Lipomas are common mesenchymal tumors that can be easily diagnosed based on their characteristic imaging findings, including the presence of an attenuation unit between -65 and -120 on computed tomography and the observation of the same signal intensity as that of subcutaneous fat on all pulse sequences of magnetic resonance (MR) imaging. Lipomas usually exhibit well-defined margins and are localized within a compartment of the involved structure. However, some lipomas such as intramuscular lipoma, angiolipoma, or neural fibrolipoma may sometimes have irregular margins [1, 2]. Even these lipomas are usually localized within the compartment. The term “hernia” refers to a condition in which a part of a body organ or tissue protrudes through a weak opening in its surrounding walls. To the best of our knowledge, there has been no radiology report describing the imaging features of a herniated soft tissue lipoma.

Here, we report the MR image findings of 3 cases of herniated lipomatous tumor in the extremity.

Case Report

Case 1

A 29-year-old man presented with a protruded soft tissue mass in the lateral knee joint area; the mass had persisted for 6 years. There was no history of trauma. Although there was no pain at the lesion site, application of compression on the tumor resulted in pain along the lateral side of the knee joint. MR images revealed a well-defined outwardly protruding fatty mass in the subcutaneous fat layer. The size of this tumor was 4.6 × 3.1 × 2.2 cm (longitudinal diameter [L] × transverse diameter [T] × anteroposterior diameter [AP]). This fatty mass contained hypointense, nodular, and septal non-fat areas that did not enhance following contrast administration. On a fat-suppressed T2-weighted image, the protruded portion of the tumor appeared hyperintense, whereas the other portion exhibited suppressed
signal intensity (Fig. 1A-F). After surgery, this tumor was pathologically diagnosed as a fibrolipoma (Fig. 1G).

**Case 2**

A 34-year-old woman presented with a palpable mass on the volar aspect of the right hand; the mass had persisted for 8 months. Compression of the tumor resulted in pain. MR images showed a well-defined fatty mass in the subcutaneous fat layer. This mass had herniated through a defect in the palmar aponeurosis, and it measured 1.7×1.8×1.2 cm (L×T×AP). It contained several small nodular non-fatty areas that were eccentrically lo-

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**Fig. 1.** A 29-year-old man with a fibrolipoma.  
**A, B.** Coronal spin-echo T1-weighted MR images show a well-defined fatty mass with hypointense, nodular, and septal non-fatty areas [arrow] in the subcutaneous fat layer. This mass protruded outward [arrow].  
**C, D.** Axial spin-echo T2-weighted images show an ovoid fatty mass [arrow] in the subcutaneous fat layer; the mass protruded outward [arrow].  
**E.** Coronal fast-spin-echo T2-weighted image with fat suppression shows the hyperintense protruded portion of the tumor [arrow].  
**F.** Coronal post-contrast T1-weighted image shows no significant enhancement in the tumor [arrow].  
**G.** Photomicrograph of the histological specimen (original magnification, ×40; H & E stain) shows adipose tissue containing collagen fiber bundles.
The non-fatty areas appeared hypointense on T1-weighted images, hyperintense on T2-weighted images, and well enhanced on contrast-enhanced images. A gadolinium-enhanced T1-weighted image with fat suppression showed faint enhancement in the herniated and the waist portions of the tumor (Fig. 2A-D). This tumor was definitively diagnosed as an angiolipoma after surgery (Fig. 2E).

**Case 3**

A 54-year-old man presented with a large palpable mass in the arm; the mass had persisted for 30 years. Recently, he experienced numbness in the hand. Clinical examination revealed hypoesthesia in the hand.

**Fig. 2.** A 34-year-old woman with an angiolipoma.  
**A.** Coronal spin-echo T1-weighted MR image shows an ovoid fatty mass with hypointense, nodular, non-fatty areas (arrow) in the subcutaneous fat layer.  
**B.** Axial spin-echo T2-weighted image shows focal herniation of the fatty mass through the palmar aponeurosis defect (arrow).  
**C, D.** Axial post-contrast T1-weighted images with fat suppression show nodular enhancement (arrow) of the non-fatty areas. There is faint focal enhancement in the herniated portion of the tumor (arrow).  
**E.** Photomicrograph of the histological specimen (original magnification, ×40; H & E stain) shows scattered capillary vessels in the adipose tissue.
excluding the thumb. MR images showed an intramuscular fatty mass that had herniated to the subcutaneous fat layer through a defect in the muscular fascia (Fig. 3A, B). The size of this mass was 9.5 x 5.4 x 4.6 cm (L x T x AP). This tumor contained non-fatty areas comprising only thin, smooth, and hypointense septa. After surgery, the mass was diagnosed as an intramuscular lipoma (Fig. 3C).

Discussion

Muscle herniation is common in the musculoskeletal system (3-7) and is defined as a protrusion of a portion of muscle through an acquired or congenital defect in the enclosing fascia. It can lead to local pain and tenderness. In contrast to the commonly occurring muscle herniation, intercompartmental herniation of a lipoma has not been reported. All our cases described above had a waist at the opening site of herniation. The lipomas herniated irrespective of the size and location of the tumor. In 2 of our patients (Cases 2 and 3), the lipomas had herniated through the fascial defects in the palmar aponeurosis and triceps. We believe that pre-existing fascial defects, most probably, led to these herniations. Fascial defects can be classified as traumatic or constitutional (7). Traumatic defects can be direct or indirect, resulting from a blow to the contracted muscle. Constitutional defects are either congenital or secondary to vigorous exercise that leads to muscle hypertrophy and elevated intracompartmental pressure.

In Case 1, the lipoma had herniated to the skin; this occurred probably due to the weakness of the supporting connective tissue of the subcutaneous fat layer.

According to other reports, signal intensity and enhancement patterns of non-fatty areas of lipomas have been used to identify component tissues such as vessels, fibrous tissue, muscles, and focal fat necrosis on MR images (1, 2). However, when areas other than these non-fatty areas were viewed, 2 patients (Cases 1 and 2) exhibited a poorly de-
fined change in signal intensity in the waist and herniated portions of the tumors. We speculate that this finding suggests either an edematous change due to the ischemia resulting from pressure in the waist portion of the tumor or focal fat necrosis induced by ischemia of a long duration, which was not observed in the 2 cases.[Editor 5] (*Memo: If the reference is to Cases 1 and 2, please revise the phrase as "in the 2 cases. Further, please check the changes made in the entire sentence.) In these 2 patients who complained of pain when the tumor was compressed, the pain may be related to the edematous change. In Case 3, numbness may not be directly related to tumor herniation, but may be related to nerve compression by the enlarged tumor. It is well known that non-fatty areas such as septa play an important role in differentiating between classic lipoma and well-differentiated liposarcoma (8-10). In our cases, it was easy to differentiate the lipomas from liposarcoma because the image findings of the non-fatty areas of the lipomas were distinctly different from those of a liposarcoma.

In conclusion, lipoma occasionally herniates through a fascial defect or loosened supporting connective tissues in the subcutaneous fat layer. This phenomenon may occur due to a congenital defect or traumatic change. Herniation leads to the development of a waist portion in the lipoma and occasionally decreases the blood flow due to compression, leading to a focal ischemic change. Although this ischemic change in the lipoma appears as an abnormal signal change on MR imaging, the imaging finding is clearly different from that associated with a liposarcoma.

References