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CT Appearance of Unfused Ossicles in the Lumbar Spine

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The computed tomographic (CT) appearance of unfused ossicles in the lumbar spine has had little attention. Unfused ossicles result from accessory ossification centers near the tip of the vertebral processes. Their main importance lies in distinguishing them from fractures. The CT appearance of unfused ossicles in the lumbar spine was correlated with that of the corresponding surface anatomy from a cadaver specimen. Thereafter, 100 consecutive CT studies were reviewed and two cases of presumedly unfused ossicles were found. The CT appearance of unfused ossicles and their differential diagnosis is discussed.

Unfused ossicles result from accessory ossification centers near the tip of the vertebral processes (fig. 1). Their main importance lies in distinguishing them from fractures. In a correlative computed tomographic (CT) anatomic study of 10 cadaver lumber spines, one unfused ossicle of the superior articular process of L3 and one partly fused ossicle of the inferior articular process of L2 were found. We describe the CT appearance of the unfused ossicles.

Materials and Methods

The body of a 65-year-old man who died of cardiac disease and had no history of spinal trauma was frozen and the lumbar spine was removed with a band saw and positioned in a Styrofoam box [1]. The specimen was scanned on a GE CT 9800 scanner in a direct sagittal plane with 3 mm collimation, 200 mA, 4 sec scan time, and 120 kV. Axial images were obtained from the sagittal by reformatting with 1-pixel-thick slices. No direct axial images were obtained. The location of the first and last CT scan was marked on the Styrofoam box, and this portion was then removed with a band saw and placed on the stage of a heavy-duty microtome LKB 2250. As 0.05-mm-thick sections were removed, the surface of the specimen was photographed. The CT scans and the exactly corresponding surface anatomy were compared. In particular, the appearance of the ossicles was noted.

One hundred consecutive CT examinations of the spine were reviewed to find clinical illustrations of unfused ossicles. These examinations were performed on a GE CT 9800 scanner with 5 mm slice thickness at 5 mm intervals, 200 mA, 4 sec scan times, and 120 kV. A lateral digital localizer was used, and scans parallel to the plane of the nearest intervertebral disks were obtained. In most cases CT scans were obtained from the L3 through the mid S1 vertebrae.

Results

In the anatomic sections, the unfused ossicle of L3 appeared as a well corticated, smooth fragment, 5 × 6 mm, located above the tip of the superior articular process (Fig. 2A). The 0.7-mm-wide space separating the ossicle from the process was filled with fluid resembling synovial fluid. The ossicle altered the shape of and increased the height of the superior articular process.

The ossicle at the lower tip of the inferior articular process of L2 also had smooth

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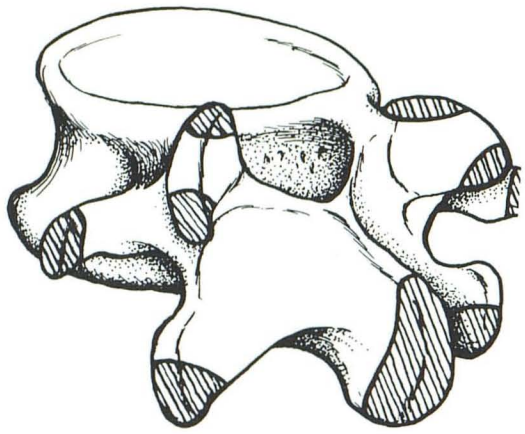

margins and fluid separating it from the process, except where it was fused laterally with the vertebral arch. The ossicle increased the total length of the facets (Figs. 2A and 2B).

In direct sagittal CT scans the lines separating the ossicles from the articular facets were readily recognized both in skeletal and soft-tissue windows (fig. 2B). The ossicles were seen less clearly in the reformatted axial images (figs. 2C and 2D).

In 100 consecutive CT studies two cases of presumed unfused ossicles were found: one involving the L3 superior process in a 17-year-old woman and one involving the L3

Fig. 1.—L3 vertebra. Cross-hatched areas represent potential sites for ossicles. Size of ossicles and angles of planes separating them from processes vary.

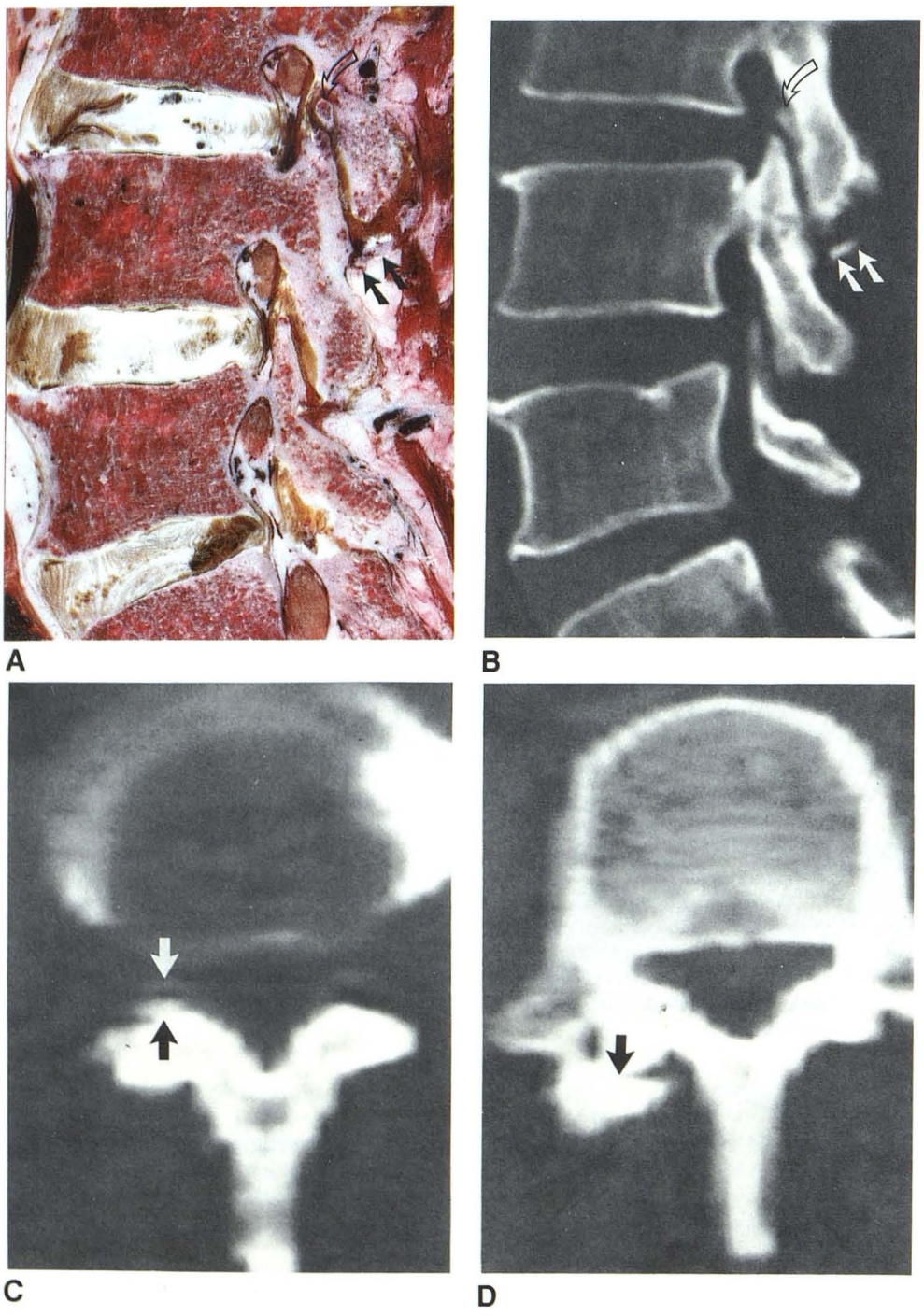

Fig. 2.—Unfused ossicles of L2 and L3. **A**, Parasagittal cryosection. Ossicle of L3 superior articular process (*open arrow*) is behind yellow ligament. Compared with superior articular process at level below, tip of ossicle projects more superiorly and has rounded superior margin. Ossicle at tip of inferior articular process of L2 (*solid arrows*) is clearly separated from process by fluid-filled space contiguous with facet joint. **B**, Corresponding CT scan. Ossicle separated from tip of superior process of L3 (*open arrow*). Ossicle at tip of inferior process of L2 is seen as separate bony structure (*solid arrows*). **C**, Axial image reformatted from sagittal images. Unfused ossicle in front of L2 inferior articular process (*black arrow*) and at tip of superior articular process of L3. Ossicle is behind yellow ligament (*white arrow*). **D**, Axial reformatted image through partly fused ossicle (*arrow*) at inferior articular process of L2.

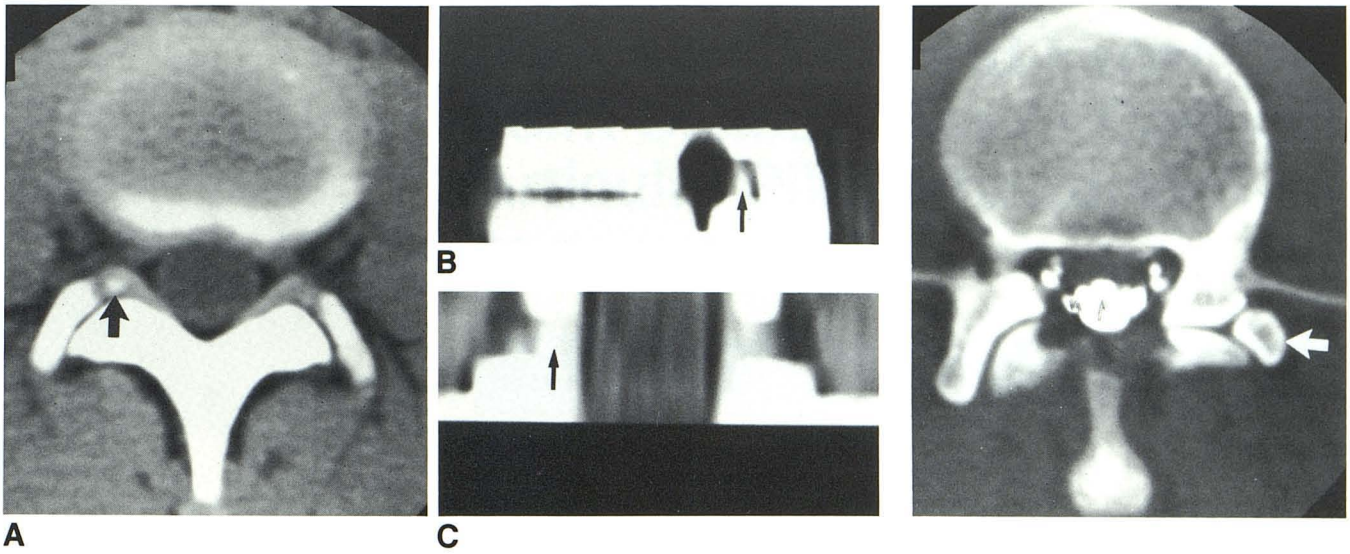

Fig. 3.—17-year-old woman. **A**, CT scan. Presumed ossicle (*arrow*) behind yellow ligament at L2–L3. Ossicle is separated from lateral part of superior articular process of L3. Reformatted sagittal (**B**) and coronal (**C**) images. Ossicle (*arrows*) above superior articular process.

Fig. 4.—50-year-old man. CT image through pedicle level of L3 vertebra. Ossicle of mammillary and accessory processes (*arrow*). Ossicle has smooth and well corticated margins.

mammillary and accessory processes in a 50-year-old man. In the first case the axial CT images revealed a lucent line separating the ossicle and the superior articular facet (fig. 3A). The cranial location of the ossicle was readily seen on reformatted sagittal and coronal images (figs. 3B and 3C). In the second case the unfused ossicle consisting of mammillary and accessory processes appeared as a well defined, corticated bone separated from the neural arch (fig. 4).

Discussion

The unfused lumbar ossicles rarely have any clinical significance [2–8]. One report suggested that, when subjected to trauma, the ossicle may cause persistent low back pain requiring surgery [9]. Despite its superficial resemblance to a fracture or degenerative change, an ossicle can usually be recognized definitively on CT images. The ossicle is usually an incidental finding in a patient with no history of trauma. The most common location is the inferior articular processes of L2 or L3. Although the size of the ossicle varies, it always has well corticated smooth margins unlike fractures, which are irregular and often multiple. The ossicles are bilateral or multiple in about 20% of cases.

Although the ossicle of L3 resembled calcification of the yellow ligament, it was located behind the yellow ligament. Furthermore in our 17-year-old patient, calcification of the yellow ligament would have been unlikely. The reformatted images showed the characteristic location of the unfused apophysis above the tip of the superior articular process.

In reports based on plain radiographs the incidence of lumbar unfused ossicles was 0.5%–1.5% [3]. Our clinical review was too small to estimate the incidence of this finding. Although unfused ossicles can occur at any spinal process they are most common at the inferior articular processes. Since they are separated from the process by a nearly horizontal line, it may be difficult to demonstrate them using 5-mm-thick axial CT slices. If thinner slices are used the unfused ossicles are more likely to appear separated. A reformatted sagittal image may depict the separation line to better advantage than can an axial image. Unfortunately, the reformatted axial images obtained in the cadavers were not the most effective way to demonstrate the ossicles. Direct axial images, especially if narrow collimation is used, may show them more effectively. The location and appearance of the ossicles should be sufficiently characteristic that they can be recognized, as in our clinical examples.

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