

Effect of Ultrasound Therapy on Synovial Chondromatosis of Knee Joint: A Case Study



Medical Science

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ABSTRACT

The purpose of this case report was to describe the use of ultrasound therapy for synovial chondromatosis of knee joint. A 45 year old house wife with history of synovial chondromatosis of left knee with severe pain on activities and multiple loose bodies posteromedial to the joint space received ultrasound therapy and isometric strengthening exercises for two weeks. The patient reported a reduction in pain and a comparative radiographic reading reported minimal resolution in radio dense opacity size of calcified loose bodies. The results suggested the effectiveness of ultrasound therapy on pain relief resulting in improved functionality and sclerolytic effect on breaking calcifications.

Introduction

Synovial chondromatosis is a rare disease in which cartilaginous masses form in the synovial membrane.¹ Synovial chondromatosis is the development of multiple osteochondral bodies in the synovium of a joint or in the serous of a tendon sheath or a bursa. It can be classified in two types; the intraarticular which is more frequent and the bodies are loose or attached to the synovium and the extraarticular or paraarticular type where usually one body is attached to the serous of a tendon sheath or bursa.² It is usually monarticular. Joints most often affected are the knee, hip, ankle and elbow.³ There is a predilection in males, with a male-to-female ratio of 1.8:1⁵ and a peak incidence in the fifth decade.⁴ At physical examination, the joint is usually swollen and the range of motion is decreased. It may be painful or painless. Intermittent giving way and locking sensation are present.⁶ The aetiology of the disease is still unknown. Many theories have been formulated to explain the origin, but it has so far not been possible to pinpoint an aetiological primum movens⁷. There is no family history and usually no convincing history of previous trauma.⁸ Chondromatosis presents three different pathological phases : (1) active intrasynovial disease with no free loose bodies; (2) osteochondral nodules in the synovial membrane and osteochondral bodies lying free within the joint cavity ; and (3) multiple free osteochondral bodies, apparently produced by previously active, but now quiescent, intrasynovial disease.⁹

The X-rays, the MRI and CT imaging help greatly in the diagnostic approach. MRI shows the loose bodies even though they have not been ossified yet in early stages. Magnetic resonance also reveals the precise site of the bodies (loose or attached to the synovium), shows the amount of intraarticular fluid and demonstrates the damage of articular cartilage in late stages.^{10,11,12} In most cases diagnosis is easy on imaging alone due to the typical radiodensities in the joint or in relationship to a tendon. The typical radiological appearance of synovial chondromatosis is stippled calcification in and around the affected joint. Loose bodies in the joint seen in radiographs tend to confirm the diagnosis.¹³ Differential diagnosis should include chondrosarcoma of bone where the bone is extensively eroded. When there is only one loose body should suspect osteochondritis dissecans, osteoarthritis and Charcot joint.

Therapeutic ultrasound as a treatment modality that has been used by therapists over the last 50 years to treat injuries. Mechanical vibration at increasing frequencies is known as

sound energy. The normal human sound range is from 20 Hz to 20,000 Hz. Beyond this upper limit, the mechanical vibration is known as Ultrasound. The frequencies used in ultrasound therapy are typically between 1.0 and 3.0 MHz. Sound waves are longitudinal waves consisting of areas of compression and rarefaction. Exposure to sound wave will cause oscillation of the particles of that material. Clearly any increase in the molecular vibration in the tissue can result in heat generation, and ultrasound can be used to produce thermal changes in the tissues. In addition to thermal changes, the vibration of the tissues appears to have effects which are generally considered to be non thermal in nature.^{14,15,16,17,18,19}

Areas of mature, undesired calcification are often effectively treated with ultrasound in various clinical set up. Various studies demonstrated favourable effect of ultrasound on conditions like calcific bursitis, calcific tendinitis, myositis ossificans etc.^{20, 21}

Treatment of Synovial chondromatosis consists of open or arthroscopic removal of ossified bodies with subtotal or partial synovectomy. Some authors do not recommend synovectomy because they believe that it has controversial results and one case report demonstrated radiotherapy as a successful modality.^{22, 23, 24, 25, 26} Most authors favor simple removal of loose bodies over synovectomy because of post operative complications like joint stiffness.¹³

The subject of this study, a 45 year old female with phase 3 synovial chondromatosis who was suggested for surgical removal of loose bodies but was not ready for surgery. She was having considerable pain in standing and walking and was sent to physiotherapy department for short wave diathermy to left knee and strengthening exercises to left lower limb but after a week's treatment there was no reduction in symptoms. In view of these it is decided to give ultrasound therapy along with strengthening exercises. The overall aim was to reduce pain, resume her normal daily activities and resolve calcific loose bodies since ultrasound therapy demonstrated resolving effects on calcific depositions.^{20,21,27,28}

Case Presentation

A 45 year old house wife, uneducated and from a lower middle background presented to Physiotherapy outpatient department with a complaint of chronic pain over left knee joint. The pain was of sharp type that was located over the postero medial aspect of the left knee joint. The pain was

aggravated by weight bearing activities and relieved by rest. Pain was graded 7/10 on Numerical Rating Scale on weight bearing activities and subsided to grade 4/10 by rest.

Physical Examination

Swelling present over postero medial aspect of left knee joint but no redness. On examination, the patient weight was within normal limits with respect to her height. No lower limb alignment abnormalities or leg length inequalities were noted. There was tenderness present over postero medial aspect of knee joint. Left knee joint passive range of motion were normal for flexion and extension. Resisted testing was giving a grade of 4 for all movements of left knee joint. Other orthopedic examinations illustrated negative results

Radiograph illustrated early osteoarthritis with reduced space of medial compartment of knee joint and several calcific loose bodies posterior to the knee joint.

MRI of left knee joint (Figure 1) gave an impression of reduction in joint space due to degenerative changes, destruction/fragmentation of body of posterior horn cell and presence of multiple rounded calcified areas consistent with Synovial Chondromatosis

Method

Informed consent was taken from the patient prior to starting of the study. An X ray of affected knee was taken before starting the treatment i.e. on 28.05 09 (Figure 2). Treatment continued with given dosage for 14 days and second X ray was taken on 11.06.09 (Figure 3). A comparative reading of the two X rays to note the changes post treatment was obtained from the radiology department. Ultrasound therapy was administered for 10 minutes per session to the area over the calcification at a frequency of 1 MHz and an intensity of 2 W/cm² in continuous mode²⁹. The transducer was 5 cm² and an aqua sonic gel was used as the couplant. Patient was in prone position with the postero medial area of left knee exposed. Apart from Ultrasound therapy the patient was given with isometric strengthening exercises to Quadriceps and Hamstrings.

Results

The patient reported a reduction in pain i.e. on Numerical Rating Scale 1/10 on rest and 3/10 on weight bearing activities after ultrasound therapy. A comparative radiographic reading before (Figure 2) and after 14 days (Figure 3) of treatment reported that there was minimal resolution in radio dense opacity size of calcified loose bodies. It is further reported that one lesion overlying medial epicondyle of tibia appears to be resolved indicating positive result.

Discussion

The study result shows that ultrasound therapy caused changes in pain and calcific loose bodies seen in synovial chondromatosis. The pain relief can be due to the increased blood supply to the area due to the application of ultrasound. Joints have limited blood flow and as a result, they recover from arthritic flare-ups very slowly. In addition, inflammation and waste matter build-up due to the decreased blood flow causing extreme pain to arthritis sufferers. So therapeutic ultrasound acts as a blood flow stimulation therapy to increase circulation in the affected joint and aids in decreasing pain.

The apparent effect of ultrasound therapy on calcific loose bodies is not well established. This may be attributed to mechanical effect of high frequency vibrations created by ultrasound energy which produces deformation of the molecular structures of loosely bonded substances like tissues. This produces micro massage of tissues which has sclerolytic effect i.e. break down of calcification or adhesion in tissues³⁰.

Ultrasound may stimulate the accumulation of peripheral blood mononuclear cells by activating endothelial cells³¹. Since activated endothelial cells express and release a variety of chemoattractant substances such as chemokines (monocyte chemoattractant protein, interleukin-8, and normal T-cell) and cytokines (interleukin-2 and stem-cell factor) causing migration of macrophages which might be involved in the phagocytosis of calcified particles³²⁻³⁴. At higher intensities, ultrasound may trigger or accelerate the disruption of apatite-like microcrystals by stimulating macrophages to remove calcifications by phagocytosis^{35,36}. Finally, the increase in the temperature of tissues exposed to ultrasound may facilitate the disintegration of calcium deposits due to increase in blood flow (i.e., induce hyperemia) and metabolism²⁰.

Conclusion

This case is reported because of its rarity. Lack of awareness of this condition may lead to incorrect diagnoses and unwarranted surgery. While research in this field is limited in quantity at the current time, the results warrant further investigation.

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Conflicts of interest

None identified

Figures



Figure 1. X ray of affected knee before starting the treatment.



Figure 2. X ray of affected knee after 2 weeks the treatment.

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