

# Parosteal ossifying lipoma of the fibula: a case report with contrast-enhanced MR study and a review of the literature

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**ABSTRACT** This report describes a rare case of parosteal ossifying lipoma of the fibula. Very few reports have described the magnetic resonance (MR) imaging features with gadolinium enhancement of this neoplasm. In this case, low-signal-intensity strands within the lipomatous mass on T1-weighted image with varying degrees of enhancement were detected. Thus, parosteal ossifying lipoma should be included within the group of gadolinium-enhanced benign lipomatous tumours that may mimic liposarcoma on MR imaging. However, the characteristic radiographic appearance, together with computed tomography or MR imaging features, should aid in the correct diagnosis of this condition.

*Keywords: fibula, lipoma, MR imaging, parosteal ossifying*  
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## INTRODUCTION

Parosteal lipoma is a rare benign lipomatous neoplasm that occurs in direct contact to the periosteum of an underlying bone. These lipomas are most commonly located adjacent to the femur or the radius.<sup>(1)</sup> Only eight cases involving the fibula have previously been reported,<sup>(2-8)</sup> four of which contained the osseous component, hence the name parosteal ossifying lipoma.<sup>(3-5,8)</sup> Although there are several reports with magnetic resonance (MR) imaging findings of parosteal lipomas, only three have described gadolinium-enhancement patterns<sup>(8-10)</sup> and in only one case, the tumour was attached to the fibula.<sup>(8)</sup> We present a rare case of parosteal ossifying lipoma of the fibula in a female patient as studied by plain radiography and MR imaging with gadolinium enhancement, along with a review of the related literature.

## CASE REPORT

A 35-year-old woman presented with a palpable mass at the left calf for 2–3 months. The abnormality was discovered incidentally by the patient while massaging her leg after housework. No associated pain, paraesthesia or weakness was observed. The mass did not enlarge. The patient had no underlying disease or previous history of trauma. On physical examination, a mass was observed at the lateral aspect of the patient's left calf, about 5 cm in size, located at about 17 cm above the left ankle joint. The mass had a firm to hard consistency and was fixed to the underlying bone. There was no tenderness on palpation. The overlying skin and soft tissue showed no discolouration or inflammatory change. No associated neurodeficit or evidence of vascular compromise was detected. Other systems were within normal limits and there was no significant laboratory finding.

Radiographs showed a well-defined radiolucent mass adjacent to the lateral aspect of the left fibula, which was associated with

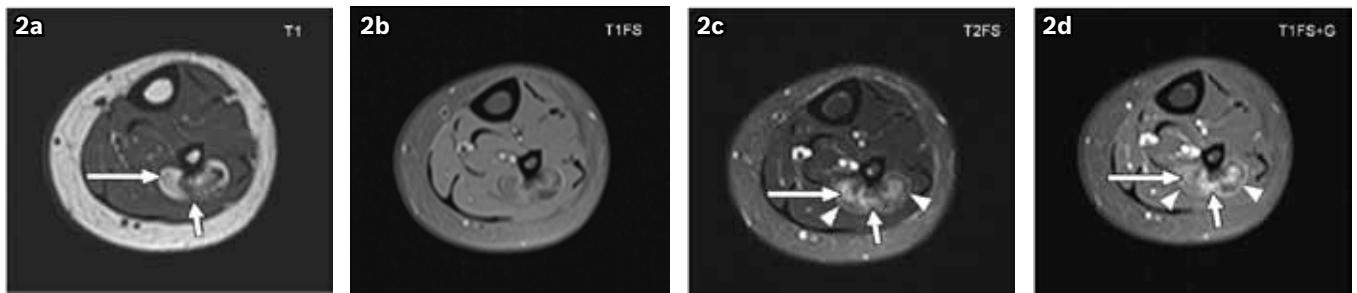


**Fig. 1** Plain radiograph of the left leg in lateral view shows a well-defined radiolucent mass adjacent to the lateral aspect of the left fibula. An irregular-shaped, smoothly marginated osseous excrescence is seen within the radiolucent mass, attached to the underlying cortex. No destruction of the underlying bone is detected.

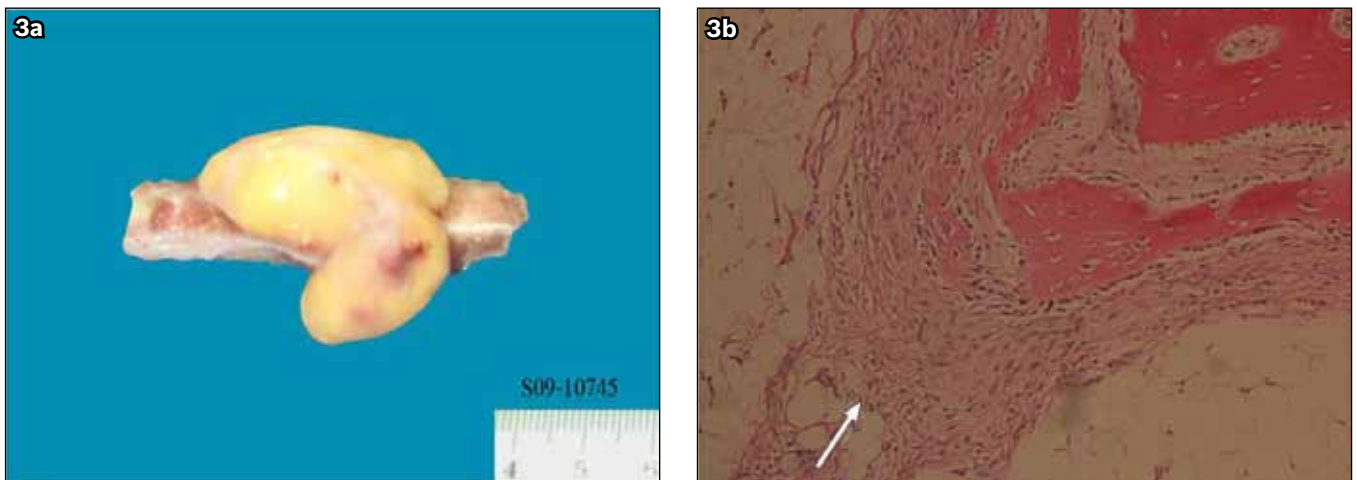
an osseous excrescence attached to the underlying cortex (Fig. 1). The first clinical impression was that of a soft tissue tumour or a tumour-like lesion, including parosteal chondroma, myositis ossificans and lipoma variant. MR imaging of the patient's left leg revealed a deep-seated, oval-shaped intramuscular mass in the peroneus and flexor hallucis longus muscles, abutting the lateral

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**Fig. 2** Axial MR images show (a) a well-circumscribed soft tissue mass with high signal intensity on T1-W image, and signal drop paralleling subcutaneous fat in (b) fat-suppression T1-W and (c) T2-W images. The bone excrescence attaches to the cortex of the fibula but does not show continuity with the marrow cavity or the fibular cortex. Low-signal strands within the lipomatous component are noted on the T1-W image (long and short arrows in 2a), which turn bright on the T2 FS-W image (long and short arrows in 2c) and show varying degrees of enhancement after gadolinium injection (long and short arrows in 2d). A thin rim of high-signal T2 surrounds the mass (arrowheads in 2c), which expressed enhancement after gadolinium (arrowheads in 2d). This could be the reactive zone or muscle oedema.



**Fig. 3** (a) Photograph shows the gross specimen with a well-circumscribed lobulated glistening yellowish mass attached to a portion of the fibula. (b) Photomicrograph of the specimen shows an island of trabeculae of woven bone rimming with active osteoblasts surrounded by fibroblastic stroma (arrow) (Haematoxylin & eosin,  $\times 100$ ).

and posterior cortex of the left fibular shaft, and measuring about 3.0 cm  $\times$  1.8 cm  $\times$  4.0 cm in transverse, anteroposterior and craniocaudal dimensions, respectively (Fig. 2). Its caudal extent was about 13.0 cm above the ankle joint. The mass had a predominantly fatty component, with signal intensity paralleling subcutaneous fat on all pulse sequences. Low-signal T1 strands were observed within the lipomatous mass, which became high-signal on the T2-weighted image, and showed varying degrees of enhancement after gadolinium administration. In addition, there was a thin rim of high-signal intensity on T2-weighted image surrounding the mass, which showed enhancement after administration of gadolinium; this could be the reactive zone or muscle oedema. The mass did not have continuity with the fibula by the marrow cavity or the cortical bone. No neurovascular involvement or bony invasion was detected. Based on imaging findings, the differential diagnoses were lipoma variant, low-grade liposarcoma and vascular malformation.

The patient underwent *en bloc* excision. Gross examination revealed a well-circumscribed, lobulated and glistening yellow mass, measuring 3.5 cm  $\times$  3.0 cm  $\times$  3.0 cm, attached to a portion of the fibula. The cut surfaces showed a homogeneous, glistening fatty tissue-like appearance with focal areas of white gritty tissue (Fig. 3a). Microscopically, the mass was made up of mainly

mature adult fat cells and a few foci of ossifying area composed of fibroblastic stroma and interspersed with woven and mature bone that was arranged in trabeculae and rimmed with active osteoblasts (Fig. 3b). No evidence of recurrent disease was identified at the follow-up examination four months post surgery, and no clinical complication was detected.

## DISCUSSION

Lipomas are the most common benign soft-tissue neoplasms, and account for almost 50% of all soft-tissue neoplasms. The majority of soft-tissue lipomas are superficial. Deep lipomas are less frequently encountered. They are found underneath the superficial fascia, most commonly intramuscular in location.<sup>(1)</sup> Osseous lipomas may be considered a separate group of rare benign lipomatous neoplasms affecting the bones, exhibiting either medullary, cortical or parosteal involvement.<sup>(3)</sup>

Parosteal lipomas are exceedingly rare benign lipomatous neoplasms located adjacent to the periosteum of an underlying bone. Approximately 150 cases of parosteal lipoma have been reported to date, accounting for 0.3% of all lipomas.<sup>(1)</sup> The original description of this condition was published in the German literature by Seering in 1836. The term 'parosteal lipoma', which was introduced by Power in 1888, was preferred over the

previously applied 'periosteal lipoma' due to its mere description of contiguity with the periosteum rather than a misleading implication of the precise tissue of origin.<sup>(2,9)</sup>

In contrast to subcutaneous lipomas, which are more commonly found in the neck and back, parosteal lipomas are more common in the extremities, occurring adjacent to the diaphysis or diametaphysis of the bone. The most common sites of parosteal lipomas are in the thigh contiguous with the femur or in the forearm adjacent to the radius. They have also been reported in the tibia, humerus, scapula, clavicle, ribs, pelvis, metacarpals, metatarsals, mandible and skull.<sup>(2)</sup> Parosteal lipomas in the fibula are quite rare, and to our knowledge, have previously been reported in only eight cases,<sup>(2-8)</sup> four of which exhibited osseous component and only one case had undergone gadolinium-enhanced MR study.<sup>(8)</sup>

Typically, lipomas are composed of only mature adipose tissue. However, other mesenchymal elements, such as smooth muscle or fibrous, cartilage or bone tissue, may occasionally be found. Osseous or chondral components are more frequently observed in osseous lipomas than in lipomas without connection to bone. However, not all osseous lipomas are ossifying lipomas, and the two terms may be confused. The former defines localisation of the tumour within the bone, while the latter describes the tumour composites. The terms ossifying lipoma, osteolipoma and lipoma with osseous metaplasia have been applied to describe a lipoma containing foci of ossification.<sup>(11)</sup> To our knowledge, there are only a few reports of parosteal lipomas with ossifications that were 'parosteal ossifying lipomas'.<sup>(8,12)</sup> In addition, the term 'parosteal lipomas with hyperostosis' has also been described, which implied an over-production of the cortical bone resulting from reactive changes of the adjacent bones.<sup>(2)</sup>

Miller et al<sup>(4)</sup> classified parosteal lipoma into four types according to the presence and characteristic of the associated bone reaction. Type I comprised parosteal lipoma that has no ossification, while Types II, III and IV referred to those with pedunculated exostosis, sessile exostosis and patchy chondro-osseous modulation, respectively. In our case, an ossification with broad-based attachment to the fibular cortex was demonstrated; thus, the lesion may be classified as type III according to the above classification.

The clinical features of parosteal lipomas are similar to those of subcutaneous lipomas, except that the former are almost exclusively solitary, with an exception of a reported case of multiple parosteal lipoma by Fernández-Sueiro et al.<sup>(13)</sup> The affected patients are generally aged 40–60 years. They usually present with a slowly growing, painless mass fixed to the underlying bones in the extremities. Due to its deep-seated location, the tumour is usually detected only when it has enlarged and it is usually difficult to determine the tumour consistency. Symptoms of neurodeficits have occasionally been reported, most commonly associated with forearm lesions adjacent to the radius, resulting in posterior interosseous nerve palsy.<sup>(1,12)</sup> In 2006, Seki et al<sup>(7)</sup> presented the first report of a patient with parosteal lipoma

adjacent to the fibula, causing common peroneal nerve palsy. In our case, the presenting symptom was a palpable painless mass at the calf, without neurological deficits.

Radiographic features of a parosteal ossifying lipoma are characteristically a well-circumscribed radiolucent mass around a bony excrescence attached to the cortex of the underlying bone. The lack of continuity between the medullary cavity of the underlying bone and the excrescence, and the presence of radiolucency differentiate the lesion from osteochondroma.<sup>(9)</sup> Computed tomography (CT) imaging has been shown to provide great assistance for evaluation of parosteal lipomas and to confirm the radiographic findings.<sup>(12)</sup> Both lipomatous and osseous components of the tumour can be easily appreciated based on the characteristic CT attenuations. Both the cortical and marrow components of the bony excrescence may be demonstrated, again without continuity with those of the underlying bone. Enhancement of the fibrous tissue component adjacent to the osseous excrescences has been described. However, differentiation between cartilaginous and fibrous components by CT is rarely possible.<sup>(1,9)</sup>

MR imaging has been considered the most useful adjunct to conventional radiography in the pre-operative evaluation of parosteal lipoma owing to its superb soft-tissue contrast and multiplanar imaging capability.<sup>(9,10)</sup> The MR imaging features of parosteal lipoma have been reported by several authors,<sup>(5-11)</sup> but only three have described findings on gadolinium-enhanced MR images.<sup>(8-10)</sup> These reports described the parosteal ossifying lipoma as a juxtacortical mass with signal intensity identical to that of subcutaneous fat in all pulse sequences, including fat suppression images. Low-signal-intensity strands were sometimes presented within the lipomatous tissue on T1-weighted images, corresponding to fibrovascular strands that are commonly found in lipomatous lesions.<sup>(5)</sup> Small portions of increased signal intensity in these fibrovascular tissue septae may be seen on longer TR (repetition time) images. In our case, we detected low-signal-intensity strands within the lipomatous mass on T1-weighted images, which turned bright on fat-suppressed T2-weighted images. There were varying degrees of enhancement at the previously mentioned low-signal T1 strands in the lipomatous portion. The thin rim surrounding the lesion on high-signal T2-weighted image, which showed enhancement after gadolinium injection, could represent the reactive zone or muscle oedema; it does not look like cartilaginous component, as cartilage itself does not usually become enhanced. In addition, there was no histologically demonstrable cartilage component in this case.

MR imaging has limitations for demonstration of minimal osseous component, but larger osseous excrescences are often well-delineated. Cortical bone, represented by areas of persistently low signal intensity on all pulse sequences, might be the only component seen in small excrescences. Larger osseous excrescences may demonstrate signal intensity paralleling those of bone marrow, without continuity with the underlying bone. In addition, MR imaging has been proven to be able to

delineate cartilaginous tissue within the tumour, seen as areas of intermediate intensity on T1-weighted images and high intensity on T2-weighted images. Cartilage and fibrous tissue are distinguishable by their different characteristic signal intensity on MR imaging.<sup>(8-10)</sup>

Kransdorf et al, in an attempt to define MR imaging features that distinguish lipomas from well-differentiated liposarcoma, concluded that although a certain number of lipomas with non-adipose areas would demonstrate an imaging appearance similar to well-differentiated liposarcoma, certain features may suggest malignancy. These features include increased age, large size, thick septa, nodular and/or globular or non-adipose mass-like areas and decreased percentage of fat composition.<sup>(14)</sup> Panzarella et al suggested that a false positive predictor of liposarcoma may occur with gadolinium-enhanced benign lipomatous tumours including angiolipoma, fibrolipoma, hibernoma and ossifying chondroid lipoma, owing to their increased vascularity.<sup>(15)</sup> Amores-Ramirez et al<sup>(8)</sup> recently pointed out that parosteal ossifying lipoma should be included in such a group due to its enhancing component. However, the characteristic radiographic appearance, together with CT or certain MR imaging features, should be sufficient for correct diagnosis. To our knowledge, no proven case of parosteal liposarcoma has been reported till date. Our case highlights that parosteal ossifying lipoma of the fibula, although benign in nature, shows gadolinium enhancement, and should thus be included in the differential diagnosis of gadolinium-enhanced benign lipomas.

MR imaging is considered superior to CT in the pre-operative evaluation of muscle atrophy, and thus plays an important role in the evaluation of the presence and site of nerve impingement by parosteal lipoma. Also, MR imaging can be used to determine the progression or improvement of such a complication. Murphey et al<sup>(9)</sup> reported muscle atrophy in 38% of their patients. However, we did not find evidence of muscle atrophy or any symptom of nerve involvement in our case.

In conclusion, we have presented a rare case of parosteal ossifying lipoma in the fibula. Characteristic radiographic, CT and MR imaging features should enable correct pre-operative diagnosis, although the tumour expresses areas of enhancement after gadolinium administration. Hence, parosteal ossifying lipoma should be included in the differential diagnosis of gadolinium-enhanced benign lipomas.

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