

## Tc-99m RBC perfusion and blood-pool scintigraphy in the evaluation of vascular leiomyoma of the hand

Seok Tae LIM,<sup>\*\*\*</sup> Min-Woo KIM<sup>\*</sup> and Myung-Hee SOHN<sup>\*\*\*</sup>

*Departments of \*Nuclear Medicine and \*\*Research Institute of Clinical Medicine,  
Chonbuk National University Medical School, Chonju, Korea*

A 62-year-old man with a soft, non-tender, movable mass 2.5 × 2.5-cm in diameter in the volar surface of the right index finger over the proximal phalanx underwent Tc-99m RBC perfusion and blood-pool scintigraphy to evaluate the vascular nature and extent of the mass. Highly increased activity on early and delayed blood-pool images with increased perfusion was demonstrated in the mass. The lesion with high flow rates and large blood pool spaces was considered highly suggestive of one of the various types of peripheral hemangioma. Angiography revealed a vascular neoplasm with tumor vessels. Microscopic examination of the resected tumor revealed vascular leiomyoma containing numerous dilated vascular channels. These scintigraphic abnormalities were regarded as resulting from hypervascularity demonstrated angiographically and blood pooling within the dilated vascular channels demonstrated histologically. It is concluded that Tc-99m RBC perfusion and blood pool scintigraphy may be an important non-invasive approach to demonstrate vascular leiomyoma prior to surgical biopsy or resection.

**Key words:** vascular leiomyoma, hemangioma, Tc-99m RBC scintigraphy

### INTRODUCTION

VASCULAR LEIOMYOMA is a benign smooth muscle tumor that originates in the muscularis layer of vessel walls. The tumor is presented as a slow-growing, non-tender, movable, and occasionally painful mass.<sup>1</sup> Although soft tissue tumors of the hand are common, vascular leiomyoma occurs uncommonly and is often misdiagnosed.<sup>1</sup> Preoperative diagnosis is rarely made, but when soft tissue tumor develops in the hand, we should attempt to evaluate the vascular nature and extent of the tumor prior to surgery or resection in order to avoid bleeding during the procedure, but ultrasound and angiography of such lesions are not always diagnostic. Tc-99m red blood cell (RBC) perfusion and blood-pool scintigraphy may be used to establish the diagnosis and evaluate the vascular nature

and exact extent of the soft tissue lesions.<sup>2–7</sup>

We recently evaluated a soft tissue tumor of the hand, proved to be vascular leiomyoma, in a 62-year-old man by means of Tc-99m RBC perfusion and blood-pool scintigraphy. This paper describes the findings and role of Tc-99m RBC scintigraphy in an unusual case of vascular leiomyoma arising from proper palmar digital arteries in the index finger.

### CASE REPORT

A 62-year-old man was admitted for evaluation of a mass on his right index finger. The mass has been progressively enlarging for ten years. There was no history of trauma or infection. Physical examination revealed an otherwise healthy man in a good nutritional state. Examination of his hand showed a soft, non-tender, movable mass 2.5 × 2.5-cm in diameter in the volar surface of the right index finger over the proximal phalanx. Preoperative laboratory studies including a complete blood count with differential and erythrocyte sedimentation rate were within normal limits.

Roentgenogram of the right index finger showed a soft

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For reprint contact: Myung-Hee Sohn, M.D., Department of Nuclear Medicine, Chonbuk National University Hospital, 634–18 Keumam-dong Duckjin-gu, Chonju, Chonbuk 561–712, KOREA.

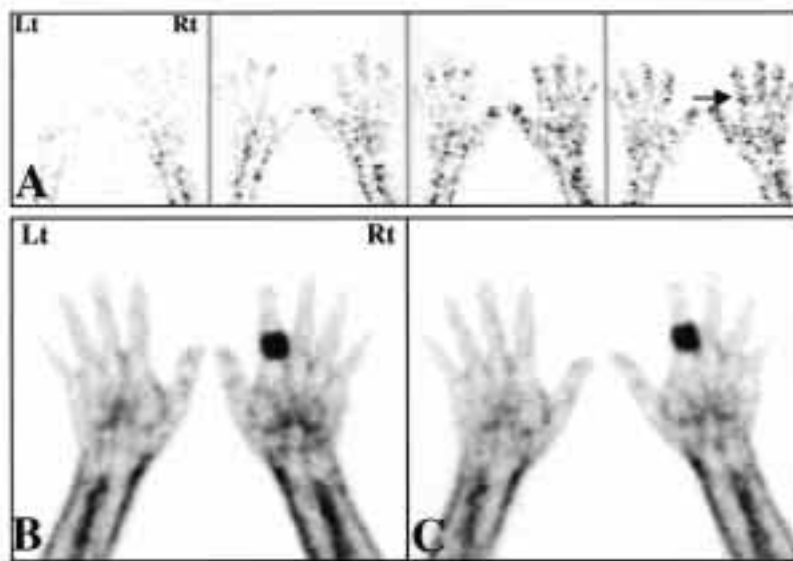
E-mail: mhsohn@moak.chonbuk.ac.kr



**Fig. 1** Lateral views of the roentgenogram of the right index finger demonstrate a soft tissue mass (*arrow*) without phleboliths in the mass and erosion of the underlying bone.

tissue mass without phleboliths in the mass, or erosion of the underlying bone (Fig. 1). An ultrasonogram revealed that the mass was a hypoechoic soft tissue tumor. Doppler study showed prominent vasculature within the mass. On the impression of a vascular lesion such as hemangioma, Tc-99m RBC scintigraphy was taken after an injection of 555 MBq (15 mCi) of Tc-99m-labeled autologous RBC, by using the modified *in vivo* technique. Perfusion images demonstrated a focal area of increased activity corresponding to the mass in the right index finger. Early and delayed blood-pool images taken at 5 and 60 minutes after injection of Tc-99m RBC showed a highly increased blood pooling corresponding exactly to the area of the mass (Fig. 2). Based on these findings, hypervascular neoplasm with a large vascular space was considered likely.

Angiogram of the right hand was obtained to visualize



**Fig. 2** Perfusion images (A) (3 sec/frame) demonstrate a focal area of increased activity in the right index finger (*arrow*). Early (B) and delayed blood-pool images (C) taken at 5 and 60 minutes show a highly increased blood pooling corresponding exactly to the area of the mass.



**Fig. 3** Angiogram of the right hand demonstrates an intensely staining neoplasm with tumor vessels supplied from proper palmar digital arteries of the index finger.



**Fig. 4** Photomicrograph shows proliferation of smooth muscle cells between dilated vascular channels, which is consistent with vascular leiomyoma (hematoxylin and eosin stain; original magnification,  $\times 100$ ).

the vascular anatomy adjacent to the mass. The mass was a vascular tumor with tumor vessels supplied from proper palmar digital arteries of the index finger (Fig. 3). The patient safely underwent excisional biopsy. The pathologic diagnosis was a vascular leiomyoma composed of proliferation of smooth muscle cells between dilated vascular channels (Fig. 4).

## DISCUSSION

Leiomyoma is a benign tumor of smooth-muscle origin that can occur wherever smooth muscle is present. The uterus and gastrointestinal tract are considered the most common locations. Their occurrence in the hand is extremely uncommon, because of the paucity of smooth muscle in the hand, which is restricted to the erector pili muscle, vascular wall and sweat glands.<sup>8</sup> Most leiomyomas of the hand appear to be associated with vascular structures and to be forms of vascular leiomyoma.<sup>8-10</sup>

Vascular leiomyomas arise in the tunica media of the vessel walls. They occur more frequently in the lower extremities than in the upper extremities.<sup>1</sup> When vascular leiomyomas develop in the upper extremities, they can occur in the hand, wrist or forearm. When the hand is affected, vascular leiomyoma tends to be located in the volar surface and not seen distal to the distal interphalangeal joint.<sup>11</sup> The lower extremity tumors occur twice as often in women and the upper extremity tumors occur more frequently in men. The peak incidence is in the fourth to sixth decade of life.<sup>1</sup> Surgical excision is the treatment of choice.

Clinically, the most common complaint with a vascular leiomyoma is a non-tender, movable, slow-growing mass. The tumor causes pain in approximately 60% of patients.<sup>1</sup> The tumor varies in size from 0.5 to 4.0 cm (mean, 1.5 cm) in diameter. A history of trauma is present in only half of the cases. The average duration before the excision of the tumor is 11 years.<sup>12</sup> Clinical diagnosis is very difficult and is usually made postoperatively. Roentgenographically, a soft-tissue mass may be seen. Pressure erosion of the adjacent bone can occur from expansile growth of the lesion.<sup>13</sup> Doppler ultrasonography can demonstrate the vascular nature of the lesion, but the tumor is often misdiagnosed.<sup>12</sup> In this case, hemangioma was considered. Angiography may be beneficial in demonstrating the vascular nature and extent of the tumor, but this procedure is invasive.

The usefulness of Tc-99m RBC scintigraphy in the detection and evaluation of peripheral soft tissue vascular lesions, such as hemangioma and arteriovenous malformation, has been well described.<sup>2-7</sup> This procedure is relatively non-invasive and easy to perform and has no complication. Peripheral hemangioma on Tc-99m RBC scintigraphy characteristically has been reported to have low perfusion and high blood pooling (perfusion-blood pool mismatch) due to sluggish blood flow and a large

blood pool,<sup>3-5,15</sup> but there was some difference between scintigraphic findings due to different histopathologic types of peripheral hemangiomas.<sup>15,16</sup> Cavernous and venous hemangioma showed normal or slightly increased perfusion with increased blood pooling because of low flow rates and a large blood pool space. Capillary and racemose hemangioma showed increased perfusion and blood pooling because of high flow rates and moderate blood pool space. On the other hand, soft tissue arteriovenous malformations showed increased perfusion and normal or slightly increased blood pooling reflecting a high flow rate and small blood pool space.<sup>6,7</sup> Perfusion and blood pool scintigraphic findings are characteristics to be considered in distinguishing between soft tissue arteriovenous malformations and hemangioma, but the scintigraphic findings in this study showed increased perfusion and blood pooling. One of the various histopathologic types of peripheral hemangioma with high flow rates and large blood pool space was considered likely, but the pathologic diagnosis was a vascular leiomyoma with proliferation of smooth muscle and dilated vascular channels.

To the best of our knowledge, there are no previous reports giving Tc-99m RBC scintigraphic evaluation of the detection of vascular leiomyoma. The increased perfusion of vascular leiomyoma on Tc-99m RBC scintigraphy correlated with hypervascularity in tumor vessels revealed angiographically, and the intensely increased blood pooling correlated with Tc-99m RBC pooling in dilated vascular channels within the tumor, and were revealed microscopically. Although we could not find characteristic findings on Tc-99m RBC scintigraphy in distinguishing between vascular leiomyoma and various types of hemangiomas, this procedure was a useful method for the investigation of the vascular nature and exact extent of a soft tissue tumor of the hand, proved to be vascular leiomyoma, before a surgical procedure is undertaken. We conclude that Tc-99m RBC perfusion and blood pool scintigraphy may be a quick, relatively non-invasive method of choice for a patient suspected of having vascular leiomyoma.

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