ORIGINAL ARTICLE

OUTCOME ANALYSIS OF PRIMARY CHEST WALL TUBERCULOSIS: A SERIES OF 32 CASES

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Background: Chest wall tuberculosis is a rare disease, and although incidence has decreased further with advances in antituberculosis chemotherapy, it remains prevalent in developing countries. Diagnosis is difficult because pus smears or bacterial cultures of aspirate frequently fail to yield tuberculous bacilli. To discuss the characteristics of this rare disease and suggest an optimal strategy for management, we share our experience with 32 patients managed surgically and with antituberculosis chemotherapy. **Methods:** In this descriptive case series we retrospectively reviewed the medical records of 32 patients managed from May 2006 to May 2016. **Results:** Out of 32 cases of chest wall tuberculosis, 59.4% (n=19) patients had a current or previous history of tuberculosis. Presenting complaints were chest pain, a palpable mass and pus discharge in most patients. A preoperative bacteriologic diagnosis was positive in only 3 patients. Generous abscess debridement was done in 21 (65.63%) cases, abscess debridement and partial rib resection in 11 (34.38%), abscess debridement and partial sternum excision in 7 (21.88%), and clavicle excision in 2 (6.25%) patients. Postoperative wound infection was noted in 1 (3.13%) patient. There were no recurrences. **Conclusion:** Chest wall tuberculosis requires generous debridement of diseased tissue including under lying bone, meticulous obliteration of residual dead space by vascular muscle flap, and negative suction drainage in addition to antituberculosis chemotherapy for good post-operative results with acceptable morbidity and mortality

Keywords: Tuberculosis; Cold Abscess; Chest wall; Surgery

Citation: Majeed FA, Ali A, Zafar U, Taimure SZA, Mahmood U. Outcome analysis of primary chest wall tuberculosis: A series of 32 cases. J Ayub Med Coll Abbottabad 2021;33(3): 357–62.

INTRODUCTION

Skeletal tuberculosis, especially in the chest wall, has a low incidence rate globally.[1] The advent of effective pharmacotherapy has further decreased its incidence, although it persists as a major surgical challenge in developing countries.[2] Unfortunately, despite its clinical significance there is a paucity of data on this disease and its treatment in the developing world. Although the lungs are the main target organ in tuberculosis, extrapulmonary tuberculosis infection is also quite prevalent (15–20%) in the USA.[3] Moreover, skeletal tuberculosis accounts for 2.6% of all tuberculosis cases [1]. A recent case series of skeletal tuberculosis reported involvement of the spine in 50%, pelvis in 12%, hip and femur in 10%, knee and tibia in 10%, and rib in only 7% of the cases.[4] The chest wall is involved in 1% to 10% of skeletal tuberculosis cases.[5,6]

In different case series, varying presentations of tuberculous abscess of the chest wall have been reported, based on prominent clinical and pathological features. These include: a) tuberculous subcutaneous abscess[7], b) rib caries[8], c) tuberculous sinus of the chest wall [9], rib tuberculosis [10,11], tuberculous osteomyelitis of the sternum and ribs[12,13], cold abscess of the chest wall[14,15], and simply chest wall tuberculosis [2,16,17]. Yet all these terms refer to same entity, i.e., tuberculosis of the chest wall with or without bone involvement. The main presentation of this disease is as a solitary, steadily growing chest wall mass with or without pain, and ranging in consistency from soft to firm.[14,18,19] Abscesses may sometime make a fistulous tract, and can destroy chest wall bone or cartilage.

Retrospective studies based on medical records have limitations in that they cannot suggest the exact mechanism of tuberculous abscess development. This entity is therefore a particular challenge, given that the diagnosis of tuberculous abscess of the chest wall is often difficult.[2] Medical therapy alone often fails to treat the disease, and in most cases surgical intervention is required.[15] Studies to date have suggested that the pathogenesis of tuberculous abscess of the chest wall has three mechanisms: a) direct spread of underlying lung or pleural tuberculosis, b) spread of chest wall tuberculous lymphadenopathy, and c) hematogenous spread. Immunodeficiency due to an underlying medical cause may precipitate the development of cold abscesses.[6,13]

The purposes of this retrospective chart review are to share our experience with 32 cases of chest wall tuberculosis (with or without bone involvement) managed surgically in combination with medical therapy, and discuss the clinical features, diagnostic workup and desirable outcomes to achieve optimal therapeutic management with acceptable morbidity and mortality.

MATERIAL AND METHODS

This retrospective chart review was conducted at Combined Military Hospital (CMH), Lahore Cantt, Pakistan. We have reviewed the medical records of all

patients diagnosed with chest wall tuberculosis with or without bone involvement. The first patient was diagnosed in May 2006. Since then, 32 patients were diagnosed with skeletal tuberculosis / chest wall tuberculosis in next 10 years". This review was undertaken as a department-led quality improvement initiative, and this time period was selected because of the stringent, high-quality rules for data registry maintenance in effect during this period. Before the initiation of this review, ethical approval was sought and granted by the Institutional Ethical Review Board at CMH Lahore. Moreover, anonymity of all patients was ensured by removing their identification numbers and names.

A total of 32 patients with tuberculous abscess of the chest wall were treated surgically during the study period. The preoperative diagnosis in all patients was established from their history, physical examination, pus culture for tuberculous bacilli, sputum analysis, acid-fast bacilli (AFB) staining, radiological findings on X-ray, computed tomography (CT) scan, and (in selected patients) bone scan. The diagnosis was confirmed by histopathological study showing caseous granulomatous necrosis, tuberculous bacilli or Langhan's giant cells in specimens obtained during the surgery. All patients were followed up for 2 years postoperatively. Patients having spinal caries, empyema necessitans, tuberculous abscess of the breast or post-thoracotomy sternal tuberculosis osteomyelitis were excluded. There were no other inclusion or exclusion criteria based on age, comorbid medical or surgical illnesses, socioeconomic background or ethnicity. All patients deemed medically fit for surgery were included.

A Microsoft Excel-based (2013) data abstraction tool was created with variables pertaining to the patients' clinical records, clinical presentation, diagnostic modalities, preoperative medication, operative techniques and postoperative management. These variables were selected after critical review of previous publications on the topic. All variables were defined by the senior authors, and a manual was developed to aid data extraction and ensure good inter-rater reliability. The data abstraction tool was then piloted by two junior researchers to avoid any discrepancies and ensure accuracy in the data extraction process., Cohen's kappa statistics was not calculated to assess inter-rater reliability. Two junior researchers working independently from each other extracted the data from the patients' records. Thereafter, the extracted data were cross-checked for any discrepancies, which were then resolved by discussion in conjunction with the senior authors.

All data were analysed with SPSS (v.20; IBM, IL, USA). Quantitative variables are presented as the median (range), and categorical variables as frequencies (percentages). The chi-squared statistic was used to identify associations between categorical variables, and Spearman's rho was calculated to find correlations between quantitative variables.

RESULTS

In this retrospective analysis of 32 cases, 21 patients (65.63%) were males and 11 (34.37%) were females, with ages ranging from 12 to 60 years (mean age 31.43±11.92 years). Out of 32 cases, 13 patients (40.63%) had old or current tuberculosis of other organ system as well, i.e., pulmonary tuberculosis (n=10) and tuberculosis of the small intestine (n=2). The main presenting complaint was cold abscess in all 32 patients. The lesions ranged in diameter from 3 cm to 10 cm (mean 5.18±1.69), and 53.13% (17) of these lesions had a discharging sinus. A single sinus was seen in 58.8% (n=10) and two or more sinuses were seen in 41.1% (n=7) (Figure-1). Most patients (65.63%, n=21) complained of pain and tenderness; erythema was observed in 12 patients and 4 had cough with blood-tinged sputum.

The location of the lesion in most cases was on right anterolateral chest wall (n=10, 31.25%), followed by the left anterolateral chest wall (n=7, 21.88%), lower sternum (n=5, 15.63%), upper sternum (n=4, 12.5%), posterior chest wall (n=3, 9.38%) and axilla (n=3, 9.38%). All patients had a single lesion. A preoperative diagnosis was established in 3 patients using AFB staining of sputum samples and growth of tuberculous bacilli on cultures of pus samples. A preoperative CT scan (Figure 2) done in all patients showed soft tissue cold abscess in 21.88% (n=7), cold abscess with sinus tract in 15.63% (n=5), cold abscess with rib involvement in 34.38% (n=11), cold abscess with sternum involvement in 21.88% (n=7), and cold abscess with clavicle involvement in 6.25% (n=2). A bone scan done in 26 patients (when bone involvement was suspected based on CT scan findings) showed rib involvement in 42.3% (n=11), of whom 72.7% (n=8) had only one rib involved, while 27.2% (n=3) had two ribs involved. The sternum was involved in 26.9% (n=7), and the clavicle in 0.07% (n=2). Bone Scan findings helped in the planning surgical approach and give valuable information regarding extent of bone tissue debridement required.

Out of 32 cases, 13 patients had history of anti-tuberculous chemotherapy which included a standard regimen preoperatively, ranging from 6 to 36 weeks. The remaining patients were given antituberculosis treatment for 2 weeks before final surgery. The goal of surgery was complete excision of the abscess cavity and involved surrounding tissue. We used four different surgical procedures depending on the extent of bone and soft tissue involvement. Wide excision was done for cold subcutaneous abscesses in 37.5% (n=12) patients; wide debridement with partial excision of the rib in 34.3% (n=11), wide debridement with sternum nibbling in 21.8% (n=7), and debridement with partial excision of the

clavicle in 6.2% (n=2). After excision, generous wound irrigation and meticulous obliteration of residual dead spaces were done. Most patients (81.3%, n=26) required myoplasty with local muscle flap mobilization or a muscle pedicle flap (Figures 3 and 4). A thin negative suction drain was placed in all patients for a mean period of 10.5 days (range 7 to 14 days). Tissue diagnosis was confirmed on histological examination of excised tissue samples showing chronic caseous granulomatous inflammation in all 32 cases. All patients were given a four-drug antituberculosis regimen (isoniazid, rifampicine, ethambutol and pyrazinamide) for 2 months followed by 2 drugs for a total duration 12 month, started immediately after surgery based on the preoperative diagnosis or very high clinical suspicion on CT scan and operative findings. Postoperative wound infection was observed in only 3.1% (n=1), and was managed conservatively. No patient developed chronic draining sinus tract or local recurrence during the 2-year follow-up period.

No significant differences in the proportion of symptoms and findings on clinical examination were noted. According to the one-sample chi-squared test, most of the cases were misidentified as normal on X-ray. No significant trends were noted in CT scan or bone scan findings. Similarly, no significant trends were noted in surgical management of patients except for myoplasty not being performed in 6 cases.

Table-1: Symptoms and findings on physical examination in 32 patients with chest wall tuberculosis

Variable	Category	Frequency (n)	Percentage (%)	Chi-squared	*p*-value
Location	Right parasternal	10	31.2	7.0	0.221
	Left parasternal	7	21.9		
	Posterior chest wall	3	9.4		
	Upper sternum	4	12.5		
	Lower sternum	5	15.6		
	Axilla	3	9.4		
Discharge	Yes	18	56.2	0.5	0.480
	No	14	43.8		
Erythema	Yes	12	37.5	2	0.157
	No	20	62.5		
Productive cough	Yes	4	12.5	18.0	<0.001
	No	28	87.5		
Local tenderness	Yes	20	62.5	2.00	0.157
	No	12	37.5		
Local pain	Yes	21	65.6	3.125	0.077
	No	11	34.4		
Cold abscess	Yes	32	100.0	-	-
	No	0	0.0		
Abscess sinus	Single sinus tract	10	31.2	3.06	0.216
	Multiple sinus tracts	7	21.9		
	No sinus	15	46.9		
Preoperative diagnosis	Yes	3	9.38	21.13	<0.001
	No	29	90.68		
Systemic tuberculosis	Yes	13	40.6	1.125	0.289
	No	19	59.4		

Table-2: Radiographic and histopathological findings in 32 patients with chest wall tuberculosis

		Count	Column n %	Chi-squared	*p*-value
X-ray	Normal	28	87.5	42.438	<0.001
	Rib involvement	3	9.4		
	Lung involvement	1	3.1		
CT scan	Cold abscess	7	21.9	10.75	0.057
	Abscess with sinus tract	5	15.6		
	Abscess with rib involvement	10	31.2		
	Abscess with sternum involvement	7	21.9		
	Chest wall abscess with lung lesion	1	3.1		
	Cold abscess with clavicle involvement	2	6.2		
Bone scan	Rib involved	11	37.5	7.69	0.104
	Sternum involved	7	25.0		
	Normal	8	18.8		
	Not examined	4	12.5		
	Clavicle involved	2	6.2		
Chronic caseating granulomatous inflammation	Yes	32	100.0	-	-
	No	0	0.0		
	Not examined	0	0.0		

Table-3: Surgical procedures done in 32 patients with chest wall tuberculosis

		Count	Column n %	Chi-squared	*p*-value
Generous debridement of abscess	Yes	32	100.0%	-	-
	No	0	0.0%		
Tract excision	Yes	18	56.2%	0.50	0.480
	No	14	43.8%		
Bone nibbling and rib excision	Yes	22	68.8%	4.500	0.034
	No	10	31.2%		
Myoplasty	Yes	26	81.2%	12.50	<0.001
	No	6	18.8%		

Figure-1: Chest wall tuberculosis involving the clavicle, with discharging sinus

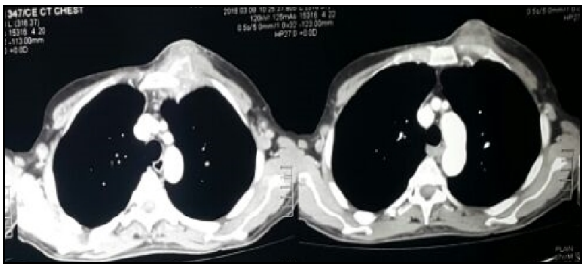

Figure-2: CT scan chest (axial view) showing tuberculous abscess of the chest wall involving the sternum and costal cartilage

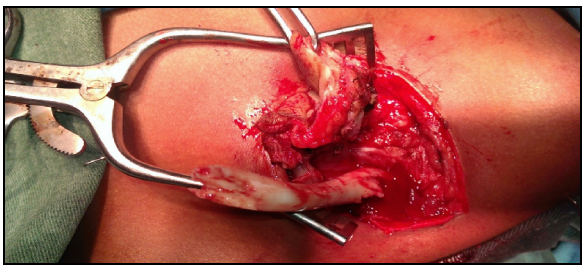

Figure-3: Generous debridement of cold abscess with excision of the sinus tract and diseased clavicle

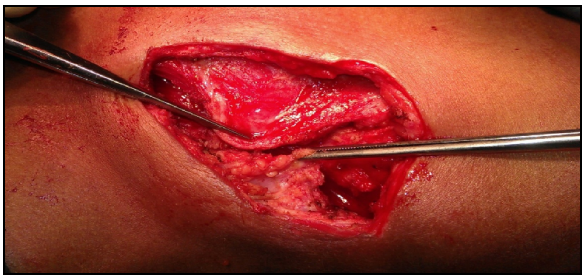

Figure-4: Obliteration of dead space with a muscle flap

DISCUSSION

The present retrospective analysis of chest wall tuberculosis presents a descriptive case series of 32 Pakistani patients. All patients were managed surgically, followed by an antituberculosis pharmacotherapy regimen. All patients went into remission with no relapses.

Our results emphasize the fact that patients can present with new chest wall lesions in the absence of any history of tuberculosis or active disease. In present analysis, only 40.62% (n=13) of our patients had a positive history of tuberculosis or active tuberculosis. This finding corroborates a previous case series by Faure et al., who elicited a positive history of tuberculosis in only 33% of their cases [14]. Similar findings were reported by Keum *et al*., who found that 32.4% of their patients with chest wall tuberculosis had a positive history of tuberculosis.[20]

The preoperative diagnosis of tuberculous abscess of the chest wall is often difficult, and in most cases the diagnosis is confirmed on postoperative histopathological study. Preoperative diagnoses can be based on pus culture for tuberculous bacilli, sputum analysis, AFB staining and polymerase chain reaction assay. Published studies also recommend needle aspiration and incisional biopsy to confirm the diagnosis preoperatively.[14,16,21,22] However, preoperative diagnoses have poor sensitivity and specificity in most cases. For example, Faure *et al.*[14] reported a diagnostic rate of 36.3% with needle aspiration. Similarly, poor sensitivity has been reported with other diagnostic methods. For example, Sakuraba *et al.*[22] reported a positive AFB test in 62.29% (n=9/13) patients, a positive polymerase chain reaction test in 28.57% (n=4/13), and positive mycobacterial culture in 42.86% (n=6/13) in their case series of 23 patients. In addition, Kim *et al.*[23] reported a positive preoperative bacteriological diagnosis in only 3.75% (n=3/80) cases, and diagnosis was confirmed on postoperative pathological study in all reported cases. Keum *et al.*[20] reported that only 17.64% (n=12/68) patients were diagnosed preoperatively with bacteriological methods. Cho *et al.*[24] recommended preoperative needle aspiration or surgical biopsy when there is no history of or currently active

pulmonary tuberculosis, and when CT scan findings show a poorly demarcated mass. In the present study 9.37% (n=3/32) of our patients were diagnosed preoperatively based on pus culture, sputum analysis or AFB staining, and the rest of the patients were diagnosed on the basis of a positive history, clinical features and typical CT scan findings; all diagnoses were confirmed on postoperative pathological study.

As noted above, needle aspiration and bacteriological diagnostic tests are fewer sensitive tools to diagnose chest wall tuberculous abscesses. Therefore, many authors advocate surgical biopsy, which allows chest wall tuberculosis to be diagnosed without preoperative bacteriological studies – an option that may be especially useful in areas where the prevalence of tuberculosis is high. The clinical features of chest wall mass, positive history of pulmonary tuberculosis and typical CT scan findings can be used to diagnose a tuberculous abscess of chest wall clinically.

In the present analysis, chest CT scan identified all cases of chest wall tuberculosis. A CT scan was done in all our patients, and demonstrated cold abscess in all 32 of them, rib involvement in 11, sternum involvement in 7 and clavicle involvement in 2 patients. We therefore recommend chest CT scan as the most valuable radiological diagnostic technique for the preoperative diagnosis of a chest wall tuberculosis cold abscess. It not only helps diagnose tuberculous abscess of the chest wall, but also discloses the extent of the abscess cavity and involvement of the underlying ribs, sternum, cartilage and pleural cavity. It provides valuable information on the functional status of the lungs, and rules out tumours of the chest wall [25]. However, diagnosis by CT scan can also have drawbacks. For example, Cho *et al*. concluded that a superficial location of the tuberculous abscess does not rule out involvement of the underlying rib. However, bone Scan is very useful in identifying the involvement of underlying bone tissue. In our study, bone scan was done in those patients (n=26) in which CT scan findings were suggestive of bone involvement. Bone Scan findings confirmed bone involvement in all cases and also helped in planning the extent of resection and type of procedure required. It led to generous debridement of soft tissue and underlying infected bone. We believe, this more aggressive approach reduced residual diseased tissue to minimum and helped achieve disease free area pots-operatively.

In our study 13 out of 32 patients had history of antituberculosis medication preoperatively, and all patients were prescribed a four-drug antituberculosis regimen (isoniazid, rifampicine, ethambutol and pyrazinamide) for 2 months followed by 3 drugs for 9–12 months postoperatively. Antituberculosis chemotherapy is very important, yet few studies report successful treatment of chest wall tuberculosis with medication only[7], and most reported high recurrence rates with medical treatment alone[8,14,22]. Faure *et al*.[14] strongly advised antituberculosis chemotherapy for 1 to 3 months after diagnosis, but if the lesion fails to improve or the patient's condition worsens, surgical management is indicated. Hence, antituberculosis chemotherapy alone is not sufficient and a combination of medical and surgical interventions is mandatory to treat this disease and keep recurrence rates low.

The rate of postoperative infection in our case series was very low at 3.1% (n=1/32), and there were no recurrences during the 2-year follow-up period. In our study generous bone resection is advocated if there are evidence of bony, periosteal or perichondrial involvement or if there is an overlying fistulous tract on the rib or sternum. A very meticulous approach for wound closure was employed after generous debridement of the lesion, and wounds were closed primarily by using native vascular muscle flaps to obliterate dead space completely, with a small drain in place for a few days. Chest wall muscle mobilization and use of a vascular flap reduce postoperative recurrence and surgical site infection. If any dead space is left it may lead to postoperative wound infection and sinus formation. Several types of surgical procedures have been described by different authors. Weissberg and Refaely believed that drainage in combination with antimicrobial therapy is the best approach for early disease, while debridement and excision are necessary for more extensive disease[25]. Optimal surgical therapy consists of complete excision of the abscess with primary closure. Complete excision of a cold abscess includes the abscess and its wall, fistulous tracts, affected lymph nodes and underlying bone or cartilage, yet avoids the unnecessary loss of healthy chest wall tissue in order to reduce morbidity and recurrence.[17,23] Keum *et al*. [20] reported a high incidence of surgical site infection (11.24%) and attributed this to inappropriate closure of the dead space.

We believe that more generous resection is associated with less recurrence. In this study we observed no recurrences over 2 years follow up, due to wide excision of the abscess, involved boney tissue and fistulous tracts followed by very meticulous closure technique using muscle flaps and indwelling catheters for drainage. These results corroborate findings reported in previous studies. For example, Kim *et al*.[23] reported a higher recurrence rate of 40% in their drainage and debridement group compared to a rate of 9.2% in the complete resection group. Paik *et al*.[15] reported a slightly higher 16% recurrence rate

in their excision group and a very low 1.6% recurrence rate with rib resection.

CONCLUSION

Chest wall tuberculosis requires generous debridement of diseased tissue including under lying bone, meticulous obliteration of residual dead space by vascular muscle flap, and negative suction drainage in addition to antituberculosis chemotherapy for good post-operative results with acceptable morbidity and mortality.

AUTHORS' CONTRIBUTION

FAM: Supervisor of the study.
AA: Date collection, data analysis, literature review write up and correspondence.
UZ: Data collection and data analysis.
SZAT: Data collection, literature review.
UM: Data collection.

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Submitted: January 1, 2019	Revised: January 20, 2020	Accepted: February 7, 2020

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