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Nutrient canal of the fibula

Abstract  Objective. To investigate the radiological features of the nutrient canal in the fibula.
Design and patients. One hundred and seventy-nine dried fibulae were studied regarding the type, number, location, and direction of the nutrient canal. They were classified into a usual type (type I: a radiolucent line confined to the cortex) and an atypical type (type II: a radiolucent line extending beyond the cortex).

Results. Among the total of 230 nutrient canals seen on radiography, 197 (86%) were type I and 33 (14%) were type II. On CT scans, the ossified rim of the canal extended into the medullary cavity in type II canals. The most common site was the posteromedial aspect in both type I and type II canals. Type II canals were significantly more common in fibulae with two or three nutrient canals. The frequency of the upward direction was more common in type II canals.

Conclusion. Nutrient canals with extension of the ossified rim into the medullary canal are the cause of linear lucency that may simulate a fracture. Their features are slightly different from those of usual canals.

Key words Radiography · Anatomy · Normal variant · Nutrient canal · Fibula · Fracture

Introduction

The nutrient canal is a normal structure that carries a nutrient artery. The site of entry (foramen) and direction of the nutrient canal are usually constant, and characteristic the nutrient arteries run away from the dominant growing end of tubular bones [1, 2]. Radiologically the nutrient canal is visualized on the tangential view, and is confined to the cortex. If the lucency extends beyond the confines of the cortex, a fracture should be suspected [3]. However, an atypical nutrient canal may simulate a fracture, and the fibula is one such bone (Fig. 1) [4]. The cause of such an atypical appearance is the extension of the linear radiolucency beyond the confines of the cortex.

In this study we investigated the radiological features of the fibular nutrient canal, and tried to elucidate its anatomical characteristics.

Materials and methods

One hundred and seventy-nine dried fibulae (88 right, 91 left) from 91 subjects in the Anatomy Department were scrutinized to assess the number, level, location, and direction of nutrient canals. The age, sex, and race of 50 subjects were unknown, and 41 were Japanese. The nutrient canals that admitted at least the tip of a 24 gauge needle were evaluated. The number of the canals in the fibula, and the level, location, and direction of each canal were recorded. To record the level, the shaft was divided into six segments from proximal to distal. The surfaces or borders of the fibula were named according to a standard anatomy textbook [5]: the posterior surface, the medial crest, the medial surface, the interosseous border, the lateral surface, the anterior surface, and the posterior border. The nutrient canals within 1 mm of any border were considered to be lying on that border. The direction of a canal was noted as upward, horizontal or downward.

Anteroposterior and lateral radiographs of all the dried fibulae were obtained to show the radiographic characteristics of the nutrient canals. Radiographic features were analyzed and classified as usual type (type I), when the nutrient canal was a radiolucent line confined to the cortex (Fig. 2), or atypical type (type II), when a radiolucent line extended beyond the confines of the cortex.
The classification was performed by the consensus of two of the authors. Computed tomography (CT) was performed in typical type II canals to further investigate their appearance. Since nutrient canals had common radiographic findings, typical type II canals were selected for CT scan by the consensus of the two authors. A CT scan with a 1 mm thickness and a 1 mm interval was obtained using a commercially available scanner. We did not assess the CT findings of the type I canal because of its known features.

Type I and type II canals, classified on the basis of radiography, were compared on the following features observed on inspection: the number of nutrient canals in the fibula, and the levels, locations, and direction of each canal. The canals seen only on inspection were excluded from the analysis. The significance of the difference was analyzed by the test of equality using SPSS version 7.5 (SPSS, Chicago, IL).

**Results**

The total number of nutrient canals seen on inspection in 179 dried fibulae was 234. Of these 234 canals, four were not well demonstrated on radiography and were excluded from the analysis. Among the 230 nutrient canals seen on radiography, 197 (86%) were classified as type I and 33 (14%) as type II. The type II canal was seen only once in each fibula. CT scans obtained in four cases of type II canals confirmed a portion of the ossified rim extending into the medullary canal (Fig. 3B).

The features of type I and type II canals differed as follows:

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**Fig. 1** Lateral view of the ankle obtained for a sprain (67-year-old woman). A linear radiolucency and sclerosis extending into the medullary canal is noted (arrow). The possibility of a fracture was excluded by the physical examination.

**Fig. 2** Type I nutrient canal (unknown age, gender or race). Lateral view shows a radiolucent line confined to the posterior cortex on the plain film (arrow). A longitudinal linear density is the overlying cortical margin.

**Fig. 3A, B** Type II nutrient canal (unknown age, gender or race). A Lateral view shows a tubular radiolucency extending into the medullary cavity beyond the posterior cortex (arrow). B CT scan reveals an ossified rim of the canal extending into the medullary cavity (arrow).