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The Importance of Radiologic Signs for Giant Lipoma Differentiation From Low-grade Liposarcoma and Its Most Appropriate Surgical Treatment Protocol

Dev Lipomun Düşük Dereceli Liposarkomdan Ayırt Edilmesinde Radyolojik Bulguların Önemi ve En Uygun Cerrahi Tedavi Protokolü

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ABSTRACT

Objective: This study aimed to evaluate the importance of preoperative radiologic signs for giant lipoma differentiation from low-grade liposarcoma and reveal the appropriate surgical method.

Methods: This study retrospectively evaluated 59 patients who underwent marginal and wide resection for giant lipomas (21 were females and 15 were males) and low-grade liposarcomas (14 were females and 9 were males). Pre-biopsy radiological signs were investigated using magnetic resonance images. The pre and postoperative functional results were evaluated using the Upper Extremity Functional Index (UEFI), Lower Extremity Functional Index (LEFS), and visual analogue scale (VAS). The functional results were evaluated according to the marginal and wide resection of these lesions.

Results: The preoperative radiologic signs revealed no significant correlations between the thin septa with the giant lipoma or low-grade liposarcoma. However, a significant correlation was determined between the thick septa and globular area with low-grade liposarcoma and homogeneous mass with giant lipoma. Postoperative mid-term UEFI, LEFS, and VAS of the marginal and wide resection were significantly better than the preoperative functional results in both lesions. No differences were found between the preoperative and postoperative mid-term functional results in the marginal and wide resections of either lesion. Local recurrence was detected in four patients with low-grade liposarcoma who underwent marginal resection.

Conclusion: Therefore, thick septa, confluent globular area, and nonadipose mass are distinctive for low-grade liposarcoma, and homogeneous mass is distinctive for giant lipoma. Moreover, it would be more appropriate to treat low-grade liposarcomas with wide surgical resection.

Keywords: Giant lipoma, low-grade liposarcoma, surgical resection, local recurrence, functional results

ÖZ

Amaç: Bu çalışmada, dev lipom ve düşük dereceli liposarkom ayrımında preoperatif radyolojik bulguların öneminin değerlendirilmesi ve uygun cerrahi yöntemin ortaya çıkarılması amaçlanmıştır.

Yöntemler: Dev lipom (21 kadın,15 erkek) ve düşük dereceli liposarkom (14 kadın, dokuz erkek) nedeniyle marjinal ve geniş rezeksiyon yapılan 59 hasta retrospektif olarak değerlendirildi. Biyopsi öncesi radyolojik bulgular manyetik rezonans görüntüleri kullanılarak araştırıldı. Ameliyat öncesi ve sonrası fonksiyonel sonuçlar Üst Ekstremite Fonksiyonel İndeksi (UEFI), Alt Ekstremite Fonksiyonel İndeksi (LEFS) ve görsel analog skala (VAS) kullanılarak değerlendirildi. Bu lezyonların marjinal ve geniş rezeksiyonuna göre fonksiyonel sonuçlar değerlendirildi.

Bulgular: Preoperatif radyolojik bulgulara göre ince septa ile dev lipom veya düşük dereceli liposarkom arasında anlamlı bir ilişki yoktu. Ancak düşük dereceli liposarkomda kalın septa ve globüler alan görülmesi ile dev lipomlu hastalarda homojen kitle görülmesi arasında anlamlı bir ilişki vardı. Postoperatif orta dönem UEFI, LEFS ve VAS skorları marjinal ve geniş rezeksiyon için preoperatif fonksiyonel sonuçlardan anlamlı derecede daha iyiydi. Her iki lezyonun da marjinal ve geniş rezeksiyonlarında preoperatif ve postoperatif orta dönem fonksiyonel sonuçları arasında fark yoktu. Marjinal rezeksiyon yapılan dört düşük dereceli liposarkom hastasında lokal nüks tespit edildi.

Sonuç: Çalışmada düşük dereceli liposarkom için kalın septum, globüler alan ve nonadipoz kitlenin, dev lipom için de homojen kitlenin ayırt edici olduğu sonucuna varıldı. Bununla birlikte düşük dereceli liposarkomların geniş cerrahi rezeksiyon ile tedavi edilmesi daha uygun olacaktır.

Anahtar kelimeler: Dev lipom, iyi diferansiye liposarkom, cerrahi rezeksiyon, lokal nüks, fonksiyonel sonuçlar

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INTRODUCTION

Lipoma is the most common soft tissue tumor (1). Giant lipomas usually present at a size exceeding 10 cm and a minimum weight of 1,000 g (2). Low-grade liposarcoma is a locally aggressive soft tissue tumor with a tendency toward local recurrence and dedifferentiates to higher grades over time (3).

Significant radiological similarities were found between giant lipoma and low-grade liposarcoma. Some radiological features can help to identify a liposarcoma, such as the size of >10 cm, thick septations, and globular and/or nodular nonadipose areas (4). A significant number of lipomas have an imaging appearance that mimics liposarcoma (5). The literature reported that radiological magnetic resonance (MR)-based studies have difficulties in distinguishing these two tumor types (3,6-9).

Comparative studies on the radiological similarities of these two tumors have been reported in the literature; however, surgical methods and their functional results and complication rates are limited. Marginal or wide resection is recommended in the surgical treatment of giant lipoma and low-grade liposarcoma (10,11). However, the most appropriate surgical method remains controversial. To the best of our knowledge, this is the first comparative study to present the surgical options and their complications and functional outcomes for two different types of tumors.

We hypothesized that these two tumor types will have different radiological signs on MR images and the resection options may differ. This study aimed to evaluate the pre-biopsy radiological features of MR imaging (MRI) in distinguishing giant lipoma and low-grade liposarcoma, as well as evaluate the surgical resection types, complication rates, local recurrence rate, and functional results of marginal or wide resection of giant lipomas and low-grade liposarcomas of the upper and lower extremities.

METHODS

This study was approved by the Marmara University Faculty of Medicine Institutional Review Board (protocol no: 09.2021.811, date: 02.07.2021). All the performed procedures adhered to the ethical rules and principles of the Helsinki Declaration. The patient data were collected from orthopedic oncology notes, clinical records, and imaging systems. This study retrospectively reviewed 67 patients with giant lipomas and low-grade liposarcoma between January 2003 and January 2019. Five patients who were lost to follow-up, one who died because of myocardial infarction (15 months postoperatively) and two who died in a traffic accident were excluded from the study. Patients with metastasis at diagnosis and additional tumoral history were excluded from the study. The remaining 59 patients underwent marginal or wide resection of giant (≥10 cm) lipomas (36 patients; 21 were females, 15 were males) and low-grade liposarcomas (23 patients; 14 were females, 9 were males) were included in the study. The biopsy was performed in all patients before definitive surgery. The same musculoskeletal histopathologist evaluated the specimens. The final pathology in the resected material was compatible with the biopsy results in all patients.

Demographic data of patients were analyzed. The differential diagnosis of the radiological signs as a homogeneous mass, thin septa, thick septa, and the globular area was evaluated via MRI before biopsy (Figure 1-3). A musculoskeletal oncology team, consisting of two orthopedic surgeons, conducted the MRI evaluations and recorded the results in the oncological notes. All MRIs were performed at the same center with the use of a contrast agent. All imaging was performed with 1.5-T magnets (Magnetom Siemens Healthineers, Germany). MR scanning parameters of the T1-weighted SE image are as follows: thickness: 2-5 mm, repetition time (TR): 470-832 ms, and echo time (TE): 7–27 ms. The whole MRI session also included T2-weighted fluid-sensitive, diffusion-weighted, and postcontrast fat-saturated T1-weighted sequences.

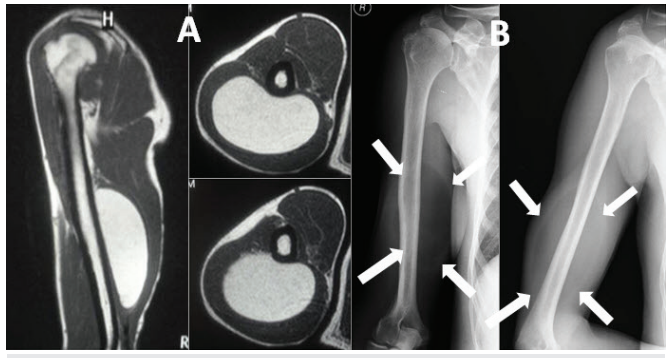

Figure 1. A 44-year-old female patient who had a giant lipoma on her right arm, A) Homogenous mass on MRI, B) Direct radiography gives clues about giant lipomas
MRI: magnetic resonance imaging

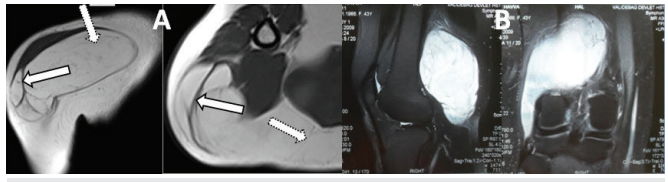

Figure 2. A) A 55-year-old female patient who had low-grade liposarcoma around her shoulder: ⇦ shows thick septa and ⇨ shows thin septa, B) MR images showing liposarcoma in the posterior compartment of the thigh in a 62-year-old man. MR images have pronounced thin septa
MR: magnetic resonance

Marginal or wide resection decision was made following the preoperative biopsy results and radiological signs (10,11). In patients with biopsy results of giant lipoma (n=36), marginal resection (n=26) was performed in the homogenous mass or mild and moderate thin septa and wide resection (n=10) in globular area, moderate and pronounced thick septa, and mild thick septa with moderate or pronounced thin septa. In patients with biopsy results of low-grade liposarcoma (n=23), marginal resection

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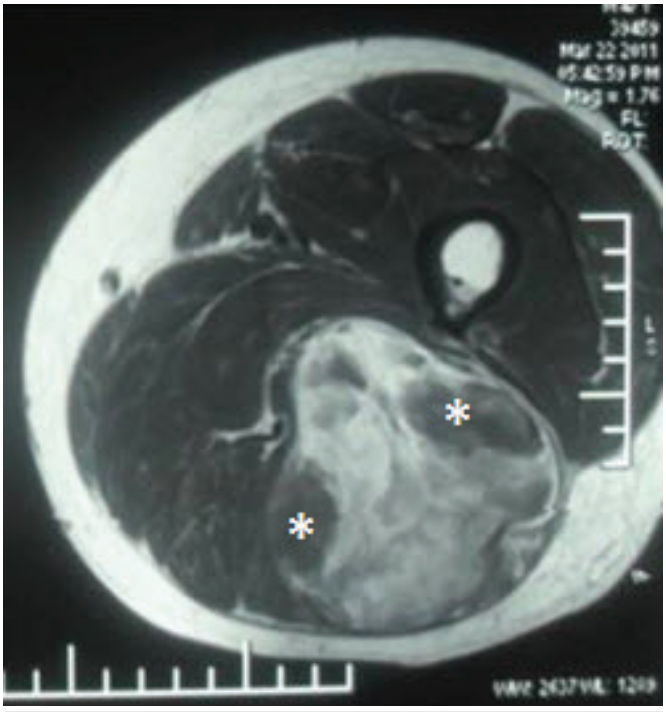

Figure 3. Transverse MR image shows a low-grade liposarcoma in the posterior compartment of the thigh. *confluent globular areas of nonadipose tissue
MR: magnetic resonance

(n=9) was performed in mild and moderate thin septa and wide resection (n=14) in globular area, moderate and pronounced thick septa, and mild, thick septa with moderate or pronounced thin septa.

Patients were followed up at 1, 3, and 12 months postoperatively. Early and late surgical complications, local recurrence, and functional results were compared in the marginal and wide resection. Preoperative and postoperative evaluation of the functional results was conducted using the Upper Extremity Functional Index (UEFI), Lower Extremity Functional Scales (LEFS), and visual analogue scale (VAS) (12,13).

Statistical Analysis

The obtained data in the study were statistically analyzed using the International Business Machines Corporation Statistical Package for the Social Sciences for Windows version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables were compared using the Wilcoxon rank-sum test, and the χ^2 test for the categorized variables. The Mann-Whitney U test was used to compare the preoperative and postoperative functional outcomes. P-values of <0.05 were accepted as statistically significant.

RESULTS

The comparison of the two groups was made according to the age, sex, average length of follow-up, and lesion location of patients (Table 1). No significant difference was found between the two groups according to the demographic data.

The pre-biopsy radiologic evaluation with the MR images revealed no significant correlation between the presence of thin septa with giant lipomas or low-grade liposarcomas (p=0.133). The presence of homogeneous mass was significantly higher in the giant lipoma group (p<0.0001). The presence of thick septa, confluent globular area, and nonadipose mass were significantly higher in the low-grade liposarcoma group (p<0.0001, p=0.02, p<0.001, respectively) (Table 2).

In the early postoperative period, wound infection was seen in three patients (one marginal and two wide resections) who were diagnosed with giant lipoma, and six patients who were diagnosed with low-grade liposarcoma (one marginal and five wide resections) (Table 3). All infections were managed by intravenous antibiotherapy without any additional interventions. No additional surgical complications were seen in early or late periods.

Marginal resection was performed in 26 giant lipomas and 9 low-grade liposarcomas and wide resection with a thin layer of muscle around the mass in 10 giant lipomas and 14 low-grade liposarcomas. Local recurrence was detected in four patients with low-grade liposarcoma who underwent marginal resection (Table 3).

The postoperative UEFI, LEFS, and VAS scores of the marginal and wide resections were significantly better than the preoperative results in the giant lipoma and low-grade liposarcoma. The differences between the preoperative and postoperative UIEF, LEFS, and VAS scores were insignificant in the marginal and wide resections of both lesions (Table 3).

Table 1. Preoperative demographic evaluation

Factors	Giant lipoma	Low-grade liposarcoma	p
Age	48.5±8.6	51.9±9.8	0.234
Male/female	15/21	9/14	0.846
Average length of follow-up (months)	40.3±15.4	33.3±14.8	0.091
Lesion location			
Upper extremity	9	6	0.925
Lower extremity	27	17	

Table 2. Magnetic resonance signs of two group

MR signs	Giant lipoma n=36	Low-grade liposarcoma n=23	p
⊖Homogeneous mass	19%	0%	<0.0001
⁂Thin septa	0.77±0.63	1.26±0.96	0.133
⁂Thick septa	0.41±0.64	1.69±0.76	<0.0001
⁂Globular area	0.19±0.40	0.82±0.83	0.02
¥Nonadipose mass	2%	11%	<0.001

⊖evaluated as present or absent, ⁂0= absent, 1= mild, 2= moderate, 3= pronounced., ¥evaluated as present or absent, MR: magnetic resonance

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Table 3. The comparison of early-late complication and preoperative and postoperative functional results of both groups according to the surgical excision

	Giant lipoma		p	Low-grade liposarcoma		p
	Marginal resection 26	Wide resection 10		Marginal resection 9	Wide resection 14	
Early wound infection	1	2	0.369	1	5	0.409
Local recurrence	0	0	-	4	0	0.029
Pre-op UIEF	52.0±10.1	47.9±6.4	0.179	41.0±6.1	46.1±6.2	0.107
Post-op UIEF	76.9±3.7	74.8±4.2	0.196	74.3±3.9	72.0±3.7	0.174
Pre-op LEFS	42.8±9.1	48.4±7.5	0.147	39.3±6.4	43.2±8.0	0.269
Post-op LEFS	75.8±4.2	72.7±5.2	0.111	74.4±4.6	72.2±3.7	0.146
Pre-op VAS	4.1±0.9	4.4±0.8	0.404	4.8±1.1	4.7±1.3	0.726
Post-op VAS	0.2±0.4	0.4±0.6	0.680	0.3±0.5	0.6±0.7	0.403

LEFS: Lower Extremity Functional Index, UIEF: Upper Extremity Functional Index, VAS: visual analogue scale

DISCUSSION

Radiological images of giant lipomas and low-grade liposarcomas may show similar features. Additionally, there is no consensus on the most appropriate treatment of these tumors. The current research comprised a comparative study that investigated the preoperative radiological signs and surgical treatment of these tumors. The main findings of this study can be summarized as follows: (a) no significant correlation was found between thin septa with giant lipomas or low-grade liposarcomas; (b) the presence of homogeneous mass was significantly higher in the giant lipoma group; (c) the presence of thick septa, confluent globular area, and nonadipose mass was significantly higher in the low-grade liposarcoma group; and (d) local recurrence was seen at four patients with low-grade liposarcoma who underwent marginal resection.

In giant lipoma and low-grade liposarcoma, most surgeons prefer marginal or wide resection according to the biopsy result (10,11). The experience of the pathologist is significant in the differentiation with biopsy. Contrarily, the differentiation of these two soft tissue masses with biopsy may fail and effective treatments may be delayed. Therefore, preoperative MRI signs and correct histopathological diagnosis are important for surgical resection without tumor cell seeding. Sato et al. (14) analyzed the pathology reports of 637 patients who were operated on with the preoperative diagnosis of lipoma. They reported that eight of these patients had liposarcoma postoperatively. In the current study, histopathological examination of the biopsy and resected specimen was assessed by the same musculoskeletal histopathologist. All of the biopsy results were the same as the final pathological results. Therefore, managing patient with orthopedic oncology with a good team and a multidisciplinary approach are important.

Specific signs with MRI have been reported for two tumors in previous studies (3-8). Thornhill et al. (8) reported that low-grade liposarcoma has more fibrous septa, is more heterogeneous, and contains more nodular or globular areas of nonadipose tissue compared with a lipoma. Pressney et al. (6) demonstrated that lipomas were composed of mature adipocytes that are separated by thin fibrous septa with no significant cytological atypia. Consistent with these studies, significant results were reached with specific MRI signs to differentiate a giant lipoma from low-grade liposarcoma in the current study. The soft tissue mass, which had a homogenous mass and mild, moderate, and thin septa on MRI was diagnosed as giant lipoma. Additionally, the soft tissue mass, which had a globular area and pronounced thick septa on MRI, was diagnosed as low-grade liposarcoma. Shim et al. (3) reported that low-grade liposarcomas are characterized by thick fibrous septa with some small or large blood vessels, and myxoid areas are detected near the septa. According to the current study results, if MR images have isolated pronounced thin septa and isolated thick septa, which can be seen in both giant lipoma and low-grade liposarcoma, a specific distinction cannot be made and a biopsy should be performed for differentiation.

Marginal and wide resection is preferred as a surgical treatment for giant lipoma and low-grade liposarcoma (10,11). However, no acceptable protocols are available that should be used in the surgical treatment for giant lipoma and low-grade liposarcoma. Unlike giant lipoma, low-grade liposarcoma can invade healthy muscles. Additionally, it is usually without a complete tumor capsule (15). Choi et al. (11) reported that marginal resection is sufficient for low-grade liposarcoma although the probability of local recurrence is high. Shim et al. (3) stated that removing the lipomas with marginal resection and low-grade liposarcomas with wide resection is appropriate since local recurrence and dedifferentiation are possible. We believe that wide resection is a more appropriate treatment for low-grade liposarcomas because the possibility of local recurrence and reoperation creates additional morbidity for the patient.

Postoperatively, the local recurrence rate of low-grade liposarcoma is higher than that of giant lipoma (7,11). The primary cause of local recurrence is usually inadequate surgical margins (10). The literature reported that the recurrence rate of lipomas ranged from 3% to 62.5% (9,16,17). Su et al. (18) reported eight patients who underwent wide resection for lipoma, without local recurrence. Bassett et al. (19) reported two (4%) recurrences in 55

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patients who were diagnosed with an intramuscular lipoma. Choi et al. (11) reported that the local recurrence rate was higher with marginal excision (11.9%) compared with wide excision (3.3%) in low-grade liposarcomas. Consistent with this study, the local recurrence ratio was 44% (4 out of 9) in the low-grade liposarcoma group who underwent marginal resection in the series studies. No local recurrences were found in the low-grade liposarcoma group who underwent wide resection. The incidence of local recurrence was significantly high for the marginal resection group. No local recurrence was observed in the giant lipoma group, in which mass was excised by marginal and wide resection. Therefore, wide resection is the optimal surgical treatment for low-grade liposarcoma (Figure 4).

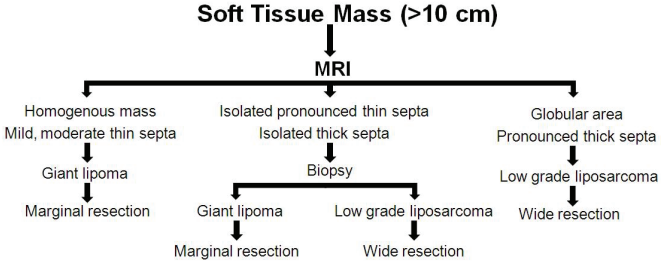

Figure 4. Surgical algorithm of a giant lipomatous tumor
MRI: magnetic resonance imaging

Choi et al. (11) reported no surgery-related infections in their low-grade liposarcoma series. Additionally, Capkin et al. (20) also observed no deep or superficial infection in their lipoma series. Compatible with the literature, no deep infections were observed in the series studied herein. However, superficial wound infections in nine patients were treated with oral antibiotics.

Nishida et al. (16) reported no functional loss in patients with intramuscular lipoma who underwent wide or marginal resections. Contrarily, Capkin et al. (20) stated that severe functional deficits were seen in large or deep-seated locations of the liposarcomas. Arvinius et al. (21) reported that 11 patients with low-grade liposarcoma were managed with marginal excision and they reported a mean Musculoskeletal Tumor Society (MSTS) score of 81.6% at 1 year postoperative. Kito et al. (22) also reported an MSTS score of 98% for the wide resection group in patients with low-grade liposarcoma. Consistent with these studies, the postoperative early 6-month functional results of marginal resection herein were significantly better than the wide resection in both lesions. Additionally, the pain was higher in the first 6 months in the wide resection group than in the marginal resection group in these two soft tissue masses, probably due to the surrounding muscle tissue resection, which can also adversely affect the functional results.

Study Limitations

This study had some limitations. First, it was retrospectively performed with a small number of patients. Hence, the major limitation was the underpowered statistical analysis. However, the radiologic features and surgical experience in a selected patient group were presented. Second, some of the patients had relatively short follow-up periods; however, recurrence can occur after many years. Third, only the differences of these lesions based on the MR images were reported. The utilization of other modalities, such as ultrasound, may provide additional benefits in distinguishing the two tumor types. Finally, functional scores can be biased, as they evaluate only a few functional outcomes, but not the overall health condition and quality of life of patients. Nevertheless, further comparative, long-term studies with larger patient groups are necessary to confirm these findings.

CONCLUSION

Some indications on MR images differentiate a giant lipoma from low-grade liposarcoma. The presence of a homogeneous mass is distinctive for giant lipoma, and thick septa, confluent globular area, and nonadipose mass are distinctive for low-grade liposarcoma on MR images. Local recurrence was seen only in four patients with low-grade liposarcoma who underwent marginal resection. Therefore, considering that low-grade liposarcomas may pose the risk of local recurrence in inappropriate surgery, marginal resection is an improper surgical treatment for low-grade liposarcoma. Wide or marginal resection of both lesions does not adversely affect the functional outcomes, but patients may experience more pain after the wide resection. Multicentric studies with large patient numbers are needed in the literature.

Ethics Committee Approval: This study was approved by the Marmara University Faculty of Medicine Institutional Review Board (protocol no: 09.2021.811, date: 02.07.2021).

Informed Consent: Written consent was obtained from the participants for their records to be included in the study. All data were collected in accordance with the principles of Declaration of Helsinki.

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