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## Original Article

# Prevalence and radiologic features of elastofibroma dorsi: a CT study

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## ABSTRACT

**Background:** The study aimed to examine the prevalence and radiological features of Elastofibroma Dorsi (ED), detected incidentally in patients who underwent CT for various reasons.

**Materials and Methods:** A total of 8378 chest CT examinations were reviewed retrospectively for ED from January 2019 to April 2020. Lesion side, thickness, density, and whether stated in the initial report were examined.

**Results:** Of the 8378 patients, 87 patients (1.03%) (41 women and 46 men) had a total of 114 ED. There was no significant difference in the mean age of ED patients regarding gender ( $p < 0.001$ ). When the ages of the patients included in the study with ( $n = 87, 52.0 \pm 14.7$ ) and without ED ( $n = 8291, 42.0 \pm 15.2$ ) were compared, there was a statistically significant difference ( $p < 0.001$ ). The rate of bilateral ED was 31%. A positive correlation was determined between mean ED thickness and age ( $p = 0.001$  and  $p = 0.041$  for right and left, respectively). It was noted that none of the patients were diagnosed in the first radiological report.

**Conclusions:** ED is a slow-growing non-neoplastic, soft tissue tumor with a typical periscapular location. Being aware of this entity will prevent the need for advanced diagnostic evaluation. The characteristic appearance of these lesions will reduce unnecessary biopsy and surgery with increased radiologist awareness of their recognition.

**Keywords:** elastofibroma dorsi, prevalence, computed tomography, soft tissue neoplasms

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## Introduction

Elastofibroma Dorsi (ED) is a non-neoplastic, slow-growing, benign, rare soft tissue tumor [1]. It is generally observed between the fourth and seventh decades of life, mainly in women [2,3]. 12-73% of cases are bilateral [4-6]. Although the exact etiology remains unclear, friction, trauma, tissue degeneration, and genetic predisposition among co-occurrence hypotheses have been described in the literature [6].

Clinically, 50% of cases are asymptomatic, and when symptoms occur, mild or severe pain accompanied by a clicking sound during abduction and adduction of the shoulder is typical for ED [7,8,9].

In the cross-sectional examination, ED contours may be sharp or ambiguous. The mass contains both fibrous tissue and adipose tissue. CT and MRI are particularly effective in diagnosis as they demonstrate the layered nature of the tumor's fat and fibrous tissue (with imaging properties similar to muscle on CT and MRI). Imaging features and localization are usually typical, and a definitive diagnosis can be made in most cases. CT is less sensitive in demonstrating adipose tissue than MRI, and therefore, it can be determined as a homogeneous mass slightly lower than muscle density on CT [9].

This study aimed to examine the prevalence and radiological features of ED, detected incidentally in a large population of patients who had CT for various reasons.

## Materials and Methods

### Patient cohort

All patients referred to the Radiology Department for various reasons (e.g., nodule follow-up, infection, lung cancer, staging of other tumors, acute trauma, mediastinal mass) between January 2019 and April 2020 were evaluated retrospectively. A total of 8378 chest CTs constituted the study group. Of these patients, 4584 (55.3%) were male, 3704 (44.7%) were female, and the mean age was  $42.1 \pm 15.2$  years (0-94). Approval from the Institutional Review Board of Haseki Research and Training Hospital was obtained without the requirement for patient informed consent because of the retrospective origin of the study (Decision number: 2020-131).

### Imaging

All CT images were acquired using a 128 detector CT alignment (Philips Ingenuity, Netherlands). Images were obtained with the patient at the end of inspiration and su-

pine position with 120 kV tube voltage, tube current-exposure time product, 512x512 matrix, 415 mm FOV, 200-300 mAs, and 1.25 mm section thickness after reconstruction.

### Image analysis

After reviewing all patients retrospectively, the two radiologists evaluated the determined ED lesions with consensus regarding lesion density and thickness, and the lesion side was noted. While evaluating the lesion size, the thickness was measured as the greatest diameter in the axial plane (Figure 1). The initial radiology report of the patients with ED was reviewed regarding whether the lesion was mentioned in the first evaluation.

### Statistical Analysis

SPSS 15.0 for Windows program was used for statistical analysis. Descriptive statistics were presented as numbers and percentages for categorical variables and mean, standard deviation, minimum, maximum, median, and interquartile range values for numerical variables. Numerical variables in two independent groups were compared using the Student's t-test when the normal distribution condition was met and the Mann-Whitney U test when the normal distribution condition was not met. Chi-Square Test performed the comparisons of the rates in the groups. Correlations were analyzed by Spearman Correlation Analysis when the parametric test condition was not met. The statistical alpha significance level was accepted as  $p < 0.05$ .

## Results

In our study, 87 (1.03%) of 8378 patients had a total of 114 EDs. There were unilateral lesions in 60 (69.0%) patients and bilateral (31.0%) lesions in 27 (Figures 2,3). Of the ED patients, 46 (52.9%) were male, and 41 (47.1%) were female. The mean age was  $54.6 \pm 14.8$  years (range 20-85) for females and  $49.7 \pm 14.5$  years (range 24-81) for males. There was no significant difference in the mean age of men and women with ED ( $p < 0.001$ ) (Table 1). When the ages of the patients included in the study ( $n = 87$ ,  $52.0 \pm 14.7$ ) with and without ED ( $n = 8,291$ ,  $42.0 \pm 15.2$ ) were compared, there was a statistically significant difference ( $p < 0.001$ ) (Table 2).

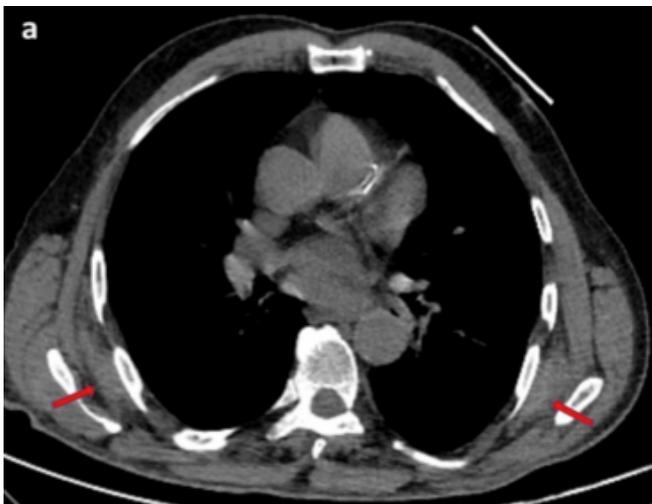
In our study, the rate of bilateral ED was 31%. There was no significant difference between the mean age of patients with bilateral lesions and those with unilateral lesions ( $p = 0.101$ ), and no significant gender difference was determined in both patient groups ( $p = 0.737$ ) (Table 3).



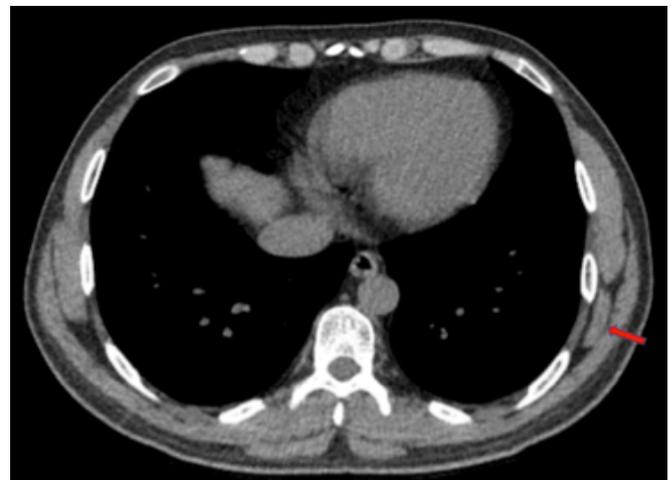
**Figure 1.** The thickness was measured as the greatest diameter in the axial plane as shown in the right (17.6 mm) and the density was measured as shown in the left of the patient ( $15.8 \pm 16.5$ , range (-) 21-51).



**Figure 2b.** Coronal CT image; of the same patient.



**Figure 2a.** Non-contrast axial CT image; bilateral ED (red arrows) with a streaky fatty component in an 83-year-old male patient located between the serratus anterior and latissimus dorsi muscles bilaterally.



**Figure 3.** In the axial CT image, a 66-year-old female patient with left unilateral ED (red arrow).

**Table 1.** The entire patient population; Number of patients with and without ED, age, and gender.

		Age			Gender		
		Mean±SD (Min-max)	Median (IQR)	p	Female n (%)	Male n (%)	p
N=8378	Total	42.1±15.2 (0-94)	41 (30-52)		3746 (44.7)	4632 (55.3)	
Elastofibroma dorsi	No	42.0±15.2 (0-94)	41 (30-52)	<0.001	3705 (98.9)	4585 (99.0)	<0.001
	Yes	52.0±14.7 (20-85)	52.5 (40.25-63)		41 (1.1)	47 (1.0)	

**Table 2.** Average age of patients with and without ED.

Elastofibroma dorsi		No (n=8291)		Yes (n=87)	
		Mean±SD (Min-max)	Median (IQR)	Mean±SD (Min-max)	Median (IQR)
		42.0±15.2 (0-94)	41 (30-52)	52.0±14.7 (20-85)	52.5 (40.25-63)
	p-value			<0.001	

**Table 3.** Age and gender of patients with unilateral and bilateral ED.

Elastofibroma dorsi	n (%)	Female/Male		Age
		n (%)	n (%)	Mean±SD (Min-max)
Unilateral	60 (69.0)	29 (48.3%)	31 (51.7%)	50.3±14.3 (20-85)
Bilateral	27 (31.0)	12 (44.4%)	15 (55.6%)	55.9±15.3 (24-81)
	p-value	0.737		0.101

All lesions were evaluated separately, and the mean ED thickness was measured as  $8.2 \pm 6.5$  mm (range 2.9-54.2). It was measured as  $8.95 \pm 5.81$  mm (3-27) on the right and  $7.60 \pm 6.89$  mm (2-54) on the left side. A positive correlation was determined between mean ED thickness and age ( $p = 0.001$  and  $p = 0.041$  for right and left, respectively). There was no significant difference in mean ED thickness regarding the side and gender ( $p = 0.086$  and  $p = 0.621$ , respectively).

The mean ED density was  $18.4 \pm 24.3$  (-58-61.5) HU. It was  $14.58 \pm 27.70$  (-58.6-61.5) HU on the right, and  $21.28 \pm 21.15$  (-32-57.7) HU on the left side, with no significant difference between them ( $p = 0.243$ ). When the right and left side densities were compared according to the genders, no significant difference was determined ( $p = 0.947$  and  $p = 0.792$  for the right and left, respectively). In patients with ED, there was no significant correlation between density and size for both sides ( $p = 0.172$  and  $p = 0.352$  for right and left, respectively). The left-sided ED frequency was significantly higher than the right-sided ED ( $p = 0.048$ ).

Almost all ED patients had lesions isodense with adjacent muscle structures and contained linear hypodense areas on imaging. When the initial imaging reports of the patients were reviewed, none of the lesions were mentioned in the first radiological report. All patients with ED had non-contrast imaging examinations. Therefore, the enhancement feature could not be evaluated. When evaluated from the clinical point of view by retrospectively reviewing the hospital electronic medical record system, none of the patients with ED had dorsalgia or shoulder pain, which are the main symptoms of this entity.

## Discussion

ED is a benign, rare soft tissue tumor with a characteristic appearance and localization on CT and was first defined by Jarvi and Saxen in 1961 [10,11]. The typical location is at the level of the lower end of the scapula between the latissimus dorsi and serratus anterior muscles. Elastofibroma develops in this localization in 99% of cases [4]. However, different localizations, including the olecranon, tricuspid valve, interspinal, ligamentum flavum, foot, greater trochanter, deltoid, axilla, intra-articular, intraspinal and ischial tuberosity, stomach, cornea, and me-

diastinum, have been reported in the literature [12-21]. Nagamine et al diagnosed elastofibroma in the olecranon and ischial tuberosity in addition to the subscapular level, which is classically located in the patient group, and associated this condition with genetic and structural factors [4]. In elastofibromas observed outside the classical localization described in the literature, the diagnosis was made almost entirely pathologically.

A retrospective study by Brandser et al, in which they evaluated 268 patients describing the prevalence and imaging features of ED in 1998, indicated the prevalence of ED as 2% in the group of patients over 60 years of age. Our study determined the prevalence of ED as 1.03%. We associated this result with the lower mean age ( $42.1 \pm 15.2$ ) of our entire study population compared to the aforementioned study [20,22]. In the study of Tepe et al, the prevalence of ED was 2.73%, and the mean age of patients with and without ED was 68.2 and 56.1 years, respectively [12]. In our study, this result was 42.0 and 52.0, respectively, and similarly, the mean age of our patients without ED population was low. In their study involving the Jarvi and Lansimies autopsy series, they reported the prevalence of ED as 16%. This difference with the CT series can be attributed to the small size of the lesions in the second study and the macroscopic definition of some lesions as only a streak in the fascia [23].

In studies with large series in which ED was reported in the literature, the female gender was generally more common [6,12,22-25]. Although there was no statistically significant difference in our study, there were 46 male patients (52.9%) in total with predominance. In the study of Chandrasekar et al, similar to our study, there was male predominance with the rate of 80% [26]. The tendency of ED to be bilateral has been detected in many studies, and it has been reported at a rate of approximately 12-73% [4-6,27-29]. In our study, the rate of bilateral lesions was 31%. There was no significant difference between the mean age of patients with bilateral lesions and those with unilateral lesions, and our result was consistent with the literature [12].

A significant relationship was observed between ED thickness and age on both sides in our study. In the literature, a similar relationship was reported by Tepe et al only for the right side [12]. However, there was no significant

difference in ED thicknesses when compared regarding the side or gender in our study. Moreover, the mean density of ED was measured as  $18.4 \pm 24.3$  HU on the right and  $21.28 \pm 21.15$  HU on the left side. Negative HU values of fat density depend on the fat component in the tumor, and according to our knowledge, such a measurement has not been evaluated before in the literature. None of the patients with ED in our study were diagnosed with ED at the initial report. Although the diagnosis of ED is easily made with CT, it can be overlooked in the first report, similar to other studies in the literature [12,22,31].

Diagnosis of ED is made radiologically by MRI and CT according to the typical location of the tumor and imaging characteristics [7,11,22,30]. Lesions with a fibrous component and linear adipose tissue in typical periscapular localization, especially when bilateral, can be diagnosed as ED accurately without biopsy. Adipose tissue has a hypodense appearance on CT and T1-T2 hyperintense signal on MR. The imaging feature of fibrous tissue is similar to muscle tissue in CT and MRI [12]. The sensitivity of CT in the diagnosis of ED is lower than MRI. After intravenous gadolinium, the mass shows minimal-moderate or significant contrast material uptake [3].

ED excision is not recommended in asymptomatic cases since no malignant transformation has been described before [6,7,31]. When the biopsy is required, open biopsy or at least core needle biopsy is recommended. Fine needle biopsy is not recommended due to the hypocellular nature of the tumor [7]. Tumors that may be located in this region in the differential diagnosis include fibroma (in cases with fibrous predominance), aggressive fibromatosis, metastasis, hemangioma, and atypical lipoma and liposarcoma in patients with lipomatous component [7,33-36]. These tumors can be distinguished from ED radiologically by CT and MRI as they do not demonstrate the laminar pattern of ED.

Microtrauma, elastin degeneration, enzyme defect, genetic factors, and vascular insufficiency have been suggested in the etiology [36-41]. More than 50% of ED cases are asymptomatic. However, some patients may experience swelling, shoulder stiffness, friction noise with shoulder movements, and pain [34,42,43]. Rarely, clinical findings may change, and ED may be mistakenly confused with subacromial bursitis or rotator cuff tear [27].

The treatment of ED is surgical excision. A surgical operation is recommended when the tumor is greater than 5 cm, the patient is symptomatic and radiological findings are compatible with malignancy [44]. A conservative approach can be preferred if the patient is asymptomatic, and the tumor can be followed up clinically. Radiotherapy can be used in high-risk patients for surgery [14].

None of the patients with ED had either dorsalgia or shoulder pain, which are the main symptoms of ED. The condition might be related to the small mean size of ED and only six patients had a tumor size of greater than 2 cm. Patients diagnosed with ED are under follow up by thoracic surgery clinic in our hospital but there are no patients requiring surgery yet.

The main limitation of our study was the lack of histopathological verifications of the patients.

In conclusion, ED is a slow-growing, non-neoplastic soft tissue tumor with a typical periscapular location. Being aware of this entity and its radiologic features will prevent the need for advanced diagnostic evaluation. The characteristic appearance of these lesions, typically bilateral, will reduce unnecessary biopsy and surgery with increased radiologist awareness of their recognition.

### **Declaration of conflicting interests**

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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### **Ethics approval**

Approval from the Institutional Review Board of Haseki Research and Training Hospital was obtained without the requirement for patient informed consent because of the retrospective origin of the study (Decision number: 2020-131).

### **Authors' contribution**

BKY,SÖ,Tİ,TSC,NG,BA; material preparation, data collection and analysis. BKY; the first draft of the manuscript was written by. BKY, RT: revised the final version of the manuscript. All authors read and approved the final manuscript. All authors contributed to the study conception and design.

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