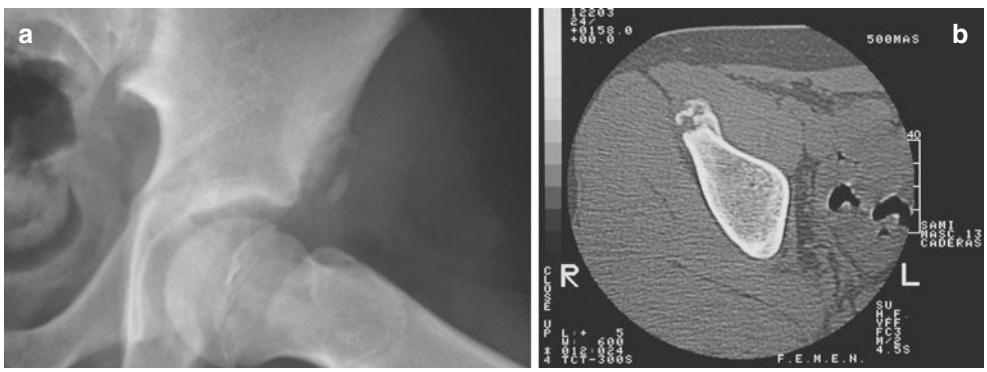

Fig. 63.2 Avulsion injury. Roentgenogram (**a**) and CT scan (**b**) showing a cortical avulsion in the iliac spine at the insertion of the rectus femoris

63.9.2 Histological Features

- The histological pattern is similar to a repairing fracture process (endosteal and periosteal callus) (Figs. 63.4, 63.5, and 63.6).
- The osteoid trabeculae are lined by typical osteoblasts.
- Reactive cartilage may be present, similar to a fracture callus.
- Typical mitosis may be present, especially in the early phase of evolution.

63.10 Pathologic Differential Diagnosis

63.10.1 Osteosarcoma

- The brisk mitotic activity and the osteoid production may result in a mistaken overdiagnosis of malignancy.
- Atypical mitoses or cellular pleomorphism are never seen in an avulsion injury.

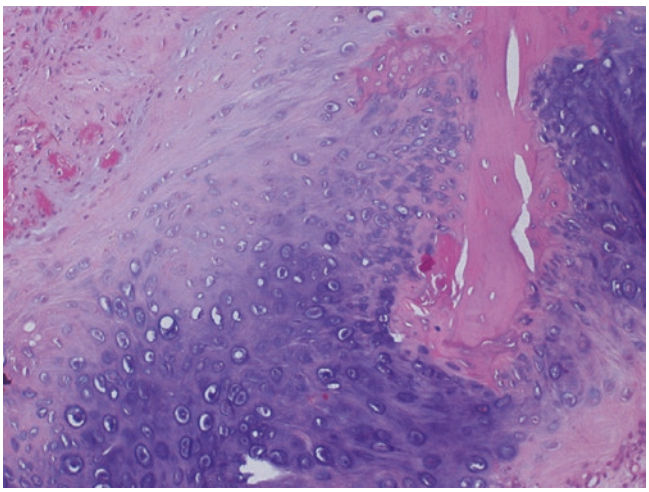

Fig. 63.4 Microphotograph showing peripheral muscle fibers and a chondroid fracture callus

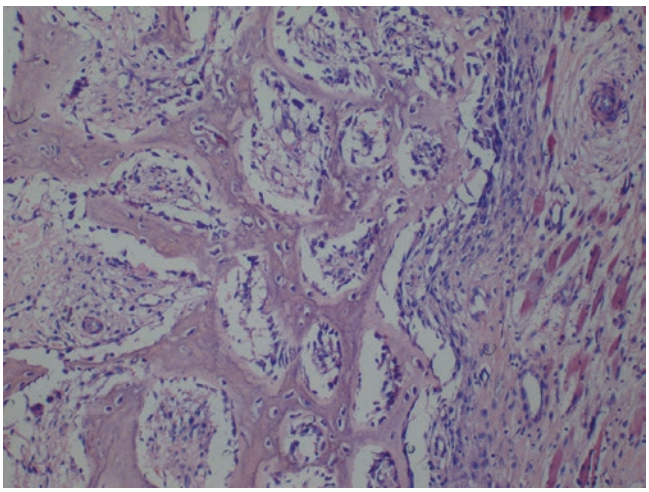

Fig. 63.5 The histological pattern is similar to a repairing fracture process with endosteal and periosteal callus

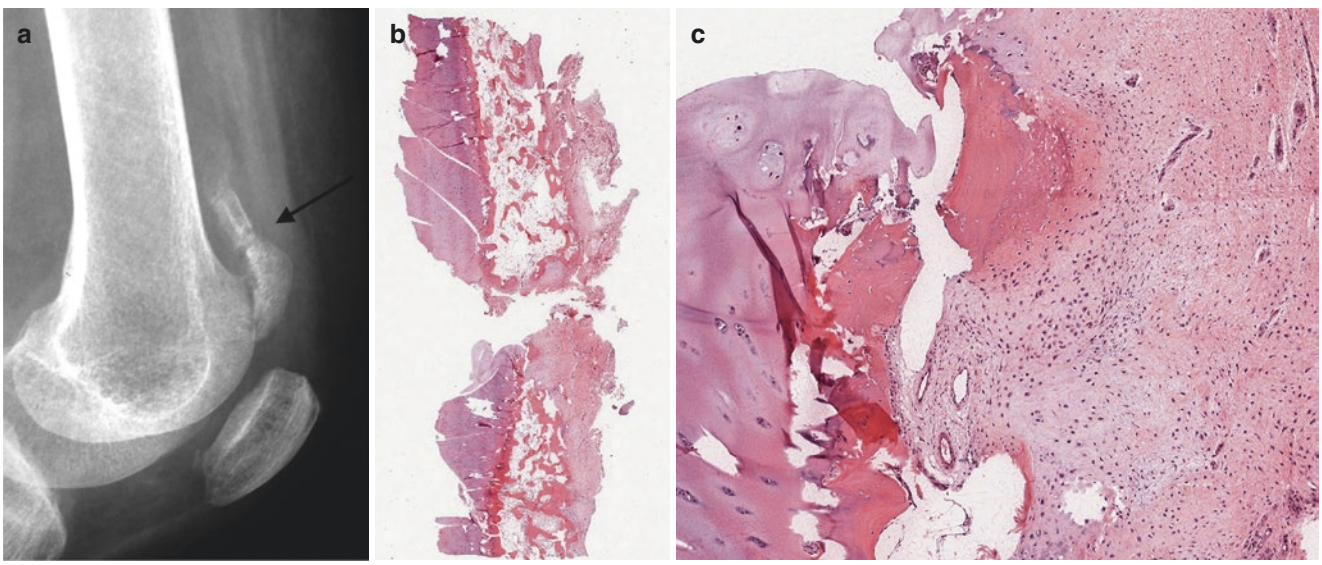

Fig. 63.6 Avulsive fracture of a mineralized tendon insertion segment. (**a**) Radiograph showing fracture of the ossified tendon end (*arrow*). (**b**) Panoramic microphotograph of both ends of the fracture fragments. (**c**) Reactive fibro-chondro-osteoid proliferation

63.11 Prognosis

- Benign lesion, with excellent prognosis.

63.12 Treatment

- Lesions often can be confidently diagnosed on the basis of radiographic features and puncture needle or surgical biopsy, so that surgical treatment is not necessary; follow-up may be done by radiographic studies.

Suggested Reading

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