Osteofibrous dysplasia (OFD) is a relatively uncommon osseous-fibrous disease that usually affects children under the age of ten. It has a strong predilection to anterior tibia with a various clinical presentation ranging from asymptomatic to painful bony deformity. Radiologically, OFD manifests as well-circumscribed intracortical lucency/lucencies. The clinicopathological and radiological similarities between OFD and fibrous dysplasia, classic adamantinoma and differentiated adamantinoma pose great challenges in terms of diagnosis and management of this often self-limiting disease. In this article, two cases of OFD that have a slightly unusual age of presentation will be presented. Current evidence regarding to the clinicopathologic and radiological features of OFD will also be summarized, along with discussion on its main differential diagnoses.

Osteofibrous dysplasia (OFD) is a relatively rare developmental condition of bone in children and adolescents, almost always affecting the tibia. Its main differential diagnoses include classic adamantinoma, differentiated adamantinoma (or so-called osteofibrous dysplasia-like adamantinoma) and fibrous dysplasia. These lesions may resemble one another radiographically, clinically and histologically [1], yet distinction of one condition from the other is important as the treatment for the benign OFD is different from the treatment for malignant adamantinoma.

OFD usually occurs below the age of ten [2], and it may occasionally be seen in the newborn [3]. We present two further cases of OFD that have a slightly unusual age of presentation, along with literature review on the clinicopathologic and radiological features of this condition.

Case 1
A thirteen-year-old girl developed right shin pain after a trivial trauma. Subsequent conventional radiograph revealed a pathological fracture across a radiolucent lesion centering on the anterior diaphyseal cortex and extending into the medulla (Fig 1). Cross k-pin internal fixation of the tibial fracture was performed. Diagnostic curettage was also done, proving this radiolucent lesion to be an osteofibrous dysplasia. Conservative approach was adopted and four years later she reported progressive anterior bulging of proximal tibia with tenderness. Follow up conventional radiograph showed relapse of the osteofibrous dysplasia, appearing as a circumscribed intracortical lucency at the same location accompanied by a small pathological fracture (Fig. 2). Repeat routine radiograph in two months time showed that the tumor continued to enlarge in size (Fig. 3), thus therapeutic bone curettage was performed. At surgery a solid lobulated tumor with cortical breakthrough was found, and artificial bone graft was used to fill the bony defect after curettage. Pathology showed a fibrosseous lesion in which osteoid with prominent osteoblastic rimming was embedded in
**Figure 1.** Pathological fracture and radiolucent cortical lesion in anterior tibia that extended into the diaphyseal marrow cavity.

**Figure 2.** Radiolucent cortical lesion with intervening sclerosis and partially ground glass appearance in tibial diaphysis, representing recurrent OFD. The OFD was associated with a small fracture.

**Figure 3.** PA view a. and lateral b. of the right tibia demonstrated enlargement of the osteolytic cortical lesion with progressive involvement of the medulla.
the storiform fibrous stroma (Fig. 4). The patient recovered well from the surgery, and there was no evidence of recurrence after one year follow-up.

Case 2

A seventeen-year-old girl presented with limping gait due to painful right leg for one month. On examination, a protruding mass was found at her right proximal shin. Plain radiograph revealed a radiolucent intracortical lesion with ground-glass density and well-defined geographic border located at mid-diaphysis of right tibia (Fig. 5). Therapeutic bone curettage was performed due to progressive symptoms. A solid whitish tumor with lobulation was found at surgery, causing tibial endosteal erosion and mild cortical expansion. Histologically the tumor was composed of plump spindle cells in storiform pattern with bony trabeculae formation inbetween and osteoblasts surrounding the bony trabeculae (Fig. 6), representing OFD. Mixed artificial bone graft and allograft were used to fill the bony defect. The lesion appeared to heal well on the follow up routine radiograph three months later.

Figure 4. Histology showed spicules of woven osteoid (white arrow) with prominent osteoblastic rimming (black arrow) in a bland fibrous stroma.

Figure 5. a. A well-defined lobulated radiolucent lesion arised from mid-diaphysis of right tibial cortex expanding into the medulla, in favor of OFD. b. Lateral view showing diaphyseal thickening and intracortical lucencies.
**DISCUSSION**

An intracortical radiolucent lesion arising in the tibial diaphysis of young individuals generates a unique list of differential diagnosis, of which osteofibrous dysplasia, differentiated adamantinoma, classic adamantinoma and fibrous dysplasia are of prime importance. The osteolytic nature of osteofibrous dysplasia and adamantinoma and their common occurrence in tibial diaphysis are helpful clues to differentiate them from other cortical lesions such as osteoid osteoma, nonossifying fibroma, subacute osteomyelitis with Brodie’s abscess and stress fractures.

The term OFD was first described by Campanacci in 1976 [4], where the reported thirty nine cases described osteolytic expansive lesions in the tibia of children [3]. Histopathologically, OFD is a fibro-osseous lesion consisting of mixture of spindle cell stroma and bone with keratin positive cells. This appearance of woven bone separated by fibrovascular stroma allows OFD to resemble fibrous dysplasia superficially. However, in OFD the woven bone spicules are surrounded by a uniform rim of osteoblasts, and it demonstrates a zonal phenomenon with maturation of woven bone to bone at the periphery of the lesion in a lamellar fashion [5]. Fibrous dysplasia differs by lacking the osteoblastic rimming of woven bone.

OFD has a strong predilection to occur in the diaphysis of tibia, with ipsilateral fibular involvement in up to 20% of the cases [4]. There have also been reports of OFD involving ulna and radius. Vast majority of OFD is unilateral, although there were at least seven cases of bilateral OFD reported to date [6].

Most of the patients with OFD present between five and ten years of age, although, as demonstrated by our two cases, they can be diagnosed much later.

Symptoms and signs of OFD include swelling over the tibia with or without pain, anterior bowing, pathological fracture and pseudoarthrosis [7]. It can also be asymptomatic.

Radiographically, OFD is a lytic eccentric intracortical lesion with well defined geographic margin (or at times appears as multiple lucencies separated by sclerotic borders), while fibrous dysplasia is primarily an intramedullary process. Where both cortex and medulla are involved (like our two cases), the distinction between OFD and fibrous dysplasia becomes more difficult. Tissue analysis may be needed if the distinction cannot be made confidently based on clinical information (fibrous dysplasia seldom causes pain, less commonly involves tibia and occurs in older age group) or radiological ground (fibrous dysplasia is intramedullary and causes cortical thinning but not cortical thickening due to its expansile nature).

As mentioned above, differentiated adamantinoma and adamantinoma are the other key differential diagnoses of OFD apart from fibrous dysplasia; and no discussion on OFD is complete without mentioning adamantinoma. In fact, these three conditions are so similar histogenetically that they are regarded as a spectrum of the same disease showing various degree of epithelial differentiation [8, 9]. Some authors even believe OFD may be either a precursor or a regressive phase of adamantinoma [9], although the evolution of OFD to the adamantinoma or vice versa has not been confirmed [9]. Classic adamantinoma is a rare malignant epithelial bone tumor, with a prevalence rate of 0.1-0.5% of all primary bone tumors [8]. This low grade tumor is characterized most commonly by epithelial cells surrounded by a relatively bland spindle-cell osteofibrous component [10]. A stromal component with a fibrous dysplasia-like appearance is present in many cases. On the other hand, differentiated adamantinoma (or osteofibrous dysplasia-like adamantinoma) possesses features of both OFD and classic adamantinoma: it is characterized by predominance of osteofibrous stroma in which minimal amounts of epithelial cells are only detected by careful search on routine hematoxylin and eosin stained sections and then confirmed by subsequent
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immunohistochemistry. Although also typically occurs in the tibial diaphysis, adamantinoma differs from OFD by its age predilection (average age about 30, patients seldom present younger than 15 years old) and by its common symptom of pain. Its radiological appearance more often poses aggressive features such as a moth-eaten border, complete medullary cavity involvement and long lesion length (average 13 cm as opposed to the 6 cm in OFD and differentiated adamantinoma) [8], although adamantinoma may occasionally appear identical to OFD.

Being a benign lesion, OFD frequently regresses spontaneously while differentiated and classic adamantinoma tend to persist or progress with time. It is therefore crucial to achieve diagnosis as accurately as possible, as the management strategies for the aforementioned benign and malignant conditions are very different. Careful radiological analysis (using conventional radiography, computed tomography or magnetic resonance imaging) can sometimes provide helpful clues to differentiate benign from malignant intracortical bubbly/osteolytic lesions, but tissue confirmation is needed in cases with uncertain radiological diagnosis or prior to definite surgical treatment as the radiographic appearances of these lesions may overlap one another. It is also important to interpret the tissue confirmation result with the radiological appearances.

OFD commonly affects children and disease progression often ceases or even resolves with the termination of growth. Therefore conservative management remains the mainstay treatment for this benign osseous-fibrous disease. In a retrospective study done by S. B. Hahn et al. in 2007 where they enrolled fourteen patients diagnosed with OFD, all cases of patients with biopsy-proved OFD over the age of fifteen were closely observed, and all showed a benign course [11]. In addition, it is believed that young age at time of diagnosis, large lesion size and aggressive initial disease progression are some of the most important factors to predict disease recurrence after surgical removal of the tumor [4]. A wait-and-see approach is thus logical since surgery may not cure the disease, especially if the patients are young and pre-puberty. However, surgery is recommended if there is increasing bony destruction, bony deformity and rapid progression caused by OFD. In this context a radial extraperiosteal approach, rather than intra-lesional curettage should be performed, as subperiosteal curettage or subperiosteal excision frequently result in recurrence [1]. In view of this, our two patients, who choose curettage as it is the least invasive surgery, will require regular long term follow-up. Adamantinoma (classic or differentiated), on the other hand, requires surgical resection once the diagnosis is confirmed.

In conclusion, we have described two cases of OFD with unusual age of presentation. The clinicopathologic and radiological aspects of OFD and some of its important differential diagnoses are also discussed, in the hope to increase awareness of this uncommon osseous-fibrous condition and to summarize the current evidence for diagnosing and managing this benign condition.

REFERENCE

骨纖維發育不良症：兩病例報告與文獻回顧

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骨纖維發育不良症是一種好發於十歲以下孩童的罕見骨纖維疾病。這種大多長在前脛骨的疾病有多樣的臨床表現，從無症狀到疼痛變形都有。影像上，骨纖維發育不良症呈現邊界清楚之骨皮質病灶。不論在影像學上或臨床病理學上，骨纖維發育不良症和纖維性結構不良症及釉質上皮癌十分相似，也因此衍生了許多診斷及治療上的困擾。這篇文章除了介紹兩例年齡較不尋常的骨纖維發育不良症之外，也會將其臨床病理及影像學特徵和鑑別診斷作新的整理。