Painful Chest Wall Swellings: Tietze Syndrome or Chest Wall Tumor?

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Abstract

Objective Tietze syndrome (TS) is an inflammatory condition characterized by chest pain and swelling of costochondral junction. Primary chest wall tumors may mimic TS. In this article, we report our experience of approximately 121 patients initially diagnosed as TS and determined chest wall tumor in some cases at the follow-up.

Methods This is a retrospective review of patients diagnosed as TS by clinical examination, chest X-ray, electrocardiogram, routine laboratory tests, and computed tomography (CT) of chest: all treated and followed up between March 2001 and July 2012. There were 121 cases (41 males and 80 females; mean age, 39.6 $\pm$ 3.2 years) of TS.

Results In 27 patients with initial normal radiological findings, the size of swellings had doubled during the follow-up period (mean, 8.51 $\pm$ 2.15 months). These patients were reevaluated with chest CT and bone scintigraphy and then early diagnostic biopsy was performed. Pathologic examination revealed primary chest wall tumor in 13 patients (5 malignant, 8 benign). CT had a sensitivity of 92.3% and a specificity of 64.2% in detection of tumors (kappa: 0.56, $p = 0.002$), whereas the sensitivity and the specificity of bone scan were 84.6 and 35.7%, respectively (kappa: 0.199, $p = 0.385$).

Conclusion Primary chest wall tumors could mimic TS. Bone scintigraphy or CT is not specific enough to determine malignant and other benign disorders of costochondral junction. Therefore, clinicians should follow TS patients more closely, and in case of increasing size of swelling, early diagnostic biopsy should be considered.

Keywords
- chest wall tumor
- computed tomography
- surgery
- bone scintigraphy

Introduction

Tietze syndrome (TS) is an inflammatory condition characterized by chest pain and swelling of costochondral junction of unknown etiology. It usually occurs in younger adults (<40 years old). More than 70% of cases occur on only one side (unilateral) and affect one joint. The diagnosis is confirmed by palpitation of a tender swelling at the costochondral junction. The imaging

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modalities such as tomography or scintigraphy could be used in the diagnosis of TS for excluding the other abnormalities of the ribs and costochondral junctions.[1,2] Primary chest wall tumors are a heterogeneous group of neoplasm arising from bone, soft tissue, or cartilage of the chest wall. They are rare tumors, with an incidence of <2% and represent approximately 5% of all thoracic neoplasms.[3] Anterior chest wall involvement due to malignancy is very rare and can be overlooked, resulting in a delay in diagnosis.[4] In the literature, several case reports stated that chest wall malignancies such as Hodgkin and non-Hodgkin lymphoma, metastatic bone diseases, multiple myeloma, and plasmacytoma can mimic or misdiagnosed as TS.[4–6] Primary chest wall tumors may mimic benign conditions such as TS. Awareness of the possibility of this situation could minimize the delay in diagnosis, which is especially important for malignancies.

Materials and Methods

A retrospective analysis of 121 cases diagnosed as TS and treated, rediagnosed, and followed up between March 2001 and July 2012 in three different institutions is presented. The initial complaints were painful swelling of costochondral junction in all patients with no history of trauma to the thorax, tuberculosis, or symptoms of systemic disease. This group consisted of 41 (33.88%) male and 80 (66.11%) female patients, with a mean age of 39.6 ± 3.2 years. The diagnostic methods, treatments, and pathological characteristics of the excised lesions and the follow-up records of the outpatient clinic were evaluated.

Clinical examination, chest X-ray, electrocardiogram, and routine laboratory tests were performed. Computed tomography (CT) of the chest was done for excluding other abnormalities. Focal enlargement, ventral angulation and calcification of costal cartilage, and swelling of soft tissue were evaluated as positive CT findings.

The diagnosis of TS was done in patients with painful and tender swelling at the costochondral junction when routine laboratory tests and imaging findings (chest X-ray and CT) were all normal. Those patients who initially had positive findings on CT listed above and who were biopsied without follow-up were excluded from the study.

All patients received anti-inflammatory treatment. The follow-up schedule was as follows: first control was 2 weeks after the treatment and second control was 3 months later for the patients who were still suffering from the pain and swelling. Then the controls were done once a year for the patients who still had symptoms and swelling. All patients were advised to admit to the hospital if they notice swelling growth without waiting control time. The patients were followed up for 38.4 ± 6.7 months (range, 2–74 months).

Technetium-99m (Tc-99m) bone scintigraphy was performed in combination with thorax CT during the follow-up period of the cases with a doubling in the diameter of swelling. Increased uptake of radioactivity on bone Tc-99m scans was evaluated with positive bone scan findings. Excisional biopsy was also performed for these cases. Results of CT and bone scan were compared with the surgical specimens.

Sensitivity, specificity, and negative predictive value for CT and bone scan were calculated, classifying malignant and benign results as diagnostic and the other results as nondiagnostic.

Radical en bloc excisions were performed in all malignant chest wall tumors that have been detected by excisional biopsy. En bloc excision included the ribs just above and below the lesion, the adjacent muscles (at least with 4-cm clear margin) and the underlying pleura. Affected rib was excised as much as feasible because of possible intramedullary and periosteal involvement. For tumors involving the sternum, resection includes a portion of the sternum depending on the size and location of the tumor. Any involved structures such as lung, pericardium, or chest wall muscles were all included in the resection. Wide resection for chest wall tumors can result in large tissue defects that require reconstruction. On the anterior chest wall, defects less than 5 cm were closed with a Marlex patch followed by a primary muscle and cutaneous closure. Large defects bigger than 5 cm were reconstructed with a sandwich of two layers of Marlex mesh and filler of methyl methacrylate, when rigidity was needed. The filler of methyl methacrylate was prepared and applied between two layers of Marlex mesh and molded to fit the counter of the chest wall. The composite prosthesis was then sutured before the methyl methacrylate was solidified.

This study protocol was approved by the Medical Ethics Committee of our institution.

Results

The swelling was located in the upper chest wall area (first–second–third costochondral junction) in 84 patients and in the middle part of the anterior chest wall area (fourth–fifth costochondral junction) in 37 patients. The diameter of the swelling varied from 1 to 3 cm. The chest X-ray, electrocardiogram, routine laboratory tests, and chest CT was normal, so the diagnosis of TS was made.

All patients received nonsteroidal anti-inflammatory drugs (NSAIDs) for 2 weeks. In 75 patients, the pain and the tenderness were resolved by NSAIDs. In 46 patients, the pain and the tenderness were diminished by NSAIDs.

In 34 (28.09%) patients, the swelling disappeared after 2 weeks of treatment with NSAIDs. In 22 (18.18%) patients, the swelling disappeared in the first year of follow-up, and in 20 (16.52%) patients the swelling disappeared in the second year of follow-up. Eighteen patients (14.87%) still have swelling and minimal pain.

In 27 (22.31%) patients (17 males, 10 females with a median age of 35.29 years), the diameter of swelling had doubled (mean, 8.51 ± 2.15 months) in the first year of follow-up. In these patients, the initial radiological studies revealed no abnormalities. These patients were reevaluated with chest radiography and routine laboratory tests. Moreover, for differential diagnosis, CT of chest and Tc-99m bone scintigraphy were performed. Radiological and scintigraphic evaluations revealed positive and normal findings (►**Table 1**, ►**Fig. 1A–D**). Excisional biopsy with a diameter of 2 to 3 cm was performed because of the increasing size of swelling (►**Fig. 2A–B**). The histopathological findings of these

Table 1 Clinicopathologic characteristics of the patients

No. of patients	Sex	Age	Initial diameter of swelling (cm)	Doubling time of swelling (mo)	Chest CT	Bone scintigraphy	Pathology
1	**M**	**34**	**2**	**6**	**Positive**	**Positive**	**Chondroma**
2	M	27	1	8	Positive	Positive	Chondritis
3	M	32	1	9	Negative	Negative	Normal cartilage tissue
4	**F**	**50**	**1**	**9**	**Positive**	**Negative**	**Osteochondroma**
5	**M**	**34**	**1.5**	**7**	**Negative**	**Negative**	**Chondroma**
6	F	25	1	8	Positive	Positive	Chondritis
7	**M**	**41**	**1.5**	**4**	**Positive**	**Positive**	**Chondrosarcoma**
8	M	39	0.5	9	Positive	Positive	Normal cartilage tissue
9	**M**	**36**	**2**	**6**	**Positive**	**Positive**	**Plasmacytoma**
10	M	49	1.5	11	Negative	Negative	Chondritis
11	**F**	**43**	**2**	**2**	**Positive**	**Positive**	**Chondrosarcoma**
12	F	31	2	7	Positive	Positive	Normal cartilage tissue
13	F	48	0.5	9	Negative	Negative	Chondritis
14	**M**	**40**	**1.5**	**6**	**Positive**	**Positive**	**Chondrosarcoma**
15	**M**	**30**	**1**	**10**	**Positive**	**Positive**	**Chondroma**
16	M	22	2	12	Negative	Positive	Chondritis
17	F	29	0.5	8	Positive	Positive	Chondritis
18	**F**	**27**	**1**	**4**	**Positive**	**Positive**	**Chondrosarcoma**
19	M	23	1.5	13	Negative	Positive	Normal cartilage tissue
20	**M**	**45**	**2**	**7**	**Positive**	**Positive**	**Chondrosarcoma**
21	M	41	2	9	Negative	Negative	Normal cartilage tissue
22	**F**	**39**	**2**	**8**	**Positive**	**Positive**	**Plasmacytoma**
23	F	27	1.5	13	Negative	Positive	Chondritis
24	**M**	**33**	**2**	**10**	**Positive**	**Positive**	**Chondroma**
25	M	34	2	9	Negative	Positive	Chondritis
26	F	26	0.5	14	Negative	Negative	Normal cartilage tissue
27	**M**	**38**	**1.5**	**12**	**Positive**	**Positive**	**Plasmacytoma**

Abbreviation: CT, computed tomography.
The bold text signifies the patients whose biopsies were pathologic.

patients were chondritis in eight patients, chondrosarcoma in five patients, solitary plasmacytoma in three patients, chondroma in four patients, osteochondroma in one patient, and normal cartilage tissue in six patients (►**Table 1**). In eight (6.61%) patients (chondrosarcoma and plasmacytoma), primary malignant chest wall tumor was found and in five (4.13%) patients (chondroma and osteochondroma) primary benign chest wall tumor was found.

We compared the histopathological findings with the results of CT and bone scan. The sensitivity of CT was 92.3% (95% confidence interval [CI], 0.6669–0.9863) and the specificity was 64.2% (95% CI, 0.3876–0.8366). The negative predictive value (►**Table 2**) was 90% (95% CI, 0.7104–0.9761). Also the kappa value was 0.560 ($p = 0.002$). The sensitivity of bone scintigraphy was 84% (95% CI, 0.5777–0.9567) and the specificity was 35% (95% CI, 0.1634–0.6124). The negative predictive value (►**Table 3**) was 71.43%. Furthermore, the kappa value was 0.199 ($p = 0.385$).

Five patients with chondrosarcoma underwent a wider surgical resection. In three patients, the defect was less than 6 cm and was closed with a Marlex patch followed by a primary muscle and cutaneous closure. In two patients, there were large defects because of the partial resection of sternum, and in these patients the defects were closed with a sandwich of two layers of Marlex mesh and filler of methyl methacrylate. These five patients with complete excision of chondrosarcoma received no further treatment. Three patients with solitary plasmacytoma received radiotherapy after excisional biopsy. Thirteen patients (10.74%) with primary chest wall tumor were tumor free after 5 years follow-up.

Discussion

TS is defined as a self-limiting disorder characterized by nonsuppurative painful swelling of the upper costal cartilages

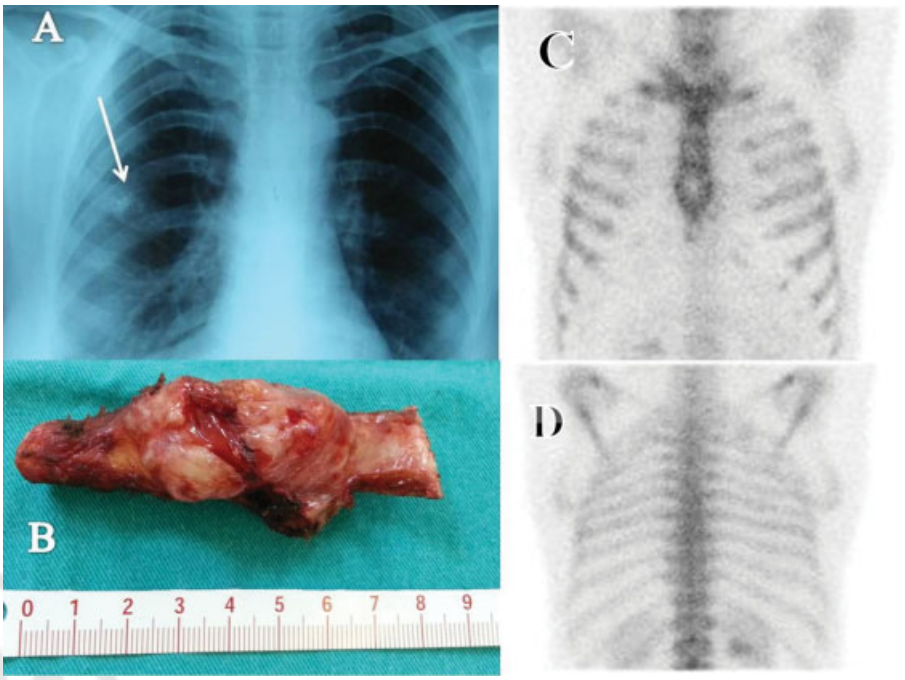

Fig. 1 (**A**) A 50-year-old woman's chest X-ray after 9 months of her first admission shows an expansion and calcification on the costochondral junction of the right third rib (arrow). (**B**) In the same patient, excisional biopsy of the rib was done and the pathological examination was osteochondroma. (**C**) The anterior view of the preoperative bone scan of the same patient shows no radioactivity uptake in the ribs. (**D**) The posterior view of the preoperative bone scan of the same patient shows no radioactivity uptake in the ribs.

of unknown etiology.[7] It generally occurs in individuals younger than 40 years.[8] The disorder has a tendency for the second and third costochondral junctions and occurs with the same frequency on both sides of chest.[9]

CT scan is useful in the diagnosis of TS, especially to exclude other abnormalities of the sternum and ribs.[10,11] Bone scintigraphy, a highly sensitive but nonspecific indicator of bone disease, has been useful in the diagnosis of various benign and malignant bone and joint disorders.[12] Histological examination of the swelling generally shows the nonspecific characteristics of hypervascularization and degenerative changes of the cartilage-like calcification, or some hypertrophic changes.[7] It is generally considered a benign condition and may resolve on its own without treatment. If required, NSAIDs, local corticosteroid injections, minimizing physical activity, and applying local heat will be sufficient for the treatment of this condition.[1,2]

Primary chest wall tumors are uncommon and most chest wall resections are performed for metastatic tumors or tumors of the lung that invade the chest wall.[13] Primary malignancies involving the anterior chest wall usually arise from ribs, sternum, sternoclavicular or chondrocostal junction, and from adjacent soft tissues.[4] The most common benign tumors include osteochondroma, chondroma, fibrous dysplasia, and desmoid tumor.[14] The most common malignant tumors include soft-tissue sarcoma, chondrosarcoma, and Ewing sarcoma.[15] As we found in our series, chondrosarcomas are the most common malignant primary neoplasm of the chest wall. Unlike with osteosarcoma and Ewing sarcoma, chemotherapy is not an effective treatment

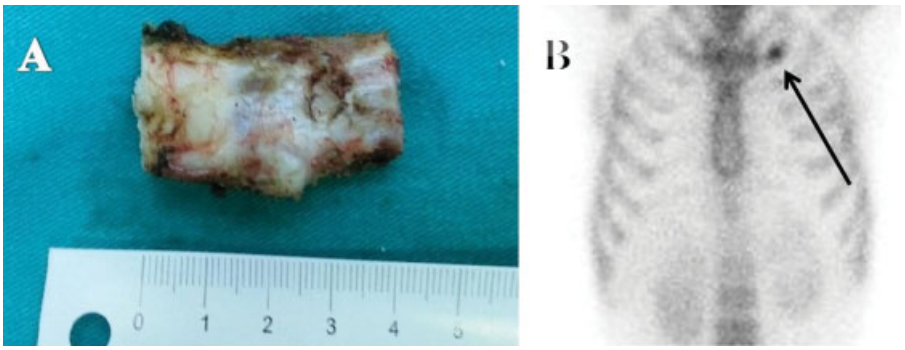

Fig. 2 (**A**) In a 22-year-old man after 12 months of his admission, the swelling on the left first costochondral junction had doubled and excisional biopsy was done. The pathological examination was chondritis. (**B**) The preoperative Tc-99 M bone scintigraphy of the same patient shows an increased uptake of radioactivity on the left first costochondral junction (arrow).

Table 2 Sensitivity and specificity of computed tomography in determining primary chest wall tumors

		95% Confidence interval		Power of test
Sensitivity	0.9231	0.6669	0.9863	0.9274
Specificity	0.6429	0.3876	0.8366	0.0761
Prevalence	0.4815			
False negative	0.0769			
False positive	0.3571			

modality for chondrosarcomas, where neoadjuvant therapy is the primary treatment for osteosarcoma and Ewing sarcoma.[16] In a recent study, Bagheri et al reported 40 patients with chest wall malignancies in which most were sarcomas. Surgery was performed in 5 patients and 35 patients underwent extensive resection and reconstruction. Five (12.5%) patients received neoadjuvant therapy and 30 patients (75%) were treated with adjuvant therapy. The 3-year survival rate was reported as 65%, where in 24 patients, recurrences were observed.[17]

Physical examination is usually not helpful in distinguishing between benign and malign tumors, as fixation of the mass and pain can be associated with both benign and malign tumors.[3]

Features of CT scan are also not always diagnostic of malignancy except in the presence of cortical destruction and soft-tissue swelling. Involvement of a single rib with the tumor does not necessarily imply that it is benign, as a malignant tumor may be monostotic at early phases of its progress.[18] Magnetic resonance imaging (MRI) is a multiplanar imaging modality with superior tissue-resolving features in the diagnosis of chest wall tumor. There are also some reports regarding the use of MRI in the diagnosis of TS.[19,20] The bone scintigraphy is indicated in patients with costochondral pain to identify the organic etiology. It reveals information regarding both inflammatory and degenerative changes of costochondral junction and it provides additional information about the projecting pain causes and unexpected malignant tumors. So it is a beneficial imaging modality in patients with chest wall pain and swelling with undefined etiology.[21] Osteoscintigraphic scanning has a high sensitivity but poor specificity for most of the bone pathologies. Functional nuclear medicine modalities generally have a limited role in the imaging of primary bone tumors but are very useful in the initial detection of metastases.[12,22] In this study, we used bone scintigraphy in which the diameter of swelling had doubled. On the other hand, the sensitivity and specificity of CT were superior to bone scintigraphy, but both of them were not at desired levels. We did not use MRI in the diagnosis or at the follow-up of these patients. However, MRI may be a better option in these situations and we have also started using MRI in patients with nonresolving or increasing size of swelling.

The clinical features that suggest a tumor is malignant are as follows: recent and rapid increase in size, invasion of adjacent structures, and the presence of metastases, especially to the lungs.[23] In our study, we found rapid enlargement of swellings in 27 patients, who were diagnosed and followed up as TS, after a diagnostic biopsy malignancy was found in 6.61% (8 of 121 patients). These findings suggest that the diagnosis of TS requires close follow-up. If no resolution or even an increase in size is evident, a diagnostic biopsy must be considered without delay.

In general, nonexcisional biopsy of a tumor of the chest wall is not recommended because of the risk of implantation of tumor tissue along the needle track after aspiration biopsy.[24] Excisional biopsy is still the preferred mode of treatment of small primary chest wall tumors. The general approach for a primary chest wall malign tumor is to perform wide excision of all the involved structures, regardless of size.[25] In the case of a primary malignant tumor of a rib, the ribs just above and below the involved rib, the adjacent muscles, and the underlying pleura should be excised.[16]

Defects in the chest wall after surgical resection can be closed with various procedures. For smaller defects (< 5 cm), the skeletal component can be ignored and the defect can be closed with only soft tissue. Several materials and techniques can be used to reconstruct wide chest wall defects including assorted muscle flaps, omental transplants, and various prosthetic materials.[26,27] In our patients, we had use

Table 3 Sensitivity and specificity of Tc-99 M bone scan in determining primary chest wall tumors

		95% Confidence interval		Power of test
Sensitivity	0.8462	0.5777	0.9567	0.6775
Specificity	0.3571	0.1634	0.6124	0.0761
Prevalence	0.4815			
False negative	0.1538			
False positive	0.6429			

synthetic Marlex mesh either alone or reinforced with methyl methacrylate.

On the basis of our experience, we conclude that a malignant tumor of chest wall may begin as a swelling like in TS and all laboratories and imaging findings could be normal initially. In cases of increasing size of swelling, chest CT, MRI, and bone scintigraphy could be done for differential diagnosis. However, in this study, we found thorax CT was superior to bone scintigraphy, but it was not at the desired level for diagnosing unexpected pathologies associated with costochondral junction. Therefore, malignancy should always be suspected during the diagnosis and follow-up of TS and early diagnostic biopsy should be kept in mind in cases of nonresolving or increasing size of swelling.

Conflict of Interest
None declared.

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