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The Study of Relationship between Anatomical Sites and Depth of the Lipoma

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Background: Lipomas are the most common benign tumors and surgical removal is the treatment of choice. However, some deep-seated lipomas are technically challenging to surgically excise from a dermatologist's perspective. This study was planned to help predict the depth of lipomas depending on their anatomical site of occurrence.
Objective: To determine whether there is a relationship between the anatomical site and the depth of lipomas.
Methods: We retrospectively reviewed the medical records of 459 patients with 459 lesions diagnosed as lipoma, surgically treated between June 2006 and June 2019. Histopathologic evaluation was performed to determine the relationship between the depth and the specific subtype of the lipoma.
Results: The most common site of occurrence was the trunk (177; 38.6%). Most of the lipomas (388; 84.5%) were located in the subcutaneous fat layer. Some lipomas (71; 15.5%) were found in deeper tissues, such as the intramuscular, intermuscular, and submuscular layers. The forehead and flank had a higher incidence of deep-seated lipomas than other areas.
Conclusion: Our results revealed that lipomas in the forehead and flank are more likely to occur in deeper layers. In clinical practice, physicians often skip radiologic evaluation before surgery. However, we recommend preoperative radiologic evaluation before surgical excision of lipomas of the forehead and flank.

Keywords: Dermatologic surgery, Lipoma

INTRODUCTION

Lipomas are the most common soft-tissue tumors, and they may occur at any site. The typical clinical presentation is a solitary, slow-growing, and painless subcutaneous tumor located in the trunk or extremity in adults[1]. Most of them arise in subcutaneous tissues, and these tumors are easily diagnosed by clinical examination without the need for radiographic evaluation[2]. Lipomas can be easily treated with simple excision. A simple skin incision with tumor enucleation is preferred rather than wide excision because most lipomas are relatively well encapsulated[3].

Deep-seated lipomas, such as intramuscular, intermuscular, and submuscular lipomas, are less common and are larger than subcutaneous lipomas[4]. Deep-seated lesions tend to be less circumscribed and occasionally demonstrate a more infiltrative growth pattern. These lesions also need to be differentiated from malignancies such as lipoma-like well-differentiated liposarcomas[5]. The extent of resection often needs to be modified based on the depth to avoid injury to important neurovascular or muscular tissues and to prevent functional impairment. Therefore, surgical excision of deep-seated lipomas is technically challenging, and preoperative radiographic evaluation is required[6]. It is best to perform a preoperative imaging test for all lipomas, but there are difficulties in actual clinical practice due to problems such as cost. Therefore, if we understand the distribution of deep-seated lipomas, imaging tests can be used more reasonably. Previous research for the distribution of deep-seated lipoma reported that these lesions were found mainly in the forehead and chest wall[7]. Another researcher reported that

47% of intramuscular lipomas occur in the chest wall and upper limb[8].

However, to the best of our knowledge, all clinical investigations regarding the distribution of lipomas were performed in the Western countries. Also, most studies were performed by other departments, such as orthopedics and radiology, but not dermatology.

In this single-center, large-scale study, we analyzed the epidemiology and characteristics of deep-seated lipomas in Korean patients, who visited the Department of Dermatology in Kyung-Hee University hospital.

MATERIALS AND METHODS

Patients

We retrospectively reviewed the medical records (including photographs) of 459 lesions from 459 patients who were diagnosed with lipoma and surgically treated in the Department of Dermatology, Kyung Hee University Hospital at Gangdong, between June 2006 and June 2019. We only included patients with a single lipoma. All lipoma operations were performed by a board-certified dermatologist with lidocaine as the local anesthetic agent. After the operation, the histopathologic features of all excised specimens were analyzed by board-certified pathologists. The following clinical data were collected during the review of medical records and photographs: patient age and sex; lipoma duration; symptoms (only presence or absence of pain or tenderness); and the anatomical site, size, depth, and clinical configuration of the lesions. We identified lipomas in 14 different anatomical sites (Fig. 1). We received the patient's consent form about publishing all photographic materials.

Methods

In this study, most lesions (387 of the 459 lesions) were subjected to one or more radiographic imaging studies: 379, 27, and 19 lesions underwent ultrasound (US) scans, computed tomography (CT) scans, and magnetic resonance imaging (MRI) scans, respectively. The depth of the remaining lesions (72 lesions) was determined by preoperative clinical findings and by reviewing the operation records. Based on these data, we classified the lipomas according to the depth as follows: superficial lipomas, which were located in the subcutaneous fat layer, including lipomas that originated from the subcutaneous fat layer and infiltrated the fascia or muscular layer, and deep-seated lipomas that were located in one of the muscular layers (submuscular, intermuscular, or intramuscular layer). We then investigated distribution of deep-seated lipoma according to anatomical sites. In addition, all lesions were histopathologically analyzed and classified into specific lipoma subtypes, such as angiolipoma, fibrolipoma, and liposarcoma. We further classified subtype of lipoma into depth. The study protocol was approved by an institutional review board (IRB) of Kyung Hee

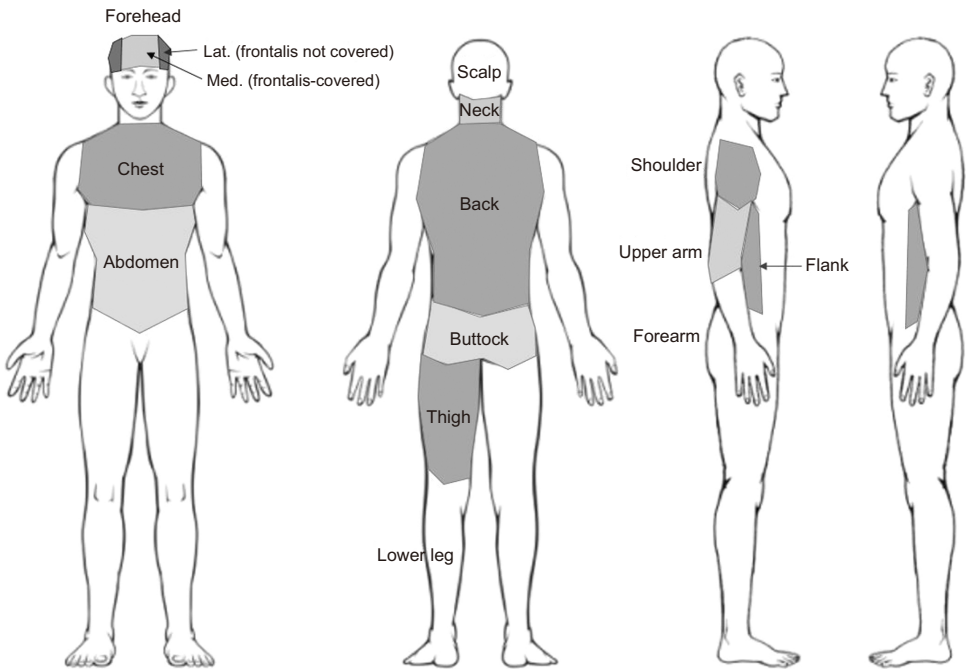

Fig. 1. Diagram for body site division. Med: medial side of the forehead that was covered by the frontalis muscle, Lat: lateral side of the forehead that was not covered by the frontalis muscle.

University Hospital at Gangdong (IRB No. KHNMC 2020-12-036).

RESULTS

Patient characteristics

Among the 459 patients diagnosed with lipoma, there were more males than females (247 vs. 212; male-to-female ratio, 1.16:1). The youngest patient was 5 years old, and the oldest was 77 years old. The mean age at diagnosis was 44 years. Most patients (n=413; 90.0%) were asymptomatic at diagnosis. Some patients (n=46, 10.0%) had mild to moderate intermittent pain or tenderness. The mean interval between the onset of symptoms and surgical treatment was 1.9 years (range, 5 months to 3.7 years).

Relationship between anatomical site and depth of lipomas

The most common site of lipoma was the trunk (177 of the 459 lesions, 38.6%). A total of 153 lesions (33.3%) were located in the head and neck region; 82 lesions (17.9%) in the upper extremities, including the shoulder girdle; and 47 lesions (10.2%) in the lower extremities, including the thighs and buttocks (Table 1). The forehead was the most common location among the head and neck region. The forehead was divided into the medial side, which was covered by the frontalis muscle, and the lateral side, which was not covered by the frontalis muscle. The number of lipomas and deep-seated lipomas were greater on the medial side of the forehead.

The back, upper arm, and lower leg were the most common sites of lipomas in the trunk, upper extremities, and lower extremities, respectively. Most of the lipomas (388; 84.5%) were located in the subcutaneous fat layer. However, few (71; 15.5%) were deep-seated lipomas located in the intramuscular, intermuscular, and submuscular layers. For the 71 deep-seated lipomas, the most common site was the forehead, followed by the flank, neck, and back (Fig. 2). The prevalence of deep-seated lipomas for each anatomical site is described in Table 1.

Table 1. The anatomical distributions of lipomas in our patients

Variable	No. of lesions (%)	Deep-seated lipoma (%)
Head & neck		
Scalp	41 (8.9)	0
Forehead-Med	37 (8.1)	30 (6.5)
Forehead-Lat	24 (5.2)	19 (4.1)
Neck	29 (6.3)	3 (0.7)
Others (cheek, ear)	22 (4.8)	0
Total	153 (33.3)	
Trunk		
Chest	15 (3.3)	0
Abdomen	34 (7.4)	0
Flank	29 (6.3)	16 (3.5)
Back	99 (21.6)	3 (0.7)
Total	177 (38.6)	
Upper extremities		
Shoulder	26 (5.7)	0
Upper arm	41 (8.9)	0
Forearm	15 (3.3)	0
Total	82 (17.9)	
Lower extremities		
Buttock	13 (2.8)	0
Thigh	11 (2.4)	0
Lower leg	23 (5.0)	0
Total	47 (10.2)	
Total	459 (100)	71 (15.5)

Med: medial side of the forehead that was covered by the frontalis muscle, Lat: lateral side of the forehead that was not covered by the frontalis muscle.

Comparison of clinical features of lipomas depending on the depth

The size of the lipoma is defined as the length of the longest axis of the lesion. The mean size of all lipomas in our patients was 4.53 cm (range, 0.5~15 cm). Specifically, according to the depth, the mean sizes of the superficial and deep-seated lipomas were 4.12 cm (range, 0.5~10 cm) and 5.44 cm (range, 2~15 cm), respectively. Deep-seated lipomas were larger than superficial lipomas.

The median duration of lipomas at the time of diagnosis was 4.83 years (range, 3 months to 20 years). Specifically, the median durations of superficial and deep-seated lipomas at diagnosis were 4.45 years (range, 3 months to 15 years) and 6.43 years (range, 1~20 years), respectively. The duration of deep-seated lipomas at diagnosis was longer than that of superficial lipomas.

Most patients were asymptomatic at the time of diagnosis. The remaining patients (46; 10.0%) had mild to moderate de-

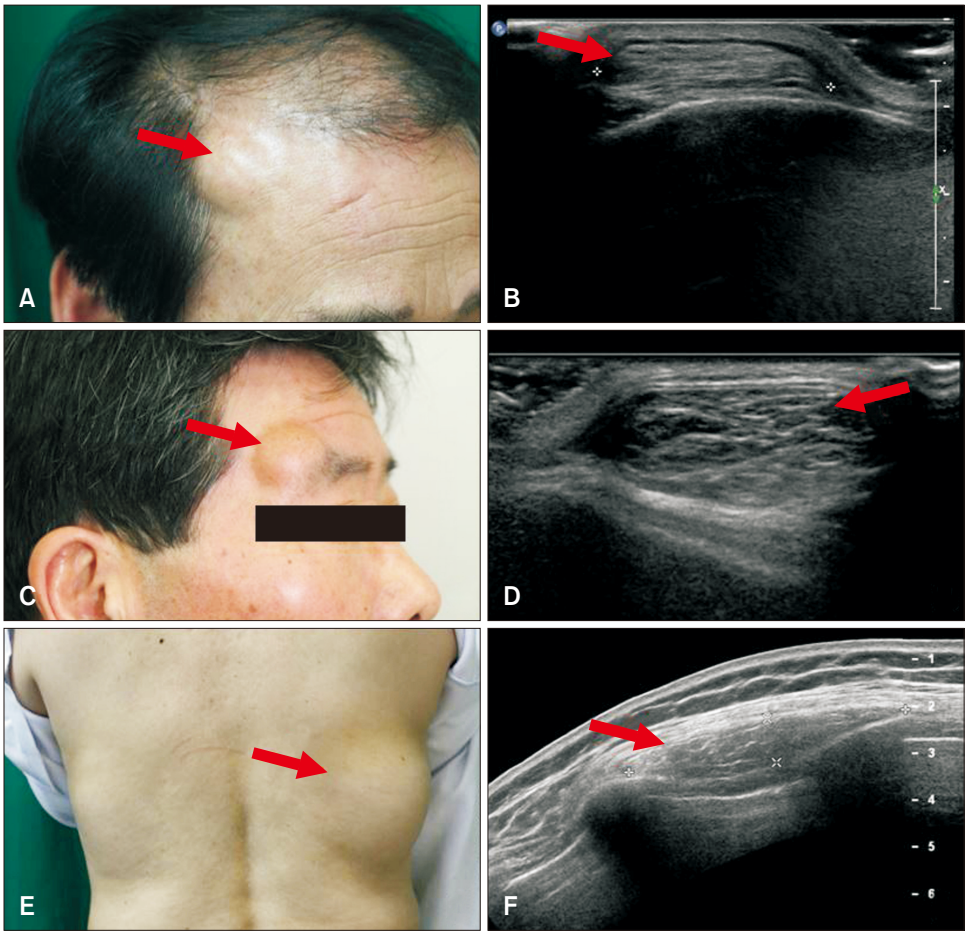

Fig. 2. (A) Lipoma developed on the forehead (56-year-old male patients, onset 20 years ago). (B) In sonography, the size of the lipoma was measured as 3 cm×3 cm, and the location was submuscular lipoma located under the frontalis muscle. (C) Lipoma developed on the forehead (53-year-old male, Onset 3 years ago). (D) In sonography, the size of the lipoma was measured as 2.5 cm×2.5 cm, and the location was subfascial. (E) Lipoma on the flank (48-year-old female, onset 5 years ago). (F) In sonography, the size of the lipoma was measured as 8 cm×5 cm, and the location was intermuscular lipoma located between latissimus dorsi and serratus anterior. Red arrows indicate the lipoma.

Table 2. The histopathological subtypes of lipomas in our patients

Variable	Lipoma	Angiolipoma	Fibrolipoma	Liposarcoma	Total
Subcutaneous fat layer location	253 (65.2)	93 (24.0)	40 (10.3)	2 (0.5)	388 (100)
Deep location	54 (76.1)	4 (5.6)	11 (15.5)	2 (2.8)	71 (100)
Total	307 (66.9)	97 (21.1)	51 (11.1)	4 (0.9)	459 (100)

Values are presented as number (%).

gree of intermittent pain or tenderness. Among the symptomatic patients, those with deep-seated lipomas (n=29) experienced pain more frequently than those with superficial lipomas (n=17).

Relationship between histopathologic subtype and depth of lipomas

All the 459 excised specimens were examined by experienced pathologists (Table 2). The histopathologic subtypes of all lipomas were as follows: angiolipoma (97; 21.1%), fibrolipoma (51; 11.1%), and liposarcoma (4; 0.9%). All other lesions (307; 66.9%) were classified as ordinary lipomas. The specific subtypes of deep-seated lipomas were as follows: ordinary lipoma (54; 76.1%), angiolipoma (4; 5.6%), fibrolipoma (11; 15.5%), and liposarcoma (2; 2.8%).

DISCUSSION

Lipomas are the most common soft-tissue neoplasms, accounting for almost 50% of all soft-tissue tumors[9]. These tumors may arise at any location but are most frequently found in the trunk, chest, thigh, arm, and shoulder[10]. In our study, the trunk (38.6%) was the most common site, followed by the head and neck, upper extremities, and lower extremities. These tumors are usu-

ally found in the subcutaneous layer and are easily removed by incisions on the overlying skin[3]. However, sometimes they are found in deeper layers such as the intramuscular or intermuscular layer, which could make diagnosis difficult and require more surgical effort[4,5].

Deep-seated lipomas are subfascial benign mesenchymal soft-tissue tumors composed of mature white adipocytes[1,4]. The reported frequency of deep-seated lipomas among all benign adipocytic tumors is variable. The reported frequencies of intramuscular lipomas and intermuscular lipomas were approximately 1.8%, and 1.7%, respectively[11,12]. In this study, the proportion of deep-seated lipoma was 15.5%, and this result was higher than those of previous studies. The cause of this high proportion of deep-seated lipoma was related to our cohort which enrolled only the patients who took surgical intervention. Considering the characteristics of patients who visit the department of dermatology in a large center, they may have been transferred from the primary clinic to a large center owing to the deep location of lipomas.

Most lipomas are well encapsulated and have a predominant lipomatous component. However, deep lipomas may contain other components that could be attributed to metaplasia of mesenchymal cells (angiolipoma, chondrolipoma, myxolipoma, myolipoma, spindle cell lipoma, and hibernoma)[1]. Some deep-seated lipomatous tumors showed atypical histopathologic findings and were classified as atypical lipomas, atypical lipomatous tumors, or well-differentiated liposarcomas[3]. In our study, we found a total of four liposarcomas, and the proportion of liposarcoma was higher among deep-seated lipomas (0.5% vs. 2.8%).

Complete excision is the treatment of choice for deep lipomas[3]. However, if the deep-seated lipoma is located adjacent to a neurovascular bundle, complete excision may be difficult, and there is an increased risk of local recurrence and neurologic complications[13]. During surgery, the deep-seated lipoma may need electro-cauterization for hemostasis, which causes muscle spasm and pain, for which local anesthesia with lidocaine is inadequate. Therefore, surgical planning through preoperative radiologic examination may help prevent local recurrence and surgical complications as well as choose an appropriate anesthetic method for safe surgery[6].

In real clinical practice, most lipomas are located in subcutaneous tissue; therefore, dermatologists easily overlook the possibility of deep-seated lipoma. A routine radiologic examination could increase the economic burden for patients, and dermatologists may hesitate to perform routine preoperative radiologic examination.

Dermatologists should be aware of the possibility and distribution of deep-seated lipomas to guide decision-making regarding preoperative radiologic examination.

In our study, we found 71 deep-seated lipomas. Forehead and flank accounted for the majority of deep-seated lipomas (49 and 16, for forehead and flank, respectively). Several previous reports suggested that lipomas occurring in the forehead and chest area include a higher proportion of deep-seated tumors[14,15]. These previous speculations have been confirmed by our results from a large scale of patients. Apart from the forehead, the chest is reported as a location of frequent deep-seated lipomas[7]. However in our study, there was no deep-seated lipoma in the chest area.

In addition to the forehead, our results suggest that a high proportion of large-sized lipomas occurring in the flank may also be deep-seated lipomas. These lipomas are more difficult to notice at an early stage than subcutaneous lipomas; thus, they are likely to be detected late, after the size has increased.

In this study, we found a high frequency of deep-seated lipomas in the forehead and flank. The findings for forehead lipomas were consistent with those previously reported[7]. However, the flank had not been reported previously as a frequent site of deep-seated lipoma. Our findings are significant as this was a relatively large-scale cohort study, with histopathological analysis. The etiology of lipoma is unclear. Flank and forehead regions have a thin muscle layer—frontalis muscle and internal oblique muscle, respectively, which may influence the depth of the lipomas.

The preoperative radiographic study can elucidate the exact depth of the lipomatous tumor and can rule out other malignancies such as liposarcoma. This is important for appropriate surgical treatment. Imaging features of lipomatous lesions including intermuscular lipoma, intramuscular lipoma, and lipoma-like well-differentiated liposarcoma are better characterized with CT or MRI than with US[5,13]. Ultrasonographic findings of the lipomas include well-defined to poorly defined margins and typically homogeneous echo texture; most commonly, slightly hyperechoic relative to the adjacent subcutaneous fat. However, this appearance is variable, and some lipomas show isoechogenicity or hypoechogenicity[16]. CT and MRI can suggest a preoperative diagnosis of deep lipoma when the mass is homogeneous and identical to the subcutaneous fat and the

septas are thin[17]. Several studies offer some criteria for diagnosis of liposarcoma from radiological modalities such as CT and MRI. There is a possibility of liposarcoma in lesions larger than 10 cm, with thick septa and less than 75% of fat material. However, these radiologic findings provide only limited information for differential diagnosis of lipoma subtypes. Therefore, confirmation of the diagnosis with biopsy is still important, regardless of the development of imaging technology.

In conclusion, deep-seated lipomas are less common than superficial lipomas; however, because of their depth and the need to differentiate them from other malignancies, exact preoperative diagnosis, and precise determination of the depth of the lesion are prerequisites to prevent recurrence or functional deficits. Radiologic evaluations help identify deep-seated lipomas before treatment. Therefore, we suggest that patients with lipomas in the forehead and flank areas, which were confirmed to have a higher incidence of deep-seated lipomas in our study, would benefit from preoperative radiologic evaluations.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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DATA SHARING STATEMENT

Research data are not shared

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REFERENCES

1. Weiss S, Goldblum J. Benign lipomatous tumors. In: Weiss SW, Goldblum JR, editors. Enzinger and Weiss's soft tissue tumors. 5th ed. St. Louis: Mosby, 2008:429-466.
2. Wolfe SW, Bansal M, Healey JH, Ghelman B. Computed tomographic evaluation of fatty neoplasms of the extremities. A clinical, radiographic, and histologic review of cases. Orthopedics 1989;12:1351-1358.
3. Billing V, Mertens F, Domanski HA, Rydholm A. Deep-seated ordinary and atypical lipomas: histopathology, cytogenetics, clinical features, and outcome in 215 tumours of the extremity and trunk wall. J Bone Joint Surg Br 2008;90:929-933.
4. Rydholm A, Berg NO. Size, site and clinical incidence of lipoma. Factors in the differential diagnosis of lipoma and sarcoma. Acta Orthop Scand 1983;54:929-934.
5. Nishida J, Morita T, Ogose A, Okada K, Kakizaki H, Tajino T, et al. Imaging characteristics of deep-seated lipomatous tumors: intramuscular lipoma, intermuscular lipoma, and lipoma-like liposarcoma. J Orthop Sci 2007;12:533-541.
6. Muren C, Lee M, Juhlin L. CT-diagnosis of deep-seated lipomas with alarming symptoms. Acta Radiol 1994;35:169-171.
7. Goldblum JR, Folpe AL, Weiss SW, Enzinger FM. Enzinger and Weiss's soft tissue tumors. 7th ed. Philadelphia: Saunders; 2020. p. 445.
8. McTighe S, Chernev I. Intramuscular lipoma: a review of the literature. Orthop Rev (Pavia) 2014;6:156-163.
9. Myhre-Jensen O. A consecutive 7-year series of 1331 benign soft tissue tumours. Clinicopathologic data. Comparison with sarcomas. Acta Orthop Scand 1981;52:287-293.
10. Vandeweyer E, Van Geertruyden J, de Fontaine S. Lipoma of the toe. Foot Ankle Int 1998;19:246-247.
11. Fletcher CD, Martin-Bates E. Intramuscular and intermuscular lipoma: neglected diagnoses. Histopathology 1988;12:275-287.
12. Bick EM. Lipoma of the extremities. Ann Surg 1936;104:139-143.
13. Murphey MD, Carroll JF, Flemming DJ, Pope TL, Gannon FH, Kransdorf MJ. From the archives of the AFIP: benign musculoskeletal lipomatous lesions. Radiographics 2004;24:1433-1466.
14. Tamura A, Ishikawa O, Miyachi Y. Subgaleal angiomyolipoma. J Dermatol 1994;21:514-517.
15. Grosshans E, Fersing J, Marescaux J. [Subaponeurotic lipoma of the forehead]. Ann Dermatol Venereol 1987;114:335-340. French.
16. Fornage BD, Tassin GB. Sonographic appearances of superficial soft tissue lipomas. J Clin Ultrasound 1991;19:215-220.
17. Kransdorf MJ, Bancroft LW, Peterson JJ, Murphey MD, Foster WC, Temple HT. Imaging of fatty tumors: distinction of lipoma and well-differentiated liposarcoma. Radiology 2002;224:99-104.