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# Heterotopic Ossification of the Distal Portion of Biceps Femoris. Case Report and Review of the Literature

Yutaka Yabe[1], Masahito Hatori[2], Jun Kumagai[1], Noriyuki Koizumi[1], Tsutomu Sakuma[3], Masanori Kawamura[1]

[1]*Department of Orthopaedic Surgery, Iwate Prefecture Central Hospital*
[2]*Department of Orthopaedic Surgery, Tohoku University School of Medicine*
[3]*Department of Pathology, Iwate Prefecture Central Hospital*

**Abstract**

Heterotopic ossification is the formation of mature lamellar bone in soft tissue. We report a very unusual case of heterotopic ossification arising in the distal portion of the biceps femoris muscle. A 29-year-old woman presented with knee pain after playing golf. She had had no apparent history of trauma. Radiography of the knee showed a calcified mass adjacent to the lateral side of her knee joint. The radiological diagnosis was calcification of the lateral collateral ligament. The pain soon disappeared without treatment. At the age of 45 years, she complained of a growing mass in her left knee that was occasionally painful. Computed tomography and magnetic resonance imaging demonstrated a well matured ossified mass in the lateral side of her left knee. Radiologically and macroscopically, it was found to be in continuity with the distal part of biceps femoris. The mass was excised en bloc. Microscopically, the lesion was mainly composed of well-matured lamellar bone with bone marrow and islands of cartilage showing enchondral ossification. No apparent zoning was found. Cellular atypia was not observed. Extraskeletal osteosarcoma was ruled out. The mass was diagnosed as a heterotopic ossification arising from the distal part of biceps femoris.

## Introduction

Heterotopic ossification (HO) is formation of mature lamellar bone in soft tissue and is often associated with traumatic injuries [1]. It was first described in 1692 by Patin in children with myositis ossificans progressive [2]. Based on a hypothetical etiopathogenetic mechanism, several terms have been used to denote this condition, e.g. ectopic ossification, myositis ossificans, neurogenic ossifying fibromyopathy, paraosteoarthropathy and periarticular ossification. In the current medical literature the term heterotopic ossification is used. There is no consensus on the definition and classification of HO [3]. HO typically occurs after trauma, neurogenic injury, or from congenital causes. Idiopathic heterotopic ossification has rarely been reported [1]. We present a case of HO arising in the biceps femoris muscle with no history of trauma.

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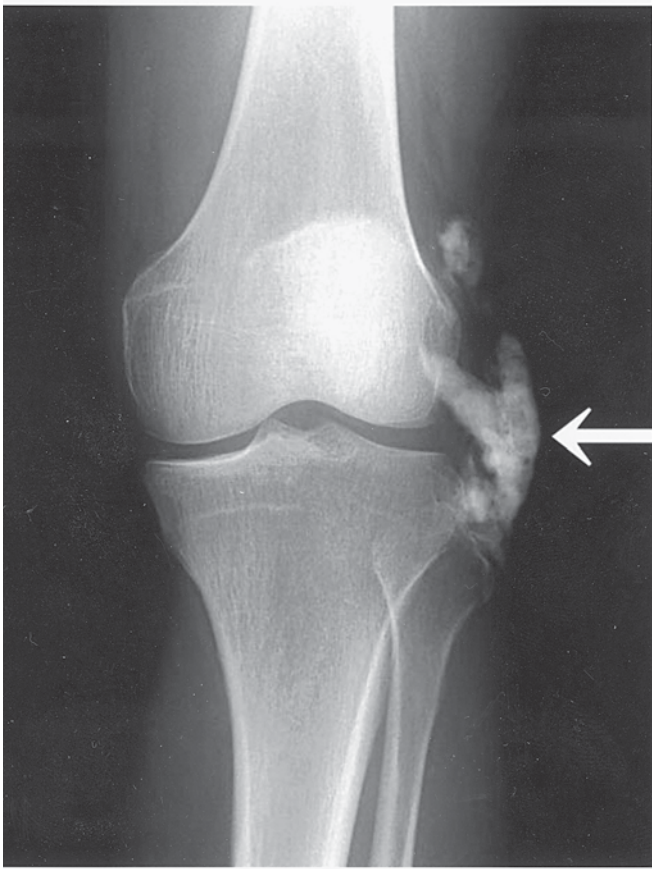

*Figure 1.* Plain radiograph showing a well-circumscribed ossified mass (arrow) adjacent to the knee joint.

## Case Report

A 29-year-old woman presented with knee pain after playing golf. She had had no apparent history of trauma. Clinical examination did not reveal a palpable mass. Radiography of the knee showed a calcified mass adjacent to the lateral side of the knee joint. The radiological diagnosis was calcification of the lateral collateral ligament. The pain soon disappeared without treatment. At the age of 45 years, she complained of a growing mass in her left knee that was occasionally painful. Clinical examination revealed a palpable mass on the lateral side of her left knee. The mass was hard, smooth, not tender, and slightly mobile. Plain radiography showed a well-circumscribed ossified mass adjacent to the lateral side of her knee joint, which was much enlarged compared with the radiograph taken 16 years ago (Fig 1). Computed tomography (CT) showed a mass close to the femur, tibia and fibula. There was no medullary continuity with the underlying bone (Fig 2). The underlying bone showed no abnormal findings. Magnetic resonance imaging (MRI) revealed that most of the mass was of low signal intensities on both T1 and

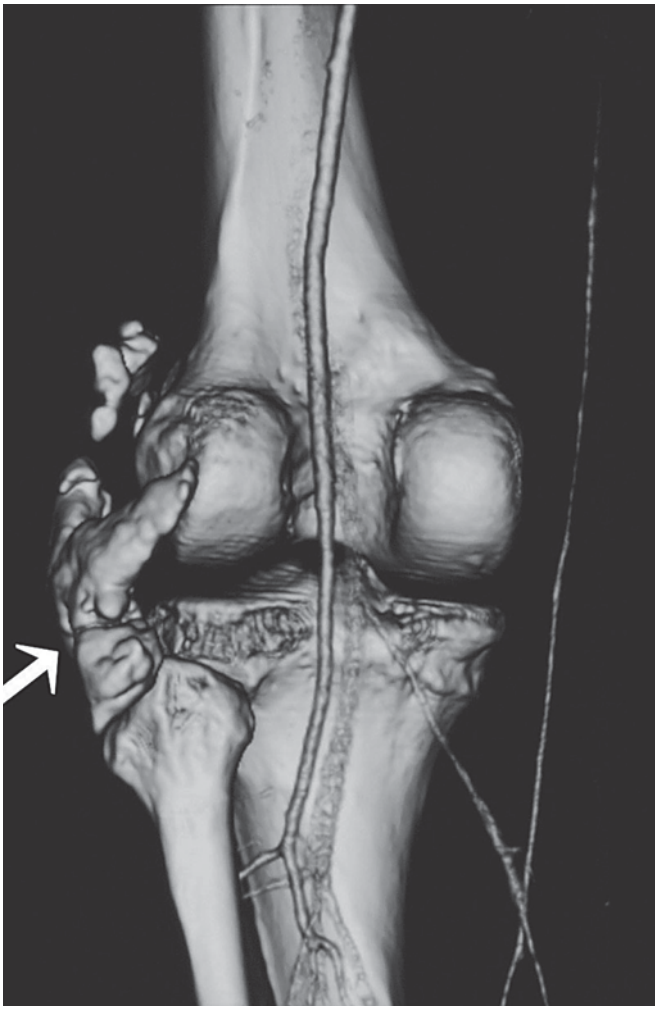

*Figure 2.* Three dimensional computed tomograph showing an ossified mass (arrow) close to the femur, tibia and fibula.

T2 weighted images. There were no abnormal signal changes within the bone marrow of the underlying bone and surrounding soft tissue. The ossified extraskeletal mass was suspected to be in continuity with the distal part of biceps femoris. Macroscopical examination at surgery revealed an irregularly-shaped mass attached to the distal part of the biceps femoris, surrounding the lateral collateral ligament. The mass was excised with the attached distal portion of biceps femoris. The mass, 7.0cm × 2.5cm × 3.0cm in size, looked as well matured bone (Fig.3).

Microscopically, the lesion was mainly composed of well-matured lamellar bone with bone marrow and islands of cartilage showing enchondral ossification. No apparent zoning was found. Cellular atypia or immature osteoid were not observed (Fig 4). Extraskeletal osteosarcoma was ruled out. The mass was diagnosed as HO arising from biceps femoris.

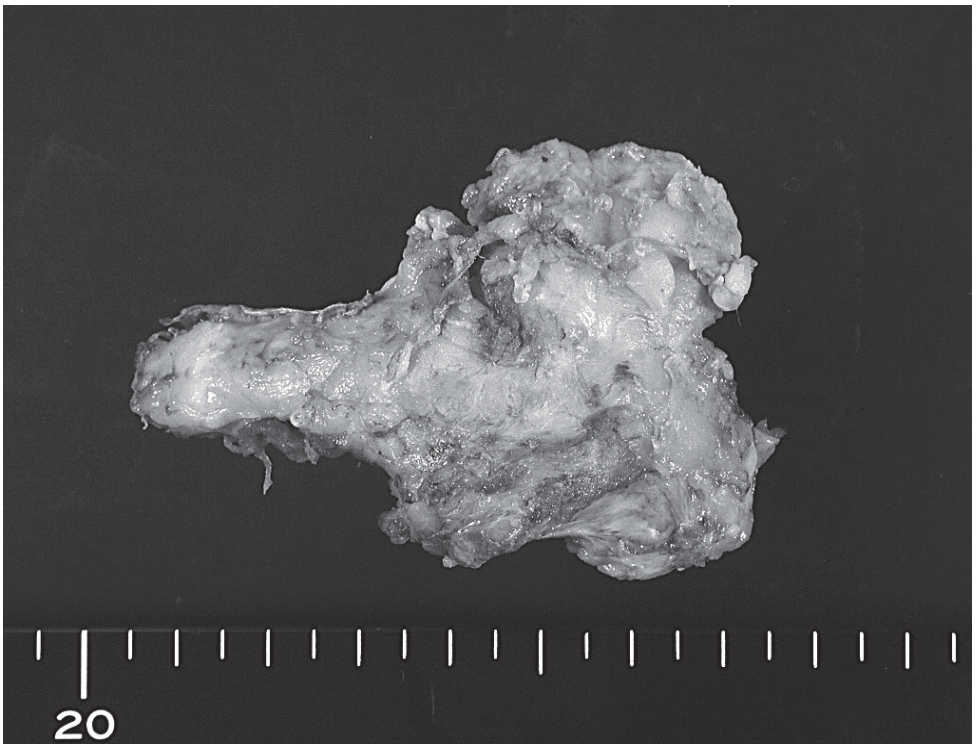


*Figure 3.* The mass was excised with the attached distal portion of the biceps femoris. The mass, 7.0 cm × 2.5 cm × 3.0 cm in size, looked as well matured bone. (right side: proximal side).

## Discussion

Most cases of heterotopic bone formation arising within muscles occur in the quadriceps femoris and brachialis [4]. Schultz reviewed 223 cases from old records of soldiers of the German army over a 10-year period. All but three cases were in the previously mentioned muscle groups [5]. HO arising within the biceps femoris muscle is extremely rare. To the best of our knowledge, there has been only one report of HO arising within biceps femoris [6]. HO formed within the muscle can be seen at any age, but most commonly occurs in adolescents and young adults, with more than one half of all cases occurring in the third decade [7]. The earliest manifestations of HO are typically localized swelling, local heat, edema, pain and decreased range of motion of the involved joints [4 ,8]. The present case did not show these signs. As the lesion matures, the pain, warmth, and erythema subside [9]. HO usually forms trabeculated bone over a period of 6 to 17 months [8]. In this case, it took sixteen years for the mass to grow substantially, much more slowly than in other reported cases.

Plain radiographs reveal either ossifications arranged in a ring around a central lucent area or a more or less homogenous calcified mass [10]. CT scan shows that

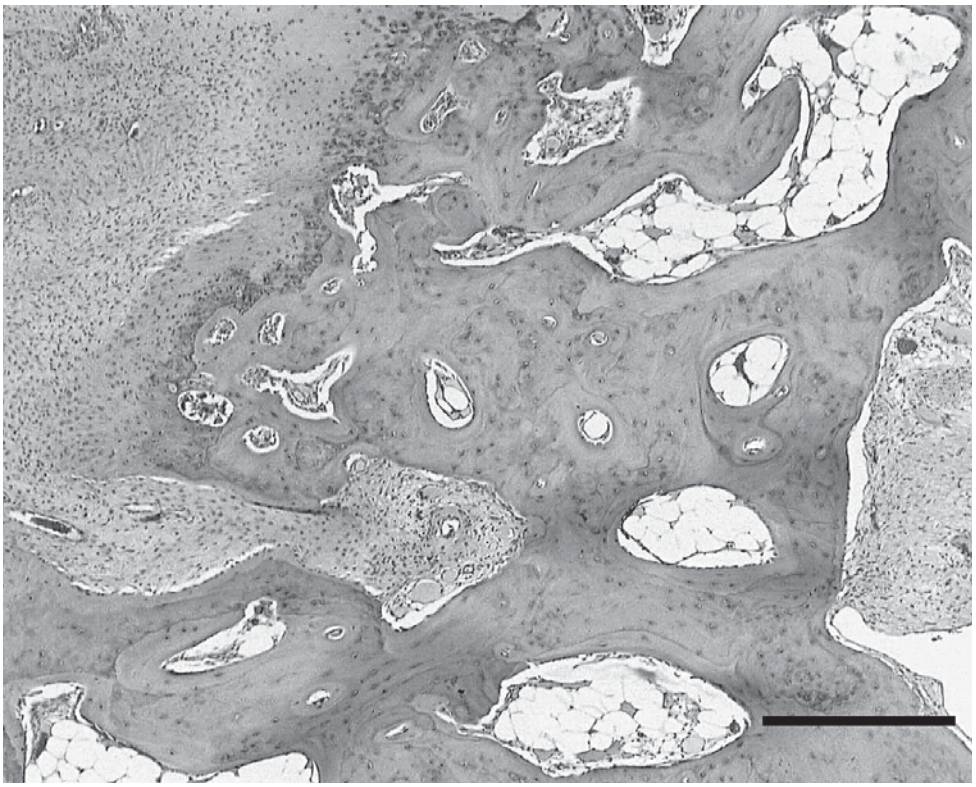

*Figure 4.* Microphotograph showing that the lesion was mainly composed of well-matured lamellar bones with bone marrow and cartilaginous metaplasia with enchondral ossification. Cellular atypia or immature osteoid were not observed. (Scale: 200 μm).

the underlying cortical bone is intact and that there is a space between the mass and the neighboring bone [10]. The MRI appearances of HO are variable and depend on the maturity of the lesion. In the early phase, T1-weighted images may either be normal, or the lesion may appear isointense compared with muscle. On T2-weighted images, HO appears as a heterogeneous focal mass with high central signal intensity. At the maturation phase, T1 and T2-weighted images may demonstrate a central area of high signal intensity representing fat between bony trabeculae, with peripheral and central low signal intensity areas of ossification [7, 11]. In the present case, plain radiography and CT demonstrated a well-ossified homogenous mass and MRI revealed that most of the mass was of low signal intensity on both T1 and T2-weighted images.

Histology usually shows three concentric layers. The cellular central zone is the least well-differentiated area and contains young fibroblasts with no cellular atypias or abnormal mitoses. Osteoblasts and osteoid deposits are visible in the intermediate zone. The outermost zone is a shell of mature bone [10]. In the present case, macroscopic zonation was not seen, probably because the ossification oc-

curred over 16 years. Microscopically, enchondral ossification was observed like the ectopic ossification in the other site [12 ,13 ,14].

The pathophysiology of HO is unknown. Several theories have been proposed, including inflammatory factors derived from denervated tissues, disrupted calcium homoeostasis, immobilisation, prolonged pressure on periarticular structures, microtrauma, vascular stasis, hypoxia, hyperthermia, and genetic factors [1]. The majority of cases of HO arising within muscles are the posttraumatic type. The basic mechanism is due to metaplasia of intermuscular connective tissue which is preceded by the formation of a hematoma. This appears to trigger a mechanism that results in the development of HO [15]. The idiopathic type is rare and occurs in patients with no predisposing injuries or conditions [16].

Craven and Urist reported transformation of primitive mesenchymal cells, present in the soft tissues of the fascia, into osteogenic cells to be the pathogenesis of HO [17]. Chalmers et al. described 3 conditions necessary for HO formation: osteogenic precursor cells, inducing agents and a permissive environment [18]. This would trigger the transformation of mesenchymal cells into bone-forming cells. This differentiation is induced by bone morphogenic proteins (BMPs) [3 ,19].

HO arising within muscles is usually a self-limiting condition and spontaneous resolution can occur. This is more likely in smaller, upper-extremity lesions than in larger or lower-limb lesions [20]. Conservative management with clinical and radiological follow-up may be sufficient when the lesion is typical [7]. Surgical excision should be considered if the patient has persistent pain, or if there is a prominent mass or limitation of motion of an adjacent joint. Only a mature lesion should be excised. Premature excision can lead to a rapid local recurrence [9]. Extraskeletal osteosarcoma should be suspected even if the lesion is small but composed of anaplastic cells and immature lace-like osteoid [21]. There are a few reports concerning the malignant potential of HO arising within muscles [22 ,23]. In the present case, the mass was excised because of the pain and because the growth continued over 16 years, and good clinical results were obtained.

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*Corresponding author:*
Masahito Hatori, M.D.
Department of Orthopaedic Surgery,
Tohoku University School of Medicine,
1-1 Seiryomachi, Aobaku, Sendai, Japan 980-8574
Tel: 81-22-717-7242, Fax: 81-22-717-7248
mhato@mail.tains.tohoku.ac.jp