ORTHOPAEDIC JOURNAL OF M. P. CHAPTER

An official publication of Madhya Pradesh Chapter of Indian Orthopaedic Association

P-ISSN 2320-6993 | www.ojmpc.com

Index Copernicus International

ICV 71.64

Indexed

2020 Jan-Jun

Volume 26

Issue 1

DePuy Synthes

COMPANIES OF Johnson & Johnson

TRAUMA | SPINE | NEURO

CRANIOMAXILLOFACIAL | IMPLANTS & INSTRUMENTS

Also deals in Arthroscopy, Plastic Surgery, Endoscopic, Implants, General Gynae Instruments & Hospital Equipments.

Raghuveer Singh Kushwaha
Director
+91-98270-26129, 94250-64629

SHREE SURGICALS

LG-12, President Tower, 6/2 South Tukoganj, Madhumilan Square, Indore - 452 001 (M.P.)
Phone : +91-731-4043376, 6461999 | shree_surgicals_indore@yahoo.co.in

EDITORIAL TEAM

M.P. ORTHOPAEDICS ASSOCIATION
2020-21

PRESIDENT	Dr. Prof. R.K.S. Dhakad, Gwalior
SECRETARY	Dr. Prof. Saket Jati, Indore
PRESIDENT ELECT	Dr. Pramood Neema, Indore
PAST PRESIDENT	Dr. Prof. R. K. Jain, Indore
PAST SECRETARY	Dr. Prof. Deepak S. Maravi, Bhopal
VICE PRESIDENT	Dr. Abhay Shrivastava, Jabalpur Dr. Ajay khare, Ujjain
JOINT SECRETARY	Dr. Manish Maheshwari, Indore Dr. Dipendra Sonkar, Bhopal
TREASURER	Dr. Akhil Bansal
WEBMASTER	Dr. Pradeep Chaudhary, Indore
ASSIST SURGEON WELFARE COMMITTEE	Dr. D. K. Sharma, Indore
EXECUTIVE MEMBERS	Dr. Sudhir Rathore, Guna Dr. Hakimuddin Bohra, Pipariya Dr. V.D.Suryavanshi, Jabalpur Dr. Vipin Maheshwari, Ratlam Dr. Rajesh Dashore, Indore Dr. Vivek Sing, Ujjain Dr.Manish Dwivedi, Bhopal Dr.Sharad Jain, Mandsore Dr.Abhishek Mishra, Gwalior Dr. Pranav Mahajan, Indore
ADVISOR	D. D. K. Taneja Dr. N. Shrivastava Dr. Pradeep Bhargava Dr. J. Jamdar Dr. S.K. Lunawat

ORTHOPAEDIC JOURNAL OF

M. P. CHAPTER

VOLUME 26 | ISSUE 1 | JAN-JUN 2020

INDEX

A Life to Live Beyond Orthopaedics

Jain S

Mahatma Gandhi Memorial Medical College, Indore

Why we have chosen Orthopaedics for ourselves? There can many personalized reasons for the above, but the commoner are – its lucrative, paying, satisfying, early practice settlement, definitive and terminal branch. There are hardly any females in the branch; hence Orthopaedic branch is totally all boys party without any inhibitions. They have all sorts of fun and enjoyment. Orthopods live life king size.

The various modes of leisure for orthopods are parties, exercises/physical activity/gyming followed by travelling, food and wine, whereas less common in them are music and arts (photography, painting, sculpture). Party with friends, colleagues or family members is most common form of enjoyment for orthopods and most of orthopaedicans are party animals having regular parties. On an average orthopods do party or attend functions about one per week. These parties are full with boozing and smoking and almost more than 80 % of the surgeons are drinkers in these parties having average more than two drinks per day. Only 20% of orthopaedic surgeons are non-drinkers. About 30 % of the orthopaedians are smokers, among which 20 % are chain smokers. Many of the academic conferences, short table gatherings and group discussions held over the dinner table for orthopaedic surgeons arranged by the pharmaceuticals are for alcohol only. Many of the academic meetings attended by the members outside the hometown are not for academic content, but only for the food, alcohol, banquet or entertainment, outside the hometown as they are away from inhibitions. These gatherings between the orthopod surgeons is always with adult jokes and abusive slangs which is commonly done over smoke and booze.The average happiness rating for an orthopaedician is 3.96 out of 5.

Orthopaedic surgery, as a branch is rewarding profession, but it is a very demanding also. Orthopaedics is a hectic, intense and stressful branch. It needs high learning curve in lesser time and lot of physical effort. Being an emergency branch, emergency duties can be day and night and you need to attend, manage and sometimes may have to operate also in odd hours, which when started, there is no warranty when will it end. The load, burden, malpractice and negligence allegations are increasing day by day, thus it is increasing the practice risk and now there is very less margin of error. This time commitment can negatively impact family time and adversely affect work life balance. It is common for Orthopods in the bedroom, having sleepless night thinking that how could that screw go out during the surgery. We can commonly see orthopaedicians using derogative language and abusive words in operation theatres and hospitals among themselves and to patients even. Being all boys party, there is lack of softness and politeness of the behaviour of many of the orthopaedicians as well. Further the cut throat competition and decline in ethical values have led to envy among themselves and with others. These have made the life of an orthopaedician difficult and stressful and also have affected their family-life, with equal increase in rate of remarriage and divorce.

This stressful and demanding life among us has lead us to seek measures to overcome stress. We seek pleasures in dealing with this intense and hectic life of orthopaedic surgeon. We seek this escapism in smoking and boozing, which at times and for few of us is over the acceptable limit. The competition between the minded maniacs for smoking and drinking crosses the barriers and it has made many of our friends addicted even. This along with stressful life, sedentary habits and medical comorbidities like hypertension and diabetes has made us vulnerable for serious problems. In recent time, we have lost eminent orthopods for the unknown reasons, the damages of which cannot be repent. Many

of our orthopaedic surgeons are still dealing with some serious chronic morbidities and terminal illnesses, most of which could be prevented.

As it is rightly said Orthopedic surgeons are "strong as an ox and twice as smart", but we as an orthopaedic surgeon should strive for a balanced life to care for ourselves and our families as well as profession. We want work satisfaction and healing touch for our patients. At the same time we owe responsibility to family. Its a bitter truth that only family will be with us in all our difficult times. Neglecting family life for excelling professionally does happen in lives of many of us. No one will remember you for working day in and day night or working on weekends when others are enjoying. Its imperative to strike a critical balance between work and family life. Mobile phone is again a big stress for a doctor. Patients in India feel it their right to call on a doctors mobile at any time for petty issues. Many of us don't switch off mobiles even on vacations for the fear of loosing patients. Another area is Professional jousting. At times we get complications from other colleague and patients and their relatives try to make us talk about the previous orthopods alleged mistakes. Many times we receive x rays on Whats app seeking opinions from patients. We need to be very careful on such situations as today litigations against doctors are on a rise. If we talk something loose about any colleague, some or the other day it is bound to backfire on us.

What needs to be done, is balance between the professional and personal life. In professional life we needs to focus on limitations of our body as well as mind. Rather than treating ourselves as machine consider ourselves human. Professionally, strict to the duties towards patient by being understanding, honest, polite, competent, ethical and committed and have empathy towards patients. Towards our peer members we need to be respectful and should not be involved in medical jousting and entice. We should keep our self-updated and should not be overburdened and exhaustive. Admit Our limitations and overcome the shortenings. In personal life we need to take time for leisure, family and friend and not the least for ourselves. Keep yourself simple and low maintained. Keep time for your hobby like traveling, shopping, singing, painting, playing or music etc. Nurture your relations with family and friends. Take care of your health with balanced diet and light exercises.

Finally we want to be happy and healthy, caring and competent and good travel companions for people through the journey we call life, which can be done by none other than we ourselves.

Dr. Saurabh Jain
Editor, OJMPC

Current Concepts In Diagnosis & Management Of Osteoarticular Tuberculosis

Dhammi IK, Kumar S

Department of Orthopaedics, University College of Medical Science, Delhi

Abstract

Tuberculosis is common worldwide and in endemic in India. Musculoskeletal tuberculosis, involving spine and other joints is seen in 1% to 3% of patients with tuberculosis. The disease has varied clinical presentation & lack of charateristic radiographic findings leading to delayed diagnosis and treatment. Early confirmed diagnosis & proper medical treatment are essential for control of the disease.

This review article based on the recent literature review discuss the clinical presentation, diagnosis and management of osteoarticular tuberculosis.

Keywords: Tuberculosis, osteoarticular, tubercular osteomyelitis

Address of correspondence:
Dr. Ish K Dhammi
Specialist,
Department of Orthopaedics,
UCMS and GTBH, Delhi
Email – DhammiIk@gmail.com

How to cite this article:
Dhammi IK, Kumar S. Current concepts in diagnosis and managemen of osteoarticular tuberculosis. Ortho J MPC. 2020;26(1):3-13
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/97

Introduction

Worldwide, tuberculosis (TB) is one of the top ten causes of death & the leading cause from a single infectious agent. In 2017, TB caused an estimated 1.3 million deaths (range, 1.2–1.4 million) among HIV-negatives & additional 0.3 million deaths among HIV-positive people [1]. Pulmonary TB (PTB) is most common form of tubercular disease but can affect extra-pulmonary sites exclusively or in combination with PTB [2].

Musculoskeletal tuberculosis, although relatively rare, is observed in 1% to 3% of patients with TB, out of which approximately one-half show spinal involvement & the remaining involves the extraspinal osteoarticular joints [3-6]. Tubercular tenosynovitis & arthritis is usually monoarticular & the organism can be isolated from the joint [7].

Patients generally have mild local & constitutional symptoms, frequently leading to significant delays in diagnosis, due to its varied clinical presentation & frequent lack of charateristic radiographic findings [8,9]. This delay in diagnosis & treatment, may result in additional bone or joint destruction [8-11]. Therefore, early diagnosis & treatment are essential. We therefore performed a review of these topics based on the recent literature review regarding clinical presentation, diagnosis and management of osteoarticular tuberculosis.

I. Clinical Presentation: TB arthritis is characteristically monoarticular, most commonly affecting spine & weight-bearing joints as knee, hip & ankle. Synovial type of TB arthritis is more common in these joints [12]. Multiple sites involvement is rare & is observed in 5-30% only [13,14]. Reactivation of old tubercular lesion after treatment occurs in 17-34% & is most common in hip joint [7,15].

It commonly presents with chronic joint pain & swelling with minimal signs of inflammation & restriction of movements. Effusion, painless periarticular cold abscess, chronic sinus

formation, regional muscle wasting & deformity occur late. Systemic constituional symptoms of fever, weight loss, loss of apetite, malaise & night sweats may or may not be present during active TB synovitis & arthritis. They may also have hypersensitivity phenomena such as erythema nodosum, episcleritis, uveitis & Poncet's arthritis. 50% of individuals may have active pulmonary TB at the time of diagnosis [16]. Thus patient with clinicoradiologically suspected osteoarticular tuberculosis should also be screened for active pulmonary or other primary extrapulmonary foci.

Table 1. Clinically, TB of joints have been classified into 5 stages [17-19].

Stage	Type	Movement	Clinical	Radiological	Prognosis
I	Synovitis	>75%	Soft tissue swelling	Haziness of articular margins & rarefaction	Excellent
II	Early arthtitis	50 to 75%	pain & spasm	Rarefaction, osteopenia, marginal bony erosions mild joint space reduction	Good with mild stiffnes
III	Advanced arthritis	> 75 % loss in all direction	Pain, spasm, loss of ROM	Marked diminution of joint space & destruction of joint surfaces	Fair with notable loss of motion
IV	Subluxation / dislocation	III + Gross restiction	a. III + deformity	Pathological dislocation Hip - w&ering /migrating Knee - triple deformity	Poor
V	Treminal arthritis & deformity	IV + Ankylosis	IV + gross deformity	Deformity with degenerative arthrosis	Poor

Specific involvement of tubercular arthritis:

1. Hand & wrist: Common in children < 5 years, but can affect any age group. Hand or wrist gradually becomes painful & swollen with joint effusions, synovial thickening & restricted range of motion. Systemic symptoms as fever, weight loss, anorexia or regional lymphadenopathy may be seen. In advanced case, wasting of hand & forearm muscles, deformity, enlargement of digits/metacarpals (sausage finger/spina ventosa), discharging sinuses, tubercular ulcers, cold abscess & compound palmar ganglia may be present. Rarely, patients have carpal tunnel syndrome, or involvement of nails.
2. Elbow: Can affect any age group. Patients present typical with local & constitutional features as swelling, pain, limitation of motion, synovial thickening etc. Rarely, ulnar nerve or posterior interosseous nerve palsies may be presenting feature. In advanced stage, wasting of arm & forearm muscles, elbow deformity in flexion/extension, pathological dislocation, discharging sinuses & cold abscesses may develop.
3. Shoulder : Can affect all ages, but is more common in adults than children. Patients present with pain, restricted shoulder movements (particularly limited external rotation & abduction) and muscle wasting (particularly deltoid & supraspinatus). In advanced case, there may be marked destruction of humeral head & glenoid with muscle atrophy or deformity (particularly, fibrous ankylosis with humeral head pulled up against glenoid & arm fixed in adduction & internal rotation). Systemic constitutional features, discharging sinuses around shoulder & cold abscess are uncommon. "Caries sicca" is the most common form – which is a dry arthropathy (rather than exudative). Relatively rare, it usually presents in the advanced stage with disabling symptoms that may mimic more common pathologies such as neuropathic shoulder, rheumatoid arthritis, & adhesive capsulitis.
4. Hip: Can affect any age, but most common in children & young adults. Three stages are
   a) Synovitis - characterized by gradual hip pain, limping (antalgic gait), fullness around hip caused by joint effusion, restricted range of movement & deformity (affected limb is flexed, abducted & externally rotated with apparent lengthening).
   b) Early arthritis - characterized by pain with every hip movement, muscle spasm, atrophy, bony destruction and deformity (affected limb flexed,

adducted & internally rotated with apparent limb shortening).

c) Advanced arthritis - characterized by very painful joint movements, grossly restricted movement and limb shortening. Pathological dislocation or subluxation may occur due to bony destruction of acetabulum/femoral head.

5. Knee: Can affect any age group. Patients present with painful, swollen, tender knee which is warm to touch, with limping & reduced range of motion. Systemic symptoms and regional lymphadenopathy may be seen. In advanced case, the joint may feel boggy due to synovial thickening, with joint effusion & wasting of thigh muscles. Discharging sinuses, cold abscess or deformity ranging from mild flexion deformity to severe triple deformity (flexion, posterior subluxation, external rotation & valgus) may be present.
6. Spine: Patients present with localized back pain, tenderness & constitutional symptoms along with or without signs of spinal cord compression. Advanced disease may have severe pain, spinal deformity, paraspinal muscle wasting & neurological deficit.

II. Laboratory investigations & Imaging

1. Blood: Low haemoglobin, relative lymphocytosis, raised erythrocytic sedimentation rate (ESR) are often found in active stage. Raised ESR, however, is not necessarily a proof of activity of infection. Its repeated estimation at 3 to 6 months intervals gives a valuable index to the activity of the disease [20].
2. Mantoux test: Stantard dose of 5 tuberculin units (TU-0.1 ml) is injected intradermally & read 48 to 72 hrs later. Person who has been exposed to the bacteria is expected to mount an immune response in skin containing bacterial protiens. A positive reaction (induration more than 10 mm) is present in tuberculous disease. A negative test, in general, rules out the disease. The tuberculin test may be negative in disseminated T.B, after vaccination, recent viral infection or steroid therapy, or in immunocompromised individuals [20]. This test in not recommended, currently.
3. Immunological test: Interferon gamma release assays (IGRAs by quantiferon assay), blood – based assays rely on the stimulation of host blood cells with M. tuberculosis-specific antigens & measure the production of interferon gamma. Although it more specific than the montoux test, but they are currently unable to distinguish between active disease & latent TB infection & hence not recommended [21,22].
4. Ziehl-Neelsen staining: This test is rapid, easy & requires minimal infrastructure; however, minimum load of 5,000-10,000 bacilli/ml is required & species differentiation is not possible. It may be helpful in sputum smears, but as osteoarticular TB is paucibacillary, hence this test has limited value [23].
5. Fluorescence microscopy: It utilizes fluorescent dye to stain the organisms and when excited by UV light using special microscope, bacteria appear as bright rods in a dark back ground. It is used successfully for rapid diagnosis of pulmonary TB; but in osteoarticular TB, particularly paucibacillary disease, use is not clearly established. Fluorescence microscopy is faster & more sensitive than conventional light microscopy, but the expense, need for a dark room & poor specificity limit its usefulness [23].
6. Culture: Isolation of organism on culture is gold standard for diagnosis of TB. Culture media used are egg based (Lowenstein – Jensen medium), agar based (Middlebrook 7H10,7H11) or liquid based (Mycobacterium growth indicator tube). Culture can detect as little as 10 bacilli/ml of sputum, differentiate different mycobacterial species, can be used for drug senstivity testing & is useful in symptomatic smear negative cases. But drawbacks of conventional culture methods are time consuming (6 to 8 weeks) & require strict quality control. Rapid culture methods like BACTEC which detect mycobacteria based on metabolism

(detects C14 labelled CO2 & reports as growth index(GI) value) rather than visible growth give results within 7-14 days. MGIT(mycobacteria growth indicator tube) method, detects growth early in 7 to 12 day by nonradioactive detection system using flurochrome for detection & drug screening, hence is useful for drug susceptibility testing [23].

7. Tissue biopsy: TB guidelines TAC subcommittee for bone & joint TB recommends that wherever possible, all patients should have a biopsy of the lesion, to provide a specimen for culture to confirm the diagnosis, perform drug susceptibility testing, and to rule out other diagnoses. Tissue biopsy can be done under radiological guidance, arthroscopy or via open surgical biopsy. Arthroscopic biopsy is advantageous as it visualizes the lesion, helps excision of affected tissue for diagnostic testing, & simultaneous therapeutic intervention if required. Percutaneous CT-guided biopsy is preferred, but some patients may require open biopsy. Regional enlarged lymph nodes / sinus tract curettage/edge biopsy can be sent for culture & histopathology, but microbiological result may be misleading due to contamination/colonization/2^0 infection. Biopsy is not needed for culture and microbiologically confirmed TB, but if patient is microbiological negative for TB then percutaneous biopsy is advised and if the foci is not easily accessible percutaneously or needs surgical management, then should undergo open surgical biopsy. Specimens should also be collected, when therapeutic invasive procedure is done. Specimens collected should be sent for:
   a. Microscopy & culture for pyogenic bacteria
   b. Microscopy & culture for MTB
   c. Histopathology / cytology.

   Histopathology shows, mononuclear, granulomatous reaction pattern i.e. granulomas with or without central caseation necrosis. Inflamatory reaction patterns on histopathologic examination of tissue are of secondary importance because other conditions such as fungal infections, foreign body reactions & sarcoidosis may be associated with granulomatous inflammation. Direct demonstartion of organism in tissue section by ZN staining is difficult to do, compared to do in direct smears. Thus histopathologic evidence for diagnosis of TB is adjunctive, always circumstantial & never a replacement for culture [23].
8. Cytological examination of smears: Direct smears may be stained with May-Grunwald-Giemsa (or Romanowsky dyes) & ZN stain for cytopathologic examination allowing recognition of inflammatory patterns & acid – fast organisms and making a tentative diagnosis in a day, but the diagnosis is always circumstantial and never definitive. This can be done for intraoperative consultation also [23].
9. Serological testing: This test can be used for antigen & antibody detection; however serological tests are expensive, require trained personnel, have low senstivity, are affected by BCG vaccination, previous infection & cannot distinguish between MTB & non-tubercular mycobacteria. Serological tests have so banned in India for TB [23].
10. Molecular methods: Detection & identification of mycobacteria directly from samples can be done by polymerase chain reaction (PCR) & nucleic acid amplification test. PCR provides rapid diagnosis within 48 hrs, has high senstivity, can identify the species & requires very small volume of specimen; however it cannot differentiate between live & dead mycobacteria. High cost, availability & infrastructure required limits its usage. Another molecular assay LPA (line probe assay) is based on reversed hybridization principle. DNA material is hybridized with specific oligonucleotide probes & after addition of enzyme substrate complex with chromogen results in purple/brown precipitates, which is visually interpreted. It is useful to detect resistance against rifampicin & isoniazid [23]. Gene Xpert (CBNAT) MTB/RIF automates & integrates sample processing & PCR in a single disposable plastic

cartridge, giving accurate results within 2 hrs. It simultaneously detects MTB & resistance to rifampicin. WHO recommends its use as initial diagnostic test in adults & children suspected of having MDR-TB or HIV associated TB [24-26].

11. Roentgenographic findings: Bone & joint TB is a slowly developing disease, which takes 3-4 months of disease process to show radiological features. First radiological sign of an active disease is localised rarefaction/osteoporosis. The speed of decalcification depends on reactive hyperemia, which is most intense in exudative infections. In synovitis stage, x-rays will show epiphyseal & metaphyseal decalcification and swollen synovial shadow. As the disease advances, the articular margins loose sharpness & become fuzzy. X-ray findings in arthritic stage are joint space narrowing secondary to destruction of articular cartilage and small zone of osteolytic area suggestive of granular foci surrounded by diffuse osteoporosis. Even if the lesion is located in one carpal/tarsal bone, remaining carpals/tarsals also rapidly decalcify, suggesting on x-ray that the infection affects all [23]. Tuberculous cavity at center may show a sequestrum of bone or calcification of caseous tissue which is irregular soft, feathery and coke –like sequestrum, which is surrounded by an osteolytic ring representing the fibrous wall. Bone is osteoporotic/normal/or dense, depending on the defence reaction. Radiological signs at this stage resemble as osteomyelitis. Joint effusion is seen as soft tissue shadow and abscesses may be seen as vague irregular densities in surrounding soft tissues. Advance destructive process may produce collapse of bone /subluxation/dislocation/migration & joint deformities. Damage to growth plate produces angular deformities due to irregular growths. The synovitic lesion, near epiphysis stimulates osteogenesis of epiphyseal growth plate, which may lead to premature appearance/enlargement of the ossific nuclei and may stimulate longitudinal growth. When it damages the growth plate & encroaches on the area of endochondral ossification, growth is irregularly retarded & deformity results. Spinal tuberculosis shows erosion & fuzziness of the paradiscal margins, disc space reduction & regional osteoporosis. There is an increased soft tissue shadow/paravertebral shadow (fusiform, spindle shaped, bird nest appearance, saw tooth appearance), destruction/collapse of vertebral body & kyphosis of vertebral column [23]. New bone formation (periosteal reaction) /ossification are seen in tuberculosis of hand and foot as the foci is superficial and it may encircle & enlarge the diaphysis in small long bones of hand/foot [23]. With treatment, recalcification is seen, suggestive of reduction of disease activity. Secondary to healing, the peri-focal bone is thickened as a calcified ring, as the decalcified trabeculae start calcifying [23].
12. Computerised tomography: It detects disease earlier even when destroyed areas of bone erosion is small and in areas of skeleton not appreciated on plain X- rays as craniovertebral spine, cervicodorsal spine, rib, sternum, sacroiliac joint and posterior elements of vertebrae. Intraspinal encroachement & dystrophic calcification is well appreciated by CT scan. CT guided biopsy/aspiration provides tissue for histological/cytological/microbiological diagnosis. Further, swelling in soft tissues caused by edema, granulations, exudations or abscess formation can be demonstrated, earlier. Calcification in abscess, as seen on CT is pathognomic of TB [23]
13. MRI: It is more sensitive & specific than X-rays & CT scan to detect tuberculous lesion and can diagnose disease in pre-destructive stage. MRI can show abscess/granulation tissue/caseous tissue, localized tuberculoma & generalized granuloma in multiple planes & can delineate soft tissue masses in both sagittal & coronal plane. The spinal cord changes, such as cord edema, atrophy,

syringomyelia, arachnoiditis myelitis, myelomalcia, syrinx, can be appreciated. It shows the extent & spread of tubercular debris under anterior & posterior longitudinal ligament, subligamentous spread of a paraspinal mass, abscess which shows low signal on T1 & high signal on T2 weighted images, encroachment of vertebral canal, compression of spinal cord by granulation material, bone or disk, identifying cranial & caudal level of obstruction and can evaluate for spinal tumor syndrome [23].

14. PET-CT scan: It helps in picking, residual inflammation in cases where the signs of healing are ambiguous on contrast MRI. SUV max (maximum standardized uptake value) of early phase PET-CT scanning is statistically significant in differentiating tuberculous from pyogenic spondylitis. It has high sensitivity & specificity for detecting & identifying the process of inflammatory activity in spondylitis [23].
15. Ultrasonography (USG): It is a useful non-invasive modality to detect soft tissue mass (solid or liquid), deep-seated abscesses & to perform USG guided aspiration. It is particularly useful in follow-up evaluation of psoas abscess when patient is under cover of ATT to document resolution of psoas abscess [23].

Diagnosis

Key principles of diagnosing osteoarticular TB as stated in INDEX TB guidelines are:

(a) High suspicision in patients with signs of joint infection with insidious onset & charaterisitic imaging features.
(b) Refer such patient to orthopaedian who can assess the joint & perform a biopsy for culture & histopathology
(c) Whenever possible and safe for patient take pus/fluid/aspirate/specimens and sent it for microscopy, culture (for all mycobacterial, pyogenic and fungal testing) and histopathology because it confirms diagnosis; drug susceptibility testing can be done to guide ATT and alternative diagnoses can be picked up [11].

The hierachy of evidence for the diagnosis of TB [23]

1. Culture
2. Molecular testing, PCR, other tests in development.
3. Demonstartion of AFB in direct smears or tissue sections.
4. Tissue reaction patterns: granulomas necrotising/non–caseating, necrosis without AFB
5. Radiological examination & imaging studies.
6. Physical examination of the patient.
7. Therapeutic response

III. Principles Of Management

Tuberculosis is a systemic medical disease. The mainstay of treatment remains uninterrupted antitubercular chemotherapy.

a. **Pre chemotherapy era:** The treatment was orthodox conservative treatment. During the Atharva veda period (3500 BC -1800 BC) "sipurdu" a herbal medicine was used along with good food, sun exposure, fresh air, rest & immobilization, given in specialised rooms called 'sanatoria'. Hippocrates (400 BC) & Galen (131-201 AD) used forceful maneuvers & manipulations to correct deformities. In late 19th & early 20th century, HO Thomas, Sir Robert Jones & Dame Agnes Hunt, also supported 'The sanatoria concept", in which patients were kept for 1-5 years, as the natural course of diseases was 3 -5 years. Only in one third patients the aim was achieved, rest of patients used to die or remained severly crippled. Surgical drainage of abscesses usually lead to persistent discharging sinus & rise of death.

b. **Post Chemotherapy era:** Antitubercular drugs (streptomycin 1947, para amino salicylic acid 1949, isoniazid 1952, pyrazinamide 1956, ethambutol 1962 & rifampicin 1967) changed the outcome of tuberculosis in general. The treatment was classified along chemotherapy in three philosophies:
(a) Universal surgical extirpation was advocated by Hodgson, Fellander &

Mukhopadhaya, where surgery under cover of ATT was done in all cases.
(b) Middle path regimen where a long course of drugs was advocated for all & surgery only for complications.
(c) Modified middle path regimen where a short 6-9 month course of antitubercular drugs was advocated for all & surgery only for complications.

Middle path regimen as per Tuli includes rest, antitubercular chemotherapy (streptomycin 1 gm/day for 3 months, para-amino salicylic acid 12 gm/day for 18 months & isoniazid 300 mg/day for 24 months), regular supervision, gradual mobilization after 6-9 months with braces/calipers for next 18-24 months, minor surgical procedures when required like aspiration of abscesses, excision of sinus tract etc [23].

c. General treatment

General care: It includes rest, high caloric & high – vitamin diet, fresh air or living in warm dry climate, daily heliotherapy, good hygienic & nursing care [27].

Rest, Mobilization & Brace: All patients of spinal tuberculosis are advised to sleep on hard bed. In craniovertebral, cervical & cervicothoracic lesions, traction is used in early stages to put diseased part at rest, particularly for cases with neural deficit & with pathological subluxation/dislocations. In active stage, joints given rest and braced in functional position. In presence of gross destruction especially in hip, knee & ankle cases, continuation of immobilization may lead to spontaneous sound ankylosis. Later they are started on intermittent guarded active & assisted exercises under cover of antitubercular drugs to retain useful functional range of movements.

Traction: In presence of deformities, traction is used to correct deformity, maintain the limb in functional position, hold inflamed joint surfaces apart, offer unhindered observation and local response to treatment & permit repetitive guarded assisted & active joint motion. This maintenance of traction & intermittent active & assisted joint motion during healing and post synovectomy/debridement/excisional arthroplasty stage encourages cells to develop into of healthy synovial membrane & well lubricated useful fibrocartilage adapted to the function of the joint. This permits return of reasonable function even in damaged joint & maintain lasting healed status [28].

Ambulation: Initial stage is without weight bearing. As the disease heals & pain subsides, weight bearing is permitted accordingly, under observation. If symptoms or signs increases, patient goes back a stage; if there is steady progress he goes forward (Thomas' test of recovery), but movements or degree of weight bearing is never forced beyond tolerable discomfort (functional treatment) [28]. Guarded weight bearing for lower limbs is started 3-6 months after subsidence of signs of activity, and braces/appliances are gradually discarded after its use in about 2 years [28].

d. Antitubercular chemotherapy

Invasive diagnostic procedures for confirming diagnosis are not always practicable & in such circumstances, clinician judgement is needed as to whether ATT should be started without a microbiological/histopathological diagnosis, or whether a period of observation is appropriate. Index-TB guidelines assert that in TB-endemic areas, it is reasonable to start ATT in patients with strong clinical & radiological evidence of TB of bones & joints & to monitor their progress. It also assert that that all bone & joint TB should be treated with extended courses of ATT with intensive phase consisting of 4 drugs (isoniazid, rifampicin, pyrazinamide & ethambutol) for 2 months, followed by continuation/maintenance phase consisting of 3 drugs (isoniazid, rifampicin, ethambutol) lasting 10–16 months, depending on site of disease, patient's clinical course & response.

1. Rifampicin: is semisynthetic antibiotic, acts on dormant intracellular mycobacterium, has good absorption in empty stomach. It causes red-brown discolouration of body fluids. 10mg kg is daily recommended dose with adult dose between 450-600 mg [11].

2. Isoniazid: has ability to penetrate cell which contain tubercle bacillus. Toxic effects include rashes, fever, vitamin B- deficiency & neurologic effects on reflexes & bladder function. The daily recommended dose is 3-8 mg/kg [27].
3. Pyrazinamide: it is bactericidal drug, which is well absorbed orally & eliminated by hepatic metabolism. It may cause nausea, flushing, arthralgia & hepatotoxic reactions. It is prescribed as 35 mg/kg/day [27].
4. Ethambutol: has replaced para-amino salicylic acid (PAS) as it has fewer toxic reactions & is well tolerated. Dose is 2.5 mg/kg for 60 days, then 15 mg/kg single daily dose [27].
5. Streptomycin: it acts best at 9.0 pH & so it should be accompanied by a buffered alkaline solution when injected intra synovially. Permanent toxic effects are related to 8th nerve palsy causing deafness & vertigo. The daily recommended dose is 1gm [27].

e. Abscess, Effusion & Sinuses

For palpable abscesses & large joint effusions, treatment is aspiration & instillation of one gram streptomycin alone or combined with injectable isoniazid at each aspiration. Local instillation is not necessary, if sufficient local concentration of antibiotics is achieved after parenteral administration. If aspiration fails to clear, then open drainage of abscesses is performed. All radiologically visible abscesses don't require drainage, if under ATT. Drainage is done for very large paravertebral abscess which increase in size in spite of ATT, prevertebral cervical abscess causing dysphagia or dyspnoea, incidentally during decompression for paraplegia or during debridement of diseased vertebrae for active tuberculosis. Sinuses usually heal within 6-12 weeks under ATT. 1% may require longer treatment & excision of the tract with or without debridement. It is important to note that sinus ramification is always greater than appreciated, complete surgical excision is indeed impracticable & fortunately unnecessary [28].

f. Surgery in Tuberculosis of Bones & Joints

Surgery is only adjunct and supportive to systemic antitubercular therapy and is not a substitute for prolonged course of antitubercular drugs. A trial of conservative treatment is justified in most of the cases before surgery is contemplated. Nonoperative treatment is usually adequate in pure synovial tuberculosis (without articular involvement), low grade, early arthritis & even advanced (stage III, IV) arthritis, especially in upper extremity. Operative procedures should be done after stabilization of general condition of patient under protective cover of ATT & before the development of drug resistance. The interval could vary depending on case, in general minimum 1-4 weeks of ATT & general treatment is advisable before any major surgical intervention [28]. In general, at any stage of disease, if lesion is not responding favourably to effective antitubercular drugs, there is doubt in diagnosis, or it is a case of refractory recrudescence of infection, exploration & appropriate operation is considered mandatory.

Extent & Type of Surgery

Arthrodesis is now rarely indicated as a primary mode of treatment. Reconstruction, reposition of joints, juxta-articular osteotomies, soft tissue releases & arthroplasties to obtain, mobile, stable joints with biological control of disease is now considered as rational treatment in tuberculosis.

Excision of focus is done, if juxtaarticular osseous focus is threatening the joint, despite adequate ATT. Synovectomy partial or total along with joint debridement limited to infected synovium, sequestra, pockets/cavities of pus & sinuses only is indicated in nonresponsive cases of tubercular synovitis & early arthritis. In advanced arthritis of hip & elbow in adults (nonresponsive cases or cases who did not obtain acceptable range of movements) excisional arthroplasty followed by frequent repetitive active & assisted movements of the operated joint to obtain a functional arc of movements is given.

Arthroplasty in patients with active tuberculous disease has proved disastrous. In advanced knee arthritis (& rarely in ankle, hip & wrist) in adults, for gross deformity & pain, compression arthrodesis should be performed by any of the standard techniques of arthrodesis extra or intra-articular may be adopted in tubercular arthritis under cover of modern drugs. In cases of healed disease with painless ankylosis in deformed position a juxta-articular corrective osteotomy is performed (for hip, knee & ankle or any joint) to bring the joint to best functional position. Following surgery, immobilization in plaster cast is continued till solid fusion is obvious radiologically (3 to 6 months) [28].

g. Outcomes & healed stage: Monitoring of treatment response in patients is done by:-

A) **Clinical** - General improvement in well-being, resolution of fever, weight gain, increase in appetite resolution of sinus/ulcer

B) **Haematological** – increase in Hb & RBC count, decrease in ESR

C) **Radiological** – shows appearance of remineralisation and sharpening of margin.

D) **Imaging** – MRI shows resolving collections, reduction in marrow edema & replacement of marrow by fat seen as high signal in T1 & T2 images & no contrast enhancement [27].

Thus patients diagnosed as confirmed/probable bone TB with improved clinical, haematological and imaging features as above, on completion of ATT and no relapse of disease are labelled healed status, and can stop ATT [11].

h. Presumptive treatment failure

Treatment failure should be suspected for bacteriologically confirmed or clinically diagnosed bone TB, when after completing at least 5 months ATT have -

a) Persisting or worsening local & systemic symptoms & signs

b) No improvement or deterioration of the lesion on repeat imaging

c) Appearance of new lesion/new abscesses/lymphadenopathy

d) Non-healing ulcer/sinus or wound dehiscence post-operatively.[11]

Possible causes of deterioration on treatment or failure to improve on treatment are poor adherence to ATT, drug resistance, paradoxical reaction, immune reconstitution syndrome associated with HIV or alternative diagnosis.

Such patients of presumptive treatment failure should undergo complete blood count, inflammatory markers such as ESR, liver enzymes, urea & electrolytes, fasting blood glucose/HbA1c & HIV test, repeat imaging & repeat diagnostic sampling or biopsy, which should be send for a) staining for AFB & culture for MTB with drug susceptibility testing b) Gram's stain & bacterial & fungal culture c) histopathology. PCR-based tests have variable sensitivity in bone TB & there is uncertainty in previously treated TB [11]. These groups of patient with bacteriologically confirmed or clinically diagnosed treatment failure should be treated by specialist team and by carefully monitoring empirical treatment with second-line drugs, guided by drug susceptibility testing [11].

Resistance: Multidrug Resistant (MDR) tuberculosis is defined as tuberculosis resistant to isonizid & rifampicin [24]. Extensively Drug-Resistant (XDR) tuberculosis is defined as tuberculosis resistant to isoniazid & rifampicin & any fluoroquinolone & at least one of the three second-line injectable drug (capreomycin, kanamycin, & amikacin) [24]. When strains are resistance to all first & second line anti –TB drug, then it is known as extremely drug resistant TB (XXDR-TB) or totally drug resistant TB (TDR-TB) [24].

Accurate & rapid detection of drug resistance are critical for improving patient care & decreasing the spread of TB. The main Drug Susceptibility Testing (DST) methods are absolute-concentration method & Proportion Method (PM) on Lowenstein-Jenson (L-J) medium, but both methods take some weeks for the results. Automation of culture using BACTEC MGIT 960 (M960) and Xpert MTB/RIF assay, which enables simultaneous detection of Mycobacterium Tuberculosis (MTB) &

Rifampicin (RIF) resistance are now widely used [26]. Xpert result that is positive for rifampicin resistance should be carefully interpreted & take into consideration the risk of MDR-TB for given patient with high prevalence for MDR-TB.

Paradoxical reaction: A patient with confirmed or probable skeletal TB on ATT, who initially improves & then subsequently has worsening of constitutional symptoms or signs of TB in the absence of another diagnosis or drug resistance, is paradoxical reaction. Features are same as for treatment like increased size of lesion, appearance of new lesions, recurrent fever & night sweat or development of another form of TB except that these show initial improvement. In drug-resistant cases, patient fails to improve or deteriorate from the start of ATT and shows no improvement until an effective second-line ATT regimen is started, whereas in paradoxical reaction, there is usually an initial improvement, followed by deterioration. In such patients, ATT should not be stopped or altered, but supplemented by NSAIDS & other supportive treatment, which are usually sufficient and patient usually begin to improve again [11].

Conclusion

Tuberculosis is common and endemic in India. Due to its varied clinical presentation and lack of characteristic radiographic findings, the diagnosis and treatment is delayed. Tuberculosis should be suspected in patients with signs and symptoms of joint infection with insidious onset and characteristic imaging findings along with presence of constitutional features and these patients should be investigated. The mainstay of treatment is antitubercular chemo-therapy and surgery is only adjunct and reserved for unresponsive cases.

References:

1. World Health Organization. Global tuberculosis report 2018. Geneva, Switzerland: World health organization. 2018. (https://www.who.int/tb/global-report-2019)
2. Norbis L, Miotto P, Alagna R, Cirillo DM. Tuberculosis: lights & shadows in the current diagnostic landscape. New Microbiol 2013;36:111-20.
3. Malaviya AN, Kotwal PP. Arthritis associated with tuberculosis. Best Pract Res Clin Rheumatol 2003;17:319-43.
4. Iademarco MF, Castro KG. Epidemiology of tuberculosis. Semin Respir Infect 2003;18:225-40.
5. Narang S. Tuberculosis of the entheses. Int Orthop 2012;36:2373-8.
6. Samuel S, Boopalan PR, Alexander M, Ismavel R, Varghese VD et al. Tuberculosis of and around the ankle. J Foot Ankle Surg. 2011;50:466-72.
7. Abdulaziz S, Almoallim H, Ibrahim A, Samannodi M, Shabrawishi M, et al. Poncet's disease (reactive arthritis associated with tuberculosis): retrospective case series & review of literature. Clin Rheumatol 2012;31:1521-28.
8. Sharma SK, Mohan A. Extrapulmonary tuberculosis. Indian J Med Res. 2004;120:316–353.
9. Walker GF. Failure of early recognition of skeletal tuberculosis. Br Med J 1968;1:682-3
10. Hsiao CH, Cheng A, Huang YT, Liao CH, Hsueh PR. Clinical & pathological characteristics of mycobacterial tenosynovitis & arthritis. Infection 2013;41:457-64.
11. Index TB Guidelines. Guidelines on extra-pulmonary tuberculosis for India. New Delhi, India: World Health Organization. 2016.(https://tbcindia.gov.in/showfile.php?lid=3245).
12. Sequeira W, Co H, Block JA. Osteoarticular tuberculosis: current diagnosis & treatment. Am J Ther 2000;7:393-8.
13. Hanza M. Joint & spine tuberculosis. Rev Rheum 1994;60:83-6.
14. Valdazo JP, Perez-Ruiz F, Albarracin A, Sanchez-Nievas G, Perez-Benegas J, et al. Tuberculous arthritis. Report of a case with multiple joint involvement & periarticular tuberculous abscesses. J Rheumatol 1990;17:399-401.

15. Enarson DA, Fujii M, Nakielna EM, Grzybowski S. Bone & joint tuberculosis: a continuing problem. Can Med Assoc J 1979;120:139-45.
16. Krama SB, Lee SHS, Abramson SB. Non-vertebral infections of musculoskeletal tuberculosis. In: Rom WN, Garay SM. Tuberculosis. 2nd edn. Newyork: Lippincott, William & Wilkins. 2004 pp577-591.
17. Martini M, Ouahes M. Bone & joint tuberculosis: a review of 652 cases. Orthop 1988;11:861-6.
18. Spiegel DA, Singh GK, Banskota, Ashok K. Tuberculosis of the musculoskeletal system. Tech Orthop 2005;20:167-78.
19. Wang MN, Chen WM, Lee KS, Chin LS, Lo WH. Tuberculous osteomyelitis in young children. J Pediatr Orthop 1999;19:151-5.
20. Tuli SM. Diagnosis & investigations. In: Tuli SM. Tuberculosis of the skeletal system. 4th ed. New Delhi:Jaypee 2010. pp34-37.
21. Ewer K, Deeks J, Alvarez L, et al. Comparison of T-cell-based assay with tuberculin skin test for diagnosis of Mycobacterium tuberculosis infection in a school tuberculosis outbreak. Lancet 2003;361:1168–73.
22. Brock I, Weldingh K, Lillebaek T, et al. Comparison of tuberculin skin test & new specific blood test in tuberculosis contacts. Am J Respir Crit Care Med. 2004;1;170(1):65-9.
23. Jain AK. The pathology of osteoarticular tuberculosis. In: Jain AK. Tuberculosis of bones, joints & spine. 1st ed. New Delhi:CBS 2017 pp38-40.
24. World Health Organization. Definitions & reporting framework for tuberculosis- 2013 revision. Geneva, Switzerland: World health organization. 2013. (WHO/HTM/TB/2013.2)
25. Zhao P, Fang F, Yu Q, et al. Evaluation of BACTEC MGIT 960 system for testing susceptibility of Mycobacterium tuberculosis to first-line drugs in China. PLoS One. 2014;9(9):e99659.
26. Lawn SD, Mwaba P, Bates M, Piatek A, Alex&er H, et al. Advances in tuberculosis diagnostics: the Xpert MTB/RIF assay & future prospects for a point-of-care test. Lancet Infect Dis 2013;13:349-61.
27. Jain AK. Bone infections In: Jain AK. Turek's Orthopaedics principle & their application. 7th ed. New Delhi:Wolters Kluwer 2016. pp296-97.
28. Tuli SM. Principles of management of osteoarticular tuberculosis. In: Tuli SM. Tuberculosis of the skeletal system. 4th ed. New Delhi:Jaypee 2010. pp59-62.

Trochanteric support plate with Dynamic Hip Screw, is this combination a feasible option in unstable trochanteric fractures?

Agarwal Y, Pathak A, Gaur S, Tiwari A, Verma R, Aher D

Investigation preformed at Gandhi Medical College, Bhopal

Abstract

Background: Dynamic Hip Screw (DHS) is the gold standard for stable trochanteric fractures and Proximal Intramedullary nail (IMN) is beneficial in treating intertrochanteric femur fractures with comminution and loss of lateral buttress. DHS augmented with trochanteric support plate can buttress the broken lateral trochanteric wall. Thus we conducted this study is to evaluate the role of the trochanteric support plate (TSP) with DHS in unstable trochanteric fractures.

Materials & Methods: 25 patients presenting with unstable trochanteric fractures treated with TSP with DHS were evaluated for intraoperative blood loss and duration of surgery. Functional outcome was assessed as per the Kyle's Criteria, Harris Hip Score, and ambulatory outcome.

Results: 21 patients with mean age of 67.14 years were available for study. The mean duration of surgery and blood loss was 100.5 minutes and 312 ml, respectively. All fractures, except 1 united. Nonunion occurred in 1 case due to screw cut out. Af final followup, all patients had excellent to good harris hip score and 91% had excellent Kyle's criteria, while 9% had good Kyle's criteria.

Conclusion: The DHS with trochanteric support plate is an acceptable alternate device for managing unstable intertrochanteric fractures with broken lateral wall. It's an easy, low cost, easily available and less demanding surgical procedure giving excellent results.

Keywords: Unstable trochanteric fractures, Broken lateral wall, Trochanteric support plate, Dynamic hip screw.

Address of correspondence:
Dr Abhishek Pathak,
Associate Professor,
Department of Orthopaedics,
Gandhi Medical College, Bhopal
Email – abhishek.dr@gmail.com

How to cite this article:
Agrawal Y, Pathak A, Gaur S, Tiwari A, Verma R, Aher D. Trochanteric support plate with dynamic hip screw, is this combination a feasible option in unstable trochanteric fracture?. Ortho J MPC. 2020;26(1):14-18
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/98

Introduction

Hip fractures are common injuries in the elderly, which are one of the major public health concerns leading to loss of function and prolonged disability [1]. Many patients never return to their pre-fracture activity level [2]. Non-operative treatment of an intertrochanteric (IT) fracture is rare nowadays and is used only in medically unfit patients, which may leads to coxa vara and shortening [3].

Early surgical fixation and mobilization are current recommendations for an optimal treatment of IT fracture patients [4]. Dynamic Hip screw (DHS) is the gold standard option available for stable trochanteric fractures [5,6]. But DHS has limited ability to prevent excessive sliding and medialization of the femoral shaft especially with unstable intertrochanteric fractures, which when treated has significantly higher reoperation rate when compared to those treated with Proximal Intramedullary nail (IMN) [7]. The use of IMNs is beneficial in treating unstable trochanteric femur fractures like comminution, loss of lateral buttress, reverse oblique fracture pattern and in osteoporotic patients [6-8]. But IMN is associated with higher complication rates, is technically demanding,

which requires more expertise to do in comparison to DHS [9-10]. Further IMN does not confer any advantages in terms of outcome and leads to higher treatment costs [11].

The combination of trochanteric support plate (TSP) with DHS makes a biomechanically stable construction which allows reconstruction of the lateral wall to maintain adequate lever arm and avoids femoral shaft medialization associated with DHS alone [12-13]. Thus we evaluated the role of the combination of trochanteric support plate (TSP) with DHS in management of unstable trochanteric fractures.

Materials and Methods

This prospective study was conducted during October 2015 to September 2017 on 25 patients of unstable intertrochanteric (IT) fractures presenting at our center, after obtaining approval from the institutional ethics committee. Out of these 25 patients, 2 patients died during follow up and 2 were lost to follow up, thus only 21 patients, who completed minimum follow up period for 6 months constituted the cohort.

Patients presenting with unstable trochanteric fractures with age more than 18 years were included in the study whereas patients with an open fracture, with previous history of hip surgery, with multiple fractures of the ipsi-lateral limb or pathological fracture were excluded from study. AO / OTA A1, A2 and A3 fractures with broken lateral wall cortex or lateral wall thickness < 2.24 cm as measured on X rays were graded as Unstable fractures and included for the study [14-18].

After obtained medical clearance, all patients were operated under the same spinal anesthesia on fracture table. Direct lateral approach to hip was used, same as that for DHS fixation with incision extending proximally 3-4 cm more, to negotiate the spoon-like part of the TSP on the DHS, to buttress it on to the lateral aspect of the greater trochanter. Firstly, guidewire insertion was done in the centro-inferior and center part of head of the femur in the anteroposterior and lateral fluoroscopic image, respectively. This was followed by insertion of appropriate size lag screw after triple reaming and then finally DHS with TSP barrel plate was coupled on lag screw. The spoon-like part of TSP was bent to fit the contours of the proximal femur. Additional cancellous screws or encirclage wire were applied through the TSP part in some cases for additional stability as per surgeon's discretion.

Postoperatively, all patients started with static quadriceps exercise immediately. Ambulation with non-weight bearing was started on the third postoperative day and progressed to partial weight bearing as soon as possible depending on the quality of bone, stability of biomechanical construction and tolerance of the patient. Patients were followed-up regularly at 1 month, 4 months, 6 months and 1 year postoperatively.

Outcome was assessed for blood loss, intraoperative and postoperatively for functional outcome and Union. Intraoperative blood loss was assessed by number of mops used and blood collected in suction [19]. Functional assessment was done as per harris hip score and Kyle's Criteria [20]. Fracture was said to be united clinically, when there was no pain and tenderness at the fracture site and the patient was able to bear full weight without any pain and radiological, when there was no fracture line visible on rays and there was presence of bridging callus across at least three cortices [21]. Statistical analysis was done by Fischer test and Chi-square test. Results were considered significant at p-value < 0.05.

Results

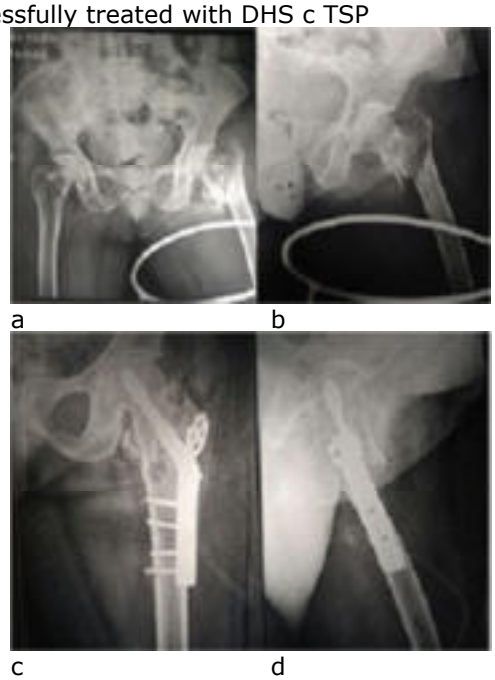
21 patients with mean age of 67.14 years (range 45 to 86 years) and male preponderance (Male: Female ratio 4:3) were included in study. Two-third of the patients had left side involved. Fall while walking was most common cause of injury seen in 90% of cases, whereas 4.8% was due to RTA and 4.7% due to fall from height. As per AO subtypes, A1.3, A2.1, A2.2, A3.1 and A3.2 were seen in 2,6,4, 4 and 5 cases respectively. There were 10 cases (47.6%) with intact lateral wall and 11 cases (52.4%)

with loss of lateral wall integrity. The mean delay in surgery from date of injury was 15.7 days (range 5 to 35 days).

The mean duration of surgery and blood loss was 100.5 minutes and 312 ml, respectively, which was found to be statistically significantly for both with p-value < 0.05 as found by Fisher exact statistical test. 2 out of 21 cases (9.5%) were found to have superficial infection, which healed with extended antibiotics.

Mean TAD (Tip Apex Distance) was 13.5 mm (range 6 to 28mm). Neck screws were placed at centro-centro position in 42%, centro-posterio in 42%, inferio-centro, inferio-posterior and centro-anterior position in each 4.7% cases. In one patient (4.7%) screw cut out occurred as the position was superior-anterior. Mean Collapse of lag screw was 6 mm (range 4 to 20mm). No leg-length discrepancy was seen in 38 % case, whereas 62% cases have shortening. Average shortening in these patients was 12.53 mm (range 5 to 25 mm).

Fig 1 – Preoperative pelvis AP (a) and lateral (b) X ray view and post op Hip AP (c) and lateral (d) view of a 60 years old patient with fracture IT successfully treated with DHS c TSP



a b

c d

All fractures united except one, in mean time of 21.6 weeks (fig 1). Nonunion as occurred in 1 case (4.75%) was due to screw cut out, which was converted to arthroplasty (fig 2). At 6 months follow up, 12 patients were able to walk without support and 8 patients were walking with support. One patient with cutout was non able to walk on the injured limb. At 6 months follow up, Harris Hip Score was found to be excellent in 28%, good in 38.1%, fair in 28% and poor in 4.76% (the one with the screw cut out) and Kyle criteria was excellent in 42.8%, good in 28% fair in 23.8% and poor in 4.76%.

Fig 2. Pre-operative X rays pelvis AP view (a) and post-operative AP view immediately (b) and 6 month (c) follow up showing failed fixation with cut off of lag screw.

a

b c

At one year follow up, all patients were walking without support and 50% had good Harris Hip Score and 50% had excellent Harris Hip Score. 91% had excellent Kyle's criteria while 9% had good Kyle's criteria.

Discussion

Intertrochanteric fractures are common fractures in all age groups leading to restriction of activity. Treatment of stable fracture is by Dynamic hip screw. But DHS in unstable fracture i.e. fracture with communittion, lateral wall broken or reverse oblique will lead to shortening, varus, medialization and cutout. TSP with DHS add buttress to the lateral wall and prevent these complications.

We treated 21 patients of unstable intertronchanteric fractures with TSP with DHS. The mean delay in surgery in our study was 15.7 days, which is quiet higher as compared to other studies which was 1 day to 3 days in known series [8,12,13,22]. This was because ours is referral center and the patients here present late. Secondly the old age patients took longer time to be stabilized before surgery.

In our series, mean duration of surgery and blood loss was 100.5 minutes and 312 ml, respectively, which is also higher than reported series (range 75 to 90 min and 210 to 240 ml). Obviously, since these patients presented us late and we operated then with mean delay of 15 days, it was difficult to achieve reduction close, which have increased the duration of surgery and the blood loss.

Average shortening in our patients was also slight more than the reported series i.e. 12.53 mm in our series compared to average of 8 mm in reported series, but this did not cause any functional impairment. In our series, 20 out of 21 fractures united, in mean time of 21.6 weeks, with all showing excellent results at end of one year as per Harris Hip Score and all able to walk without support. 91% had excellent Kyle's criteria while 9% had good Kyle's criteria. In spite of the delayed presentation and late surgery, the results in ours series were comparable to the reported series [8,12,13,22]. Nonunion as occurred in one of our case (4.75%) was due to screw cut out, which was due to superior placement of the lag screw, which had caused cutout and nonuion.

The study is limited by small sample size, lack of randomization and comparable groups. We suggest further comparative study with large group and longer follow-up studies to be done.

Conclusion

Treatment of unstable intertrochanteric fractures is reported to have high complication rate. The DHS with trochanteric support plate is an acceptable alternate device for managing unstable intertrochanteric fractures with excellent functional outcome even when these patients present late as seen in our series showing only one nonunion occurred out of twenty-one cases and no other major complication.

References

1. Trikha V, Rastogi S. Epidemiology and rehabilitation of hip fractures in the geriatric population. Int J Phys Med Rehab. 2005 Apr;16(1):16-9.
2. Hall SE, Williams JA, Senior JA, Goldswain PR, Criddle RA. Hip fracture outcomes: quality of life and functional status in older adults living in the community. Intern Med J. 2000 Jun 1;30(3):327-32.
3. Sidorowicz J, Gaździk T, Jaworski JM. Conservative treatment of trochanteric fractures in the elderly. Wiad Lek. 1998;51(9-10):419-23. (article in polish)
4. Siu AL, Penrod JD, Boockvar KS, Koval K, Strauss E, Morrison RS. Early ambulation after hip fracture: effects on function and mortality. Arch Intern Med. 2006 Apr 10;166(7):766-71.
5. Socci AR, Casemyr NE, Leslie MP, Baumgaertner MR. Implant options for the treatment of intertrochanteric fractures of the hip. Bone Joint J. 2017 Jan 1;99(1):128-33.
6. Mittal R, Banerjee S. Proximal femoral fractures: principles of management and review of literature. J Clin Orthop Trauma. 2012 Jun 30;3(1):15-23.
7. Mokawem M, Bobak P, Aderinto J. The management of pertrochanteric fractures of the hip. Orthop Trauma. 2012 Apr 30;26(2):112-23.
8. Kumar R, Singh RN, Singh BN. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. J Clin Orthop Trauma. 2012 Jun 30;3(1):28-36.
9. O'Brien PJ, Meek RN, Blachut PA, Broekhuyse HM, Sabharwal S. Fixation of intertrochanteric hip fractures: gamma nail versus dynamic hip screw. A randomized, prospective study. Canadian J Surg (J canadien de chirurgie) 1995 Dec;38(6):516-20.

10. Penugonda RS, Vanga A, Gangireddi S, Seetam RS. Comparative study between proximal femoral nailing and dynamic hip screw in the management of intertrochanteric fractures of femur. J Evid Based Med Healthc. 2015 Feb 2;2(5): 541-50.
11. Page PR, Lord R, Jawad A, Dawe E, Stott P, Rogers B, Gill R. Changing trends in the management of intertrochanteric hip fractures – A single centre experience. Injury. 2016 Jul 31;47(7):1525-9.
12. Gupta RK, Sangwan K, Kamboj P, Punia SS, Walecha P. Unstable trochanteric fractures: the role of lateral wall reconstruction. Int Orthop. 2010 Jan 1;34(1):125-9.
13. Madsen JE, Naess L, Aune AK, Alho A, Ekeland A, Strømsøe K. Dynamic hip screw with trochanteric stabilizing plate in the treatment of unstable proximal femoral fractures: a comparative study with the Gamma nail and compression hip screw. J Orthop Trauma. 1998 May 1;12(4):241-8.
14. Babst R, Martinet O, Renner N, Rosso R, Bodoky A, Heberer M, Regazzoni P. The dynamic hip screw support plate for management of unstable proximal femoral fractures. Helv Chir Acta. 1993 Mar;59(4):521-5.
15. Gotfried Y. The lateral trochanteric wall: a key element in the reconstruction of unstable pertrochanteric hip fractures. Clin Orthop Relat Res. 2004 Aug 1;425:82-6.
16. Geissler N, Meffert O, Stapel A, Heymann H. Results of surgical management of unstable pertrochanteric femoral fractures with the dynamic hip screw and T-plate. Unfallchirurgie. 1994 Apr;20(2):72-5.
17. Hsu CE, Chiu YC, Tsai SH, Lin TC, Lee MH, Huang KC. Trochanter stabilising plate improves treatment outcomes in AO/OTA 31-A2 intertrochanteric fractures with critical thin femoral lateral walls. Injury. 2015 Jun 30;46(6):1047-53.
18. Ghattas PJ. Objective measures for estimating intraoperative blood loss. In 2012 Ann Meet Am Osteopathic Aca Orthop. Colorado Springs, Colorado 2012 Oct (pp. 25-28).
19. Corrales LA, Morshed S, Bhandari M, Miclau III T. Variability in the assessment of fracture-healing in orthopaedic trauma studies. J Bone Joint Surg Am. 2008 Sep 1;90(9):1862-8.
20. Kyle RF, Gustilo RB, Premer RF. Analysis of six hundred and twenty-two intertrochanteric hip fractures. Orthop Trauma Directs 2010 Nov;8(6):25-9.
21. Kempf I, Grosse A, Taglang G, Favreul E. Gamma nail in the treatment of closed trochanteric fractures. Results and indications of 121 cases. Revue de chirurgie orthop et reparatrice de l'appareil moteur. 1993;79(1):29-40.
22. Cho SH, Lee SH, Cho HL, Ku JH, Choi JH, Lee AJ. Additional fixations for sliding hip screws in treating unstable pertrochanteric femoral fractures (AO type 31-A2): short-term clinical results. Clin Orthop Surg. 2011 Jun 1;3(2):107-13.

Is It Worthy To Replace Hip Than To Go For Intramedullary Osteosynthesis In Unstable Intertrochantric Fractures In Elderly- A Prospective Comparative Study

Sabir AB, Mohan R, Faizan M, Jilani LZ, Ahmed S, Shaan ZH

Investigation preformed at Jawahar Lal Nehru Medical College, Aligarh Muslim University, Aligarh

Abstract

Background: Internal fixation for the management of unstable intertrochantric femoral fractures in elderly is difficult and less successful due to communition and poor bone stock. Arthroplasty for unstable intertrochantric fracture in elderly has produced promising results as per literature. So, we conducted this study to compare the results of intramedullary devices with cemented bipolar hemiarthroplasty in unstable osteoporotic intertrochanteric fractures in elderly patients.

Material & methods: 51 patients, 65 years or older with unstable osteoporotic intertrochanteric femoral fractures were treated with internal fixation or hemiarthroplasty. Intraoperative parameters and functional outcome as per Harris Hip Score were compared.

Results: Average age of patients for intramedullary fixation and arthroplasty was 73 ± 6 years and 75 ± 6.5 years respectively. Average delay in surgery for group A (PFN) and group B (hemiarthroplasty) was 5.7 days and 6.56 days, mean duration of surgery was 75 min (range 45 to 125) and 95 min (range 70 to 132), mean blood loss was 180ml (range 150 to 280) and 270 ml (range 250 to 420) respectively. Harris hip score at one year were better in arthroplasty group but almost comparable at two year.

Conclusion: Primary arthroplasty provides a stable, painless and reasonably functional joint, which provided early mobility and rehabilitation and hence is a better way of managing an osteoporotic unstable intertrochanteric fracture in elders especially. However, overall long term functional outcomes are almost similar for two groups.

Keywords: Intertrochanteric fracture, Internal fixation, Arthroplasty, Harris Hip Score

Address of correspondence:
Dr. Mohd Faizan,
Assistant Professor,
Department of Orthopaedics Surgery,
Jawahar Lal Nehru Medical College,
Aligarh Muslim University, Aligarh
Email – mohdfaizan2002@gmail.com

How to cite this article:
Sabir AB, Mohan R, Faizan M, Jilani LZ, Ahmed S, Shaan ZH. Is It Worthy To Replace Hip Than To Go For Intramedullary Osteosynthesis In Unstable Intertrochantric Fractures In Elderly- A Prospective Comparative Study. Ortho J MPC. 2020;26(1):19-23
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/99

Introduction

Incidence of intertrochanteric (IT) fracture, which is common in elderly population, is increasing due to the improved healthcare facilities and life expectancy [1,2]. Stable intertrochanteric fractures can be adequately managed by osteosynthesis i.e. internal fixation and early rehabilitation with reasonably good results [3]. But osteoporosis (as common in elderly) and unstable IT (lateral blow out, subtrochanteric, comminuted) fractures are two of the most important variables leading to poor functional outcome [4-6].

Management of these unstable intertrochanteric fractures is controversial and challenging because of poor bone stock, osteoporosis and other underlying comorbid conditions [4]. Although, osteosynthesis with help of fixed nail plate, trochanteric stabilizing plate with dynamic hip screw (TSP with DHS) or proximal intramedullary interlocking nail

(PFN) is described for these unstable fractures, but none of them ensures absolute fracture stability and complete bone union in elderly patients [4-7]. Reasons are many like, in comminuted fractures stabilization and fixation of all pieces is not possible, PFN not very appropriate for Indian population because of anthropometric variations of proximal femur, difficulty in placement of femoral neck screws at correct position and the most importantly, all these fixation require prolonged immobilization specially in osteoporotic bones with weak fixation. Management of such cases with primary cemented hemiarthroplasty allows patient to ambulate early, thus avoiding most of the complications related to immobilization [7-9].

Many series are published on results obtained with fixation or with hemiarthroplasty in unstable intertrochanteric fracture. But none of the studies compared the outcome of two modalities of treatment i.e. fixation and hemiarthroplasty. Hence we conducted this prospective study to compare the functional results of internal fixation and hemiarthroplasty in unstable intertrochanteric fractures.

Material and Methods

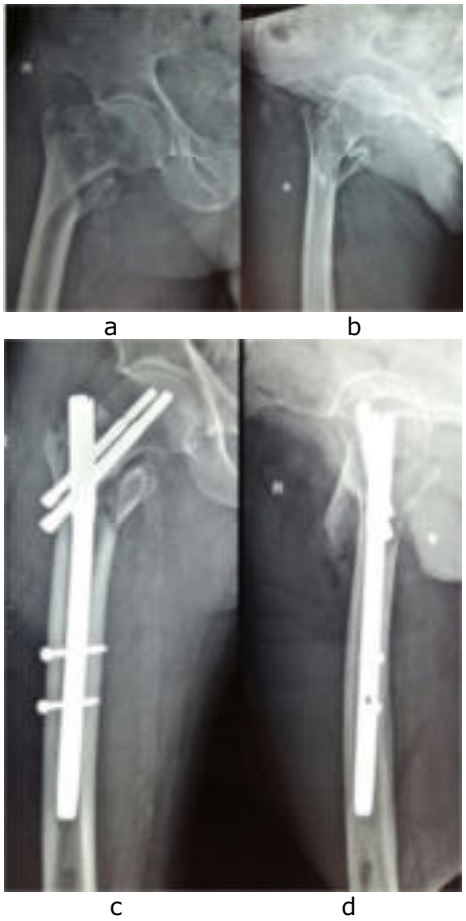
This prospective study is done in 51 patients of intertrochanteric fracture (unstable, comminuted, osteoporotic, trochanteric nonunion and failure of fixation) which were treated at our center by internal fixation (26 patients) or with hemiarthroplasty (25 patients) from 2012 to 2016. Institutional ethical clearance and written informed consent was obtained.

All patients with age more than 65 years with unstable, comminuted, osteoporotic, nonunion or fixation failure of intertrochanteric fracture, who were able to walk unassisted before fracture were included in the study. Open fracture, history of hip arthritis, pathologic fractures and bilateral fractures were excluded from study.

All patients were admitted and after a preoperative workup and anesthetic fitness were planned for surgery. Comorbidities were noted and DEXA scan was done in all patients to see the level of osteoporsis. The patients were randomized into two groups as per odd or even. Intramedullary fixation with PFN was done in group A (odd) and hemiarthroplasty with cemented bipolar prosthesis in group B (even).

In group A (PFN), cephalomedullary (Proximal femoral nail) nailing was done by standard method. After achieving closed reduction on fracture table, a trochanteric entry was made and guide wire introduced. This was followed by sequential reaming and passage of proper size nail and then finally both proximal and distal locking done (fig 1).

Fig 1. Pre-operative AP (a) and lateral (c) x rays and post-operative AP (c) and lateral (d) xrays of IT fracture treated by intramedullary nailing in group A



In group B (hemiarthroplasty), all patients were operated in lateral decubitus position via posterior approach. After posterolateral incision and incising tensor fascia lata, the fractured head was dislocated by lifting the trochantric fragment attached with short external rotators (without cutting the rotators). This was followed by femoral canal

preparation, rasping and insertion of proper size cemented bipolar prosthesis with adequate anteversion. Calcar was reconstructed with cement where it was deficient. Greater trochanter was repaired with stainless steel wire or ethibond suture depending on communition (fig 2).

Fig 2. X ray pelvis AP view pre-operative (a) & post-operative (b) of communited IT fracture showing hemiarthroplasty with cemented bipolar and trochantric reconstruction with tension band wire

a b

Postoperatively, range of motion exercises were started from second post-operative day. Toe touch and partial weight bearing was allowed from the third and seventh post-operative day respectively. Full weight bearing was started as per patient pain tolerance. Patients were followed by regularly at regular intervals and outcome assessment was done at final follow up of 12 month using Harris hip scoring system and radiologically by plain radiographs.

Results

A total of 51 patients with 26 in group A (PFN) and 25 in group B (hemiarthroplasty) with mean age 78 years (range 65 to 83) were included in study. Mean follow-up was 3.5 years (range 1.5 to 4). Left side (87.5%) involvement is more than right side (12.5%). Out of 26 patients in group A, 18 were females (69.23%) and 8 were males (30.67%) and in group B 18 were females (72%) and 7 were males (28%). All the fractures belonged to unstable type of fractures. 43% patients were hypertensive, 17.5% were diabetic, 14.5% had cardiac problems and only 25% cases were without any medical comorbidity. DEXA scan showed osteoporosis in 75% and osteopenia in 25% cases.

Average delay in surgery for group A (PFN) and group B (hemiarthroplasty) was 5.7 days and 6.56 days, mean duration of surgery was 75 min (range 45 to 125) and 95 min (range 70 to 132), mean blood loss was 180 ml (range 150 to 280) and 270 ml (range 250 to 420) respectively, with p value <0.05 indicating that blood loss for hemiarthroplasty was significantly more (table 1).

The mean hospital stay was 10 days (range 7 to 21) in group A and 22 days (range 14 to 30 days) in group B. In group A, 16 patients (61.5%) were discharged within a week after first wound inspection, 6 patients (23.07%) after stitch removal after 2 weeks and 4 patients discharged after 3 weeks due to superficial wound inspection. In group B, 12 patients (48%) discharged from hospital within a week of operation and 10 patients (40%) after stitch removal on 2 weeks, 3 patients (12%) discharged after 30 days because of superficial wound infection. In group A, weight bearing was started at mean 48 days (range 42 to 56), whereas in group B mean 8 days (range 5 to 14), hence there was significant statistical difference between time to achieve full weight bearing.

The mean Harris Hip score at 6 weeks were 56.2 and 78.1, at 3 month was 74.53 and 85.87 and at last follow up at 2 years was 87.5 and 88.90 in group A and group B respectively (table 2). Regarding complication, 1 patient in group A had Z-effect; dislocation was seen in 1 patient in group B, whereas superficial infection was seen in two cases, one from each group.

Table 1 - Outcome difference in group A and B.

Parameters	Group A (PFN)	Group B (Hemiarthroplasty)
Mean delay in surgery (days)	5.7	6.56
Duration of surgery (Min.)	75	s95
Blood loss (ml)	180	270
Full weight bearing (days)	48	4
Hospital stay (days)	9	15

Table 2 – Mean Harris Hip Score in both groups

Duration	Group A	Group B
3rd day	45.30	47.00
2 weeks	48.20	58.61
6 weeks	56.20	78.10
3 months	74.53	85.87
2 years	87.50	88.90

Discussion

Outcome of osteoporotic, comminuted, unstable intertrochanteric fracture depends on bone stock, patient age, general health profile, co-morbidities, interval between injury and type of surgery and fixation [4-7].

Treatment of intertrochanteric fractures can be by osteosynthesis or hemiarthroplasty [4-10]. In elderly osteoporotic fractures, osteosynthesis can be difficulty without immobilization because of poor fixation, as cut out of hardware can be a complication with early mobilization [4-7,11]. Hemiarthroplasty, allows early mobilization but is technically demanding the in intertrochanteric fractures [7-9]. We compared the outcome of osteosynthesis by PFN and hemiarthroplasty by cemented bipolar in unstable intertrochanteric fractures in 51 patients, We found that, although the blood loss was significantly higher in hemiarthroplasty group, but the hospital stay, time to full weight bearing mobilization and early Harris hip score was better in hemiarthroplasty group as compared to PFN group. The functional outcome at final follow-up of 2 years was comparable in our study in both the groups.

Peifu tang et al compared both methods hemiarthroplasty and PFNA in IT fracture and found higher complication in hemiarthroplasty group and in elderly patients PFNA was superior to hemiarthroplasty [12]. Our results of current study are contrary to their study but are in accordance with study by Haentjens et al who compared results of internal fixation and bipolar arthroplasty for comminuted and unstable trochanteric fractures [13]. They showed 75% satisfactory results and less postoperative complications in hemiarthroplasty group due to early weight bearing in this group. Others also emphasized the ability of early mobilization by hemiarthroplasty done for osteoporotic unstable intertrochanteric fracture, as seen in our study, where hemiarthroplasty patients were full weight bearing mobilized in mean 8 days compared to 48 days in PFN group [7-9,14-19].

Overall failure rates in internal fixation of IT fracture ranges from 18%-40%, which is further higher in elderly with unstable fractures [20]. The incidence of screw cutout is about 14%. The low rate of cutout in our study is due to fact that we placed the neck screw in central position in both the views as recommended [20,21]. Further these patients in PFN, had late full weight bearing mobilization, which prevented cutout. Our study, also had low dislocation rate as compared to Woo and Morrey and Vahl AC et al because we did not cut the rotators and proper tense closure was achieved and augmented when needed [18,22].

Conclusion

Hemiarthroplasty for unstable osteoporotic, unstable, comminuted intertrochanteric fractures allows early rehabilitation and full weight bearing walk, which prevents the complication of non-ambulation and makes the post-operative period comfortable and easy for the patient and attendants. But the procedure is limited by higher implant cost, greater blood loss, dislocation, restriction regarding squatting and cross-legged position.

References

1. Dahl E. Mortality and life expectancy after hip fractures. Acta Orthop Scand. 1980; 51(1):163-70.
2. Grisso JA, Kelsey JI, Strom BL, Chio GY. Risk factors for falls as a cause of hip fractures in women. N Engl J Med. 1991;324:1326-31.
3. Rosenblum SF, Zuckerman JD, Kummer FJ, Tam BS. A biomechanical evaluation of the gamma nail. J Bone Joint Surg Am. 1992;74(3):352-7.
4. Heyse-Moore GH, MacEachen AC, Jameson Evans DC. Treatment of trochanteric fractures of the femur. J Bone Joint Surg Br. 1983;65:262-7.
5. Dimon JH, Hughston JC. Unstable intertrochanteric fractures of hip. J Bone Joint Surg Am. 1967;49-A:440-50.

6. Kaufer H. Mechanics of the treatment of hip injuries. Clin Orthop Relat Res. 1980;146:53–61
7. Kyle RF, Gustilo RB, Premer PF. Analysis of Six hundred and Twenty–two intertrochanteric Hip Fractures. J Bone Joint Surg Am. 1979;61: 216-21.
8. Sturt G. Bipolar prosthetic replacement for the management of unstable intertrochanteric fractures in the elderly. Clin Orthop Relat Res. 1987;224:169-77.
9. Cleas H, Broos P, Stappaerts K. Pertrochanteric Fractures in Elderly patient Treatment with Ender's nail, blade-plate or endoprosthesis? Injury. 1985;16(4):261-64.
10. Sarmeinto. Intertrochanteric fractures of femur 150-degree angle nail plate fixation and early rehabilitation, a preliminary report of 100 cases. J Bone Joint Surg Am. 1963;45:706-722.
11. Morihara T, Arai Y, Tokugawa S, Fujita S, Chatani K, Kubo T. Proximal femoral nail for treatment of trochanteric femoral fractures. J Orthop Surg 2007;15(3):273-7.
12. Tang P, Hu F, Shen J, Zhang L, Zhang L. Proximal femoral nail antirotation versus hemiarthroplasty: A study for treatment of intertrochanteric fractures. Injury. 2012;43(6) :876-81.
13. Haentjens P, Casteleyn PP, De Boeck H, Handelberg F, Opdecam P. Treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. Primary bipolar arthroplasty compared with internal fixation. J Bone Joint Surg Am 1989;71:1214–25.
14. Grimsrud C, Monzon RJ, Richman J, Ries MD. Cemented hip arthroplasty with a novel circlage technique for unstable intertrochanteric hip fractures. J Arthroplasty 2005;20:337–43.
15. Kim SY, Kim YG, Hwang JK. Hemiarthroplasty compared with intramedullary fixation of unstable intertrochanteric fractures: J Bone Joint Surg Am. 2005;87:2186-92.
16. Tronzo RG. The use of an endoprosthesis for severly comminuted trochanteric fractures. Orthop Clin North Am. 1974;5:679-81.
17. Stern MB, Angerman A. Comminuted intertrochanteric fractures treated with a Leinbach prosthesis. Clin Orthop Relat Res 1987;218:75–80.
18. Vahl AC, Dunki Jacobs PB, Parka P. Haarman HI. Herniarthroplasty in elderly, debilitated patients with an unstable femoral fracture in the trochanteric region. Acta Orthop Belg 1994;60:274-9.
19. Ain MC, Andres BM, Somel DS, Fishkin Z, Frassica FJ. Total hip arthroplasty in skeletal dysplasias: patient selection, preoperative planning and operative technique. J Arthroplasty 2004;19:1-7.
20. Davis TR, Sher JL, Horsman A, Simpson M, Porter BB, Checketts RG. Intertrochanteric femoral fractures. Mechanical failure after internal fixation. J Bone Joint Surg Br 1990;72:26–31.
21. Chang WS, Zuckerman JD, Kummer FJ, Frankel VH. Biomechanical evaluation of anatomic reduction versus medial displacement osteotomy in unstable intertrochanteric fractures. Clin Orthop Relat Res 1987;225:141–6.
22. Woo RY, Morrey BF. Dislocations after total hip arthroplasty, J Bone Joint Surg Am 1982;64:1295-301.

Comparative Study between Minimally Invasive Percutaneous Plate Osteosynthesis and Open Reduction Internal Fixation For Management Of Proximal Humerus Fracture

Choudhari P, Verma A, Jain N

Investigation preformed at Shri Aurobindo Medical College, Indore

Abstract

Background: Fractures of the proximal humerus comprise nearly 4% of all fractures and 26% of fracture of humerus. Surgical options ranges from open reduction internal fixation (ORIF), intramedullary device fixation, external fixation to hemi arthroplasty. We compared the clinical and radiological outcomes of minimal invasive plate osteosynthesis (MIPO) and open reduction and internal fixation (ORIF) in patients with proximal humerus fractures.

Material & Methods: This prospective study included 24 patients with 2 part and 3 part proximal humerus fracture treated with ORIF or MIPO technique, with 12 patients in each group. A matched pair analysis was performed and patients were followed up for 3 months, 6 months and 12 months both radiographically and clinically using Constant and Murley score.

Results: The average of patients was 47.2 years. Average blood loss and mean duration of surgery was 287.50 ml and 102.9 mins, in ORIF group and 198.33 ml and 93.75 mins in MIPO group. The mean Constant Murley Score at 12 months in the MIPO group was 77.00, while in the ORIF group it was 72.33. MIPO group experienced significantly less pain, higher satisfaction in activities of daily living, and greater range of motion. In the MIPO group, only one patient had infection whereas in ORIF group three patients, had complications with one each having infection, varus collapse and malunion

Conclusion: The use of MIPO with a locking compression plate in the management of proximal humerus fractures is a safe and superior option compared to ORIF.

Keywords: Proximal humerus, minimally invasive plate osteosynthesis (MIPO), locking compression plate

Address of correspondence:
Dr. Pradeep Choudhari,
Professor,
Department of Orthopaedics,
Aurobindo Medical College, Indore
Email –
pchoudhari@rediffmail.com

How to cite this article:
Choudhari P, Verma A, Jain N. Comparative Study between Minimally Invasive Percutaneous Plate Osteosynthesis and Open Reduction Internal Fixation For Management Of Proximal Humerus Fracture. Ortho J MPC. 2020;26(1):24-29.
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/100

Introduction

Fracture of the proximal humerus is the third most common fracture, which accounts for 5% to 9% of all fractures [1]. Treatment of complex fracture patterns (two, three or four part) of the proximal humerus is still a challenging and controversial problem, which can ranges from non-operative management, percutaneous fracture fixation, open reduction and internal fixation (ORIF), and arthroplasty [2-6]. But osteoporosis-related proximal humeral fracture requires better methods of fixation to decrease the complications associated with fixation failure and long-term immobilization [7-9]. With the introduction and improved design of locking plate, closed manipulative reduction (CMR) technique and minimal invasive technology, the outcome in these fractures in osteoporosis has improved.

Although minimal invasive plate osteosynthesis (MIPO) and open reduction and internal fixation (ORIF) show difference in outcomes and complications in the treatment of proximal humerus fractures, but it remains unclear whether MIPO is superior to ORIF [10-13]. Thus the goal of this study was to evaluate the clinical efficacy of CMR techniques combined with MIPO and to compare it with ORIF in the treatment of proximal humeral fractures.

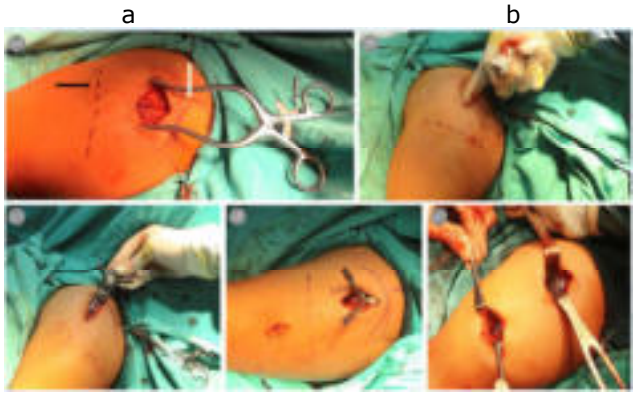
Materials & Methods

This is a prospective randomized comparative study was conducted at our center on 24 patients of proximal humerus fracture presenting from December 2016 to August 2018. Before including them in this study, informed consent and institutional ethical committee clearance was obtained.

All skeletally mature patients with Neer's type II or III displaced proximal humerus fractures were included in the study. Pathologic fractures, open fractures or with associated neurovascular injury or poly trauma were excluded from study. All fractures were classified using NEER'S classification and were randomized to receive treatment either by MIPO or ORIF, both of which was done under brachial block or general anesthesia in supine position [14].

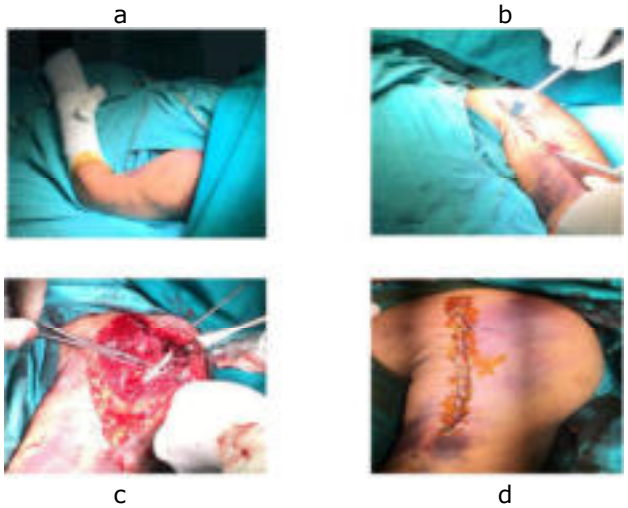
In MIPO surgery, the first step was closed manipulative reduction (CMR) following which a longitudinal skin incision was given from the lateral edge of the acromion and extending distally for about 3-4 cm. On deep dissection, the deltoid musculature was split along its fibers and greater tuberosity was exposed. Proximal humerus locking plate was inserted along the humeral shaft proximally to distally. The plate was positioned just beneath between the periosteal preventing the axillary nerve. Plate position was assessed fluoroscopically. When C-arm fluoroscopy showed the correct relative position of the plate and fracture, the proximal five to six locking screws were placed into the head and with a 2 cm-long incision distally over the distal holes in plate three or four screws were placed onto the humeral shaft (fig 1).

Fig 1 – Intra-operated photo (a to e) showing minimal invasive plate osteosynthesis technique (MIPO)



For ORIF group, standard deltopectoral approach was used between pectoralis major and deltoid and the proximal humeral fracture was exposed and reduced directly. After confirming of satisfactory reduction by C-arm perspective, an appropriate length of the proximal humeral locking plate was selected and placed on the lateral aspect of the greater tuberosity and fixed with locking screws into the humeral head and shaft (fig 2). Post-operatively, shoulder was immobilized by shoulder immobilizer for three days; thereafter patients were encouraged to start passive shoulder exercises and then slowly full range of motion as per pain tolerance of patient.

Fig 2 – Intra-operated photo (a to d) showing open reduction and internal fixation (ORIF) via deltopectoral approach



Both MIPO and ORIF groups were compared for intraoperative parameters surgical incision length, blood loss and operative time. Clinical and radiological assessment was done regular intervals at 6, 10, 14 weeks and six months postoperatively. Union was said when clinically there was no pain or tenderness and radiologically, when bridging callus was present at fracture site in at least three cortexes in both views. At the final follow-up, the functional outcome was evaluated using the Constant- Murley score.

Fig 3 – Shoulder and arm AP view pre-operative (a), immediate postoperative (b), and at one year follow-up (c) of proximal humerus fracture treated with ORIF and locking plate. Clinical photo (d to e) showing good results.

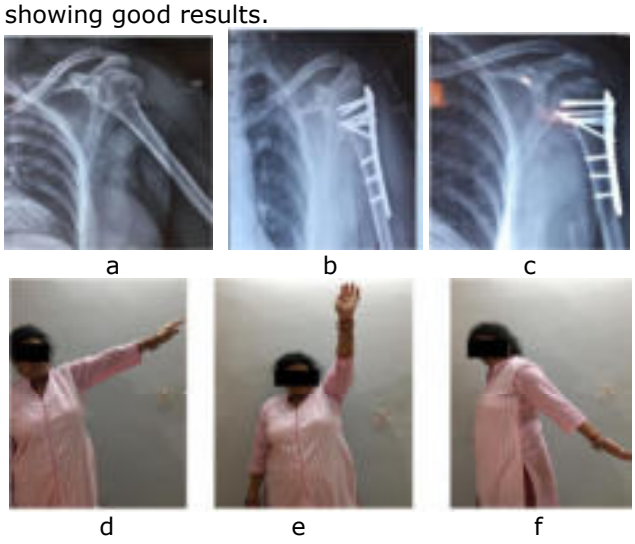
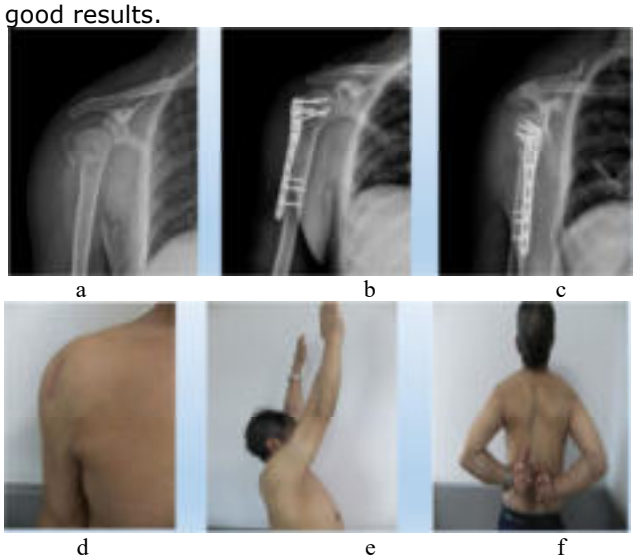


Fig 4 – Shoulder and arm AP view pre-operative (a), immediate postoperative (b), and at one year follow-up (c) of proximal humerus fracture treated with MIPO technique. Clinical photo (d to f) showing good results.



Results

A total of 24 patients, were included in the study, with 12 patients in each groups of MIPO and ORIF. The overall average age was 47.2 years with average age in the MIPO group to be 45.33 years and 50.25 years in the ORIF group (table 1). As per Neer classification, there were 7 (58.3%) cases of type II fractures and 5 (41.7%) of type III fractures in the MIPO group, while the ORIF group included 4 (33.3%) cases of type II fractures and 8 (66.7%) cases of type III fractures. There was no significant difference between the MIPO and ORIF group in gender, age and Neer type of fractures.

There were significant differences between the two groups in volume of blood loss and operative time. Compared with the ORIF group which had an average of 287.50ml of blood loss and 102.9 min of mean surgery time, the MIPO group had less blood loss with an average of 198.33 ml and shorter operation time with an average of 93.75 minutes, both of with was significant with p value <0.05 (fig 3 & 4).

The Constant score was higher in the MIPO group at 3 and 6 month follow-up compared to the ORIF group. In addition, patients in the MIPO group experienced significantly less pain, higher satisfaction in activities of daily living, and greater range of motion at the 3 and 6 months follow-up ($p < 0.05$). Although, the level of strength was not significantly different at same time ($p > 0.05$).

The mean Constant Murley Score at 12 months in the MIPO group was 77.00 ± 4.75, while in the ORIF group it was 72.33 ± 8.00, which was not statistically significant ($p>0.05$). In the MIPO group, only one patient had infection whereas in ORIF group three patients, had complications with one each having infection, varus collapse and malunion (table 1).

Table 1 – Comparison of results of MIPO and ORIF (MIPO – minimal invasive plate osteosynthesis / ORIF – open reduction and internal fixation)

	MIPO	ORIF	p value
Total patients	12	12	-
Mean age (years)	45.33	50.25	
Male Female	8 (66%) 4 (33%)	7 (58%) 5 (41%)	-
Right Left	7 (58%) 5 (41%)	6 (50% 6 (50%)	-
Mode of injury a. Fall from height b. Vehicle accident c. Self-fall	 1 (8%) 5 (41%) 6 (50%)	 1 (8%) 7 (58%) 4 (33%)	
Neer's classification a. Two part b. Three part	 7 (58%) 5 (41%)	 4 (33%) 8 (66%)	
Intra-operative parameter a. Mean Surgical Time (min) b. Mean Blood Loss (ml)	 93.7 198.33	 102.9 287.5	 0.007 0.006
Mean Union time (weeks)	11.0	11.92	0.13
Constant Murley score a. Poor (<55) b. Moderate (56- 70) c. Good (71-85) d. Excellent (>85)	77.00 0 (0%) 1 (8%) 11 (91%) 0 (0%)	72.3 0 (0%) 2 (16%) 10 (83%) 0 (0%)	 0.096
Complications a. None b. Malunion c. Infection d. Varus collapse	 11 (91%) 0 (0%) 1 (8%) 0 (0%)	 9 (75%) 1 (8%) 1 (8%) 1 (8%)	

Discussion

Proximal humerus fractures are common fractures and treatment should concentrate on maximizing the functional outcomes with minimal pain and disability [2-7]. In the present study, we compared the outcome of proximal humerus fractures treated with MIPO and ORIF in comparable groups with no significant differences between the groups in gender, age and Neer's type of fracture.

Intra-operative parameters (duration of surgery, blood loss), post-operative functional outcome and union time of MIPO group was better than that of ORIF, which was statistically significant. Although, the functional outcomes of these two groups as evaluated by Constant-Murley scores showed that MIPO brought better results than ORIF but the difference was not significant at one year follow up.

Further the postoperative complications like infection, varus collapse and malunion were lesser in MIPO group. In our study, in MIPO group also, few postoperative complications occurred, including superficial infection, numbness of anterior edge skin, and slight pain. Many reported cases treated with this technique had similar complications [15-19].

Superior result of MIPO over ORIF, as seen by our and other studies is due to decreased surgical trauma to the soft tissue and preservation of periosteal circulation in MIPO [20]. This could also lead to higher complications like nonunion, necrosis, pain and infections in ORIF group as compared to MIPO group, which is also supported by many reports [7,15-19]. The better outcome and lower complications of the MIPO group may be either due to the fact that there was better reduction with less operative time, or to the fact that less damage is caused to the blood supply of the fracture fragments [13,21,22]. The MIPO technique may retain more osteogenic fracture healing factors at the fracture site than ORIF [23].

Conclusion

Our study shows that MIPO with LCP requires less surgery time, causes less blood loss, shortens hospital stay, results in less scarring,

and is cosmetically more appealing and acceptable to female patients compared to ORIF. Further, MIPO provides better functional results and has less morbidity at one year follow-up, although our study is limited by a lesser number of patients.

References

1. Badman BL, Mighell M. Fixed-angle locked plating of two, three and four-part proximal humerus fractures. J Am Acad Orthop Surg 2008;16:294–302.
2. Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. Injury 2006;37:691–7.
3. Berkes MB, Little MT, Lorich DG. Open reduction internal fixation of proximal humerus fractures. Curr Rev Musculoskelet Med 2013;6(1):47–56.
4. Bjorkenheim JM, Pajarinen J, Savolainen V. Internal fixation of proximal humeral fractures with a locking compression plate: a retrospective evaluation of 72 patients followed for a minimum of 1 year. Acta Orthop Scand 2004;75:741–5.
5. Niemeyer P, Hauschild O, Strohm PC, Muller Ch A, Sudkamp NP, Kostler W. Fracture treatment in the elderly. Acta Chir Orthop Traumatol Cech 2004;71:329–38.
6. Shrader MW, Sanchez-Sotelo J, Sperling JW, Rowland CM, Cofield RH. Understanding proximal humerus fractures: image analysis, classification, and treatment. J Shoulder Elbow Surg 2005;14:497–505.
7. Grawe B, Le T, Lee T, Wyrick J. Open Reduction and Internal Fixation (ORIF) of Complex 3 and 4 Part Fractures of the Proximal Humerus: Does Age Really Matter? Geriatr Orthop Surg Rehabil 2012;3(1):27–32.
8. Solberg BD, Moon CN, Franco DP, Paiement GD. Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome. J Orthop Trauma 2009;23:113–19.
9. Edelstein Y, Ohm H, Rosen Y. Metallosis and pseudotumor after failed ORIF of a humeral fracture. Bull NYU Hosp Jt Dis 2011;69(2):188–91.
10. Lau TW, Leung F, Chan CF, Chow SP. Minimally invasive plate osteosynthesis in the treatment of proximal humeral fracture. Int Orthop 2007;31:657–64.
11. Liu J, Li SH, Li ZH, Wang JG, Yang CX, Zhang L, et al. Case-control study on minimally invasive percutaneous new plate osteosynthesis applied in proximal humerus fractures in elder patients. Zhongguo Gu Shang 2013;26:4–8.
12. Ku YW. Integration of traditional Chinese and western medicine in the treatment of old limb fracture: report of 94 cases. Chin Med J (Engl) 1978;4:476–80.
13. Wan Hazmy CH, Maizuliana SH, Mastura M, orazlina M. Adequacy of pain relief in closed manipulative reduction of fracture and dislocation. Med J Malaysia 2006.
14. Majed A, Macleod I, Bull AM, Zyto K, Resch H, Hertel R, et al. Proximal humeral fracture classification systems revisited. J Shoulder Elbow Surg 2011;20:1125–32.
15. Olerud P, Ahrengart L, Ponzer S, Saving J, Tidermark J. Internal fixation versus nonoperative treatment of displaced 3-part proximal humeral fractures in elderly patients: a randomized controlled trial. J Shoulder Elbow Surg 2011;20:747–55.
16. Brunner A, Thormann S, Babst R. Minimally invasive percutaneous plating of proximal humeral shaft fractures with the Proximal Humerus Internal Locking System (PHILOS). J Shoulder Elbow Surg 2012;21:1056–63.
17. Hess F, Sommer C. Minimally invasive plate osteosynthesis of the distal fibula with the locking compression plate: first experience of 20 cases. J Orthop Trauma 2011;25: 110–15.
18. Jones CB, Sietsema DL, Williams DK. Locked plating of proximal humeral fractures: is function affected by age, time, and fracture patterns? Clin Orthop Relat Res 2011;469:3307–16.
19. Shetty MS, Kumar MA, Sujay K, Kini AR, Kanthi KG. Minimally invasive plate osteosynthesis for humerus diaphyseal fractures. Indian J Orthop 2011;45:520–6.
20. Apivatthakakul T, Arpornchayanon O, Bavornratanavech S. Minimally invasive plate osteosynthesis (MIPO) of the humeral shaft fracture. Is it possible? A cadaveric study and preliminary report. Injury 2005;36:530–8.

21. Beale B. Orthopedic clinical techniques femur fracture repair. Clin Tech Small Anim Pract 2004;19(3):134–50.
22. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res 1987;214:160–4.
23. Liu J, Li S, Li Z, Wang J, Yang C, Zhang L, et al. Case control study on minimally invasive percutaneous new plate osteosynthesis applied in proximal humerus fractures in elder patients. Zhongguo Gu Shang 2013;26:4–8.

Evaluation Of Cast Index In Predicting The Outcome Of Pediatric Forearm Fractures

Ajmera A, Jain S, Jain M

Study performed at Mahatma Gandhi Memorial Medical College, Indore (M.P.)

Abstract

Background: Pediatric forearm fractures of radius ulna account for 40% of all pediatric fracture. Closed reduction followed by application of well molded plaster cast is the standard treatment for these fractures, which can be complicated by re-displacement inside the cast, which further needs re-manipulation or surgery. We assessed the rate if re-displacement in paediatric forearm fractures treated by cast by calculating the cast index.

Material & Methods: 30 patients with fractures of both radius ulna were treated with close reduction and cast application and Cast Index was calculated in immediate post reduction and subsequent radiographs at 2, 4 and 6 weeks. These were evaluated for re-displacement and their relation with cast index.

Results: The mean CI was found to be 0.858. Three patients had re-displacement which required re-manipulation, the mean CI in these re-displacement group was 0.92. Mean CI was found to be higher in proximal third fractures however it did not correspond to increased incidence of re-displacement.

Conclusion: Our study provides sufficient association of cast index in predicting the outcome of pediatric forearm fractures. Higher CI in proximal third fracture didn't correspond to increased incidence of re-displacement.

Keywords: Forearm fracture, Cast index, Re-displacement

Address of correspondence:
Dr. Saurabh Jain
Assistant Professor,
Department of Orthopaedics,
MGM Medical College, Indore
Email – jaindrsaurabh@yahoo.com

How to cite this article:
Ajmera A, Jain S, Jain M Evaluation Of Cast Index In Predicting The Outcome Of Pediatric Forearm Fractures. Orthop JMPC. 2020;26(1):30-33.
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/101

Introduction

Paediatric forearm fractures are amongst the most common injuries encountered in childhood which makeup 40% of all pediatric fractures [1]. Amongst fractures of forearm i.e. radius-ulna fractures, fractures occur in distal third in 60%, 20% occurs in middle third, 14% in distal physis and approximately 4% in proximal third of radius ulna [2].

Closed reduction followed by application of well molded plaster cast is the standard treatment for pediatric forearm fractures, whereas operative treatment is reserved for unstable fractures, failure to achieve closed acceptable reduction and open fractures or those associated with compartment syndrome [3-5]. Loss of fracture reduction, re-displacement or late displacement is the most common complication of manipulated forearm fractures & cast application, which also may need surgery [6-9]. The cast index (CI) is a simple and quick method of predicting the re-displacement after cast application in radius ulna fractures in paediatric patients, particularly distal radius fractures [10]. Ideal cast index is 0.7 or less for distal radius ulna fractures for reduced risk of re-displacement,

whereas a cast index of 0.8-0.84 is associated with significant risk of subsequent re-displacement [2,3,9]. Hence we conducted this study to predict the re-displacement in forearm fractures at all levels by calculating of cast index.

Material and Methods

The study was a prospective series conducted at our center in 30 cases of paediatric fracture forearm by calculating the cast index and correlating it with re-displacement rate. The study was approved by the institutional ethical committee and written informed consent from the guardian was taken before including them in the study.

All children between 2 – 12 years of age with close fracture of both radius ulna were included in study. Patients less than 2 years or more than 12 years, single bone forearm, open, pathological, segmental or intra-articular fractures were excluded from study.

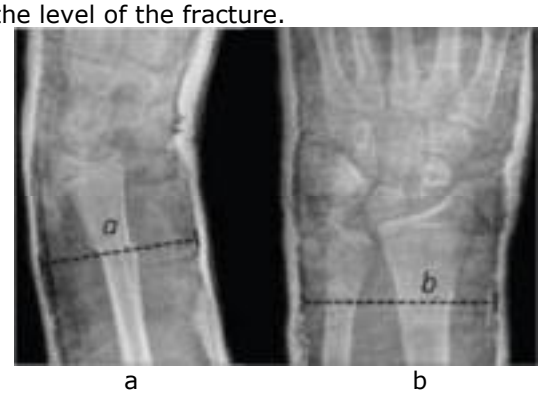
All case included in the study, were given initial symptomatic treatment with slab, Ice fomentation and limb elevation for 3 to 5 days for decreasing the swelling. When swelling subsided, under supine position under short general anaesthesia, the fracture was manipulated and closed reduced to anatomical position under image intensifier guidance. Once proper acceptable reduction was achieved, an above elbow plaster of paris cast was applied after sufficient uniform padding with elbow flexed to 90^0 with forearm in supination for proximal third fracture and mid prone position for all other fractures (table 1) [1].

Table 1 . Acceptable criteria for forearm fractures

Age (years)	Saggital plane (in degree)	Frontal plane (in degree)
4-9	**20**	**15**
9-11	**15**	**5**
11-13	**10**	**0**
>13	**5**	**0**

After the plaster had dried up, true antero-posterior and true lateral radiograph were taken and cast index was calculated using software 'IMAGEJ'. Cast index is calculated by measuring the internal anterio-posterior (AP) diameter of the cast (excluding padding) at the level of the fracture taken on lateral view and dividing it by the internal medio-lateral diameter of the cast (excluding padding) taken on AP view (fig 1). Both measurements are made on the first proper radiograph taken after closed reduction [10].

Fig 1. Calculation of cast index by measuring internal anterio-posterior (AP) diameter on true lateral view (a) and internal medio-lateral diameter on true AP view (b) of the cast (excluding padding) at the level of the fracture.



a b

Post reduction all patients were advised light finger grip and finger extension exercises along with analgesics. Patients were followed up regularly at 2, 4 and 6 weeks after cast application and radiographs were obtained in true antero posterior and true lateral views at each visit and were assessed for re-displacement as well as cast index was calculated. Patients showing re-displacement were re-manipulated under image intensifier guidance and still not having satisfactory reduction were considered for intramedullary nailing. Cast removal was done at 6 weeks when radiological callus bridging three cortexes was seen. Functional outcomes such as final range of motion were not studied.

Results

A total of 30 cases of both bone forearm fracture with mean age 7.06 year (range 2 to 12 year) were included. 17 were male and 13 were female. Mean follow period in study was 7.2 weeks (6 to 12 week). The fracture was seen at proximal, middle and distal third forearm in seen in 6, 15 and 9 cases respectively. The mean cast index of all the cases was 0.858 (range 0.65 to 1.004). The mean cast index in proximal, middle and distal forearm was 0.92, 0.86 and 0.80 respectively. Re-displacement was seen in only 3(10%)

cases with cast index of 0.75, 0.97 and 1.004 and the mean cast index in these re-displacement cases was 0.908 (range 0.75 to 1.004) (fig 2). This re-displacement was seen in one case of distal forearm fracture and two cases were in middle forearm fracture (table 2). The change in cast index at 2, 4 and 6 weeks was not significantly different. Nonunion was seen in only in one case, which was treated surgical with intramedullary nailing, the mean cast index in this case was 1.002

Fig 2. A three year child with both bone forearm fracture pre reduction x rays lateral (a) & AP (b) view, showing cast index of 0.97 after reduction in immediate post reduction in lateral (c) & AP (d) view. Lateral (e) and AP (f) x rays in 4 week follow show displacement, which was treated by intramedullary nails (g & h).

Table 2. Mean cast index at proximal, middle and distal third forearm level

Site of Fracture	No. of Cases	Cast Index	Re-displacement	Non Union
Proximal third	6 (20%)	0.92 (0.82-1.004)	-	1
Middle third	15 (50%)	0.86 (0.7-1.0)	2	-
Distal third	9 (30%)	0.806 (0.65-0.91)	1	-

Discussion

Paediatric forearm fractures are one the common childhood injuries. 80% of these fractures occur in children > 5 years of age with usual mode of injury being direct trauma to upper limb or by fall. The incidence peaks at 9–12 years in girls and 12–15 years in boys [2].

Standard treatment of these fractures is close reduction, manipulation and attaining acceptable reduction followed by application of well molded above elbow cast to maintain the alignment [1-3]. When acceptable reduction cannot be achieved and maintained by closed means operative management is required [4,6-9]. Although anatomical reduction is desirable for all fractures, some degree of angulation is acceptable in these fractures largely due to inherent ability of pediatric bone to remodel (table 1) [1].

Maintenance of reduction requires application of a well molded plaster cast with a thin uniform padding so as to achieve 3 point fixation. Even after this re-displacement remains the most common complication after cast application, which may require further manipulation or surgery. Cast index is simple and easily reproducible predictor of re-displacement in cast for forearm fractures that may further require re-manipulation calculated by just measuring internal diameter of the cast in true lateral radiograph divided by internal diameter of cast in true anterio-posterior radiograph taken in immediate post reduction x-ray [2,3].

We studied 30 paediatric patients of both bone forearm fractures from age 2 to 12 years with mean age of 7.06 years, who were treated with closed reduction and above elbow cast, and were assessed for rate of re-displacement and correlated it with cast index. The mean cast index in our study was 0.859 (range 0.65 to 1.004). The mean cast index for proximal, middle and lower third levels was 0.92, 0.86 and 0.80 respectively. This higher cast index in proximal third fracture, like other studies is due to increased muscular cover seen in proximal forearm and difficult to achieve an elliptical cast molding as compared to distal third [3].

Owing to the increased muscular cover in proximal and middle third forearm, use of cast

index as a predictor of outcome is favored for distal forearm fractures only, but we tried to include all levels of fractures of both bone forearm (proximal, middle or distal) for prediction of re-displacement rate. The reported rate of displacement is 7%-25% [3]. Re-displacement in our series was seen in only 3 (10%) cases with cast index of 0.75, 0.97 and 1.004 and the mean cast index in these re-displacement group was 0.908 (range 0.75 to 1.004). Re-displacement was in one case of distal forearm fracture and two cases were of middle forearm fracture. This showed that the re-displacement rate is not associated with the level of fractures, but is directly proportional to cast index i.e. higher the cast index higher is the chance of re-displacement. The cut-off level of cast index as given by Sheikh et al was 0.77 for re-displacement and 0.92 for second procedure by Debnath et al, whereas in our study this level was 0.85 [2,3]. The probable reason for this difference may be difference in padding material used by us compared to their study. Further our study is limited by lesser number of patients.

Ali Turgut et al associated cast index of less than 0.775 with tight cast syndrome and cast index more than 0.875 with loss of reduction. They recommended a cast index between 0.775 and 0.875 to prevent both tight cast syndrome as well as loss of reduction [11]. However in our study no patient complained of tight cast even with cast index of less than 0.775.

Conclusion

Cast index can help in predicting the outcome of pediatric forearm fractures and the chance of re-displacement, higher cast index is associated with higher chance of re-displacement in cast. The higher mean cast index proximal third fracture, owes to increased muscular in proximal forearm and it doesn't correspond to increased incidence of re-displacement.

References

1. Egol KA. Pediatric Forearm. In: Egol KA. Handbook of fractures. 5th ed. Newyork:Wolters Kluwer. 2015 pp627-41.
2. Debnath UK, Guha AR, Das S. Distal forearm fractures in children: Cast index as predictor of re-manipulation. Indian J Orthop 2011;45:341-6.
3. Sheikh HQ, Malhotra K, Wright P. Cast index in predicting outcome of proximal pediatric forearm fractures. Indian J Orthop 2015;49:398-402.
4. Garg NK, Ballal MS, Malek IA, Webster RA, Bruce CE. Use of elastic stable intramedullary nailing for treating unstable forearm fractures in children. J Trauma 2008;65:109-15.
5. Zamzam MM, Khoshhal KI. Displaced fracture of the distal radius in children: Factors responsible for redisplacement after closed reduction. J Bone Joint Surg Br 2005;87:841-3.
6. Proctor MT, Moore DJ, Paterson JM. Redisplacement after manipulation of distal radial fractures in children. J Bone Joint Surg Br 1993;75:453-4.
7. Alemdaroðlu KB, Iltar S, Cimen O, Uysal M, Alagöz E, Atlihan D. Risk factors in redisplacement of distal radial fractures in children. J Bone Joint Surg Am 2008;90:1224-30.
8. Chess DG, Hyndman JC, Leahey JL, Brown DC, Sinclair AM. Short arm plaster cast for distal pediatric forearm fractures. J Pediatr Orthop1994;14:211-3.
9. Boyer BA, Overton B, Schrader W, Riley P, Fleissner P. Position of immobilization for pediatric forearm fractures. J Pediatr Orthop 2002;22:185-7.
10. Kamat A, Mutimer J. The cast index: a simple radiological predictor of plaster cast failure in paediatric distal forearm fractures. Orthop Proceedings 2010;92-B(suppl):221-2.
11. Turgut A, Erkuş S, Koca A, Payzıner L, Çiçek AO, Kalenderer Ö. Analysis of the factors causing tight cast syndrome after closed reduction and casting of pediatric distal radius fractures. Acta Orthop Traumatol Turc. 2018;52(5):329–333.

External Fixator As A Definitive Treatment For Tibial Diaphyseal Fractures

Jain S, Patel P, Gupta S

Investigation preformed at Gajra Raja Medical College, Gwalior

Abstract

Background: Precarious blood supply, subcutaneous nature and lack of soft-tissue cover of the shaft of the tibia make these fractures vulnerable to open fractures with high rate of nonunion and infection. External fixators have been used to treat these open tibial fractures as temporary mode of fixation. We evaluated the role of external fixator as a definitive treatment for tibial diaphyseal fractures.

Materials & methods: 57 patients with open tibial diaphyseal fracture with various degree of soft tissues injuries, treated with external fixator as definitive fixation were included in the study. The outcome, rate of union and complications were assessed.

Results: 57 patients with mean age 34.4 (range 18 to 59 years) were included. 45 were male while 12 were females. Mean duration of trauma to surgery interval 26.5 hrs. Mean time for dynamization was 7.44 weeks. 50 patients had union with mean time of union 22.4 weeks, while 7 patients had nonunion. 13 patients had pin tract infection, out of which 7 infections healed by oral antibiotics while 6 patients eventually had pin loosening requiring change of pin under local anaesthesia. One patient had malunion.

Conclusion: External fixator is a very useful method for treatment of open tibial diaphyseal fractures which eliminates the need of second surgery and allows bone and soft tissue healing without increasing morbidity when applied properly.

Keywords: Open tibal fracture, External fixation, Dynamization

Address of correspondence:
Dr Prasant Patel,
Senior Resident,
Department of Orthopaedics,
Gajra Raja Medical College, Gwalior
Email – patelprasant9978@gmail.com

How to cite this article:
Jain S, Patel P, Gupta S. External Fixator As A Definitive Treatment For Tibial Diaphyseal Fractures. Ortho J MPC. 2020;26(1):34-39
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/102

Introduction

Tibial diaphysis fractures are among commonly occurring long-bone fractures. These fractures are frequently present as open fractures due subcutaneous nature of tibia and increasing high velocity trauma due to two wheeler and pedestrian accidents. The precarious blood supply, lack of soft-tissue cover of the shaft of the tibia and increased incident of open fracture make these fractures vulnerable to nonunion and infection. The rate of infection may be as high as 52% in grade-IIIB open fractures [1,2]. To reduce these complications aggressive treatment is required which include proper intravenous antibiotics treatment, repeated soft-tissue debridement and stable fixation of the fracture [3]. Various methods for fracture stabilization include plating, intramedullary nailing or external fixator application. Use of plating or intramedullary nailing in patients with open tibial-shaft fracture is controversial with increased risk of infection [4-6]. External fixator is especially useful, as damage controlled orthopaedics, as temporary fixation of fracture, but later needs to be converted to internal fixation with reamed or unreamed intramedullary nail [7]. Hence we conducted this study to evaluated external fixator as a definitive mode of treatment modality for tibial

diaphyseal fractures and assessed its outcome, rate of union and complications.

Material & Methods

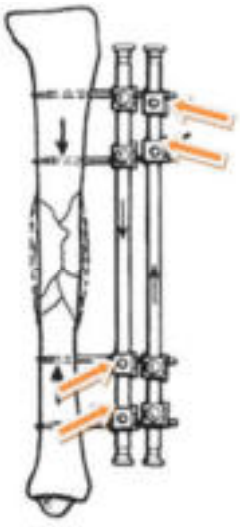
This prospective study is conducted on 60 patients of open tibial diaphsis fracture treated with external fixator as definitive method of treatment at our centre. The study was approved by institutional ethical review committee and written informed consent was obtained from all the patients before inclusion into study. Patients with open tibial diaphyseal fracture with any grade or degree of soft tissues injuries, between 16 to 65 years were included in this study. Patients with concomitant fracture in same limb, pathological fracture, and fracture associated with bone loss, neurovascular injury or with fracture extended to joint were excluded from study.

After stabilizing the patients heamo-dynamically and after advanced trauma life support resuscitation, thorough irrigation of the wound and third generation intravenous cephalosporin were given. Routine blood & radiological investigations were carried out. Radiological examination included Antero-Posterior and lateral view of leg including knee and ankle joint. The fractures were classified according to the AO/OTA classification and Gustilo-Anderson classification [8,9]. All patients were planned for debridement and fixation of fracture by external fixation under spinal anaesthesia in supine position.

Initially the surgical debridement with removal of all dead necrotic tissues, removing the free loose bone pieces was done this was followed by stabilization of the fracture with application of uniplanar AO type external fixator, under image intensifier holding the reduction manually. For application of external fixator, at least two 5.0 mm cortical Schanz screw, with radial preload, were inserted with T handle manually in each proximal and distal end of tibia after drilling. Attempts were made to avoid cancellous area of upper and lower end of tibia if fracture pattern permitted; else 6mm cancellous Schanz screws were used. After manual reduction maintaining length, axial and rotational alignment, and two connecting rods were connected to schanz screw with the help of AO clamps. More schanz screws were fixed and connected to rod with clamps on either end of fracture if needed for stability. Axial loading was done for simple transverse and short oblique fractures by unlocking pin to rod nuts of the clamp pins and re fixing it in bending stress towards the fracture for pins nearer to fracture and bending stress in the direction away from the fracture for the far pins. Pins were subjected to bending stress in reverse manner for comminuted fractures.

Postoperatively systemic antibiotic were continued for 5 days and dressing done regularly and the wound was left as such to heal, with secondary intention and dressings. Patients were encouraged to attain knee and ankle range of motion (ROM) depending on the patient pain tolerance. Axial dynamization and loading were individualized and was started once patient became painless on walking or could walk with minimal pain (fig 1). After dynamization weight bearing was encouraged. Patients were followed regularly. Once clinical or radiological union was achieved, i.e. no pain or mobility at fracture site and union in 3 cortices in anteroposterior and lateral view respectively, the external fixator frame was removed and patient was put on patellar tendon bearing (PTB) cast for further 6 week to consolidate the union.

Fig 1. Illustration showing how dynamization done by crosswise loosening of tube nuts (lower tube nuts of one rod and upper tube nuts of other rod) as marked by arrow.



All patients were assessed for union, time to union, alignment and associated complications like infection, nonunion, malunion, reoperations etc. Normal healing was defined as union within 6 months, delayed union as healing between 6 and 9 months, and nonunion as the absence of healing even after 9 months, whereas malunion was defined when there was more than 5^0 of varus or valgus alignment, more than 10^0 of anteroposterior alignment, or more than 1 inch of shortening was considered as malunion.

Results

Total of 60 patients of open tibial fractures were operated with external fixator as definitive mode of treatment. Among these 3 patients were lost to follow up, so total 57 patients with mean age 34.4 (range 18 to 59 years) were included in our study, out of which, 45 were male while 12 were females. 50(88%) patients had RTA injuries, 3(5%) had injuries due to assault and 4(7%) had injuries due to fall of heavy object over limb. 9 (15.79%) patients had associated injuries in upper or contralateral limb. As per Gustilo-Anderson Classification, type IIIB was most common type seen 31 (54.39%) patients, whereas 2(3.51%) patients had type I injury, 8(14.04%) patients had type II injury, and 16(28.07%) patients had type IIIA injury. As per AO type fracture, 21(36.84%) had A, 23(40.35%) patients had B and 13(22.80%) patients had C type injuries. In subtypes B2 was the most common injury pattern seen amongst all.

The mean duration of injury to presentation of patient to hospital was 15.8 hours (1hour – 240 hours), and mean delay in surgery was 26.5 hrs (range 9 to 248 hrs). 40 and 15 patients were operated within 24 hrs and within 3 days respectively. Mean time for dynamization was 7.44 weeks (range 5 to 10 weeks). Most of the patients i.e. 30 (52.63%) patients were dynamized by 6th or 7th week after surgery, whereas dynamization was done in 2 (3.51%), in 21(36.84%) and in 4(7.02%) patients after 4th to 5th week, 8th to 9th week and after 9th week respectively.

Except of 7 patients who had non-union, all 50 (87.7%) patients had union, in mean time of 22.4 weeks (range 15 to 29 weeks) (fig 2). Of the 7 non-union 6 were of Gustilo Anderson type IIIB (RR:1.576) and one was of IIIA (RR:0.509). None of nonunion was encountered in type I and II type injuries. 14 patients had complications, one had malunion (anteroposterior angulation $>10^0$) while 13 patients had pin tract infection, 7 of which healed by oral antibiotics while 6 eventually had pin loosening requiring change of pin under local anaesthesia.

Fig 2. Clinical photo (a) and preoperative X rays AP (b) and lateral (c) view of 38 year male patient with open tibial fracture and immediate post-operative X rays AP (d) and lateral (e), 8 weeks follow AP (f) and lateral (g) and at final follow AP (h) and lateral (i), who was treated with external fixator showing good union.

Discussion

Open tibial fractures are among most common fractures in young adults encountered at various trauma centre [9-11]. As most of these patients are young adults who sustained these fractures belong to physically highly active and productive age group, they need optimal treatment to get back to their previous work capacity as early as possible and avoid long term complications. Open tibial fractures with inherent less soft tissue coverage and added soft tissue trauma by injury poses higher risk of postoperative complications like wound dehiscence and infection [4-6]. Hence treatment of open tibial fractures demands tissue friendly surgical procedures as well as adequate fracture fixation.

External Fixator application is a commonly used technique for compound tibia fractures, its main benefit being its less invasive nature. Disadvantage of external fixator is lower stability as compared to other methods of fixation. Other limitations of the external fixator are pin tract infections, pin loosening, re-displacement, less useful in osteoporotic fracture, delayed union, non-union and malunion.

In developing country like ours, where patient load is very high and resources are limited, it is difficult getting patient into operation theatre twice especially when it is not an emergency. Irregular follow-ups, low socioeconomic group, high cost of reoperation, poor hygiene and associated pin tract infection makes conversion of temporary external fixation to definitive internal fixation, difficult [12]. Giannoudis in 96 open tibial fractures showed over 17% infection rate after conversion of external fixation to IM nailing [13]. Hence, external fixator itself is preferred as definitive treatment modality of treatment because it eliminates the second surgery, indirectly reduces the patient loads waiting for surgery and avoids the risk associated with second surgery and anaesthesia [12]. We conducted this study to confirm the role of external fixator as definitive fixation method of treatment for open tibial fractures in 57 patients with mean age 34 years and found it to be very effective with rapid healing, and few complications.

In our series, 50 (87.7%) had union, in mean time of 22.4 weeks (range 15 to 29 weeks). Similar union rate was seen by studies of Kumar (97% in 37 patients), Beltsios (91 % in 241 patients) and of Emani (95% in 62 patients) [14-16]. The mean time to union by Beltsios was 25 weeks in open fractures whereas in Emami series union time was 22 week, but 22% had delayed union [15,16]. In metaanalysis done by Bhandari et al directly comparing external fixators and unreamed IM nails, it is shown that there is no statistically significant difference between the two with respect to union, delayed union, deep infection and chronic osteomyelitis, but external fixation was associated with statistically significant increased rate of malunion and reoperations, whereas unreamed nailing showed a statistically significant increase in the rate of failure of the implant [17].

In our study, there were 15 (18.99%) delayed union and 7 (10.94%) nonunions compared to 8 to 15% non-union and 9 to 39% delayed union in reported series by Giannoudis et al, Beltsios et al, Emani et al, Kimmel et al and Velazco A [13,15-19]. The reported incidence of malunion in Beltsios series was 1.8%, Kimmel series of 26% and Giannoudis series was 20%, but in our series only one patient (1.7%) had malunion [13,15,18]. The probable reason for this is because we tried to achieve anatomic reduction before applying the external fixator, which could have led the fracture to unite without malunion. Further, the reported incidence of pin tract infection is 32 to 80% while the incidence of deep infection is 16.2%, with average 4% developing chronic osteomyelitis [3,18,19], but in our series we encounter 13 (22.8%) patients of pin tract infection, out of which 7 infection healed by oral antibiotics and only 6 (10.52%) requiring pin revision due to loosening. Low incidence of pin tract infection in our series is attributed to proper technique of pin insertion, preloading and adequate pin site dressing and care [20].

Thus external fixator, as a definitive treatment modality to achieve union in patients of open

tibial fractures provides early and strong bone union due to inherent benefits of less tissue damage and minimal disturbance of fracture site biology. But care must be taken to achieve proper reduction and to avoid pin related associated complications of infection / loosening by following proper pin insertion technique, pre-tensioning the pins and doing regular pin site care. For better functional outcomes range of motion, dynamization and weight bearing should be started early to promote healing by converting fixator frame to less rigid allowing axial micromovements at fracture site.

Conclusion

External fixator for compound tibial diaphyseal fractures is a very useful modality of treatment which eliminates the need of re-operation and allows bone and soft tissue healing without increasing morbidity when applied properly. Pin tract infection and loosening are common complications, but it can be reduced by proper technique.

References

1. Gustilo RB, Mendoza RM, Williams DN. Problems in the management of type III (severe) open fractures: a new classification of type III open fractures. J Trauma. 1984;24(8):742–6.
2. Ajmera A, Verma A, Agrawal M, Jain S, Mukherjee A. Outcome of limb reconstruction system in open tibial diaphyseal fractures. Indian J Orthop. 2015;49:429-35.
3. Patzakis MJ, Wilkins J, Moore TM. Considerations in reducing the infection rate in open tibial fractures. Clin Orthop. 1983;178:36–41.
4. Chapman MW. The role of intramedullary fixation in open fractures. Clin Orthop. 1986;212:26–34.
5. Chiron HS. Open fractures of the shaft of the tibia treated by intramedullary nailing. Bull Hosp Joint Dis. 1982;42:92-102.
6. Fairbank AC, Thomas D, Cunningham B, Curtis M, Jinnah RH. Stability of reamed and unreamed intramedullary tibial nails: a biomechanical study. Injury. 1995;26(7):483–5.
7. Giannoudis PV, Papakostidis C, Roberts C. A review of the management of open fractures of the tibia and femur. J Bone Joint Surg Br. 2006;88(3):281–9.
8. Kellam JF, Meinberg EG. Tibia. J Orthop Trauma. 2018;32:1:53-55. (AO/OTA.Classification of Fractures—Long Bones aotrauma.aofoundation.org).
9. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. J Bone Joint Surg Am. 1976;58:453–458.
10. Zettas JP, Zettas P, Thanasophon B. Injury patterns in motorcycle accidents. J trauma. 1979;19(11):833–6.
11. Li X, Yun Z, Li X, Wang Y, Yang T, Zheng L, et al. Orthopedic injury in electric bicycle-related collisions. Traffic Inj Prev. 2017;19;18(4):437–40.
12. Banskota B, Shrestha S, Chaudhary RK, Rajbhandari T, Rijal S, Shrestha BK, et al. Patterns of Orthopaedic Injuries among Motorbike Accident Admissions Presenting to a Tertiary Care Hospital in Kathmandu. J Nepal Health Res Counc. 2016;14(32):51–7.
13. Giannoudis PV, Papakostidis C, Roberts C. A review of the management of open fractures of the tibia and femur. J Bone Joint Surg Br. 2006;88:281–289.
14. Kumar DR, Sujai DS, Chethan D, Nanjundappa DH, Swamy DS. Results of open fractures of tibia treated by external fixator as primary and definitive procedure. Int J Orthop Sci. 2017;1;3(1):179–81.
15. Beltsios M, Savvidou O, Kovanis J, Alexandropoulos P, Papagelopoulos P. External fixation as a primary and definitive treatment for tibial diaphyseal fractures. Strateg Trauma Limb Reconstr. 2009;4(2):81–7.
16. Emami A, Mjöberg B, Karlström G, Larsson S. Treatment of closed tibial shaft fractures with unilateral external fixation. Injury.1995 Jun;26(5).299-303.

17. Bhandari M, Guyatt GH, Swiontkowski MF, Schemitsch EH. Treatment of open fractures of the shaft of the tibia. Bone Jt J. 2001;1;83–B(1):62–8.
18. Kimmel RB. Results of treatment using the Hoffmann external fixator for fractures of the tibial diaphysis. J Trauma. 1982;22(11):960–5.
19. Velazco A, Fleming LL. Open fractures of the tibia treated by the Hoffmann external fixator. Clin Orthop. 1983;180:125–32.
20. Moroni A, Vannini F, Mosca M, Giannini S. State of the art review: techniques to avoid pin loosening and infection in external fixation. J Orthop Trauma. 2002;16(3):189–95.

Giant cell tumor of proximal radius: A rare case report and review of literature

Jain T, Bharadwaj L, Tiwari A, Verma R

Investigation preformed at Gandhi Medical College, Bhopal

Abstract

Case report: Giant-cell tumor (GCT) of the bone is benign bone tumor which usually arises from the epiphysis of long bones. Distal femur and proximal tibia are the most common sites of this tumor. The proximal radius is extremely rare site of this particular tumor. We present a rare case of Giant cell tumor of proximal radius in a twenty-one year old girl, for which wide margin resection was performed successfully with no recurrence, complications or disability seen at one year follow up.

Keywords: Giant cell tumor; proximal radius; resection

Address of correspondence:
Dr. Anurag Tiwari,
Assistant Professor,
Department of Orthopaedics,
Gandhi Medical College, Bhopal
Email – dranurag.tiwari@gmail.com

How to cite this article:
Jain T, Bharadwaj L, Tiwari A, Verma R. Giant cell tumor of proximal radius: A rare case report and review of literature. Ortho J MPC. 2020;26(1):40-44
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/103

Introduction

Giant cell tumour (GCT), also known as Osteoclastoma, is a locally aggressive benign bone tumour, arising from epiphysis of long bones [1]. It commonly occurs in 20 to 40 year of age group and is more common in females [2]. Most common locations are distal femur, proximal tibia, distal radius and spine [3]. The proximal radius is an extremely rare site for giant cell tumours, in contrast to the distal radius. The prevalence of GCT proximal radius is reported to be 0.16%- 0.5% of all GCT cases [4].

We here thus present a rare such case of this tumour i.e. GCT in proximal radius in a twenty one year old female who was successfully managed by wide marginal resection of proximal radius.

Case report

A 21-year old female with right hand dominance presented to orthopaedic department with complain of pain and swelling over non-dominant left elbow and upper forearm since 1 month. Constitutional symptoms were absent. She had taken no treatment, except some analgesics and had never consulted a doctor.

Pain was insidious in onset, gradually progressive, localized to left lateral elbow and forearm, dull aching in character which was aggravated with supination-pronation and relieved temporarily by taking rest and oral analgesics. The pain was associated with mild to moderate swelling over the forearm and elbow which was more on the lateral aspect. Family history and past history were unremarkable. There was no other swelling in any other body parts.

On examination, there was localised moderate tenderness at radial head. On palpation, swelling was mild localized and was hard in consistency and immobile, whereas due to the swelling the deeper radial head could not be palpated. Bleeding or ulceration was absent. Range of motion (ROM) in the left elbow joint was 0° -140° of flexion, 40° of pronation, and 45° of supination (Fig 1). Distal neurovascular status was normal. All laboratory investigations were within normal limit.

Plain radiograph of affected elbow and forearm showed a relatively well-defined expansile lytic lesion in epiphysio-metaphyseal region of proximal radius with geographical bone destruction and loss of contours of radial head

and neck (Fig 2). Magnetic resonance imaging (MRI) T1 axial and sagittal image showed relatively well defined hyper-intense osteolytic destructive lesion involving proximal radius with cortical breach at anterolateral and postero-medial aspect (fig 3). The radiological and MRI features showed the typical features of giant cell tumor, but to confirm the diagnosis needle biopsy was taken which showed stromal cells, numerous osteoclastic giant cells and scattered lymphocytes, which confirmed the diagnosis of Giant cell tumor of proximal radius. Because of the marked destruction and expansion of the radius, the decision was made to perform wide margin resection of proximal radius.

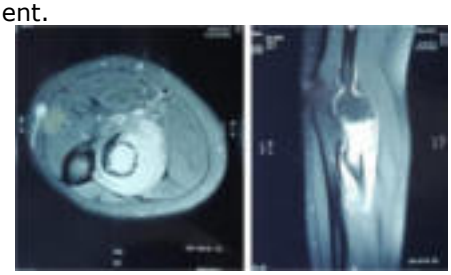
Fig 1: Clinical photograph of the patient showing restricted supination (a) and pronation (b) on the left side.

a b

Fig 2: Pre-operative radiograph AP (a) and lateral (b) views of left elbow showing expansile lesion in proximal radius with no periosteal reaction.

a b

Fig 3: MRI axial (a) and sagittal (b) image of the patient showing hyperintense lesion in proximal radius, intraosseous as well as extra osseous component.



a b

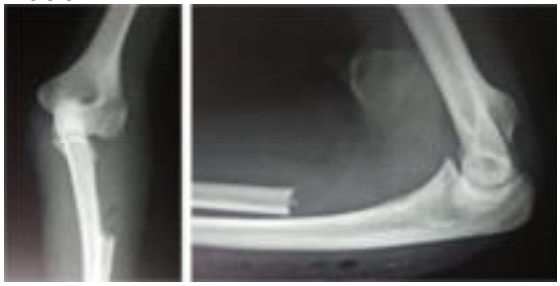
Under brachial block in supine position, Kocher approach was used to approach the proximal radius (fig 4). The annular ligament was incised along with the joint capsule. The posterior interosseous nerve was identified and was protected. An osteotomy of the radius was performed 2 cm from the distal margin of the lesion and closure was done in layers after achieving haemostasis. The specimen was sent for histo-pathological examination, which confirmed the presence of giant cell tumor, by presence of multinucleate giant cells.

Fig 4: Intra-operative photograph (a & b) showing the lesion involving the neck and proximal shaft of radius. Note the cartilage of radial head visible (black arrow).

a b

Post-operatively, patient's limb was kept in above elbow slab, which was removed after suture removal. She did not have any wound problems post-operatively. At final follow of 12 months, she had nearly full range of flexion/extension at elbow and supination/pronation with no clinical or radiological symptoms and signs of recurrence of tumour (fig 5).

Fig 5: Post-operative radiograph AP (a) and lateral (b) view and clinical photo (c & d) at 1 year post surgery. There were no signs of recurrence and complete range of pronation and supination.



a b

c d

Discussion

Giant cell tumour is a bone tumor that is most common in third to fourth decade of life, though rarely seen in younger age group also. It is benign but locally aggressive tumour involving epiphyseal region of skeletally mature long bones [1,2].

Patients may present with pain, swelling or pathological fracture. Radiologically, it presents as eccentric, expansile, lytic lesion in the epiphyses of long bones [1,2]. Distal femur, proximal tibia and distal radius are the usual sites involved [3,4]. The common differential diagnosis includes aneurysmal bone cyst, chondroblastoma, chondromyxoid fibroma, brown tumor, non-ossifying fibroma, and osteosarcoma [5,6].

The proximal radius is extremely rare site for giant cell tumours. To best of our knowledge, only, ten cases of GCT involving proximal radius have been reported so far in the literature [7-17] (table 1). Methods of treatment ranged from curettage with or without bone grafting, resection with or without reconstruction to even above elbow amputation [17,18]. Mir NA et al and Khan KM et al performed marginal resection [8,14] and Lewis MM et al, Akmaz I et al and Novais EN et al treated the tumor with curettage and bone grafting [7,9,12]. Singh AP et al in 2009 performed above elbow amputation for GCT proximal radius [11]. Dahuja A et al performed resection and reconstruction with fibula autograft [15], Nayar SK et al performed resection and reconstruction with osteoarticular allograft [16]. Song WS et al performed reconstruction with polyethylene insert; pins, screws and bone cement [13], whereas Sakayama K et al used floating radial head prosthesis [10].

Table 1 – Comparison of our case with reported literature

Sr	Year	Study	Age (yr)	Gender	Clinical presentation	Side	Duration (mths)	Treatment	Follow up (mths)	Outcome
1	1985	Lewis MM7	35	Female				Curettage + Bone grafting		
2	2003	Mir NA8	35	Male	Pain elbow	R	18	Excision	36	No recurrence
3	2004	Akmaz I9	21	Male	Discomfort proximal forearm	L		Curettage and autogenous iliac crest bone graft	36	No recurrence No infection No fracture
4	2006	Sakayama K10	73	Female	Elbow pain	L		En bloc resection and reconstruction with radial head prosthesis	72	No recurrence No loosening No dislocation
5	2009	Singh AP 11	52	Female	Pain and progressively increasing swelling around elbow	R	8	Above elbow amputation	60	No recurrence
6	2011	Novais EN12	13	Male	Multicentric GCT Pain and swelling elbow	R		Curettage + Burr + Phenol + Bone graft		Lack terminal 150 of supination and pronation
7	2011	Song WS 13	33	Male	Elbow and forearm pain	L	8	En bloc resection and reconstruction with polyethylene insert and bone cement	36	No recurrence
8	2014	Khan KM14	48	Female	Mass elbow	R	2	Wide margin excision with sacrifice of PIN	7	No recurrence
9	2017	Dahuja A 15	50	Female	Swelling around elbow with wrist drop	R		Wide margin excision with non-vascularised fibula with TENS fixation	24	No recurrence Nerve recovered at 2 months post-surgery
10	2018	Nayar SK16	23	Male	Pain in elbow	L	6	Resection and reconstruction with osteoarticular allograft	54	No recurrence Union at 17 months
11	2019	Present study	21	Female	Pain elbow	L	1	Wide margin excision	12	No recurrence

Resection and reconstruction with radial head prosthesis is a good option, when the tumor is small. Further loosening of the prosthesis is one of the most serious complications, but the major limitation with the use of radial head prosthesis (RHP) is that only short to midterm results are known and long term results of RHP are not known and the cost of RHP is a big issue especially in developing countries [19,20].

Osteoarticular allografts have been used for reconstruction after resection of giant cell tumor, which is cost effective, restores the bone stock and promotes biological bone union. But the drawbacks are that it is technically demanding surgery, long healing time, risk of fracture, risk of disease transmission, and surgical site infection [21-24]. Considering the benign nature of tumor, amputation per se has little place in the treatment of giant cell tumours.

In our case, the patient presented to us late, by that time, the disease had advanced to the extent where, curettage and bone grafting was not an advisable option, because of fear of recurrence [25,26]. Hence we planned the patient for extensive marginal resection. Resection alone, in our case appeared to be completely effective in eradicating the disease and providing excellent functional outcome. In our patient on last follow-up, she had nearly full range of flexion/extension at elbow, and supination/pronation after extensive supervised physiotherapy.

Conclusion

GCT of proximal radius is very rare tumor, for which, wide margin resection of tumour is a good, cost effective treatment with no recurrence, minimal complications, and disability.

References:

1. Campanacci M, Baldini N, Boriani S, Sudanese A. Giant-cell tumour of bone. J Bone Joint Surg Am 1987;69(1):106-14.
2. Saglik Y, Yildiz Y, Karakas A, Ogut H, Erekul S. Giant cell tumor of bone. Bull Hosp Jt Dis. 1999;58(2):98–104.
3. Mc Gough RL, Rutledge J, Lewis VO, Lin PP, Yasko AW. Impact severity of local recurrence in giant cell tumour of bone. Clin Orthop Relat Res. 2005;438:116-22.
4. Turcotte RE.Giant cell tumor of bone. Orthop Clin North Am. 2006;37(1):35-51.
5. Dahlin DC. Caldwell Lecture. Giant cell tumor of bone: highlights of 407 cases. Am J Roentgenol. 1985;144(5):955–960.
6. Murphey MD, Nomikos GC, Flemming DJ, Gannon FH, Temple HT, Kransdorf MJ. From the archives of AFIP. Imaging of giant cell tumor and giant cell reparative granuloma of bone: radiologic-pathologic correlation. Radiographics 2001;21(5):1283-309.
7. Lewis MM, Kaplan H, Klein MJ, Ferriter PJ, Legouri RA. Giant cell tumour of the proximal radius. Clin Orthop Relat Res 1985;201:186-9.
8. Mir NA, Bhat JA, Halwai MA. Giant cell tumours of proximal radius and patella—an unusual site of presentation: case report. JK Sci. 2003;5:35–37.
9. Akmaz I, Arpacioglu MO, Pehlivan O, Solakoglu C, Mahirogullari M, Kiral A, et al. An infrequent localization of giant cell tumour: proximal radius: case report. J Arthroplast Arthroscop Surg. 2004;15:174–177.
10. Sakayama K, Sugawara Y, Kidani T, Miyawaki J, Yamamoto H. Bipolar-type floating radial head prosthesis for the treatment of giant cell tumor of the proximal radius: a case report. J Shoulder Elbow Surg. 2006;15(5):9-12.
11. Singh AP, Mahajan S, Singh AP. Giant cell tumour of the proximal radius. Singap Med J. 2009;50:388–390.
12. Novais EN, Shin AY, Bishop AT, Shives TC. Multicentric giant cell tumor of the upper extremities: 16 years of ongoing disease. J Hand Surg Am. 2011;36(10):1610-3.
13. Song WS, Cho WH, Kong CB, Jeon DG. Composite reconstruction after proximal radial giant cell tumour resection. Arch Orthop Trauma Surg. 2011;131:627–630.
14. Khan KM, Minhas MS, Khan MA, Bhatti A. Giant cell tumour of proximal radius in a 48 years old lady. J Coll Physicians Surg Pak. 2014;24(1):S48-9.

15. Dahuja A, Kaur R, Bhatty S, Garg S, Bansal K, Singh M. Giant-cell tumour of proximal radius in a 50-year-old female with wrist drop: a rare case report. Strategies Trauma Limb Reconstr. 2017;12(3):193–196.
16. Nayar SK, Dein EJ, Spiker AM, Bernard JA, Zikria BA, Weber KL. Resection of a Giant-Cell Tumor of the Proximal Aspect of the Radius with Osteoarticular Allograft Reconstruction: A Case Report. JBJS Case Connect. 2018;8(1):e7.
17. Lackman RD, Hosalkar HS, Ogilvie CM, Torbert JT, Fox EJ. Intralesional curettage for grades II and III giant cell tumours of bone. Clin Orthop Relat Res 2005;438:123-7.
18. Bi Z, Pan Q, Fu C, Han X. Wrist joint reconstruction with vascularized fibular head graft after resection of distal radius giant cell tumour. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi 2010;24:1416-8.
19. Pribyl CR, Kester MA, Cook SD, et al. The effect of the radial head and prosthesis radial head replacement on resisting valgus stress at the elbow. Orthop 1986;9(5):723-6.
20. Kodde IF, Kaas L, Flipsen M, van den Bekerom MPJ, Eygendaal D. The current concepts in management of radial head fractures. World J Orthop. 2015;6(11):954–960.
21. Enneking WF, Campanacci DA. Retrieved human allografts: a clinico-pathological study. J Bone Joint Surg Am. 2001;83(7):971-86.
22. Muscolo DL, Ayerza MA, Aponte-Tinao LA. Survivorship and radiographic analysis of knee osteoarticular allografts. Clin Orthop Relat Res. 2000;373:73-9.
23. Thompson RC Jr, Pickvance EA, Garry D. Fractures in large-segment allografts. J Bone Joint Surg Am. 1993;75(11):1663-73.
24. Muscolo DL, Ayerza MA, Aponte-Tinao LA, Ranalletta M. Use of distal femoral osteoarticular allografts in limb salvage surgery. J Bone Joint Surg Am. 2005;87(11): 2449-55.
25. O'Donnell RJ, Springfield DS, Motwani HK, Ready JE, Gebhardt MC, Mankin HJ. Recurrence of giant-cell tumors of the long bones after curettage and packing with cement. J Bone Joint Surg Am. 1994;76(12):1827–1833.
26. Yip KMH, Leung PC, Kumta SM. Giant cell tumor of bone. Clin Orthop 1996;323:60-4.

Tarlov Cyst: A Case Report

Verma A, Jain S, Jain M, Mundra A

Investigation preformed at Mahatma Gandhi Memorial Medical College, Indore

Abstract

Case Report: Tarlov cyst is rare perineural cyst, which may be symptomatic and present with with low back pain, sciatica, coccydynia or cauda equina syndrome. Symptomatic tarlov cyst needs to be removed surgically. We present such a rare case of symptomatic sacral cystic mass (tarlov cyst) presenting with severe lower back pain for months which was successfully treated by sacral laminotomy and cyst excision. The aim of reporting this case was to create awareness among the surgeons regarding this rare entity and to include it in differential diagnosis of chronic low back pain.

Keywords: Tarlov cyst, sacral cyst, perineural cyst

Address of correspondence:
Dr. Saurabh Jain
Assistant Professor,
Department of Orthopaedics,
MGM Medical College, Indore
Email – jaindrsaurabh@yahoo.com

How to cite this article:
Verma A, Jain S, Jain M, Mundra A. Tarlov Cyst: A Case Report. Ortho J MPC. 2020;26(1):45-48
Available from:
https://ojmpc.com/index.php/ojmpc/article/view/104

Introduction

Tarlov cyst is a perineural cyst, which was first described by Tarlov, after whom they are named. They are usually asymptomatic and are seen as an incidental finding at autopsy [1]. Tarlov described first case of symptomatic perineural cyst and recommended its removal. Very few cases of such Tarlov cyst are reported in the literature [2-4].

Most of the cysts are asymptomatic, but some of them can be symptomatic. The cyst can present as low back pain, sciatica, coccydynia or cauda equina syndrome, which when symptomatic, may require surgical treatment [4]. Diagnosis of cyst can be confirmed on MRI, which shows the fluid filled cystic lesion arising from the sacral nerve root near the dorsal root ganglion [5]. We here report such a rare case of symptomatic sacral Tarlov cyst presenting as back pain and radiculopathy which was successfully treated by surgical excision.

Case Report

A 45 year old male, labourer by occupation presented to outdoor patient department with history of insidious onset pain in lower back since 8 months. There was no history of trauma, jerk or history of lifting any heavy object. The pain was localized to lower back, dull in nature with no diurnal or postural variations. Pain was initially relieved with rest and NSAIDS but had aggravated since last 2 months affecting the daily activities of the patient. There was history of claudication and aggravation of pain on long standing. The pain had started radiating to left lower limb upto the ankle and toes. There was no history of bladder bowel dysfunction. The constitutional symptoms like loss of appetite, fever, weight loss or malaise were absent. He had no other complaint related to other body parts with bilateral hip and knees being normal.

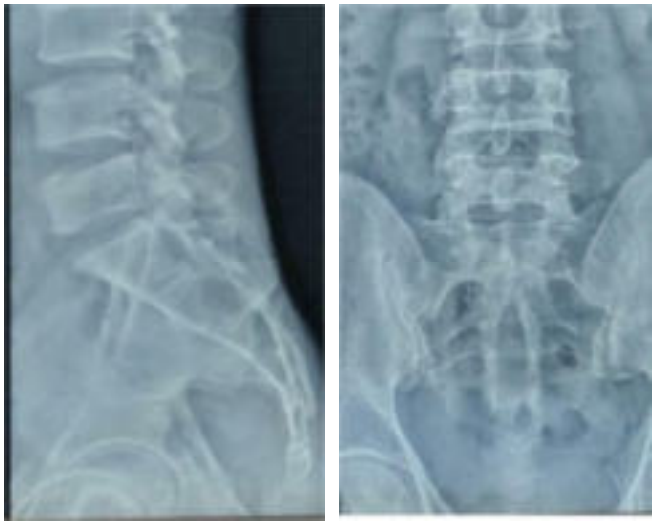
On examination, there was mild local tenderness in the sacral area and lower back. Straight leg rising was 40º on left side and 80º on right side. There was weakness of ankle dorsiflexors, toe flexors and extensors (MRC grade 3) on left side with no sensory deficit. Right side was normal. All the reflexes were normal bilaterally.

All haematological investigations and radiographs of lumbosacral spine were normal. MRI of the lumbosacral spine revealed a right

sided extra dural, 3.8×1.8cm fluid filled cyst at level of S2 vertebra causing medial compression of dural sac.

After routine pre-operative fitness patient was planned for surgical excision of cyst. Patient was operated under general anaesthesia in prone position via midline dorsal approach. Sacral laminotomy was done and a window was made in the sacrum. Flaps of ligamentum flavum elevated to expose the cyst (fig 3a). The cyst was excised and the dural sac was decompressed and a free fat graft taken from right gluteal region (fig 3b) was placed over the after the plication of cyst wall. Finally osteosacral flap was reinforced using a Recon plate. The excised cyst was sent for histopathological examination which conformed presence of nerve cells in the cyst confirming the diagnosis of Tarlov cyst.

Fig 1. Lumbosacral X rays spine AP (a) and lateral (b) view with no obvious lesion



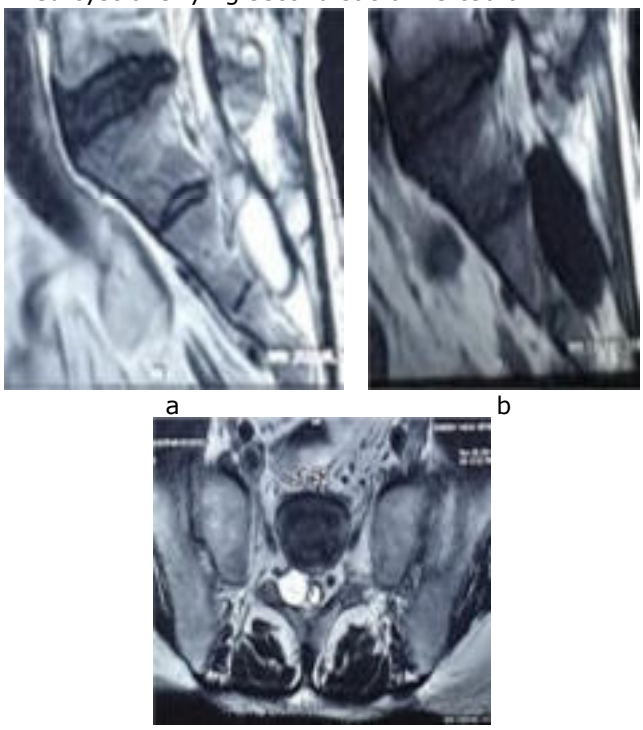
a b

Post-operatively, there was no deterioration of neurology, and patient had immediate relief from radicular pain after the surgery. His motor power increased by grade one at 2 weeks of the surgery with no complains of the pain at back or radiculopathy. At 2 weeks post-surgery, he was able to walk without any claudication.

Discussion

Tarlov cysts are most commonly found in sacral region between perineurium and endoneurium of nerve root, although they can be present at any spinal segment. Small, asymptomatic Tarlov cysts are not uncommon and may be seen in 5 to 9% of the general population but large cysts that cause symptoms are relatively rare [2]. Cyst is common in females (86%) and in age group of 31 to 60 years (80%) [3]. Our case was a 45 years male who was labourer by profession.

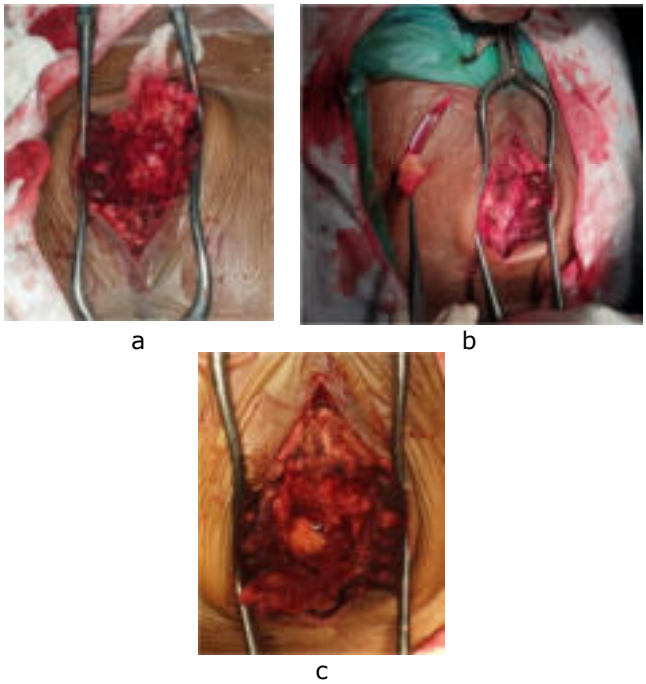
Fig 2. MRI of sacral region saggital T2WI (a), saggital T1WI (b) and axial (c) views showing fluid filled cyst overlying second sacral vertebra



a b

c

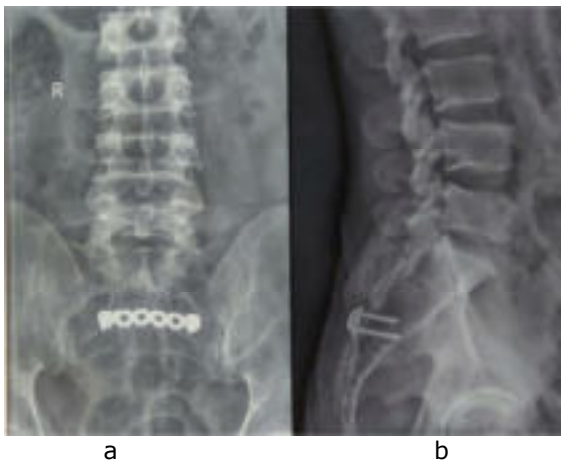
Fig 3. Intra operative photos (a to c) showing laminotomy done at S2, showing cyst and free fat graft placed in the spinal canal



a b

c

Fig 4. Post-operative lumbosacral X rays spine AP (a) and lateral (b)view showing plate over the sacrum



a b

Clinical presentation of the cyst can be variable. It can present with local or radicular pain, or different motor or sensory deficit, with or without involvement of bladder and bowel, depending on the size, location and relationship with the nerve root. Radicular symptoms from caudal nerve root may vary from sciatica, sacral or buttock pain, vaginal or penile paraesthesia or sensory changes over the buttocks, perineal area and lower extremity. Rare, but a larger cyst can even result in cauda equina syndrome [3,4].

Radiographs and CT scans are usually normal except for bone erosion of the spinal canal or neural foramina. With the advent of MRI, myelography is usually not needed now, but if done shows delayed filling of the meningocele sac. MRI is the investigation of choice which shows cyst lesion along the nerve root, which is low signal on T-1 weighted images and high signal on T-2 weighted images, similar to CSF [5,6].

Tarlov described the formation of cyst in space between the arachnoid which covers the root i.e. the perineurium (covers the root) and the endoneurium (outer layer of the pial cover of the root). It begins in one portion of the circumferential perineural space and if large enough can cause compression of the nerve root to one side, like in our case the cyst was compressing the nerve root causing radicular symptoms typically on left side. In later stages, cyst occupies the posterior root and abuts the proximal part of dorsal ganglion, which is bordered by reticulum or by nerve fibers [1].

The cause for genesis of these perineural cysts is not clear, but sacro-coccygeal trauma has been suspected, which causes hemorrhage into subarachnoid space and accumulation of red cells. This causes impediment of drainage of veins in the perineurium and epineurium, leading to rupture and subsequent cyst formation. Tarlov, Schreiber and Haddad all supported trauma as the cause of cyst formation but Fortuna et al believed that the perineural cysts were congenital, caused by arachnoidal proliferations within the root sleeve [6,7,9].

Treatment of cyst ranges from wait and watch, excision, percutaneous aspiration to excision and duraplasty. Asymptomatic cysts are left as such. Tarlov advised sacral laminectomy and complete excision of single perineural cysts together with the posterior root and ganglion whereas Paulsen advised CT-guided percutaneous aspiration of cyst [3,7]. Recently Caspar advocated microsurgical cyst excision combined with duraplasty or plication of the cyst wall, leaving the parent nerve root intact [10]. We in our case, completely excised the cyst via sacral laminectomy, followed by free fat graft over cyst wall and the repositioning of osteosacral flap using a Recon plate, so that we can mobilize patient early.

Conclusion

Symptomatic Tarlov cyst is a rare finding, which can cause radicular or other pain syndromes. We reported this rare case to create awareness among the surgeons regarding this rare entity and to have clinical suspicion and include it in differential diagnosis of chronic low back pain, considering early MRI scans.

References

1. Tarlov IM. Perineural cysts of the spinal nerve roots. Arch Neural Psychiatry. 1938;40:1067–74.

2. Prashad B, Jain AK, Dhammi IK. Tarlov cyst: Case report and review of literature. Indian J Orthop. 2007;41(4):401–403.
3. Paulsen RD, Call GA, Murtagh FR. Prevalence and percutaneous drainage of cysts of the sacral nerve root sheath (Tarlov cysts) AJNR Am J Neuroradiol. 1994;15:293–9.
4. Acosta FL, Quinones-Hinojosa A, Schmidt MH, Weinstein PR. Diagnosis and management of sacral Tarlov cysts: Case report and review of the literature. Neurosurg Focus. 2003;15:E15.
5. Rodziewicz GS, Kaufman B, Spetzler RF. Diagnosis of sacral perineural cysts by nuclear magnetic resonance. Surg Neurol. 1984;22:50–2.
6. Tarlov IM. Cysts (perineurial) of the sacral roots. J Am Med Assoc. 1948;138:740–4.
7. Tarlov IM. Spinal perineurial and meningeal cysts. J Neural Neurosurg Psychiatry. 1970;33:833–43.
8. Schreiber F, Haddad B. Lumbar and sacral cysts causing pain. J Neurosurg. 1951;8:504–9.
9. Fortuna A, La Torre E, Ciappetta P. Arachnoid diverticula: A unitary approach to spinal cysts communicating with the subarachnoid space. Acta Neurochir (Wien) 1977;39:259–68.
10. Caspar W, Papavero L, Nabhan A, Loew C, Ahlhelm F. Microsurgical excision of symptomatic sacral perineurial cysts: A study of 15 cases. Surg Neurol. 2003;59:101–6.

ORTHOPAEDIC JOURNAL OF M. P. CHAPTER

An official publication of Madhya Pradesh Chapter of Indian Orthopaedic Association

Author Guidelines

Manuscript submitted should be easy to read & edit. Detailed instructions are available on the website www.icmje.org , which gives guidelines for uniform requirements for manuscripts submitted to biomedical Journals.

All manuscripts submitted to the journal must be original research submitted to Orthopaedic Journal of M P Chapter (OJMPC) alone, must not be previously published, already accepted for publication, or under consideration for publication elsewhere, and, if accepted, must not be published elsewhere in similar form, without the consent of editor-in-chief or publisher. All the manuscript submitted to the journal receives individual identification code and would initially be reviewed by the editors then undergoes a formal double blind peer review process before publication.

Article Proof

Manuscripts accepted for publication are copy edited for grammar, punctuation, print style, and format. Page proofs are sent to the corresponding author through e-mail. They must carefully check and return the revised manuscript within 72 hours. It is the responsibility of the corresponding author to ensure that the galley proof is to be returned without delay with correction. In case of any delay, authors are responsible for the contents appeared in their published manuscripts.

Categories of Articles

Article can be sent as Research/Original article, Review article, brief reports, Case report & Letter to editors.

(a) Original article

Original articles should contain original research relevant to Orthpaedics and allied specialties and includes case control studies, cohort studies, interventional studies, experimental study. Text of study is usually divided into sections introduction, methods, Results & Discussion. Manuscripts should be accompanied with an abstract (divided into Background, Methods, Results and Conclusion) in not more than 250 words. Four to five key words in alphabetical order should be provided for indexing along with abstract.

The typical text length for such contribution in 2500-3500 words (excluding Title page, abstract, tables, figures, acknowledgements, & references)

(b) Review Article

Journal encourages submission of review article on topic of general interest. The typical length should be about 3000 words (excluding tables, figures & references) manuscript should be accompanied with Abstract of less than 250 words.

(c) Case Report

Clinical case highlighting uncommon condition or presentation are published as care reports. The Text should not exceed 1000 words & is divided into sections i.e. abstract, Introduction, case report and discussion. Include a brief abstract of about 100 words.

(d) Brief Report

Short account of original studies are published as brief reports. The text should be divided into section i.e. abstract, introduction, methods, results & discussion.

A series of cases can also be considered as brief report, provided the number of cases is reasonably large. Abstract should be 100-150 words with 3-5 keywords. Text should not contain more than 1500 words.

(e) Letter to Editor(s)

The editor welcomes and encourage correspondence relating to articles published in journal. Letter may also relate to other topic of interest to medical professional. Letter should not be more than 300 words.

Preparation of Manuscript

Title: The title of the article should be approximately 10-15 words (this may be changed with the author's approval). The first character in each word in the title has to be capitalized

Authors: The full names, qualifications, designation and affiliations of all authors should be listed at the beginning of the article. E mail id of all author is must. Your Manuscript should be typed, double-spaced on standard-sized – A 4 paper with 1" margins on all sides. You should use 12pt Arial font for manuscript, Subheadings should be in 12 point Bold Arial.

A research paper typically should include in the following order

Abstract : (Limit of 250 Words) a brief summary of the research. The abstract should include a brief introduction, a description of the hypothesis tested, the approach used to test the hypothesis, the results seen and the conclusions of the work. It can be a structured like Background, Methods, Results, Conclusion.

Key Words: write no more than six keywords. Write specific keywords. They should be written left aligned, arranged alphabetically in 12pt Arial.

Introduction: Description of the research area, pertinent background information, and the hypotheses tested in the study should be included under this section. The introduction should provide sufficient background information such that a scientifically literate reader can understand and appreciate the experiments to be described. The specific aims of the project should be identified along with a rationale for the specific experiments and other work performed.

Material & Methods: Materials and/or subjects utilized in the study as well as the procedures undertaken to complete the work. The methods should be described in sufficient detail such that they could be repeated by a competent researcher. The statistical tool used to analyze the data should be mentioned. All procedures involving experimental animals or human subjects must accompany with statement on necessary ethical approval from appropriate ethics committee.

Results: Data acquired from the research with appropriate statistical analysis described in the methods section should be included in this section. Results should be organized into figures and tables with descriptive captions. Qualitative as well as quantitative results should be included if applicable.

Discussion: This section should relate the results section to current understanding of the scientific problems being investigated in the field. Description of relevant references to other work/s in the field should be included here. This section also allows you to discuss the significance of your results - i.e. does the data support the hypotheses you set out to test? This section should end with new answers/questions that arise as a result of your work.

Conclusion: This should have statement regarding conclusion drawn from your study only.

Tables:

- Tables should be self-explanatory and should not duplicate text material.
- Tables with more than 10 columns and 10 rows are not acceptable.
- Number tables, in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.
- Place explanatory matter in footnotes, not in the heading.
- Explain in footnotes all non-standard abbreviations that are used in each table.
- Obtain permission for all fully borrowed, adapted, and modified tables and provide a credit line in the footnote.
- For footnotes use the following symbols, in this sequence: *, †, ‡, §, ||,¶ ,**, ††, ‡‡
- Tables with their legends should be provided at the end of the text after the references. The tables along with their number place in the text.
- Figures:
- The maximum number of figures should be limited to four.
- Upload the images in JPEG format. The file size should be within 4 MB in size while uploading.
- Figures should be numbered consecutively according to the order in which they have been first cited in the text.
- Labels, numbers, and symbols should be clear and of uniform size.
- Titles and detailed explanations should be written in the legends for illustrations, and not on the illustrations themselves.
- Send digital X-rays, digital images of histopathology slides, where feasible.
- If photographs of individuals are used, authors should take written permission to use the photograph.
- If a figure has been published elsewhere, acknowledge the original source and submit written permission from the copyright a credit line should appear in the legend for such figures.
- If the uploaded images are not of printable quality, the publisher office may request for higher resolution images which can be sent at the time of acceptance of the manuscript. Ensure that the image has minimum resolution of 300 dpi or 1800 x 1600 pixels.
- The Journal reserves the right to crop, rotate, reduce, or enlarge the photographs to an acceptable size.
- Acknowledgments: Limit to 100 words.
- References:
- The references / bibliography should be in Vancouver style. For full details on this refer to the following link to university of Queensland http://www.library.uq.edu.au/training/citation/vancouv.pdf .
- The titles of journals should be abbreviated according to the style used in Index Medicus.
- Use the complete name of the journal for non-indexed journals.
- Avoid using abstracts as references.
- Information from manuscripts submitted but not accepted should be cited in the text as "unpublished observations" with written permission from the source.
- Journal article: list first six author followed by et al. eg (Dumbre Patil SS, Karkamkar SS, Dumbre Patil VS, Patil SS, Ranaware AS. Reverse distal femoral locking compression plate a salvage option in nonunion of proximal femoral fractures. Indian J Orthop 2016;50:374-8)
- Books and Other Monographs

Personal author(s): Ringsven MK, Bond D. Gerontology and leadership skills for nurses. 2nd ed. Albany (NY): Delmar Publishers; 1996.

Editor(s), compiler(s) as author: Norman IJ, Redfern SJ, editors. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

Chapter in a book: Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Raven Press; 1995. pp. 465-78.

In low Back Pain due to Osteoporosis and Osteopenia

Bio-D_3 Plus Caps

Calcitriol 0.25 mcg + Calcium Carbonate 500 mg Softgel Capsules

Treat Low Back Pain Effectively & Safely

In Calcium Deficiency, Fracture Healing & during rapid growth of Childhood & Adolescence

Bio-D_3 Plus Susp.

Calcitriol 0.0625 mcg + Calcium Citrate equivalent to elemental Calcium 100 mg/5 ml

The active calcium at work

In High Risk patients of Osteoporosis & Fractures associated with high Homocysteine level

Bio-D_3 Max Caps

Calcitriol 0.25 mcg + Calcium Carbonate 500 mg + EPA 180 mg + DHA 120 mg + Methylcobalamin 1500 mcg + Folic Acid 400 mcg + Boron 1.5 mg

Maximized Osteoporosis Management

To Prevent Post Operative Infections

Stafcure 250 mg 500 mg

Cefuroxime Axetil 250 mg / 500 mg Tablet

The Staph Specialist

In Surgical wounds, Trauma & Osteoarthritis

Enzomac

Trypsin 48 mg + Bromelain 90 mg + Rutoside 100 mg Tablet

Trusted Healer, Internally & Externally

In Severe injuries, Hematoma & Sports Injuries

Enzomac Plus

Trypsin 48 mg + Bromelain 90 mg + Rutoside 100 mg + Diclofenac 50 mg Tablet

Enhanced Relief from Pain & Inflammation

MACLEODS

Gencare

EDITOR

Dr Saurabh Jain

Dept Of Orthopaedics, Mgmmc Indore

ASSOCIATION

Indian Orthopaedic Association

CHAPTER

Madhya Pradesh

PUBLISHER

Madhya Pradesh Chapter

of Indian Orthopaedic Association

CORRESPONDENCE

Dr Saurabh Jain (Editor)

Email: editor@ojmpc.com

WEBSITE & E-PUBLISH BY

SYSNANO INFOTECH

Web Development, Hosting Servers

(+91)-99931-77-656 (+91)-9977-77-0442

info@sysnano.com www.sysnano.com