Review

Chest Elastofibroma – Elastofibroma Dorsi

Eleftheria Chaini[1],
Dimitra Haini[2],
Ioannis Giannopoulos[3],
Anna-Maria Athanasiadou[4],
Angelos Tsipis[4],
Maria Gonidi[5],
Paulina Athanasiadou[4],
Kyriakos D. Hainis[1]

[1]Pulmonary Department Corfu General Hospital
[2]Radiology Department Primary Health National Network of Corfu
[3]Orthopedic Department Corfu General Hospital
[4]Iaso General Hospital, Athens
[5]Cytology Lab, Corfu, Greece

SUMMARY
Chest wall primary tumors include a broad spectrum of benign and malignant tumors. Tumor biopsy is essential to set diagnosis. This rule does not apply to the elastofibroma dorsi. Elstofibroma is an unusual, well defined tumor of soft tissues typically located in the peri-scapular region, composed of characteristic abnormal elastinophilic fibers and adipose tissue. It affects mainly elderly people and especially women. In magnetic resonance imaging and computed tomography elastofibroma presents a characteristic layered pattern of fatty and fibrous tissue. The typical location and the characteristic imaging pattern set the diagnosis of elastofibroma without the need for biopsy. Biopsy is required in atypical cases to exclude malignancy, especially sarcoma. In asymptomatic cases, simple monitoring is sufficient. Surgical excision is recommended for serious symptoms and diagnostic doubt. The prognosis is excellent. No case of malignant transformation has been described.
Pneumon 2017, 30(3):157-164.

Key words:
- Chest Elastofibroma

Correspondence:
Eleftheria Chaini
Pulmonary Physician, MMsc in Thoracic Oncology, Corfu, Greece
E-mail: elhaini@otenet.gr

INDRODUCTION

Chest wall is a site of location for primary and metastatic tumors. Chest wall primary tumors represent 1-2% of all primary tumors[1] and include benign and malignant tumors originating from the bones, cartilage and soft tissues (muscles, vessels, nerves) of the chest wall, and some haematological diseases[2].

Chest wall benign tumors consist the 56% (23/41) of the cases and include enchondroma, fibrous dysplasia, neurilemmoma, osteochondroma, granular cell tumor, fibroma, lipoma, fibrolipoma, eosinophilic granuloma, aneurysmal bone cyst. Chest wall malignant primary tumors account for 46% (18/41) of the cases and include plasmacytoma, chondrosarcoma, osteosarcoma, fibrosarcoma, desmoid tumor, leiomyosarcoma, malignant fibrous histiocytoma, tendon sheath sarcoma, hemangiosarcoma, και neurinosarcoma. The most common are the cartilaginous tumors (chondroma and chondrosarcoma) and then those derivated of the soft tissue (fibromas, lipomas, neurogenic tumors)[1].

Consequently, the presence of a tumor in the CWl is a diagnostic chal-

lenge for the clinician. The likelihood of malignancy and especially of sarcoma forces the clinician to consider all chest wall tumors as malignant until evidence of the opposite[1]. In this context tumor biopsy becomes necessary for tumor identification.

This rule does not apply fully to elastofibroma[3]. This benign tumor has in many cases typical clinical and imaging features that allow for safe diagnosis[4], avoiding further biopsy investigation or even surgical excision[5].

The presentation of the clinical and imaging characteristics of elastofibroma is the purpose of this review.

DEFINITION

Elastofibroma or elastofibroma dorsi (ED) is a benign, slowly growing tumour of soft tissue of subscapular area, composed of characteristic abnormal elastinophilic fibers and adipose tissue. It was first described by Järvi and Saxen in 1959 at the 12th Congress of Scandinavian Pathologists, who then published their work in 1961[3].

The 2002 World Health Organization (WHO) soft tissue tumor classification ranked the ED in the benign and myoinoblastic soft tissue tumors of the peri-scapular region[6].

Location

ED is typically located between the lower corner of the scapula and the posterior CW. It may be connected to the periosteum of the ribs but without invading it or other adjacent structures[7].

Elastofibroma may be unilateral or bilateral[8]. Bilateral location is more frequent with a reported frequency in diferrent series at 58.62% (17/29)[9], 66.27% (112/169)[8], 75% (6/8)[10], and 100% (9/9)[7] of cases.

Unilateral elastofibromas are more commonly located in the right chest wall with a reported frequency of 61% (35/57) of cases[8].

Size - Symmetry

The diameter of surgically excised tumours ranges from 2 cm to more than 15 cm[8,11], while in the computed tomography (CT), very small elastofibromas with diameter 1×1.5 cm[5] and 2×0.5×2 cm[12] have been described.

The diameter of the larger palpable tumours is similar to physical examination and CT[13]. However, elastofibromas with diameter of less than 3 cm are difficult to be found in physical examination and CT[7].

Bilateral elastofibromas may be symmetrical in size and location[14] or asymmetric[5,7], and many times asynchronous[10].

Unusual location of elastofibromas

Elastofibromas are typically located at the periscapular region. However, a growing number of publications in the literature have described elastofibromas located at various anatomical sites, mainly the musculoskeletal system, and more rarely the visceral organs and the gastrointestinal tract[15].

Unusual locations of elastofibromas have been described in eye[16], face[15], intraspinal space[17], mediastinum[18], tricuspid valve[19], hand[20], foot[21], axilla and inguinal region[22], infraolecranons regions[8], ischial tuberosity[8], deltoid[23], greater trochanter[16], posterior elbow[16], pancreas[15], stomach[24], intestine[25], sigmoid colon[26], και greater omentum[27].

These locations may be single or multiple, coexisting with the typical location in the sub-scapular region. Nagamine N et al[8] in a clinical-pathology study involving 170 cases of ED described 27 cases in which the tumour was located in both sub-scapular areas and in addition in the infraolecranon regions, a case with seven different anatomical locations (sub-scapular, bilateral thoracic wall, and both infraolecranon areas), a case with four different anatomical locations (sub-scapular on both sides, left infraolecranon, and right ischial tuberosity) and a case with tumour in both sub-scapular areas and in the right ischial tuberosity. One patient had a single tumor located only in the olecranon. Shimizu S et al[28] described a case which presented 15 separate elastofibromas. The location of the masses included the classic sub-scapular sites as well as buttocks and upper limbs.

EPIDEMIOLOGY

Frequency

Although ED is considered as a rare entity, its exact frequency is not known. Significant differences exist in the described incidence of ED between clinical and pathology studies.

Pauline H. Go et al[5] in a study based on data from 14 series of elastofibroma cases published between 1980 – 2009 described 330 symptomatic cases of ED. Brandser et al[12] in a CT study involving 258 asymptomatic patients over 60 years of age found five elastofibromas in 4 patients (prevalence of 2%). Blumenkrantz et al[9] described 29 cases of ED in a total of 1,751 patients subjected to PET-CT with 18F-fluorodeoxyglucose (FDG), (1.66%). Review of Ortho-

pedic Oncology data from the Royal Orthopaedic Hospital in Birmingham, UK, revealed 15 cases of elastofibromas in a total of 17,500 cases (0.086%) in patients >20 years of age[16]. Nagano S et al[29], in an analysis of the Japanese Soft Tissue Tumor Registry database, found 130 cases of ED in a total of 12,557 cases with soft tissue volume (1%).

In contrast, autopsy studies have described a much higher incidence of ED.

Jarvi and Lansimies[30] in a series of 235 autopsies, found changes in the subcapscular thoracic fascia similar to ED in 39 cases. In people over 55 years, the frequency was 24.4 per cent in females (29 of 119) and 11.2 per cent in males (10 of 89).

Giebel et al[31] in a study of 100 autopsies revealed 13 elderly patients with elastofibroma. Pre-elastofibroma-like morphological changes (e.g. few or many degenerated elastic fibres) were observed in 81% of the autopsies.

The differences in the reported incidence between clinical and autopsy studies suggest that the actual incidence of ED is higher than that described in the clinical studies. This is also supported by the fact of incidental discover of asymptomatic elastofibromas[5,7,10,12].

The absence of symptoms and the small size are obvious causes for the escape of the elastofibromas[5].

Racial - Age Distribution

ED affects mainly elderly patients. The average age at diagnosis in different series has been described in 62 years (range 6-94 years)[5], 63.7 years (range 46 - 79 years)[22], 54.9 years (range 44 - 62 years)[10], 61.1 years (range 38-78 years)[11], 65 years (range 48-72 years)[7] and 68.4 years (range 51-79 years)[16]. In contrast, ED is rare in children and adolescents[31].

Elastofibroma affects predominantly women. The female/male ratio has been described in 2.2:1 (11 women/5 men)[11], 2.5:1 (5 women/2 men)[22], 3.14:1 (22 women/7 men)[9], 3.9:1 (263 women/67 men)[5], 5:1[6] και 7:1 (7 women/1 men)[10]. However, Chandrasekar CR et al[16] described that in a series of 15 elastofibroma cases 12 patients (80%) were men and 3 were women 3 (20%).

ETIOLOGY

The etiology of ED is not fully elucidated. A number of theories have been proposed for its development.

The location of ED between the scapula and the chest wall and the initial description of the tumour in people with hard manual labor constituted the basis for the theory of mechanical friction between the chest wall and the lower tip of scapula as a mechanism of ED development[13].

According to this theory, direct mechanical stress on the elastic tissue can cause hypertrophy and secondary degeneration of the elastic fibers, as well as diffuse growth of collagenous tissue[30] alternating with the deposition of hyperplastic fat[13].

However, the higher incidence of ED in women and its location at anatomical sites not involved in mechanical overload can not support the mechanism of mechanical friction, at least as the unique cause, for the development of ED[22]. In addition, there have been described cases of ED with absence of this causative agent, such as in patients with no history of recurrent or previous trauma in the tumor area or in patients who were not hard workers[10,22,29].

Development of ED as a result of the normal age process rather than an abnormal elastogenesis or degeneration, was supported by Geibel et al[31]. This view was based on finding "pre-elastofibroma changes" in their autopsy series. These changes are determined by a weakly eosinophilic material which does not express a definitive elastic tissue formation.

Nagamine et al[8] supported the familial predisposition for the formation of ED. This view was based on the finding that of 170 cases of ED 32% of cases occurred within a single family. Familial predisposition with an underlying enzymatic defect have also been proposed as possible etiologic factors[13].

Jarvi OH and Lansimies PH[30] argued that in addition to direct mechanical stress on elastic tissue, nutritional deficiency due to failure of the vascular system against friction of the scapula and streching movements of the upper extremities may play a major role in necrotic tissue changes.

The nature of the abnormal elastic fibers is questionable and controversial and can not substantiate their mechanism of formation. Abnormal elastogenesis or degeneration as a secondary process, even combination of both mechanisms may be responsible[22].

Di Vito A et al[33] in a study of extracellular matrix and histopathogenesis in ED, argued that a mechanical strain-dependent reactivation of periostin and tenascin-C expression, as well as elastin deposition, could be responsible for the development of ED.

Kakudo N et al[34] in a histochemical, immunohistochemical, and ultrastructural study of an ED, argued that although fibroblasts can produce large amounts of elastin, microinid and collagen, elastin deposition on collagen fibers may be involved in the formation of

abnormal elastic fibers.

Although the mechanism of ED development is not fully elucidated, it is internationally accepted that it is more often in individuals performing repetitive manual labor involving the shoulder[5,35], perhaps in combination with genetic factors[29].

CLINICAL PRESENTATION

The presence and type of symptoms of ED depend on its location and size[22].

ED is usually asymptomatic[22,29], especially during the initial phases[36].

In these cases ED is accidentally detected by the patient himself, eg in the mirror, or by another person, such as a spouse or member of the family[7,16,29], or during physical examination[5,7], investigation for other disease[12] or for symptomatic ED on the contralateral side[5,7,10] or during surgery for unrelated chest injury[7].

In symptomatic cases, patients usually experience a long history of slowly growing swelling in the shoulder area for which the patient is not looking for medical attention either because the mass is asymptomatic or because the symptoms are mild.

The interval between the detection of swelling or the presence of symptoms until the search for medical assistance has been described in 3-60 months (mean duration of symptoms 20 months)[16], 4 months to 4 years[22], seven months[13] and five years[35].

When symptoms are present, these are typical and include local swelling of the shoulder[10], limitation of movement of the upper limb, mainly in the upward movements requiring slipping of the shoulder with respect to the chest wall[9,35], and sometimes pain during the movement of the shoulder[5,16,29,35-37].

The pain is usually moderate, but cases of painful swelling of the shoulder have been described[11,35].

Other symptoms include a clunking sensation during abduction and adduction of the arm[7,13] and snapping of the scapula[29].

PHYSICAL EXAMINATION

The clinical examination reveals a large, palpable, solid mass well circumscribed in the lower corner of the shoulder, usually painless. The mass may be mobile or immobile due to its attachment to the chest wall[13,16,29,35].

The tumour is more prominent on the forward flexion of the shoulder due to forward movement of the inferior angle of the scapula[16,29,35].

Small elastofibromas are not visible in the neutral position with the risk of escaping unless the patient is called to move his arm laterally or posteriorly[29].

Another mass may be present in the opposite shoulder, often smaller and clinically silent[35].

IMAGING FINDINGS

The typical diagnostic pattern of ED is characterized by alternating bundles of fibrous and adipose tissue.

CHEST RADIOGRAPHY

Chest X-ray is usually normal. Except a possible soft tissue signal intensity or elevation of the shoulder, simple X-rays do not show specific changes capable of diagnosing[22,35,38].

COMPUTED TOMOGRAPHY (CT) AND MAGNETIC RESONANCE IMAGING (MRI)

EDs have typical imaging findings in CT and MRI (Figures 1, 2a, b) which allow definitive diagnosis[7,38].

Typical imaging of ED in CT and MRI include a poorly circumscribed mass of soft tissues without wall. The mass is heterogeneous with a characteristic layered pattern of

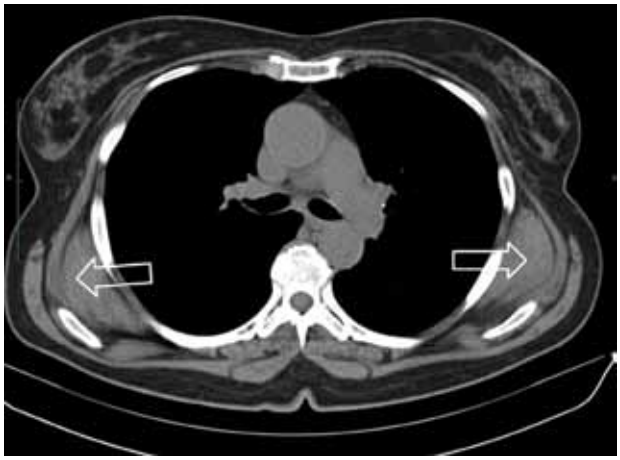

FIGURE 1. Chest computed tomography of a 62 years-old woman reveals bilateral solid formations *(arrows)* with skeletal muscle density located in lateral thoracic walls at the level of the scapulae. (Adapted from Reference[14] after permission).

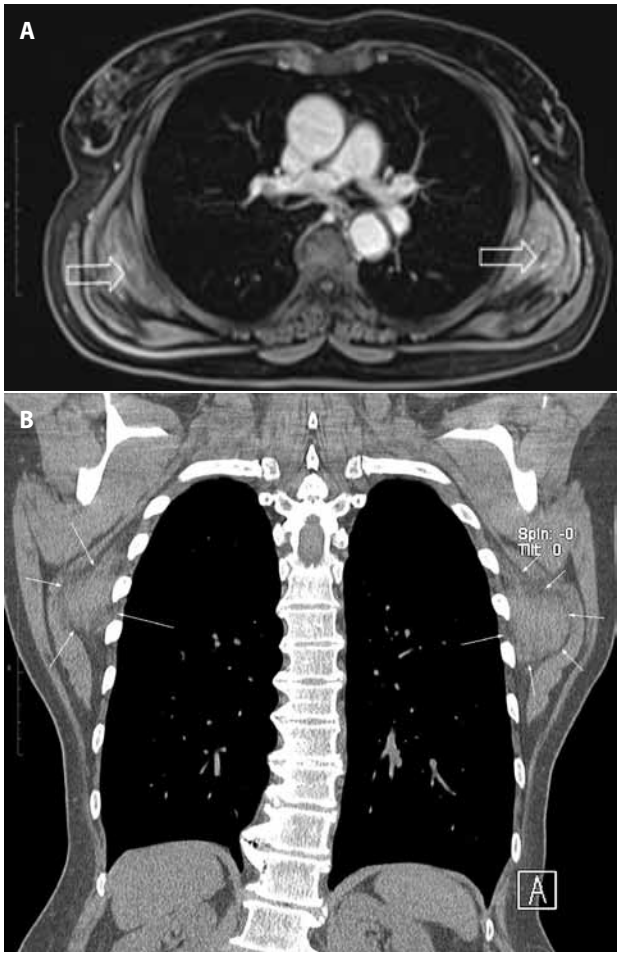

FIGURE 2 (a, b). Chest magnetic resonance imaging with intravenous contrast material of the same patient shows *(arrows)* bilateral unecapsulated symmetrical spindle shaped solid formations located at lateral chest walls at the level of the scapulae, in front of the serratus anterior muscle and lateral to the ribs. The formations are heterogeneous with alternating linear regions of skeletal muscle and fat tissue intensity. Both formations were of similar dimensions, 10×7×3.5 cm. (Adapted from Reference[14] after permission).

fatty tissue (low-density by CT, high-signal on T1 images and intermediate signal on T2 images by MRI) and fibrous tissue (similar to muscle in terms of density by CT and signal intensity by MRI)[7,38]. The lesions are located anterior to the scapula (subscapular) or caudal to the inferior pole of the scapula (infrascapular), deep in relation to the latissimus dorsi, rhomboid, and serratus anterior muscles. There is no evidence of infiltration of neighboring tissues[7].

MRI is the imaging modality of choice in diagnosing ED because it depicts better than CT the characteristic layered pattern. The mass is well-defined. Slight or moderate enhancement within elastofibromas can be observed after gadolinium administration[5,7,13,35]. However, in some cases of ED, strong enhancement can be observed after gadolinium administration which is characteristic of malignant tumors. In these cases biopsy and histopathological assessment will be required for definitive diagnosis[35,38].

In computed tomography the ED displays a typical or a non typical imaging pattern.

The typical appearance of ED in the CT includes a subscapular lenticular mass of soft tissue, with no wall, of equal density to the adjacent muscles (fibrous tissue) and linear areas of low density (fatty tissue). Mass margins show poorer differentiation from surrounding muscles compared to ultrasound and MRI[7,13,22,35]. This CT pattern is diagnostic for ED.

The atypical appearance of ED in CT includes well-described soft tissue masses with a similar density to the adjacent skeletal muscle, relatively homogenous, with no defined interspersed areas of fat attenuation[7]. This atypical pattern is usually observed in cases of smaller masses[36].

The fact that ED presents in the CT and MRI a density/signal intensity similar to that of the adjacent muscles interprets the escape of the EDs from the initial interpreting radiologists. Naylor MF et al[7] described that of 21 fibroblastomas imaged, only four (19%) were perceived by the initial interpreting radiologist, and only one (5%) was correctly diagnosed[7]. Brandser EA[12] described that none of 5 fibroblastomas in 4 asymptomatic patients had been described in the initial diagnosis of CT.

PET-CT SCAN

In PET-CT scan most tumors appear with mild or moderate diffuse metabolic activity with the SUVmax ranging from 1.4 to 3.2[9] which should not be interpreted as a malignant finding[36]. However, hypermetabolic tumors have been described[39].

ULTRASOUND

EDs present in the ultrasound a typical pattern of a well-defined soft tissue mass in the typical position of the ED, with a multilayered pattern of alternating layers of hypoechogenic fat and hyperechogenic elastic tissue, gently parallel to the chest wall[40-42]. Colour Doppler shows a vascular pattern similar to the surrounding muscles[22].

Although ultrasound represents an inexpensive di-

agnostic tool[22], it is not an imaging technique of choice for diagnosing of ED. In addition, the examination is dependent on the examiner and for this reason it is not always diagnostic[35].

DIAGNOSIS

The diagnosis of ED can be definitively determined on the basis of its clinical and imaging characteristics.

A history of long-term presence of a solid mass under the scapula[43], the bilateral location[7] and the classical imaging characteristics described above in elderly patients and especially in women place the diagnosis of ED. In these cases, the biopsy is not necessary for diagnosis[5,13,22,16,29,35].

Biopsy is necessary to confirm diagnosis in cases of unilateral EDs without the typical imaging pattern in MRI and CT scan[5,7].

Particularly unilateral mass of soft tissues larger than 5 cm in diameter in elderly patients, with MRI images of weakly defined, heterogeneous mass of soft tissue, sometimes enhanced by gadolinium, should be identified by biopsy because of the possibility of soft tissue sarcoma in this age group[16,44].

Fine needle aspiration biopsy (FNAB) is a commonly used technique to definitively diagnose the condition[10,13]. However, the collagenous nature of the mass often results in a paucicellular FNA smear, resulting in a false-negative report[5,10,22]. In these cases, a core or open biopsy is essential to get a representative tissue specimen to make a definitive diagnosis[5,22] especially in case of suspicion of a soft tissue sarcoma[15].

The differential diagnosis of ED includes sarcoma, lipoma, fibroma, liposarcoma fibromuscular tumour, desmoid tumour, hemangioma, hematoma and aggressive fibromatosis[5,35].

PATHOLOGY

Macroscopically, the fibrolastoma is characterized by a solid, slightly elastic, irregular, weakly defined mass of fat and connective tissue without wall with a consistence that assimilates rubber. The cut-surface shows white and yellow tissue caused by fat trapping, similar to a checkerboard pattern[22].

Microscopically, the fibrolastoma is characterized by the presence of a large number of abnormal elastic fibers embedded in a matrix of dense eosinophilic collagen, benign fibroblasts, and mature adipocytes[7,16,22].

Elastic fibers are difficult to be detected by hematoxylin-eosin staining[22]. They are best depicted by elastin staining[7,22], which reveals deep-stained branched and unbranched fibers[7]. The elastic fibers are sometimes elongated and larger than regular ones, mostly round shaped, densely packed[22], simulating beads on the strings[13].

The fibroelastic fibers exhibite a central dense core and serrated margins[7,45,46]. The central core represents a mature elastic tissue that appears to be secreted by active fibroblasts[46]. The peripheral zones of elastic fibers consist of a variety of fuzzy, irregularly shaped amorphous components and compactly and randomly arranged large quantities of microfibers[45].

The lesions are predominantly subcellular with fibroblastic cells without atypia and mitotic activity[22]. In the cytoplasm of the fibroblasts there are dense granular bodies, which are believed to represent elastin or elastin precursors[46]. Between the benign fibroblasts there is a varied amount of fatty tissue[7,16].

MANAGEMENT

When diagnosis of ED is definitive, its treatment depends on the symptoms it causes to the patient.

In asymptomatic patients, clinical monitoring is adequate[5] due to the benign nature of the tumor and because malignant transformation has never been described[13,22,25].

Surgical excision is indicated when there is a diagnostic doubt[10] and in severe symptomatic cases of snapping or blocking scapula, pain, or tumor-related discomfort and depending on the patient's psychological and physical strain. A therapeutic marginal excision has been shown to be sufficient and it is preferred over broad or radical excision[5,10,22,29,35,44].

The most frequent complication observed postoperatively is hematoma due to the fact that the periscapular region is highly vascular[13,29].

OUTCOME

The prognosis after surgical excision is good[13,37].

Tumor relapses have been described in 7% of the cases and are attributed to incomplete resection of the tumor[10].

CONCLUSIONS

ED is an unusual, well defined tumor of soft tissue typically located in the peri-scapular region, affecting mainly

elderly people and especially women. The typical location and the characteristic MRI and CT imaging pattern of the alternate bundles of fibrous and adipose tissue set the diagnosis without the need for biopsy. Biopsy is required in atypical cases to exclude malignancy, especially sarcoma. In asymptomatic cases, simple monitoring is sufficient. Surgical excision is recommended for serious symptoms and diagnostic doubt. The prognosis is excellent. No case of malignant transformation has been described.

REFERENCES

1. Athanassiadi K, Kalavrouziotis G, Rondogianni D, Loutsidis A, Hatzimichalis A, Bellenis I. Primary chest wall tumors: early and long-term results of surgical treatment. Eur J Cardiothorac Surg 2001; 19:589-93.
2. Leuzzi G, Nachira D, Cesario A, et al. Chest wall tumors and prosthetic reconstruction: A comparative analysis on functional outcome. Thorac Cancer 2015; 6:247-54.
3. Jarvi OH, Saxen AE. Elastofibroma dorsi. Acta Pathologica et Microbiologica Scandinavica 1961;144, supplement 52:83–4.
4. Faccioli N, Foti G, Comai A, Cugini C, Guarise A, Mucelli RP. MR imaging findings of elastofibroma dorsi in correlation with pathological features: our experience. Radiol Med 2009; 114:1283–91.
5. Go PH, Meadows MC, Deleon EM, Chamberlain RS. Elastofibroma dorsi: a soft tissue masquerade. Int J Shoulder Surg 2010; 4:97–101.
6. Fletcher CD, Unni KK, Mertens F. eds. World Health Organisation Classification of Tumors. Pathology and genetics of tumors of soft tissue and bone; elastofiroma. Lyon: IARC Press, 2002; pp. 56-7.
7. Naylor MF, Nascimento AG, Sherrick AD, McLeod RA. Elastofibroma dorsi: Radiologic findings in 12 patients. Am J Roentgenol 1996; 167:683–7.
8. Nagamine N, Hohara Y, Ito E. Elastofibroma in Okinawa: a clinicopathologic study of 170 cases. Cancer 1982; 50:1794–805.
9. Blumenkrantz Y, Bruno GL, González CJ, Namías M, Osorio AR, Parma P. Characterization of Elastofibroma Dorsi with (18)FDG PET/CT: a retrospective study. [Article in English, Spanish] Rev Esp Med Nucl 2011;30:342-5.
10. Freixinet J, Rodríguez P, Hussein M, Sanromán B, Herrero J, Gil R. Elastofibroma of the thoracic wall. Interact CardioVasc Thorac Surg 2008; 7:626-8.
11. Karakurt O, Kaplan T, Gunal N, et al. Elastofibroma dorsi management and outcomes: review of 16 cases. Interact Cardiovasc Thorac Surg 2014;18:197-201.
12. Brandser EA, Goree JC, El-Khoury GY. Elastofibroma dorsi: prevalence in an elderly patient population as revealed by CT. AJR Am J Roentgenol 1998; 171:977–80.
13. Braham E, Hergli I, Boudaya MS, et al. Elastofibroma of scapula: a case report and literature review. Ann Transl Med 2013; 1: 31.
14. Haini D, Giannopoulos I, Kardamis S, et al. Bilateral chest elastofibroma. Pneumon 2016; 29:360.
15. Goyal A, Jain D, Bhat I, Singh S. A Unique Case of Pancreatic Mass due to Pancreatic Elastofibromatosis. Case Rep Gastrointest Med 2016; 2016:2697187.
16. Chandrasekar CR, Grimer RJ, Carter SR, et al. Elastofibroma Dorsi: An Uncommon Benign Pseudotumour. Sarcoma. 2008; 2008: 756565. Published online 2008 Mar 12.
17. Prete PE, Henbest M, Michalski JP, Porter RW. Intraspinal elastofibroma. A case report. Spine 1983; 8:800–2.
18. De Nictolis M, Goteri G, Campanati G, Prat J. Elastofibrolipoma of the mediastinum. A previously undescribed benign tumor containing abnormal elastic fibers. Am J Surg Pathol 1995; 19:364–7.
19. Mohan JC, Goel PK, Gambhir DS, Khanna SK, Arora R. Calcified mobile papillary fibroelastoma of the tricuspid valve: a case report. Indian Heart J 1987; 39:237–9.
20. Kapff PD, Hocken DB, Simpson RHW. Elastofibroma of the hand. Journal of Bone & Joint Surgery 1987; 69-B468–9.
21. Cross DL, Mills SE, Kulund DN. Elastofibroma arising in the foot. South Med J 1984; 77:1194–*6*.
22. Daigeler A, Vogt PM, Busch K, et al. Elastofibroma dorsi – differential diagnosis in chest wall tumours. World J Surg Oncol 2007; 5:15.
23. Mirra JM, Straub LR, Järvi OH. Elastofibroma of the deltoid: a case report. Cancer 1974; 33:234–8.
24. Saint-Paul M, Musso S, Cardot-Leccia N, et al. Elastofibroma of the stomach. Pathol Res Pract 2003*;*199*:*637–9.
25. Ishida M, Iwai M, Kagotani A, Iwamoto N, Okabe H. Elastofibromatous change of the intestine: report of four lesions from three patients with review of the literature. International Journal of Clinical and Experimental Pathology 2014;7:2291–7.
26. Sakatani T, Shomori K, Adachi H, Hosoda A, Ito H. Elastofibroma of the sigmoid colon. Pathology Research and Practice 2000; 196:205–7.
27. Tsutumi A, Kawabata K, Taguchi K, Doi K. Elastofibroma of the greater omentum. Acta Oathol Jpn 1985*;* 35:233–41.
28. Shimizu S, Yasui C, Tateno M, et al. Multiple elastofibromas. J Am Acad Dermatol 2004*;* 50:126–9.
29. Nagano S, Yokouchi M, Setoyama T, et al. Elastofibroma dorsi: Surgical indications and complications of a rare soft tissue tumor. Mol Clin Oncol 2014;2:421-4.
30. Jarvi OH, Lansimies PH. Subclinical elastofibromas in the scapular region in an autopsy series. Acta Pathol Microbiol Scand A 1975; 83:87–108.
31. Giebel GD, Bierhoff E, Vogel J. Elastofibroma and pre-elastofibroma – A biopsy and autopsy study. Eur J Surg Oncol 1996; 22:93–6.
32. Devaney D, Livesley P, Shaw D. Elastofibroma dorsi: MRI diagnosis in a young girl. Paediatric Radiology 2005*;* 25:282–3.
33. Di Vito A, Scali E, Ferraro G, et al. Elastofibroma dorsi: a histochemical and immunohistochemical study. Eur J Histochem 2015; 59:2459.
34. Kakudo N, Morimoto N, Ogawa T, Hihara M, Koseki R, Kusumoto K. Elastofibroma dorsi: a case report with an immunohistochemical and ultrastructural studies. Med Mol Morphol 2016;

49:42-7.
35. Falidas E, Arvanitis D, Anyfantakis G, et al. Painful Elastofibroma Dorsi: A Report of a Case and a Brief Review of the Literature. Case Rep Orthop 2013; 2013:794247.
36. Pessoa J, Sasso AA, Barreto MM, Zanetti GM, Marchiori E. Bilateral elastofibroma dorsi. Radiol Bras 2016; 49:61.
37. Parratt MT, Donaldson JR, Flanagan AM, et al. Elastofibroma dorsi: management, outcome and review of the literature. J Bone Joint Surg Br 2010; 92:262–6.
38. Malghem J, Baudrez V, Lecouvet F, Lebon C, Maldague B, Vande Berg B. Imaging study findings in elastofibroma dorsi. Joint Bone Spine 2004; 71:536–1.
39. Onishi Y, Kitajima K, Senda M, et al. FDG-PET/CT imaging of elastofibroma dorsi. Skeletal Radiology 2011; 40:849–53.
40. Cota C, Solivetti F, Kovacs D, Cristiani R, Amantea A. Elastofibroma dorsi: histologic and echographic considerations. Int J Dermatol 2006; 45:1100–3.
41. Bianchi S, Martinoli C, Abdelwahab IF, Gandolfo N, Derchi LE, Damiani S. Elastofibroma dorsi: sonographic findings. AJR Am J Roentgenol 1997; 169:1113–5.
42. Solivetti FM, Bacaro D, Di Luca Sidozzi A, Cecconi P. Elastofibroma dorsi: ultrasound pattern in three patients. J Exp Clin Cancer Res 2003; 22:565–9.
43. Vastamaki M. Elastofibroma scapulae. Clinical Orthopaedics & Related Research 2001; 392:404–8.
44. Smith HG, Hannay JA, Thway K, et al. Elastofibroma dorsi: The clunking tumour that need not cause alarm. Ann R Coll Surg Engl 2016; 98:208-11.
45. Fukuda Y, Miyake H, Masuda Y, Masugi Y. Histogenesis of unique elastinophilic fibers of elastofibroma: ultrastructural and immunohistochemical studies. Hum Pathol 1987; 18:424-9.
46. Dixon AY, Lee SH. An ultrastructural study of elastofibromas. Hum Pathol 1980; 11:257-62.