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Case Report

Physiotherapy Rehabilitation Strategies to Improve Clinical Outcomes Following Joint Debridement in the Case of Shoulder Joint Tuberculosis

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ABSTRACT

Background: The shoulder joint tuberculosis (TB) is a rare disease. The shoulder joint is involved in 1–10.5% of the population with skeletal tuberculosis. The diagnosis of disease at an early stage is difficult, delaying the treatment and leading to poor quality of life.

Case summary: A 48-year-old female with shoulder joint debridement in a case of right shoulder joint tuberculosis presented with complaints of pain, weakness, and functional immobility of the right shoulder. Physiotherapy rehabilitation was given to her three days a week for the period of four months, including electrotherapeutic modality, electrical stimulation, therapeutic exercises, and upper body ergometer training. Range of motion (ROM), muscle strength, and shoulder pain and disability index (SPADI) were used as outcome measures .As a result of physiotherapy rehabilitation, patient was able to achieve an optimal functional range of motion of flexion (from 10^0 to 100^0), abduction (from 20^0 to 85^0), extension (from 5^0 to 15^0), internal rotation (from 28^0 to 35^0) and external rotation (from 35^0 to 40^0), overall improvement in shoulder joint muscles strength from grade 2 to 3, and reduction in shoulder pain and disability index from 86% to 41% despite having marked bony destruction.

Conclusion: Physiotherapy rehabilitation strategies were found to be effective for improving shoulder joint function after joint debridement in the case of shoulder joint tuberculosis. The patient achieved a functional state sooner than the patients documented in currently available literature for this diagnosis.

KEY WORDS: Tuberculosis, Extra-pulmonary, Shoulder joint, Physiotherapy.

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INTRODUCTION

Tuberculosis (TB) is a global disease caused by mycobacterium tuberculosis bacteria. It's pulmonary form is much more common than the extra-pulmonary one. Extra-pulmonary TB is a type of tuberculosis that affects organs other than the lungs (e.g., pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, or meninges) [1]. The rate of skeletal involvement among extra pulmonary TB patients is 1-3% [2]. Shoulder joint TB accounts for about 1-10.5% of skeletal TB [3]. Due to the rarity of shoulder joint TB, it is frequently overlooked in differential diagnosis and goes unnoticed [4].

Specific clinical symptoms, such as monoarticular arthritis, weight loss, nocturnal sweating, localized pain and swelling, high

erythrocyte sedimentation rate (ESR), a positive mantoux test, and typical radiographic findings are used to make the diagnosis [3]. Various treatment options such as a prolonged course of anti-tuberculosis drugs, surgical debridement, excision, and arthrodesis are available based on the extent of the disease [3,5]. However, limited literature has been published in the field of physiotherapy regarding rehabilitation following debridement. Hence, this report is intended to document the effects of physiotherapy rehabilitation strategies on post-operative joint function in shoulder TB patient.

CASE PRESENTATION

The patient is a 48-year-old female experiencing severe pain around her shoulder and difficulty in performing movements using her right upper extremity for one year. During this period, she visited multiple hospitals, and analgesics were given to reduce the symptoms. After one year of treatment with various pain relief medications, the patient noticed an exacerbation of existing problems and pus discharge from a sinus present over the anteromedial aspect of the shoulder joint. On her next visit to the hospital, an MRI report was done. Because of the worsening of clinical symptoms, the surgeon decided to go for debridement of the shoulder joint. Before surgery, various blood tests were done. During debridement, soft tissues from the shoulder joint was collected and sent for microbiology and histopathology reports, the results of which confirmed the presence of mycobacterium tuberculosis complex and tuberculous inflammation, respectively. Anti-tuberculosis drugs have been started after a confirmed diagnosis. After surgical debridement, a shoulder sling was given for 2 months. An X - ray was taken after a month of debridement (Figure 1). Two months after surgery, the patient complained of pain, weakness, and functional immobility and was referred to physiotherapy. The patient took physiotherapy sessions three times a week for four months on alternate days.

Diagnostic: For diagnosis, MRI (magnetic resonance imaging) report, blood tests, and X - rays of shoulder joint and chest were done.

MRI report revealed very minimal fluid collection in subacromial, subdeltoid bursae, and subscapularis recess; marked focal expansion of acromion process with reduction of subacromial space; extensive cortical erosive changes in the entire humeral head associated with marked synovial, capsular and bursal thickening; abnormal subchondral marrow signal in glenoid fossa; mild to moderate shoulder joint space reduction; synovial thickening in axial recess; irregular thinning of gleno-humeral joint articular cartilage; mild degenerative changes in acromio-clavicular joint and multiple mixed signal intensity confluent nodular lesions in right anterior axilla (15-32 mm approximately).

Blood tests showed decreased Hemoglobin (8.2 g%), red blood cells (3.36 million/cmm), polymorphs (55%), packed cell volume (26.7%); increased lymphocytes (26.7%), platelet count (603000/cmm), erythrocyte sedimentation rate (46 mm/hr); normal total white blood cells (10090/cmm), eosinophils (4%), basophils (0%), monocytes (5%) and C- reactive protein (<5 mg/L).

X ray findings of shoulder joint suggested, presence of multiple ill-defined radiolytic lesions in the head and neck region of right humerus with cortical surface irregularity involving articular surface of humerus; periarticular osteoporosis involving proximal humerus, acromion process of scapula and lateral end of clavicle; reduced joint space and sclerosis of glenoidal margins. (Figure 1)

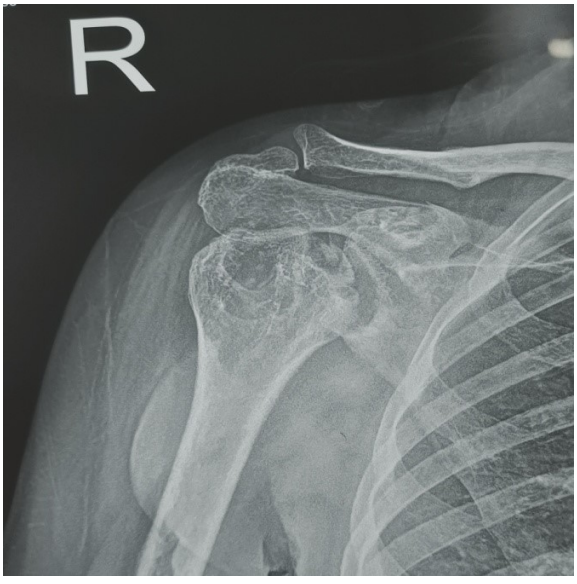

Fig. 1: Shoulder joint X – ray.

X ray findings of chest showed no abnormality. (Figure 2)

Fig. 2: Chest X – ray.

Assessment: To better understand health condition in terms of function and disability, patient's clinical findings in the international classification of functioning, disability, and health (ICF) format are illustrated below. (Figure 3)

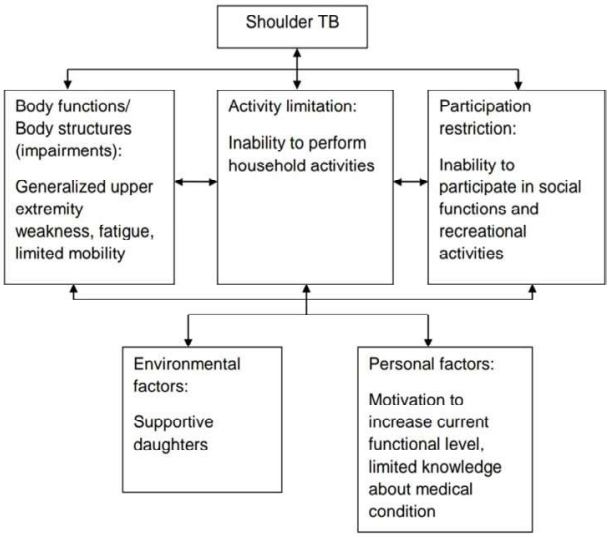

Fig. 3: ICF Model.

Based on the ICF model, the patient was diagnosed with limited mobility, strength, and impaired functional ability associated with shoulder joint TB.

Before physiotherapy, a thorough physical assessment of the patient's clinical symptoms was done using range of motion (ROM), muscle strength and Shoulder Pain and Disability Index (SPADI). The ROM of shoulder joint was assessed using a universal goniometer with 0^0 to 180^0 scale. Muscle strength was evaluated on a scale of 0 to 5 given by the Medical Research Council (MRC). SPADI includes two subscales for assessment of pain and disability [6]. Before physiotherapy rehabilitation, active ROM of shoulder joint were; flexion - 10^0 , abduction - 20^0 , extension - 5^0 , internal rotation - 28^0 , external rotation - 35^0 with altered scapulohumeral rhythm, overall strength of shoulder joint muscles was grade 2, and SPADI was 86%.

Physiotherapy rehabilitation strategies: The goals of physiotherapy rehabilitation strategies were: 1) to reduce pain; 2) to restore functional range of motion of the shoulder joint; 3) to strengthen the shoulder joint and shoulder girdle muscles and 4) to restore the patient's ability to work.

The physiotherapy rehabilitation included Transcutaneous electrical nerve stimulation (TENS), electrical stimulation to muscles, therapeutic exercises and upper body ergometer training. Physiotherapy rehabilitation strategies are discussed below in detail.

Transcutaneous electrical nerve stimulation (TENS): The rehabilitation was initiated with high TENS (high frequency and low intensity) as it is reported that use of TENS can reduce pain and use of post-operative analgesic consumption [7]. Two channels (4 electrodes) were placed around the shoulder joint in a supine lying position for 10 minutes. The stimulation causes the impulse to be carried along with large diameter A-beta afferent fibers and produces presynaptic inhibition of transmission of nociceptive A-delta and C-fibers at the substantia gelatinosa of the pain gate [7,8]. TENS was discontinued after 10 sessions as the pain was markedly reduced.

Electrical stimulation: After application of TENS, electrical stimulation to the muscles (anterior, middle, and posterior deltoid fibers) was given using surged faradic current (pulse width-1 ms, frequency-100 Hz) to facilitate muscle action. For muscle stimulation, a relaxed sitting position was given to the patient. An inactive plate electrode was placed over the nape of the neck using an adjustable strap and an active point electrode was placed over the motor point of the muscle being

stimulated. In one session, 40 contractions of each muscle were obtained with intensity strong enough to produce satisfactory muscle contraction. The patient was encouraged to attempt voluntary contractions at the same time. The electrical stimulation was discontinued after first month as the patient was able to produce satisfactory voluntary contractions. The effectiveness of electrical stimulation is established in various literatures. According to a study published by Lee et al. (2019) neuromuscular electrical stimulation is found to be effective in preventing deltoid atrophy after arthroscopic shoulder surgery [9].

Therapeutic exercises: After electrical stimulation, therapeutic exercises were given to the patient. Therapeutic exercises were designed according to the guidelines given by Kisner and Colby (10). Various assisted and active exercises to improve ROM of joint and strengthening exercises for shoulder girdle and shoulder joint muscles were given as a part of therapeutic exercises.

To improve range of motion, pain-free assisted exercises for flexion, abduction, internal rotation and external rotation in a supine lying and extension in a prone lying position were performed. Then the movements were performed in a sitting position as a progression. For further progression, assisted exercise for shoulder elevation on an inclined board in standing position was started. Gradually, assisted exercises were advanced to active exercises in pain-free ranges.

Then, various exercises for shoulder girdle muscles strengthening were performed. We started with open chain isometric exercises for elevators and depressors in side lying and for protractors and retractors in sitting. These are then progressed to closed chain (weight bearing) stabilization exercises, such as quadruped position holding with bilateral equal body weight distribution and quadruped with left arm raise.

For shoulder joint muscles strengthening, isometric exercises for flexors, abductors, extensors, internal rotators and external rotators at 0^0 were given in standing position against the wall after shoulder girdle muscle strengthening exercises. These are then

Table 1: Physiotherapy rehabilitation strategies.

	1st month	2nd month	3rd month	4th month
TENS	Type: high frequency and low intensity Electrodes: 2 channel	-	-	-
Electrical stimulation	To Anterior, middle and posterior deltoid Type of current: Surged faradic current Contractions: 40	-	-	-
Therapeutic exercises	Assisted movements (flexion, abduction, internal rotation and external rotation) in supine lying and extension in prone lying(7 repetitions/ 1 set) Shoulder girdle isometric exercises (7 repetitions/ 1 set/ 3 seconds hold) Shoulder joint muscle isometric exercises at 0^0(7 repetitions/ 1 set/ 3 seconds hold)	Assisted movements (flexion, abduction, extension, internal rotation and external rotation) in sitting position (7 repetitions/ 2 set with 1 minute of rest in between the sets) Shoulder girdle isometric exercises (7 repetitions/ 2 set/ 3 seconds hold with 1 minute of rest in between the sets) Shoulder joint muscle isometric exercises for extensors and rotators at various possible multiple angles (7 repetitions/ 1 set/ 3 seconds hold)	Assisted movements (flexion and abduction) on indined board in standing position(7 repetitions/ 2 set with 1 minute of rest in between the sets) Quadruped position hold with equal body weight distribution on each extremity(7 repetitions/ 1 set/ 5 seconds hold, after 15 days- 7 repetitions/ 2 set/ 5 seconds hold with 1 minute of rest in between the sets) Shoulder joint muscle isometric exercises at various possible multiple angles (7 repetitions/ 1 set/ 3 seconds hold)	Active exercises in standing position(7 repetitions/ 2 set with 1 minute of rest in between the sets) Quadruped position hold with left upper extremity raise(7 repetition/2 sets/5 seconds hold with 1 minute of rest in between the sets) Shoulder joint muscle isometric exercises at multiple angles (7 repetitions/ 1 set/ 3 seconds hold with 1 minute of rest in between the sets)
Upper body ergometer training	-	-	-	Started after functional ranges were achieved

progressed to multiple-angle isometrics at 20^0 , 40^0 and 60^0 for flexors and abductors, at 10^0 and 20^0 for rotators, and at 5p and 10p for extensors.

Upper body ergometer training

For improving muscle endurance, upper body ergometer training was started in a sitting position for 7 minutes with the upper body ergometer machine after the pain was reduced and functional ranges were achieved [10]. This will ultimately help in reducing disability.

The rehabilitation was given on alternate days for 3 days a week for 4 months. The duration of one session was approximately 25-30 minutes. As soon as patient was able to complete previous tasks, progress was made. The details regarding exercise progressions are given in Table 1.

RESULTS AND DISCUSSION

Table 2: Results of Physiotherapy rehabilitation strategies.

Outcome	Before Physiotherapy	After Physiotherapy
1) ROM (degrees)		
Flexion	10^o	100^o
Extension	5^o	15^o
Abduction	20^o	85^o
Internal rotation	28^o	35^o
External rotation	35^o	40^o
2) Shoulder joint muscles strength (grade 0-5)		
Flexors	2	3
Extensors	2	3
Abductors	2	3
Adductors	2	3
Internal rotators	2	3
External rotators	2	3
3) SPADI (%)		
	86%	41%

Fig. 4: Flexion before physiotherapy.

Fig. 5: Flexion after physiotherapy.

Fig. 6: Abduction before physiotherapy

Fig. 7: Abduction after physiotherapy

Bone and joint tuberculosis can be a primary, solitary lesion. The condition is usually monoarticular, with the spine, hip, and knee being the most infected joints. In the early stages of TB, primary bone involvement might be difficult to detect, resulting in a long time between TB onset and diagnosis [3]. In present case, no signs were present suggestive of other joint involvement. It took nearly a year for a confirmatory diagnosis.

Due to the delay in diagnosis and appropriate

treatment, our patient lost her functional mobility. To restore it physiotherapy rehabilitation was required. The effects of physiotherapy rehabilitation strategies were measured again using ROM, muscle strength and SPADI at the end of 4 months. The results of which are given in Table 2.

Positive trends were observed after analyzing the results of ROM. It can be said that assisted and active exercises in various positions have played an essential role in improving ROM. (Figure 4, 5, 6 and 7)

Shoulder girdle and shoulder joint muscles strengthening exercises in open chain and gradual progression in closed chain as well as electrical stimulation to deltoid muscle have improved overall strength of shoulder joint musculature.

A marked improvement in pain and disability was noted, indicated by SPADI. These outcomes could be attributed to the different physiotherapy rehabilitation strategies.

A previous study by Martini et al. (1986), on patients with tuberculosis of the upper limb joints also supported conservative management (chemotherapy and immobilization, followed by rehabilitation). They found that conservative management yields better functional results than those obtained with arthrodesis or excision of joint. However, the authors recommended undergoing surgery in the presence of a persistent handicap or a crippling deformity despite sufficient conservative treatment [5].

The effects of a lack of physiotherapy rehabilitation can be seen in a case study by Mangwani et al. (2001), on a 45-year-old male diagnosed with shoulder tuberculosis. For a treatment, 18 months of anti-tuberculosis drugs and a shoulder immobilizer sling were given. At final follow up, the patient presented with no pain and restricted shoulder ROM (flexion 15°,extension 10°, abduction 75°, internal rotation 10° and external rotation 10°) [11].

The effectiveness of various treatment options in shoulder joint tuberculosis can be analyzed from the results of another case series by Kapukaya et al. (2006), including 11 patients treated with a 10-month course of anti-tuberculosis drugs. Along with anti-tuberculosis drugs, surgical debridement was done in two patients, and arthrodesis was done in only one patient. The patient treated with arthrodesis showed less satisfactory results than those treated with other procedures. In two patients with surgical debridement at the end of their follow up of 29 and 32 months, flexion ROM was 80 ^{0} and 90 ^{0}, abduction ROM was 120 ^{0} and 130 ^{0}, external rotation ROM was 10 ^{0} and 20 ^{0}, respectively [3]. At the end of 4 months follow up, we found nearly similar results in our patient. The early return to function could be attributed to physiotherapy rehabilitation.

CONCLUSION

Shoulder joint TB is a rare condition and it should be suspected in cases of unexplained long term joint pain and restricted joint motion. Normal chest radiograph and absence of systemic symptoms do not exclude the possibility of bone tuberculosis. Proper assessment and a precise physiotherapy protocol are necessary to regain functional ability after debridement following infectious joint disease. Despite extreme joint degeneration, physiotherapy rehabilitation gave good functional results in terms of improved ROM, muscle strength, reduction in pain and disability in our patient. Continuation of the program for a longer period of time can provide further benefits.

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INFORMED CONSENT: Was duly signed by the patient to participate in this publication.

Conflicts of interest: **None**

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