

## Chest Wall Tuberculosis: Clinical Features and Treatment Outcomes

Departments of <sup>1</sup>Internal Medicine and Respiratory Center, <sup>2</sup>Thoracic Surgery, <sup>3</sup>Pathology, Kyungpook National University School of Medicine, Daegu, <sup>4</sup>Department of Radiology, Gyeongsang National University School of Medicine, Jinju, <sup>5</sup>Department of Internal Medicine, Fatima Hospital, Daegu, Korea

Young Joo Kim, M.D.<sup>1</sup>, Hee Jung Jeon, M.D.<sup>1</sup>, Chang Ho Kim, M.D.<sup>1</sup>, Jae Yong Park, M.D.<sup>1</sup>, Tae Hoon Jung, M.D.<sup>1</sup>, Eung Bae Lee, M.D.<sup>2</sup>, Tae In Park, M.D.<sup>3</sup>, Kyung Nyeo Jeon, M.D.<sup>4</sup>, Chi Young Jung, M.D.<sup>5</sup>, Seung Ick Cha, M.D.<sup>1</sup>

**Background:** A diagnosis and treatment of chest wall tuberculosis (CWTB) is both difficult and controversial. The aim of this study was to collect information on the optimal treatment for CWTB.

**Methods:** The clinical features, radiographic findings, and treatment outcomes of 26 patients, who underwent surgery and were diagnosed histopathologically, were retrospectively analyzed.

**Results:** The most common presenting symptom was a palpable mass found in 24 patients (92.3%). In all patients, CT revealed a soft tissue mass that was accompanied by a central low density, with or without peripheral rim enhancement. The sensitivity and specificity of the bone scintigram for bone involvement were 87.5% and 100%, respectively. CWTB was diagnosed preoperatively by aspiration cytology and smear for acid-fast bacilli in five out of 11 patients. Twenty-three patients (88.5%) underwent a radical excision and three underwent incision/drainage or an incisional biopsy. The duration of antituberculous medication was  $7.5 \pm 3.98$  months with a follow-up period of  $28.2 \pm 26.74$  months. Among the 20 patients who completed their treatment, nine received chemotherapy for six months or less and 11 received chemotherapy for nine months or more. Two patients had a recurrence four and seven months after starting their medication.

**Conclusion:** A 6 month regimen may be appropriate for CWTB patients who have undergone a complete excision.

**Key Words:** Tuberculosis, Chest wall, Surgery, Computed tomography, Bone scintigram

### Introduction

Despite the dramatic decline in the incidence of tuberculosis during the past several decades, it still remains a significant public health problem in the world, largely due to widespread incidence of HIV infections<sup>1,2</sup>. Chest wall tuberculosis (CWTB) makes up 1 to 5% of all cases of musculoskeletal tuberculosis<sup>3-5</sup>, which

in turn represents 1 to 2% of tuberculosis cases overall<sup>6-8</sup>. Although the chest wall is an uncommon site for osteoarticular tuberculosis<sup>9</sup>, tuberculosis is the most common type of inflammatory lesion in the ribs after a metastatic neoplasm that causes destructive rib lesions<sup>10</sup>.

However, a diagnosis of CWTB can be difficult, because the clinical presentation may resemble a pyogenic abscess or chest wall tumor<sup>11,12</sup>. In addition, CWTB often fails to respond to antituberculous chemotherapy, and there is some controversy regarding the appropriate therapeutic strategy<sup>11,12</sup>.

This study analyzed retrospectively 26 CWTB patients who underwent surgery to evaluate the clinical features and radiographic findings, and assessed the efficacy of the therapeutic strategy. The main focus was to collect

Address for correspondence: **Seung-Ick Cha, M.D.**  
Department of Internal Medicine, Kyungpook National University School of Medicine, 50, Samduk 2-ga, Jung-gu, Daegu 700-712, Korea  
Phone: 82-53-420-6412, Fax: 82-53-426-2046  
E-mail: sicha@mail.knu.ac.kr

Received: Jul. 24, 2006

Accepted: Aug. 16, 2006

This work was published in the Journal of Lung Diseases Volume 2, Number 1, Page 7~13.

information on the optimal treatment and suggest the appropriate duration of antituberculous medication for CWTB patients.

## Materials and Methods

The study population consisted of 26 CWTB patients who underwent surgery at Kyungpook National University Hospital (Daegu, Korea) between March 1998 and June 2005. The diagnosis was made based on the histopathological evidence of caseating granuloma with Langhans' giant cells in surgically procured specimens, regardless of the presence or absence of tubercle bacilli in the smear and/or the acid-fast bacilli culture from the needle aspirates or debrided materials. A HIV test was not performed on any patient.

From the medical records, all the clinical data, including clinical characteristics, bone scintigraphic findings, microbiology and cytopathology data, and treatment was analyzed. The CT images were examined by a thoracic radiologist (K.N.J.) and a pulmonologist (S.I.C.). The examination included determination of the number and location of the lesions, the chest wall layer involved, the associated pleural and parenchymal lesions, and the presence or absence of bone destruction. The surgical biopsy specimens and surgical records were reviewed by a pulmonary pathologist (T.I.P.) and a thoracic sur-

geon (E.B.L.), respectively.

### 1. Statistical analysis

The data is expressed as a mean  $\pm$  SD for continuous variables, and percentages for categorical variables. The categorical data were compared using a chi-squared test (Fisher's exact test). Two-sided *p*-values  $< 0.05$  were considered significant.

## Results

### 1. Clinical characteristics

There were 11 men and 15 women, with a mean age of 34.3 years (Table 1). All the patients were immunocompetent and there was no evidence of any intravenous drug abuse. The most common presenting symptom was a palpable chest wall mass found in 24 patients (92.3%). The remaining two complained of chest pain. The mean duration of symptoms was 72.5 days. Twenty-three patients (88.5%) had no smoking history, while three were current smokers.

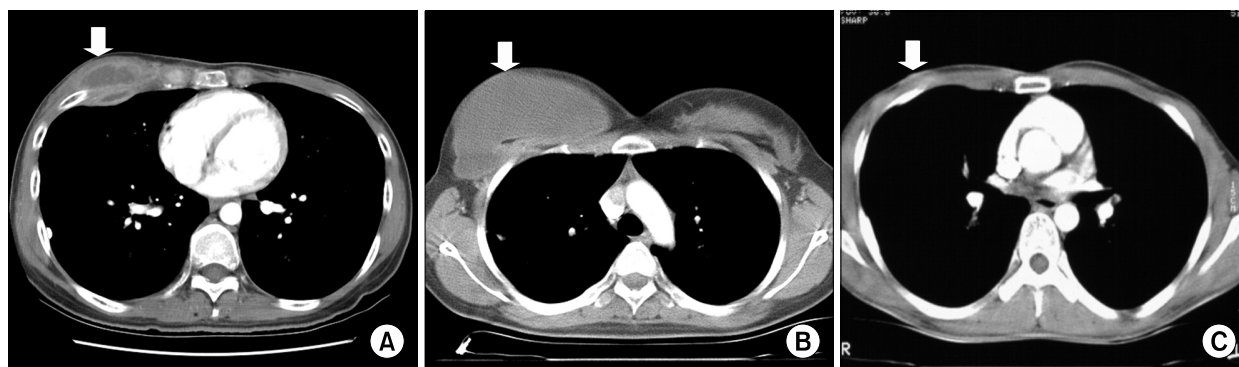
### 2. CT and bone scintigraphy findings

In all patients, CT revealed a soft tissue mass accompanied by a central low density, with or without peripheral rim enhancement (Figure 1A, B). Concomitantly, one patient also had another lesion that involved only the subcutaneous layer (Figure 1C). Of the 27 lesions, 17 (63.0%) were located in the rib shaft, seven (26.0%) in the costochondral junction, two (7.4%) in the sternum/parasternal area, and one (3.7%) in the costovertebral joint (Table 2). With regard to the chest wall layers involved, both the inner and outer sides of the ribs were affected in 22 lesions (81.5%), only the outer side of the rib in four lesions (14.8%), and only the subcutaneous layer in one lesion (3.7%) (Figure 1). Six patients (23.1%) had an accompanying loculated pleural effusion with or without calcification, while suspicious pulmonary tuberculous lesions were found in 14 patients (53.8%) regardless of their activity. The CT scan revealed, only two patients (7.7%) to have obvious bone destruction, while bone involvement was actually identi-

Table 1. Clinical characteristics of the patients (n=26)

Gender (M/F)		11/15
Age (yrs)		34.3 $\pm$ 14.75
Smoking	Current smoker	3 (11.5)
	Never smoker	23 (88.5)
Presenting symptom	Palpable mass	24 (92.3)
	Chest pain	2 (7.7)
Symptom duration (days)		72.5 $\pm$ 62.51
Abscess		
Number	1	25 (96.2)
	2	1 (3.8)
Location on chest wall	Rib shaft	17 (63.0)
	Costochondral junction	7 (25.9)
	Sternum	2 (7.4)
	Costovertebral joint	1 (3.7)

Numbers in parentheses are percentage.



**Figure 1.** Chest CT scan showing a soft tissue mass (arrow) with a central low density and with peripheral rim enhancement in the inner and outer sides of the ribs (A), and only in the outer side (B). The subcutaneous fat layer (arrow) was only involved in one lesion (C).

**Table 2.** Chest CT findings

Layers of chest wall involved	Inner & outer sides of ribs	22/27 (81.5)
	Outer side of ribs	4/27 (14.8)
	Subcutaneous layer	1/27 (3.7)
Loculated pleural effusion		6/26 (23.1)
Pulmonary parenchymal lesion		14/26 (53.8)

Numbers in parentheses are percentage.

fied in a total of 17 patients (65.4%), including 15 (57.7%) surgically and seven (26.9%) pathologically. Of the 10 patients undergoing a bone scintigram, hot uptake was observed in seven, which was subsequently confirmed either surgically or pathologically (positive predictive value, 100%) (Table 3). In contrast, of the three patients who did not show hot uptake, two did not have bone involvement (negative predictive value, 66.7%). The sensitivity and specificity of the bone scintigram for bone involvement were 87.5% and 100%, respectively.

### 3. Microbiology and cytopathology results

The microbiology and cytopathology results for the needle aspirates obtained from the subjects were examined, even though they were included in this study based on the pathological diagnosis on the surgical specimens. The acid-fast bacilli smear or *Mycobacter-*

**Table 3.** Bone scintigram (n=10)

Surgical or pathological bone involvement	Bone scintigram	
	Positive hot uptake	Negative hot uptake
Present	7	1
Absent	0	2

Sensitivity: 87.5%; Specificity: 100%; Positive predictive value: 100%; Negative predictive value: 66.7%.

*ium tuberculosis* culture for the needle aspirates were positive in four out of nine patients (44.4%). Two out of nine (22.2%) were smear-positive and two out of seven (28.6%) were culture-positive (Table 4). Of the seven patients who underwent aspiration cytology, three (42.9%) were found to have caseating granulomas with giant cells. Based on the fine needle aspiration, tuberculosis was diagnosed in six of the 11 patients (54.5%). Since it takes approximately one to two months to obtain the results of cultures for *Mycobacterium tuberculosis*, a preoperative diagnosis was made in five patients, using the smear for acid-fast bacilli and cytology. For surgically procured specimens, all 10 patients had a negative smear for acid-fast bacilli, while three out of nine had a positive culture for *Mycobacterium tuberculosis*. The stain for acid-fast bacilli on the paraffin blocks of the tissue specimens was positive in two patients (7.7%). Overall, nine patients were diagnosed micro-

biologically either from the results of the acid-fast bacilli smear and stain on a paraffin block, or from the *Mycobacterium tuberculosis* culture.

#### 4. Surgery combined with antituberculous medication and treatment outcomes

Twenty-three patients (88,5%) underwent a radical excision with or without decortication. Incision/drainage or curettage was performed in two patients. Of these two patients, one had diffuse pleural thickening with calcification, and the other was diagnosed with tuberculosis at the site of a wound infection after coronary artery bypass graft surgery. The remaining patient received only an incisional biopsy, as the sternum and

parasternal area were extensively involved by tuberculosis.

Twelve patients (46,2%) had a prior history of anti-tuberculous chemotherapy. In these patients, the symptoms of CWTB occurred before (n=4), within one year (n=4), and later than two years (n=4) after the end of the previous medication. The duration of therapy was  $7.5 \pm 3.98$  months and the follow-up period was  $28.2 \pm 26.74$  months. Six patients were classified as being "undecided cases": two were lost to follow-up; two were still undergoing antituberculous chemotherapy; one had died due to gastrointestinal bleeding; and one dropped out due to the adverse effect of medication. Of the remaining 20 patients, nine (45,0%) received medication for six months or less, and 11 (55,0%) received medication for nine months or more. Figure 2 shows the duration of antituberculous medication in each patient. Two patients experienced a recurrence of CWTB, which occurred while undergoing chemotherapy after surgery: four and seven months after the start of chemotherapy, respectively. The two patients received antituberculous medication for a total of 12 months. Except for these two patients, no more recurrences were noted in either groups ( $\leq 6$  months versus  $\geq 9$  months,  $p > 0.05$ ).

Table 4. Microbiologic and cytopathologic results

Aspirated pus	AFB smear	2/9	(22,2)
	<i>Mycobacterium tuberculosis</i> culture	2/7	(28,6)
	Cytology	3/7	(42,9)
	Smear or culture or cytology	6/11	(54,5)
Surgical specimen	AFB smear	0/10	(0,0)
	<i>Mycobacterium tuberculosis</i> culture	3/9	(33,3)
	AFB stain on paraffin block	2/26	(7,7)

Microbiologic diagnoses were made in 9 patients. Numbers in parentheses are percentages.

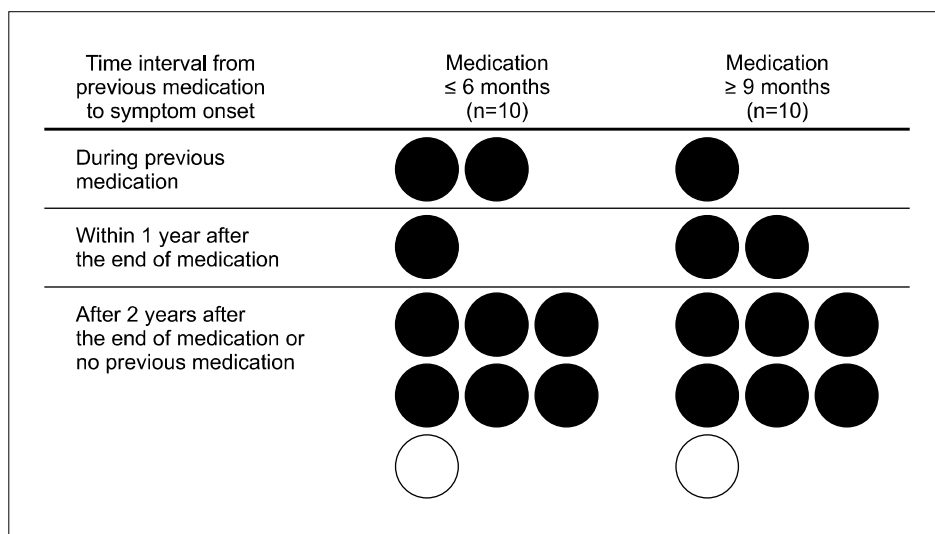


Figure 2. Six- or less than six-month regimen versus nine- or more than nine-month regimen, which was stratified by time intervals from the end of the previous medication to symptom onset of chest wall tuberculosis. The numbers mean the duration of antituberculous medication, and solid (●) and blank (○) circles indicate cured and recurred cases, respectively.

## Discussion

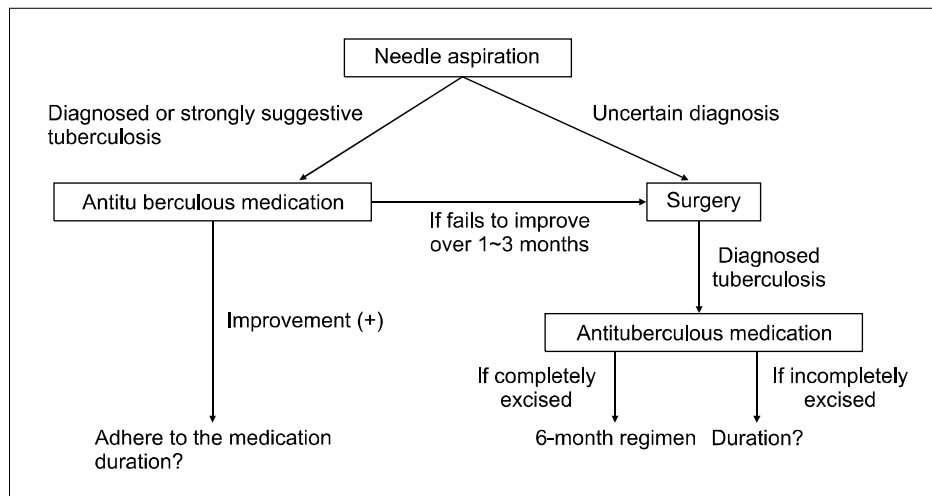
Three mechanisms have been suggested to explain the pathogenesis of CWTB: direct extension from underlying pleural or pulmonary parenchymal disease; hematogenous dissemination associated with the activation of a dormant tuberculous focus; and direct extension from a lymphadenitis in the chest wall<sup>1</sup>. In this study, six patients (23.1%) had a loculated pleural effusion. Of these five had chest wall lesions located adjacent to the pleural effusion, suggesting the possibility of a direct extension from the pleural disease in the form of empyema necessitatis. However, this may be considered to be a less common cause of CWTB compared with the latter two<sup>13</sup>. Skeletal tuberculosis is believed to result from either the lymphatic or hematogenous dissemination of bacilli from the site of the primary infection in the lungs<sup>2,13</sup>. Faure et al<sup>1</sup> suggested that an infection of the lymph nodes in the chest results from pleuritis caused by an invasion of the tubercle bacilli. The lymph nodes of the chest wall then become caseous. This necrotic and caseous material then burrows externally to form a cold abscess in the chest wall. In this study, most of the chest wall abscesses spanned the inner to the outer sides of the ribs, with the exception of four lesions located on the outer side only. In addition, most patients presented with a solitary mass rather than with multiple lesions. Hence, these findings support the pathogenesis of lymphatic spread.

Clinicians usually perform a needle aspiration or biopsy of a lesion, first to establish a diagnosis of tuberculosis and second to exclude other diagnoses. This procedure can show caseating granulomas with giant cells, acid-fast bacilli in a direct smear, or *Mycobacterium tuberculosis* in a culture. In clinical practice, the diagnostic yield of a needle aspiration is low: 29% reported by Faure et al<sup>1</sup>; and 36% reported by Hsu et al<sup>12</sup>. These results showed that a preoperative smear for acid-fast bacilli and/or cytology from aspirated pus provided diagnostic information in five out of 11 patients. However, Hsu et al<sup>12</sup> reported that a needle aspiration should be performed when a diagnosis of tuberculosis

is suspected before making any therapeutic decision.

The standard treatment for CWTB is controversial. From an analysis of 32 cases of superficial tuberculous abscess, Ward<sup>14</sup> suggested that the prompt use of anti-tuberculous drugs is the most important factor in achieving a successful outcome. Others<sup>12,15,16</sup> have reported good results using only antituberculous drugs for several months. However, the total number of cases was small, and the follow-up was frequently short. In a report by Faure et al<sup>1</sup> of the eight patients that underwent medical treatment, only one was cured by a four-drug regimen. Similarly, Hsu et al reported the successful outcome of surgical debridement in six patients, while combination chemotherapy alone was only successful in one case<sup>12</sup>. In this study, only one patient received chemotherapy alone for 12 months and improved remarkably. Therefore, medical treatment should be tried first before using a surgical approach, even though only a few patients with CWTB respond to antituberculous medication.

According to the previous reports<sup>11,12,17</sup>, a 9- to 12-month regimen of chemotherapy is recommended, including isoniazid, rifampicin, ethambutol, and pyrazinamide. However, these recommendations were based on retrospective data, and there are no reports of a randomized controlled trial of antituberculous medication for CWTB. Tuberculosis can now be treated with a 6-month regimen, which was previously reported to be effective for extrapulmonary tuberculosis<sup>18</sup>. This suggests that the same regimen may also be appropriate for CWTB patients who have undergone a complete excision. In this study, two patients experienced a recurrence of CWTB during chemotherapy: four and seven months after the start of chemotherapy. These patients had received antituberculous medication for a total of 12 months. Although these two patients were classified into the group  $\geq 9$  months according to the duration of chemotherapy, these patients could have been divided into separate groups ( $\leq 6$  months and  $\geq 9$  months). In addition, it is unclear if this was a true recurrence or a paradoxical reaction. A tuberculous cold abscess can develop while being treated for pulmonary



**Figure 3.** Diagnostic and therapeutic approaches to suspected chest wall tuberculosis.

tuberculosis, even though such an abscess can disappear after continued treatment with the same regimen. Therefore, the development of a tuberculous cold abscess does not necessarily indicate treatment failure<sup>15</sup>. Interestingly, *Mycobacterium tuberculosis* was not cultured in the aspirate from the recurred abscesses in these two patients, suggesting the possibility of a paradoxical reaction. After excluding these two cases, no recurrence was found in either groups:  $\leq 6$  months and  $\geq 9$  months. These results suggest that a 6 month regimen may also be applicable to CWTB patients who have undergone a complete excision.

The methods of surgical treatment are also controversial. Brown and Trenton<sup>19</sup> recommended an extensive debridement of the lesion, particularly in cases of bone or cartilage involvement. Paik et al<sup>11</sup> recommended a complete resection of the chest wall abscesses, including any suspicious ribs, as well as antituberculous medication, and reported a recurrence rate of 7.8%. On the other hand, other reports<sup>1,12</sup> have recommended adequate surgical debridement and an antituberculous regimen to prevent recurrence. Therefore, a radical or wide excision would appear to be the surgical method of choice, despite the lack of adequate data.

This study had several limitations. First, this study was retrospective and only included those patients who had undergone surgery. Therefore, selection bias should be considered. Second, the mean follow-up period

of 28 months was not long enough. For nonimmunosuppressed subjects, the ideal minimal follow-up period should be five years<sup>20</sup>. Third, many of the patients were not diagnosed microbiologically, but were histopathologically proven. Hence, there is the possibility of granulomatous inflammation due to a nontuberculous mycobacterial infection and other causes.

From previous reports<sup>1,12</sup> and our these results, the following recommendations can be made for diagnostic and therapeutic approaches for CWTB (Figure 3). First, when a diagnosis of CWTB is suspected, a needle aspiration should be performed to obtain specimens for a smear/culture and cytopathological diagnosis. Second, antituberculous medication should be started if tuberculosis is diagnosed or is strongly suspected. However, if the diagnosis is unclear, a surgical approach is the next step for a diagnosis and treatment. Moreover, a surgical resection should be considered if the lesion fails to improve or worsens after 1~3 months of medication. Third, a 6-month regimen may be appropriate for patients who have successfully undergone a wide excision. In non-operated patients, 9- to 12-month duration medication is commonly used even though the appropriate duration of chemotherapy remains unclear.

In conclusion, a fine-needle aspiration should be performed in suspected CWTB patients suspected of having CWTB. A 6-month regimen may be appropriate for CWTB patients whose lesions have been excised com-

pletely.

## References

1. Faure E, Souilamas R, Riquet M, Chehab A, Le Pimpec-Barthes F, Manac'h D, et al. Cold abscess of the chest wall: a surgical entity? *Ann Thorac Surg* 1998;66:1174-8.
2. Morris BS, Maheshwari M, Chalwa A. Chest wall tuberculosis: a review of CT appearances. *Br J Radiol* 2004;77:449-57.
3. Hulnick DH, Naidich DP, McCauley DI. Pleural tuberculosis evaluated by computed tomography. *Radiology* 1983;149:759-65.
4. Gayler BW, Donner MW. Radiographic changes of the ribs. *Am J Med Sci* 1967;253:586-619.
5. Mathlouthi A, Ben M'Rad S, Merai S, Friaa T, Mestiri I, Ben Miled K, et al. Tuberculosis of the thoracic wall: presentation of 4 personal cases and review of the literature. *Rev Pneumol Clin* 1998;54:182-6.
6. Eid A, Chaudry N, el-Ghoroury M, Hawasli A, Salot WL, Khatib R. Multifocal musculoskeletal cystic tuberculosis without systemic manifestations. *Scand J Infect Dis* 1994;26:761-4.
7. Garcia S, Combalia A, Serra A, Segur JM, Ramon R. Unusual locations of osteoarticular tuberculosis. *Arch Orthop Trauma Surg* 1997;116:321-3.
8. Chang DS, Rafii M, McGuinness G, Jagirdar JS. Primary multifocal tuberculous osteomyelitis with involvement of the ribs. *Skeletal Radiol* 1998;27:641-5.
9. Martini M, Ouahes M. Bone and joint tuberculosis: a review of 652 cases. *Orthopedics* 1988;11:861-6.
10. Tatelman M, Drouillard EJ. Tuberculosis of the ribs. *Am J Roentgenol Radium Ther Nucl Med* 1953;70:923-35.
11. Paik HC, Chung KY, Kang JH, Maeng DH. Surgical treatment of tuberculous cold abscess of the chest wall. *Yonsei Med J* 2002;43:309-14.
12. Hsu HS, Wang LS, Wu YC, Fahn HJ, Huang MH. Management of primary chest wall tuberculosis. *Scand J Thorac Cardiovasc Surg* 1995;29:119-23.
13. Khalil A, Le Breton C, Tassart M, Korzec J, Bigot J, Carette M. Utility of CT scan for the diagnosis of chest wall tuberculosis. *Eur Radiol* 1999;9:1638-42.
14. Ward AS. Superficial abscess formation: an unusual presenting feature of tuberculosis. *Br J Surg* 1971;58:540-3.
15. Chen CH, Shih JF, Wang LS, Perng RP. Tuberculous subcutaneous abscess: an analysis of seven cases. *Tuber Lung Dis* 1996;77:184-7.
16. Blunt SB, Harries MG. Discrete pleural masses without effusion in a young man: an unusual presentation of tuberculosis. *Thorax* 1989;44:436-7.
17. Chang JH, Kim SK, Lee WY. Diagnostic issues in tuberculosis of the ribs with a review of 12 surgically proven cases. *Respirology* 1999;4:249-53.
18. Dutt AK, Moers D, Stead WW. Short-course chemotherapy for extrapulmonary tuberculosis: nine years' experience. *Ann Intern Med* 1986;104:7-12.
19. Brown RB, Trenton J. Chronic abscesses and sinuses of the chest wall: the treatment of costal chondritis and sternal osteomyelitis. *Ann Surg* 1952;135:44-51.
20. Hopewell P, Cynamon M, Starke J, Iseman M, O'Brien R. Evaluation of new anti-infective drugs for the treatment and prevention of tuberculosis. *Clin Infect Dis* 1992;15 Suppl 1:S282-95.