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EDITORIAL

The Orthopaedic Journal of M P Chapter represents the state of art of orthopaedics being practiced primarily by the orthopaedic surgeons of MP but also state of art articles on topics of interest to all orthopaedic surgeons from various parts of India. The journal puts efforts to cultivate the habit amongst orthopaedic surgeons to maintain records, follow-ups and share them with colleagues using this platform and also encourages letters to editors by non-authors on controversial issues.

In this era of electronic print media it is easy for orthopaedic surgeons to find treatment guidelines, references and literature review easily. Evidence based management protocols although available are not at times applicable in the remote places and for the poor population. The journal specially tries to come out with problems, ideas and innovations which try to give a holistic treatment to our patients in spite of the lack of resources and in efforts to cut down the costs.

I hope you will like these ideas coming from remote and small places which will help you too in better patient management.

Prof. Dr. Alok C. Agrawal
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Editor
Orthopaedic Journal of M.P. Chapter

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ROLE OF PERCUTANEOUS CORE NEEDLE BIOPSY IN MUSCULOSKELETAL LESIONS

Kundu Z.S.* **Rana P.**** **Chechi S.K.***** **Singh S.***

ABSTRACT

Background: Biopsy is an important step in the confirmation of the diagnosis of musculoskeletal lesions. Open biopsy has greater morbidity and takes longer time to perform. Percutaneous core needle biopsy (PCNB) has evolved as a better, safe & accurate method for diagnosis of these lesions.

Methods: Between March 2006 and March 2008, this study of percutaneous core needle biopsy of lesions of bone and soft tissues was conducted in our department of orthopedics, including 105 patients of both sexes of all age groups without image guidance. The histo-pathological diagnosis were correlated and confirmed with surgical biopsy of all these lesions.

Results: Out of 105 PCNB's adequate material was obtained in 100 (95.24%). In five cases (4.76%) the material was inadequate. Sensitivity, specificity, positive and negative predictive values came out to be 95.74%, 100% and 93.33% respectively. Accuracy of PCNB to differentiate between benign and malignant lesions found to be 97.33 per cent.

Conclusion: From our study we conclude that PCNB is valuable, safe & effective technique for diagnosis of musculoskeletal lesions. This method has almost replaced open biopsy because of less number of procedure related complications and equal efficacy.

Key words: Core needle, biopsy, percutaneous, musculoskeletal lesions.

INTRODUCTION

Biopsy is an important step to confirm the diagnosis of musculoskeletal lesions. It is of two types: open and closed. Closed biopsy is further divided as fine needle aspiration cytology (FNAC) and percutaneous core needle biopsy (PCNB). [1] Open biopsy is considered to be an accurate method of diagnosing musculoskeletal lesions. Although it gives sufficient sample for making correct diagnosis, it has many disadvantages like fracture at biopsy site in osseous lesions, haematoma formation, infection and contamination of normal surrounding tissue by tumour cells. It may cause greater morbidity and takes longer time to perform, hence may delay the institution of therapy. [2]

Martin and Ellis were the first to report a systematic study of tumours sampled by means of small needle and aspiration in 1930. [3] First needle biopsy of bony lesions was performed by Coley and colleagues in 1931. [4] Considering the advantages of needle biopsy its application has been extended to all sites in musculoskeletal lesions. [5] FNAC most of the time does not provide adequate specimen for diagnosis of musculoskeletal lesions. [6] It is quite effective method in differentiation of benign and malignant soft tissue lesions but less effective in osseous lesions. In the last few decades PCNB has evolved as effective way for diagnosis of bony and soft

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tissue lesions. [7] We conducted this study to evaluate the efficacy of PCNB in making the diagnosis of musculoskeletal lesions.

MATERIAL AND METHODS

This prospective study was conducted in the department of Orthopaedics including patients of both sexes of all age groups with clinically diagnosed musculoskeletal tumours and other lesions of bone and soft tissues requiring biopsy for the treatment. A total of 105 patients of such lesions of lower extremity and back constituted the material for this study. The patient details including clinical history, age, gender, size and anatomical site of the lesion were noted. Blood investigations: haemoglobin, bleeding time, clotting time and complete urine examination were performed in routine. The relevant radiological investigations i. e X-ray of the affected part, computerized tomography and magnetic resonance imaging as per requirement were also performed. Core needle biopsy was performed using Jamshidi needle8 for the bony and tru-cut needle for soft tissue lesions. Jamshidi needle is a cylindrical needle with a tapered distal sharp bevelled cutting tip to avoid the crush artefact and plugging of the needle. Additionally it consists of a probe for needle introduction and penetration of the bony lesion and stylet for expelling the entrapped specimen. Tru-cut biopsy needle is a disposable needle in different range of gauzes with notch for entrapped specimen on its obturator and sharp tissue cutting needle closing over the obturator.

The procedure was performed in outpatient department under local anaesthesia in all the cases. A stab incision was given at a place over the lesion keeping in mind the incision of definitive surgery and its feasibility of en bloc resection of biopsy tract. The site of stab incision was decided with clinical judgement and its correlation with already performed X-ray, CT scan or MRI. Neurovascular structures and inter-muscular planes were kept in mind. The Jamshidi needle of 2mm diameter and the probe together were introduced just inside the lesion and then the probe was pulled out. The needle was then rotated clockwise and counter-clockwise approximately five times and a syringe was connected to the other end to develop vacuum to prevent the tissue core from sliding out. The needle was then taken out of the lesion maintaining the vacuum. The entrapped core was then pushed out of the needle using the stylet gently without crushing the tissue. Three to six cores (Fig. 1) were taken from different parts of the lesion by altering the directions of the path of the needle, through the shortest route decided clinically and already performed imaging investigations. No imaging guidance using ultrasonography, CT scan, MRI or image intensifier was used during this procedure.

The soft tissue lesions were biopsied using the tru-cut needle. The closed needle with its obturator was pushed just inside the lesion gently fixed with two fingers and then the obturator was pushed inside the lesion. The needle was then closed over the obturator by pushing forward entrapping the core of tissue within the notch and the needle was then pulled out of the lesion keeping it closed. The needle now was pulled back and the entrapped specimen was collected from the notch on the obturator. Samples collected were fixed in 10 percent formalin and sent for histo-pathological examination. The stab incision was stitched with one or two skin sutures as required. The histo-pathological examination was performed using routine haematoxylin and eosin stains. Special stains were used wherever required and indicated. The results were evaluated in view of histo-pathological positivity of samples and its correlation with final histopathology of the tissue obtained after definitive surgery or open biopsy in all the cases.

RESULTS

There were 73 male and 32 female patients. The age of patients ranged from 2 to 85 years (average age of 38.31 years). Majority of lesions in this study were in the extremities i.e. 68 in lower and 36 in upper extremity and one lesion was in the back. The commonest site of lesions was thigh

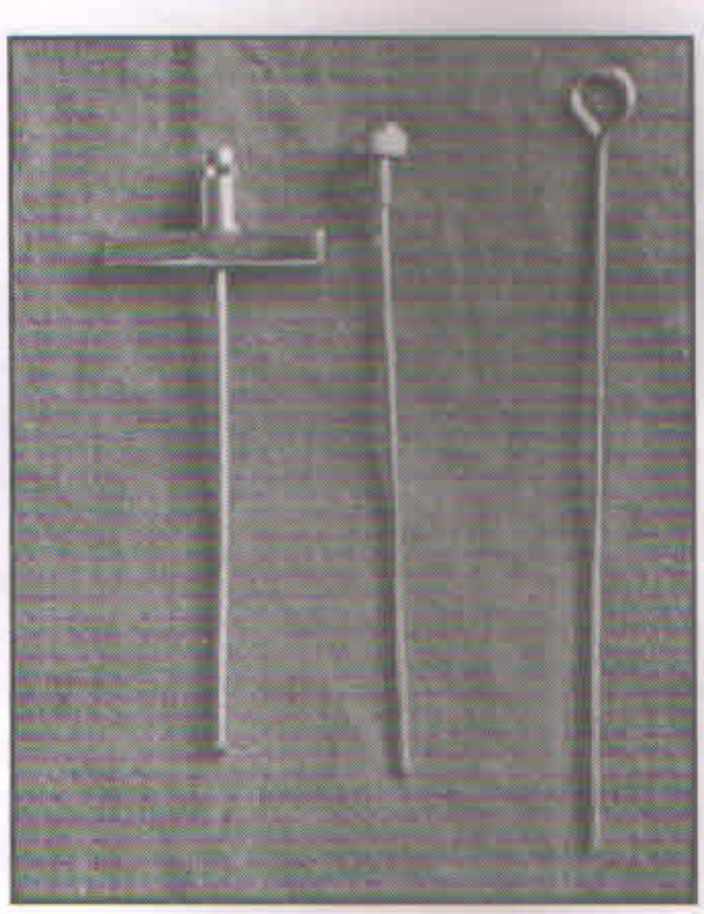

Figure 1 (a) : Jamshidi needle: the needle, trochar and stylet.

Figure 1 (b) : Biopsy through small stab being performed. The stab incision stitched with single suture

Figure 1 (c) : Eight good cores taken from a case of osteosarcoma

(n=33), followed by arm (n=14) and rest of the lesions were distributed elsewhere. The size of lesions ranged from 2 to 28 cm (average 6.3cm). After core needle biopsy there were 31 benign tumours or tumour-like lesions, 47 malignant tumours, 22 non-neoplastic lesions and five inadequate samples. The commonest lesion was osteomyelitis (n=21) followed by osteosarcoma (n=17) and skeletal metastasis (n=16). The other lesions included giant cell tumour (n=12), aneurysmal bone cyst (n=5), chronic cutaneous ulcer (n=4) and three each of Ewing's sarcoma, benign neurogenic tumour, enchondroma and ganglion. There were two lesions each of chondrosarcoma, non-Hodgkin lymphoma, multiple myeloma and malignant peripheral nerve sheath tumour respectively; and one lesion each of Langerhans cell histiocytosis, non-ossifying fibroma, malignant fibrous histiocytoma, giant cell reparative granuloma and calcinosis cutis.

Adequate material for diagnosis for diagnosis could be obtained in 100 (95.24%) cases. In five patients (4.76%) the material was inadequate for making the diagnosis. Results of PCNB were correlated with the surgical histopathology in all the cases. Ninety eight (98%) cases (out of 100 adequate aspirates) correlated correctly with final surgical biopsy. Two cases were wrongly diagnosed as benign neurogenic tumours, which later came out to be malignant tumours on open biopsy; which were suspected to be malignant on clinical examination in view of their size and location. PCNB was inadequate in five cases which were later diagnosed as echinococcus, hyperparathyroidism, myositis ossificans, hamartoma and sclerosing osteosarcoma respectively on open biopsy or surgical resection.

Overall adequacy was 95.24% (5 inadequate specimens out of 105 lesions). The accuracy of PCNB for diagnosing neoplastic lesions was 97.33% (73 correct diagnoses out of 75 neoplasms), with its sensitivity to be 95.74% and specificity 100%. The positive predictive and negative predictive values were 100% and 93.33% respectively. There was no major procedure related complication encountered during this period of study.

DISCUSSION

In musculoskeletal lesions, biopsy should be minimally invasive and should provide adequate sample for accurate diagnosis. Open biopsy has the major advantage of adequate specimen for histopathology but it is complications such as haematoma formation, infection and spreading of tumour cells into surrounding normal areas.[2]

In recent times PCNB has replaced the open biopsy due to its advantages like.[1] It is an out patient department procedure performed under local anaesthesia, less time consuming and causing minimal trauma to the patient.[2] There are less chances of contamination of normal surrounding tissue due limited tissue dissection with less haematoma and feasibility to take different cores from different areas of the representative part of the lesion by altering the tract of the needle through the same stab incision.[3] It is very suitable for deep and difficult areas like pelvis and spine where open biopsy will be too morbid; requiring general or regional anaesthesia and.[4] It is quick and cost effective.[9,10,11]

The procedure of biopsy should not be taken lightly and all the precautions and principles need to be followed properly and meticulously. For the musculoskeletal neoplastic lesions it should be performed at the specialist centre treating such lesions and by the person who will be involved in the definitive surgery or at least under his guidance. Mankin et al (1982) compiled data regarding the hazards associated with 329 biopsies of primary malignant musculoskeletal sarcomas. Analysis of the results of that study showed sixty (18.2 per cent) major errors in diagnosis and thirty four (10.3 per cent) non-representative or technically poor biopsies. Proolems arose in the skin, soft tissue, or bone of the biopsy wounds of fifty-seven patients (17.3 per cent), and the optimum treatment plan had to be altered as a result of problems related to the biopsy in sixty patients (18.2 per cent). In fifteen patients (4.5 per cent) an unnecessary amputation was performed as a result of problems with the biopsy, and in twenty eight patients (8.5 per cent) the prognosis and outcome were considered to have been adversely affected. The biopsy-related problems occurred from three to more than five times more frequently when the biopsy was performed at a referring institution rather than in a treating center.[12] They conducted a similar study in 1996 and the results obtained were unfortunately almost the same.[13] At our centre all the biopsies were performed under the guic ance of the person trained in orthopaedic oncology who was associated with the definitive treatment of these lesions. We achieved encouraging results in view of the efficacy and accuracy of these lesions even without the guidance of imaging facilities. We relied on the clinical examination along with its correlation with already performed and indicated imaging investigations including CT scan and MRI for the

location of the stab incision and for traversing the shortest path to the most representative part of the lesion to take adequate number of cores of the pathological tissue. This decision needs to be taken by the person who will be performing the final definitive surgery of the particular lesion as he is aware of the importance of resection of the biopsy tract along with the tumour.[12]

Out of 105 cases; 30 (28.57%) were benign, 45(43.86%) malignant and 25 (23.81%) other non-neoplastic lesions. Five specimens (4.76%) were considered to be inadequate for making any diagnosis on PCNB. Of 100 adequate cores obtained, our pathologists were able to diagnose the lesions correctly in 98 cases. Overall adequacy was 95.24% (5 inadequate specimens out of 105 lesions). The accuracy of PCNB for diagnosing neoplastic lesions was 97.33% (73 correct diagnoses out of 75 neoplasms), with its sensitivity to be 95.74% and specificity 100%. The positive predictive and negative predictive values were 100% and 93.33% respectively.

In 5 cases (4.76%) the core biopsy specimen were inadequate for opinion. These five lesions in which our pathologist were not able to make diagnosis included one each of echinococcus, myositis ossificans, hyperparathyroidism, sclerosing osteosarcoma and hamartoma respectively on final surgical biopsy. This was probably due to the inability of the needle to grasp and entrap the representative tissue within the bore of the needle and more number of cores should have been taken from different parts of such slippery mucoid (in echincoccus), heterogenous (in myositis ossificans and hamartoma), openly emptied spaces (in osteitis fibrosa cystica). Further it was very difficult to take specimen from very hard and sclerotic bone in one case of sclerotic osteosarcoma (proved after open biopsy). Two cases diagnosed as benign neurogenic tumors on core needle biopsy were proved to be malignant peripheral nerve sheath tumors on surgical resection. In these cases cores missed the malignant portion due to the heterogenic nature of these tumors and were probably taken from benign portion only. This emphasizes that the cores should be taken from different portions of the representative part of tumor by altering the tract of the needle.

For arriving at the accurate diagnosis the surgeon should furnish all the relevant clinical and radiological details to the histopathologist. A multidisciplinary team approach is must for achieving the correct diagnosis.[16] Samples collected should be examined for histopathology, cytology as well as the bacteriology. All the slides prepared from cores taken from different areas of the most representative portion of lesion should be examined exhaustively for making the correct diagnosis.

We conclude that the specimen harvesting was quite difficult in mucoid, hamartomatous, vascular, fibrous and sclerotic lesions (five cases). However, the overall results are well comparable to that of the literature with no major complication. The biopsy for musculoskeletal sarcomas should ideally be performed at a centre where definite surgery is to be contemplated so that the final surgical incision can be planned appropriately. Such patients should be referred to the treating centre without performing the biopsy. Adequate clinical history and relevant radiological investigations are of great importance for arriving at the diagnosis with PCNB. It is quite effective for bone as well as soft tissue lesions. In the eventuality of the inadequate material the option of the open biopsy is still available. Overall the PCNB is a valuable, safe and effective procedure for the diagnosis of musculoskeletal lesions.

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POST-OPERATIVE STAPHYLOCOCCUS AUREUS INFECTION: CAUSE OF NONUNION AND IMPLANT FAILURE

Agrawal A.C.* **Jain R.**** **Agrawal M.*****

ABSTRACT

Introduction: Bone infection after implant surgery leading to nonunion and implant failure is one of the most challenging Orthopaedic complications to treat. This study was done to find out the relationship between the type of pathogens causing postoperative infection with fracture nonunion, chronic osteomylities and implant failure.

Methodology: This is a retrospective study of 20 cases, in which post operative wound infection occurred after implant surgery from 2009 to 2012.

Results: Out of 20 postoperative infected cases, 12 were found to be infected by S. Aureus, 2 by Pseudomonas and 1 from E-Coli. 5 cases had their cultures sterile. Out of 12 cases infected by S. Aureus, 7 developed infected non union in which 4 had serious infection also leading to chronic osteomylities. 5 cases of S aureus infection got cured after implant removal following union of their fractures.

Conclusion: Most of the postoperative wound infections are caused by S. Aureus. S. Aureus is the commonest organism isolated from infected non-unions. Majority have early onset of infection. Early culture positive infection (within seven days after surgery) have poor clinical outcomes. In our setup S Aureus strain is sensitive to linezolid, clindamycin and vancomycin. The use of ceftriaxone for preoperative surgical prophylaxis in orthopaedic implant surgery is questionable. The ideal strategy for S. aureus infected implant is lacking. By surgical debridement, culture sensitivity specific antibiotic for 6 to 8 week and retention of implant, union were not achieved in majority of cases. New approach is required for prevention and management of postoperative S. aureus infected implant.

Keywords: Microbiology; Infection; S. aureus; Nonunion; Sensitivity; Causes; Prevention

INTRODUCTION

Bone infection after implant surgery leading to nonunion and implant failure is one of the most challenging Orthopaedic complications. Chronic posttraumatic osteomyelitis and infected nonunion of the tibia result in considerable morbidity and can threaten viability of the limb.[1] Although definitions vary, non union has been aptly described as a fracture in which the reparative process has come to complete standstill.[2] In well established cases there are well defined radiological and histological signs which dictate the surgical condition. Infected nonunion has been defined as a state of failure of union and persistence of infection at the fracture site for 6 to 8 months.[3] By definition infected non-union is a Cierney - Mader type 4 osteomyelitis[4] (meaning that diffuse osteomyelitis involves the entire thickness of the bone, with loss of stability).

Factors involved with fracture non-union include, systemic condition like diabetes, smoking, nicotine use, malnutrition, osteoporosis, prolonged

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use of non steroidal anti inflammatory agent, and local condition like infections, devascularisation of fracture fragment, poor stabilization, poor bone contact, iatrogenic factors, magnitude of trauma and biofilm formation on implant.[5]

Development of infection may result from compromised soft tissue and bone vascularity, systemic compromise of the host, and virulent or resistant organisms.[6] Multiple risk factors for orthopaedic surgical site infection have been identified. These include diabetes, malnutrition (a total lymphocytes count of < 1500 mm^3, serum albumin label < 3. 5 g/dl or serum transferrin label of<226mg/dl), use of tobacco, obesity, nasal carriage of S. aureus, preoperative and postoperative anaemia and urinary tract infection.[7] The particular surgeon, the length of time that the wound is open and improper use of antibiotics were shown to be significant factors in the incidence of infection.[8]

This study is done to find out relation of the type of pathogens causing postoperative infection with that of fracture non-union, chronic osteomylities and implant failure.

MATERIAL AND METHODS

This is a retrospective study of 20 cases, in which post operative wound infection occurred after implant surgery from 2009 to 2012. The criteria for the diagnosis of post-operative wound infection were those used by the National Research Council[9] of USA who defined POWI as "the presence of pus in a wound which has either discharged spontaneously or has to be released by the removal of sutures or re-opening the incision".

Cases with close or open Gustilo and Anderson type 1, 2 fractures were included in this study. All open fracture had pre-operative wound culture and sensitivity done, which was negative. All had low to medium velocity trauma. These include, 3 cases of fracture shaft femur, two treated by close interlocked femur nailing and one by femur plating, 9 cases of fracture tibia fibula, five treated by plating and four by tibial interlocked nailing, 5 cases of fracture shaft humerus, two treated by Rush nail and three by DCP plating, 1 case of fracture of both bones forearm, treated by forearm plating, 1 case of fracture of intertrochenteric femur treated by dynamic hip screw with side plate and 1case of old dislocation of elbow treated by Baksi sloppy hinge total elbow replacement. All cases were in the age group of 20 to 50 years. All patients had no other medical illness and had good nutritional status. 8 cases had history of smoking.

OBSERVATIONS AND RESULTS:

Out of 20 postoperative infected cases, 12 were infected by S. aureus, 2 by pseudomonas and 1 from E-coli. 5 cases were found to be sterile on culture. Out of 12 cases infected by S. aureus, 7 developed infected non union in which 4 had serious infection leading to the development of chronic osteomylities. 5 cases of S aureus infection got cured after implant removal following fracture union. In 3 cases with postoperative Gram negative infection, infection subsided gradually by local dressing and use of appropriate antibiotics i.e., piperacillin, and amikacin over a period of two weeks or following implant removal in one case of tibial plating. In all 7cases of infected non-union, infection occurred early, within 7 days of surgery. All these S. aureus infections were found to be sensitive to linezolid and clindamycin which was used for the duration of 6 to 8 weeks or till antibiotic resistance developed. Details of antibiotic sensitivity have been shown in Table 1. All patients planned for surgery in the department received prophylactic Ceftriaxone preoperatively and Ceftriaxone and amikacin for 5days after surgery.

Table 1
RELATIONSHIP BETWEEN FRACTURE, PROCEDURE DONE, INFECTIVE AGENTS, SENSITIVE ANTIBIOTICS AND COMPLICATIONS

S. No.	A/S	Type of fracture	Velocity of trauma	Procedure done	Personal history		Infection	Causative agent	Sensitivity	Non union	Osteomylities	Implant failure
					Smoking	Alcoholic						
1	30/m	Tibia fibula grade 2B Right	Medium	Tibial plating	Yes	Yes	Early	S. Aureus	Linezolid, Clindamycin, Vancomycin	Yes	Yes	Yes
2	50/m	Shaft humerus Left	Low	Humerus Plating	Yes	Yes	Early	S. Aureus	Linezolid Clindamycin	Yes	Yes	Yes
3	35/m	Shaft humerus comminuted left	Low	Humerus plating	No	No	Early	S. Aureus	Linezolid, Clindamycin	Yes	Yes	Yes
4	46/m	Tibial plateau Left	Medium	Tibial plating	Yes	No	Early	Gram Negative	Amikacin, Piperacillin	No	No	No
5	50/f	Lower/3rd tibia Right	Low	Tibial plating	No	No	Late	Gram negative	Amikacin, Piperacillin	No	No	No
6	38/m	Lower/3rd tibia fibula Right	Low	Tibial plating	Yes	No	Early	Gram negative	Amikacin, Piperacillin	No	No	No
7	22/m	Segmental tibia fibula grade 2b Right	Medium	Tibial interlocked nailing	No	No	Early	S. Aureus	Linezolid Vancomycin, Clindamycin, amoxicillin clavulinic	Yes	No	Yes
8	28/f	Lower 3rd tibia, fibula grade 2 Right	Medium	Tibial interlocked nailing	No	No	Early	S. Aureus	Linezolid vancomycin, clindamycin, amoxicillin clavulinic	No	No	No
9	32/m	tibia, fibula Grade 1 left	Low	Tibial interlocked nailing	No	No	Early	S. Aureus	Linezolid vancomycin, clindamycin, amoxicillin clavulinic	Yes	No	Yes
10	50/m	tibia, fibula Left	Low	Tibial interlocked nailing	Yes	Yes	Early	S. Aureus	Linezolid vancomycin, clindamycin, amoxicillin clavulinic	No	No	No

S. No.	A/S	Type of fracture	Velocity of trauma	Procedure done	Personal history		Infection	Causative agent	Sensitivity	Non union	Osteo mylities	Implant failure
					Smoking	Alcoholic						
11	35/m	Both bone forearm Left	Low	Both bone forearm plating	Yes	Yes	Early	S. Aureus	Linezolid, clindamycin, ofloxacin	No	No	No
12	28/f	shaft femur Left	Medium	Femur plating	No	No	Early	Sterile	No growth	No	No	No
13	48/m	Old dislocation elbow Right	Low	Total elbow replacement	Yes	Yes	Early	S. Aureus	Linezolid, imipenem	Yes	-	-
14	38/m	Shaft femur Left	Medium	Femur interlocked nailing	No	No	Early	Sterile	No growth	No	No	No
15	28/m	Intertrochenteric femur Left	Medium	DHS	No	No	Early	Sterile	No growth	No	No	No
16	30/m	Shaft humerus Right	Low	Rush nailing	Yes	Yes	Early	Sterile	No growth	No	No	No
17	28/m	Shaft humerus Left	Low	Rush nailing	No	No	Early	S. Aureus	Linezolid, clindamycin	No	No	No
18	38/f	Shaft humerus right	Medium	Plating	No	No	Early	S. Aureus	Linezolid, clindamycin, ofloxacin	No	No	No
19	28/m	Shaft femur left	Medium	Interlocked nailing	No	No	Early	Sterile	No growth	No	No	No
20	45/m	Tibia, fibula Right	Low	Tibial interlocked nail	Yes	Yes	Early	S. Aureus	Linezolid, clindamycin, ofloxacin	Yes	Yes	No

DISCUSSION

Bone is normally resistant to infection.[10] However trauma, orthopaedic surgery, or placement of a foreign body such as an orthopaedic implant may expose this otherwise sterile environment to infection.

S. aureus is a Gram positive cocci which is a common human pathogen living harmlessly on the skin and mucous membranes of healthy individuals.[10,11] From 1990-1992, data from the National nosocomial Infections Surveillance System for the centers for Disease Control and Prevention (CDC) revealed that S aureus was the most common cause of operative wound infections and the second most common cause of nosocomial bloodstream infections.[11]

Figure 1a and 1b : One year after tibial interlocking nail patient with S. Aureus infection develops non union with broken screw and nail with malunion of the fibula and valgus deformity.

Figure 2a and 2b : Infection with E-Coli. Patient has exposed implant but fracture united after 8 months.

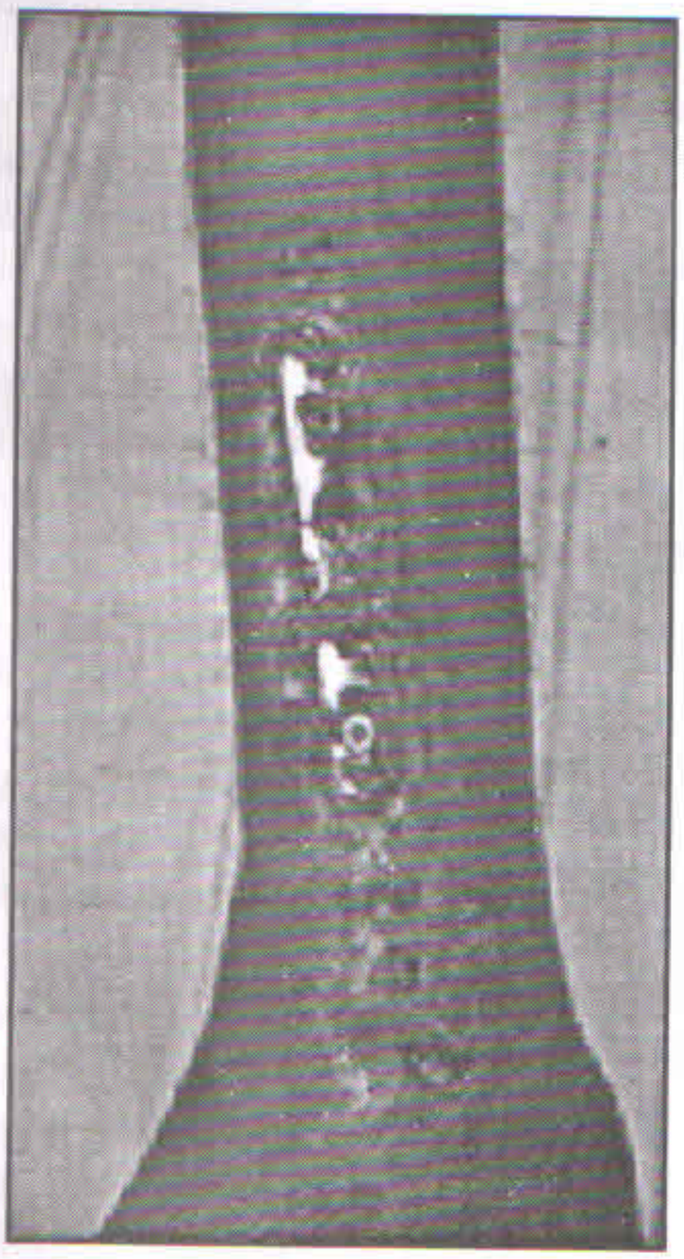

Figure 3 : Four months after humerus plating. No sign of union. Pt has S. aureus infection

A.D. Khoshrabi et al[12] in their article "study of bacteria isolated from orthopaedic implant infections and their antimicrobial susceptibility pattern" found S. aureus was the most common recovered bacterium which was mostly sensitive to vancomycin. In relation to one set of infection about 79 % of patients were having early infection. These findings were in accordance to our study in which 95% were having early onset of infection. Majority of the cases were infected by S. aureus which was sensitive to vancomycin and linezolid.

Venkatachalapaty et al[13] in their study "Factor causing non-union of fractures" found that although bone infection do not cause non-union per se. it can contribute to fracture non-union through bone death, pus formation, creation of bone gap by osteolytic infection, granulation tissue and movement of loosening implant. Inflammatory response to bacteria at the site of fracture, disrupt callus, increased gap and motion between fragments causing fracture non-union. Infection causes poor bone quality resulting ultimately in implant failure.

A study conducted by Tania Claro, Amro Widaa, et al[10] at the Department of Molecular and Cellular Therapeutics, Royal College of Surgeons in Ireland, - "Staphylococcus aureus Protein A, Binds to Osteoblasts and Triggers Signals That Weaken Bone in Osteomyelitis" found that major S. aureus virulence protein, SpA also binds directly to osteoblasts. This interaction results in the generation of multiple signals leading to inhibition of osteoblast proliferation,[14,15] induction of osteoblast apoptosis, inhibition of mineralisation and release of mediators capable of inducing bone resorption via osteoclast activation. Mineralisation is a process where phosphate and calcium becomes deposited in bone. This gives the bones additional strength and rigidity. During S. aureus infection, mineralisation (phosphate and calcium deposition) is completely inhibited. Our study supports that staphylococcus aureus interferes with fracture union.

Andrej Trampuz et al[16] in their study 'Infection associated with orthopaedic implant' found that prosthethetic joint infection (early infection: within three months) is mainly caused by S. aureus. Implant associated infection are typically caused by microorganism growing in structure, known as biofilm. The treatment of implant associated infection require appropriate surgical intervention combined with prolong antimicrobial regime depends on pathogenesis of infection, stability of the implant, antimicrobial susceptibility of the pathogens and condition of surrounding soft tissue.

Marschall Berkes, William T. Obremskey et al[17] in their study "Maintenance of hardware after early postoperative infection following fracture internal fixation" found that deep infection after internal fixation of a fracture can be treated successfully with operative debridement, antibiotic suppression, and retention of hardware until fracture union occurs.

In our study postoperative implant infection were treated by surgical debridement, culture sensitivity specific antibiotic for 6 to 8 week and retention of implant till union was achieved. By this strategy union were achieved in all the 5 culture negative, 3 Gram negative and 5 S. aureus infected cases. But 7 (58.33%) cases of S. aureus infection went on to nonunion. Of these 7 cases of non union, 4 had fractures both bones leg and 2 had fracture shaft humerus. In view of high rate of non-union with staphylococcus aureus infected implant in fracture tibia fibula and fracture shaft humerus there is a need of a different management protocol.

In our setup we used ceftriaxone preoperatively for surgical prophylaxis and 3 days during the postoperative period. As majority of postoperative wound infection were caused by staphylococcus aureus which was resistant to ceftriaxone, the use of Ceftriaxone in orthopaedic implant surgery for preoperative prophylaxis is questionable.

Ceftriaxone displays poor penetration into infected cortical bone. Penetration was satisfactory in highly vascularised cancellous bone. Drug penetration is impaired in necrotic bone and sequestra. (Garazzino S et al[18] Ceftriaxone penetration in patient with septic non union of tibia")

Trampuz A et al[19] in their study "Antimicrobial agents in orthopaedic surgery: Prophylaxis and treatment" found that the pathogenesis of implant-associated infection involves interaction between the microorganisms (biofilm formation), the implant and the host. Despite improvement of perioperative prophylaxis, orthopaedic implants still remain highly susceptible to bacterial or fungal contamination, generally resulting in persistent implant-associated infection. Therefore, perioperative and life-long prevention of infection is important. Increasing antimicrobial resistance to first- or second-generation cephalosporin requires the use of alternative agents, such as quinupristin/dalfopristin, linezolid and daptomycin, for perioperative prophylaxis. But results of clinical trials with these agents are limited. Also reviewed are potential new antimicrobial agents currently undergoing investigation, such as the novel oxazolidinone RWJ-416457, the new glycopeptide dalbavancin, the glycylcycline compound tigecycline, the new carbacephem BP-102 and novel rifamycin derivatives. Vaccination against Staphylococcus aureus with StaphVAX induced specific antibodies potentially preventing bacteraemia; however, there are no studies on efficacy in the prophylaxis of device-associated infections with this vaccine.

We agree with Trampus A et al that we further require a new strategy to prevent and manage postoperative implant infection.

CONCLUSION

The results of the present study can be concluded as follow;

1. Most of the postoperative wound infections are caused by Staphylococcus aureus.
2. S. aureus is the commonest organism isolated from infected non-union.
3. Majority have early onset of infection.
4. Early culture positive infection (within seven days after surgery) has poor out come.
5. In our setup S aureus strain is sensitive to linezolid, clindamycin and vancomycin.
6. The use of ceftriaxone for preoperative surgical prophylaxis in orthopaedic implant surgery is questionable.
7. The ideal strategy for post operative staphylococcus aureus infected implant is lacking. By surgical debridement, culture sensitivity specific antibiotic for 6 to 8 week and retention of implant, union was not achieved in majority of post operative S. aureus infected cases.
8. New approach is required for prevention and management of postoperative S. aureus infected implant.

LIMITATION

This is a small study. A larger study is required to reach a logical conclusion regarding, an ideal approach for the prevention and the management of postoperative S. aureus infected implant is needed.

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FREEZING SHOULDER SYNDROME - A STUDY OF 490 CASES FROM 1994-2008

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Frozen shoulder is a clinical entity described as the pain and restriction of shoulder movements with increasing disability of the patient the frozen shoulder or periarthritis or adhesive capsulitis is the syndrome whose exact etiology is not known however some epidemiological factors can be determined. The syndrome is characterized by pain and limitations of movements starting insidiously with feeling of low grade and dull pain over the anterior aspect of the shoulder joint commonly seen in the age of 40 to 50 years. The disease runs a prolong course starting with feeling of Heaviness and dull ache around the shoulder sometimes during the day. The intensity and duration of pain gradually increases associated with difficulty in performing certain movement of the shoulder. Later on the pain become more intense shooting in nature and distributed to the anterior & lateral aspect of arm and elbow. The movements increasingly becomes more as the time passes the pain becomes & constant feature being complaint by the patient through the day sleep. The activities of daily living like combing hair, buttoning of the blouse, raising the arm above the head becomes extremely painful and stage comes when there is absolutely no movement at the shoulder if at all patients try to move the shoulder it causes intense pain. As described by many workers this condition is a self limiting one running from months or years there by seriously disabling the patient.

BICCIPITAL TENOSYNOVITIS

Tenosynoyitis of the long head of the biceps is a common cause of shoulder pain especially in people of elderly and middle age women are affected more often than men the basic disorder is an inflammatory process that is traumatic non specific or both and that involves both the tendon & it's sheath in the inter tubercular groove. It is frequently over looked by many orthopaedic surgeons as they do not consider it a clinical entity. In their opinion if tenosynovitis does occur it is only secondary to some other lesion such as calcium deposit tear of the rotator cuff or reflex dystrophy which may occur either separately or in conjunction with bicipital tenosynovitis to produce such painful stiff shoulder, but regardless of whether the tendon involvement is primary or secondary once the tendon becomes in involved it is a major source of pain that leads to muscle spasm & limitation of motion resulting in fibrosis around the joint.

Those shoulder movements which causes biceps tendon to glide in the groove often produces pain in the anterior aspect of the joint. Flexion of the shoulder against resistance with the elbow extended may produce pain in the inter-tubercular groove. When seen early shoulder motion may be normal. But usually periarthritis of the joint is already established and motion is limited.

The cause of the tenosynovitis seemed to be one of the following (1)Trauma (2) other lesions such as calcium deposits or (3) idiopathic. When the tenosynovitis was found in conjunction with some other lesion, it may not have been caused by it.

Lippmann was one of the first to appreciate

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the role of bicipital tenosynovitis in periarthritis of shoulder.

As described in the literature the condition is chronic benign slowly progressive condition. Occasionally starts with a dull aching sensation or heaviness in the area of shoulder & arm. This sensation of heaviness & dull pain gradually increases in intensity & frequency. This period ranges from few weeks or months which is followed by increasing stiffness on the movements at the shoulder the joint. As this disturbs the sleep in the established stage there are absolutely no movement at the joint. The duration of illness is about 6 month to 1 year or even more. If we look in to the duration & morbidity period it is considerable even so as the recovery period which is again 6 months to 1 year. The recovery is 20 to 30% deficient if the management is carried out as described in the literatures that is NSIADs, local applications, physiotherapy and manipulation under anaesthesia and there is a lot of suffering to the patients. If with some form of management the duration of the illness and the recovery is reduced to weeks from months or years it will have a revolutionary change in the present day management of this disabling conditions. Looking into this concept a different kind of management should be sought.

MATERIAL & METHODS

A Study of 490 cases of this particular condition where carried out in the out-patient department in our set up. The detailed clinical history and epidemiological factors were thoroughly studied and the results were recorded in from of written documents and photographs. 496 patients of painful shoulder with varying degree of shoulder stiffness were treated at Indira Gandhi Hospital Seoni (M. P.) between 1994 - 2008.

Thorough Analysis of Age / Sex social status, onset, duration, intensity of pain Rural/urban ratio was done.

Age/ Sex occupation wise incidences are shown in the following tables.

MALE/FEMALE RATIO- ALMOST EQUAL

Male	Female
1.18:1	
Male/Female Ratio	
Male	Female
225	190
Young Patents	3
Below 30 Years	8
Middle Age Patents	55
C 30-50 Years	82
Elderly Patients (c 50 - 70 year)	80
Involvement of Shoulder	
Rt	74
Lt	66
Acute On Set (Younger age Group)	8 Patients
Insidious (Gradual)	380
Urban	108
Population	
Rural	345
Labour	223
Occupation	
Executive	30
Class House Wife	30
Pain	120
Presenting Stiffness Complaints	36
Pain + Stiffness	240

Before looking in to the study conducted, I would like to discuss briefly present day management which is as follows.

1. REST TO THE JOINT.
2. LOCAL HEAT APPLICATION.
3. NSAID.
4. LOCAL STEROID INFILTRATION WITH.
5. MANIPULATION UNDER ANAESTHESIA.

6. SURGICAL DECOMPRESSION OF BICIPITAL TENDON

1. REST TO THE JOINT

In the acute stage of tenosynovitis the patient complains of severe agonizing shooting pain which increases on attempted movements, however in most of the cases there is frequently complaints of severe pain at rest. In these circumstances rest to the joint will not give any relief to the patient.

2. LOCAL HEAT APPLICATION

Local heat application again does not give relief however, it is frequently reported by many patients that very little relief is obtained by pressing or massaging the anterior part of affected shoulder with palm of opposite hand usually the patient adopts typical posture pressing or holding the affected shoulder with the opposite hand.

3. NSAID

The NSAIDs are most widely and extensively used drugs in these cases. Even patients used to take to these drugs by their own. Usually when the patient starts getting symptoms, he runs to his family physician or locally available doctor who immediately prescribes some kind or NSAID or analgesic in initial stages. Some relief is obtained and patient goes to his work. Again after some days or months he gets pain some or the other from of same drugs are prescribed by the doctor or the patient him-self so that tne symptoms becomes more and more agonizing.

4. PHYSIO THERAPY

The role of physiotherapy in the patient of frozen shoulder is aimed at obtaining the range of movement in stiff and pain full shoulder. It is a widely used method of treatment & debated again and again. The disadvantage with this method is that is requires trained physiotherapist and a center which are not easily available to our rural population. The other point to be discussed regarding physiotherapy is that in cases of frozen shoulder the main factor which causes stiffness of shoulder is severe persistent pain which is exaggerated by slightest movement. In established cases of frozen shoulder patient complains of intense rest pain; patient does not want to move his joint even on repeated persuasion as the patient experiences severe pain as he tries to move his joint. Therefore the physiotherapy is not going to give any relief unless pain is not relived.

5. LOCAL STEROID INFILTRATION

Infiltration of one of the preparation of steroid either hydro cortisone or triamcinolone local steroid injection acetate is a widely used procedure to get relieve from pain in cases of established cases of frozen shoulder. It is discussed again & again even criticized by many a orthopaedic surgeons. Steroids are infiltrated at different sites by different surgeons. Around the bicipital groove is almost always the cause of pain and restriction joint movement which was further supported by the work of Hitchcock & De'palma the site injection will be discussed in the following chart.

The study was aimed at the injection of steroid in these conditions.

Two sites of injections were selected in 3rd group patients.

1. The steroid i. e. triamcinolone with xylocaine + Hylase were injected in the joint proper i. e. sub acromial.
2. Infiltration of steroid in bicipital groove and tendon sheeth. Results or shown in master chart in close.

6. SURGICAL DECOMFRESSION OF BICIPITAL TENDON

Besides known methods of treatment of chronic shoulder pain by above mentioned methods, there were 26 patients who did not respond to any of the above mentioned methods of treatment. These were treated by surgical decompression of bicipital tendon in bicipital groove done under local anaesthesia - a minor surgical procedure.

Patients selected for surgery were those who presented with severe nocturnal intractable pain greatly disturbing their sleep.

CONCLUSION

As Lipman first identified the role of tendon of the long head of biceps in the causation of frozen shoulder which was further supported by de "palma & Hitchcock. It is the tendon of long head of biceps which is first involved. As already told in the very first stage that is the stage of pain or stage of synovitis of tendon of long head of biceps of shoulder pain syndrome /frozen shoulder. In cases if we treat the tenosynovitis stage the forth coming much disabling condition of periarthitis or frozen shoulder can be prevented and the duration of morbidity can be reduced considerably.

The full range of movements and the shoulder were regained within 2-3 weeks after the injection and the movements were absolutely pain less. All patients were followed up constantly for pain & any kind of restriction of joint movement.

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EVALUATION OF CLOSED REAMED/ UNREAMED INTERLOCKING NAILING OF TIBIA

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ABSTRACT

30 cases of fractures of tibia (closed or Open Gustilo Gr I - III A) have been treated randomly by either reamed interlocking intramedullary nail or by unreamed interlocking nail (mainly open fractures). Results depended on the fracture configuration and nature of fracture.

Union was faster in unreamed nailing which also took less operative time. Infection rate was lower in unreamed nailing - breakage of interlocking screw was seen after unreamed nailing.

Keywords: fracture tibia, reamed interlocking nailing, unreamed interlocking nailing.

INTRODUCTION

Tibia is a common injury of young adults due to the chaotic traffic conditions of the roads which results in high velocity trauma. Due to variable results of treatment, the modalities of treatment have been numerous. The tibia is also characterized by a poor vascular supply which often leads to delayed union or non union.

Closed reamed intramedullary nailing of tibia had many advocates due to encouraging results, however some surgeons disagree and opined that reaming damages the endosteal blood supply of an already precarious blood supply of tibia.[1] Moreover reaming medullary canal is thought to increase the spread of infection due to micro-sequestrae and therefore reaming should be avoided.[5] The purpose of the present sought study was to evaluate the result of reamed/ unreamed nailing of tibia

MATERIAL AND METHODS

The study was carried out from 2009 to 2012 at Irwin Hospital, MMC Muzaffarnagar. A total of 30 cases form this study. Cases treated by open reduction and intramedullary nailing, or where closed reduction was unsuccessful have been excluded. Cases lost to follow up have also been excluded.

17 out 30 cases were treated by unreamed closed nailing while the remaining 13 have been treated by reamed closed nailing. The inclusion criterion included both sexes aged 18 - 60yrs, with fracture line 6 cm. below tibial tuberosity and 5 cm above the medial malleolus tip.

Gr I open fractures were treated by primary nailing while Gr II - III A open fractures were treated by secondary interlocking fixation after primary management by external fixation& wound closure.

All open fractures were treated by unreamed nailing (13 cases) while simple cases were treated by reamed nailing (fracture 9 cases). 4 cases of simple fracture were treated by nailing. Implant used was manufactured by M/s Sharma Pharmaceuticals Pvt Ltd.

The interlocking nail permits fixation fracture without rotational instability and is also a load

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sharing implant (in contrast to a plate for fracture union). It also permits union due to micro-movements essential for fracture union.[2]

Apart from routine investigations, specific investigation due to various indications was done as indicated. An A.P. and Lateral X-Ray of the leg were done and fracture configuration was classified.[4] After stabilization of the patient's condition, the cases were taken up for the surgical procedure.

OBSERVATION

All patients included in this study have been followed up for a minimum period of 2 years. Gr I open fracture were 8 (26.66 %) while Gr II - IIIA were 5 (%)[5]

Table 1 shows the distribution of cases according to the age of type of surgery.

Table 1

Age	Reamed ('Y') nail	Unreamed ('S')	Total
18 - 20	0	2	2
21 - 30	5	1	6
31 - 40	3	3	6
41 - 50	3	4	7
51 - 60	2	3	5

4 cases have been excluded due to lack of adequate follow up. Maximum incidence was in the most active about age group of 30 - 40 yrs

Table 2 shows the surgery according to the fracture geometry

Table 2

Type	Reamed ('Y')	Unreamed ('S')	Total	%
A3	7	5	12	50.00%
A2	1	2	3	12.50%
A1	2	2	4	16.66%
Comminuted	3	4	7	29.16%

The above table shows that A3 fracture (AO classification) are 53.3% since majority of the injuries were due to RTA (high velocity trauma)

Table 3

Type of surgery	Average operating time in minutes	Average Hospitalization time in days
Reamed	77	19 day
Unreamed	51	19.1 day

The time for unreamed nailing was less since the process of serial reaming was not done of time was saved during the surgical procedure

Table 4

Union rate (weeks)	Surgical procedure Reamed	Unreamed	%
11-12	4	5	37.50%
13-14	5	4	41.66%
15-16	4	3	29.16%
17-18	-	1	4.16%

The average time for union of fracture in both groups was nearly same and not stastically significant

COMPLICATIONS

Table 5

Complications	Reamed	Unreamed
Infections	4	1
Knee Pain	-	1
Breakage of Implant	-	1
Restriction of Ankle movements	1	-
SystemicComplication DVT/ Fatembolism	Nil	Nil

DISCUSSION

Reamed intramedullary interlocked nailing of tibia has given good results in the present study, but the incidence of infection is higher probably because of the increased operation time.

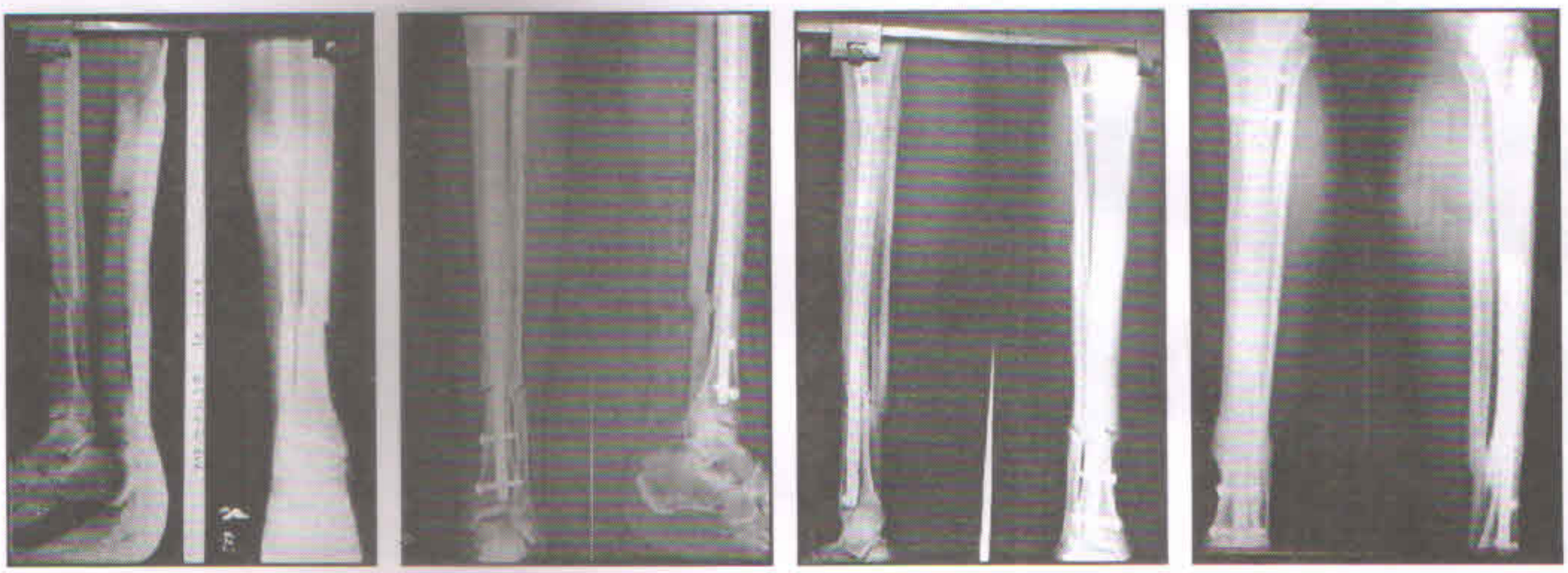

Figure 1 : X- ray's - Fractures of tibia treated by closed reamed interlock nail

Figure 2 : Patient showing full weight bearing & movements after closed reamed interlock nail

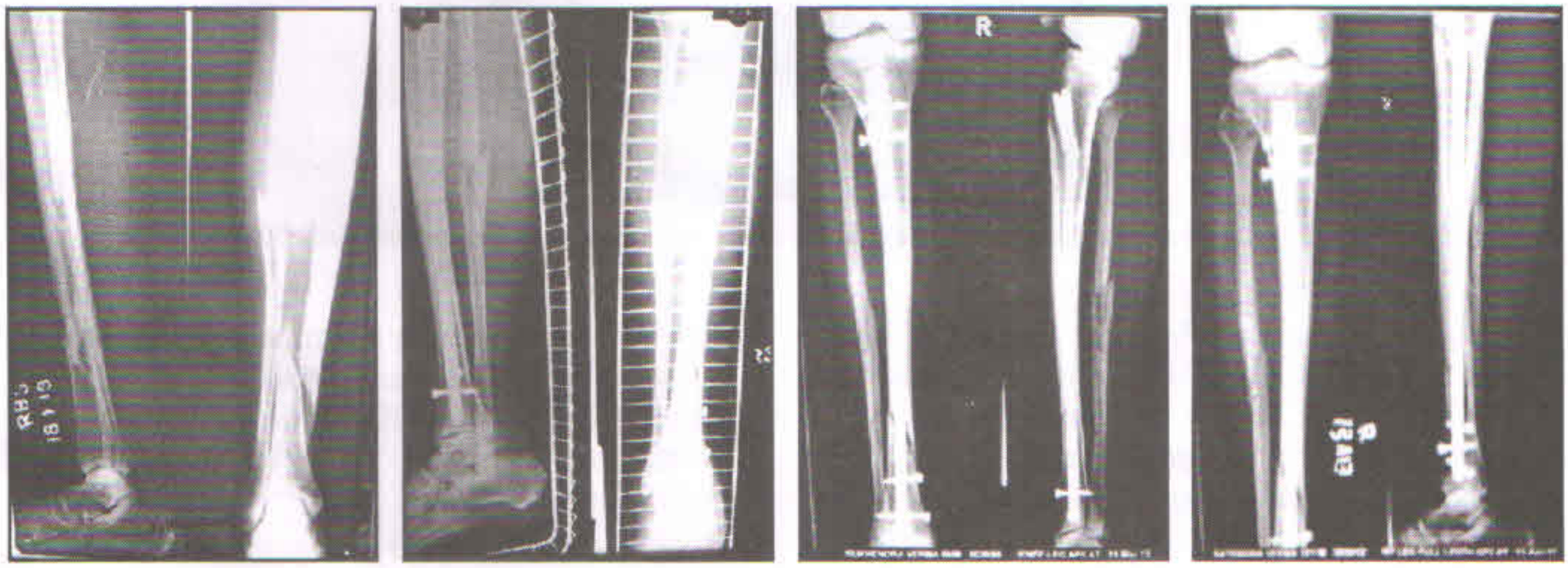

Figure 3 : X- ray's - Fracture of tibia treated by closed unreamed interlock nail

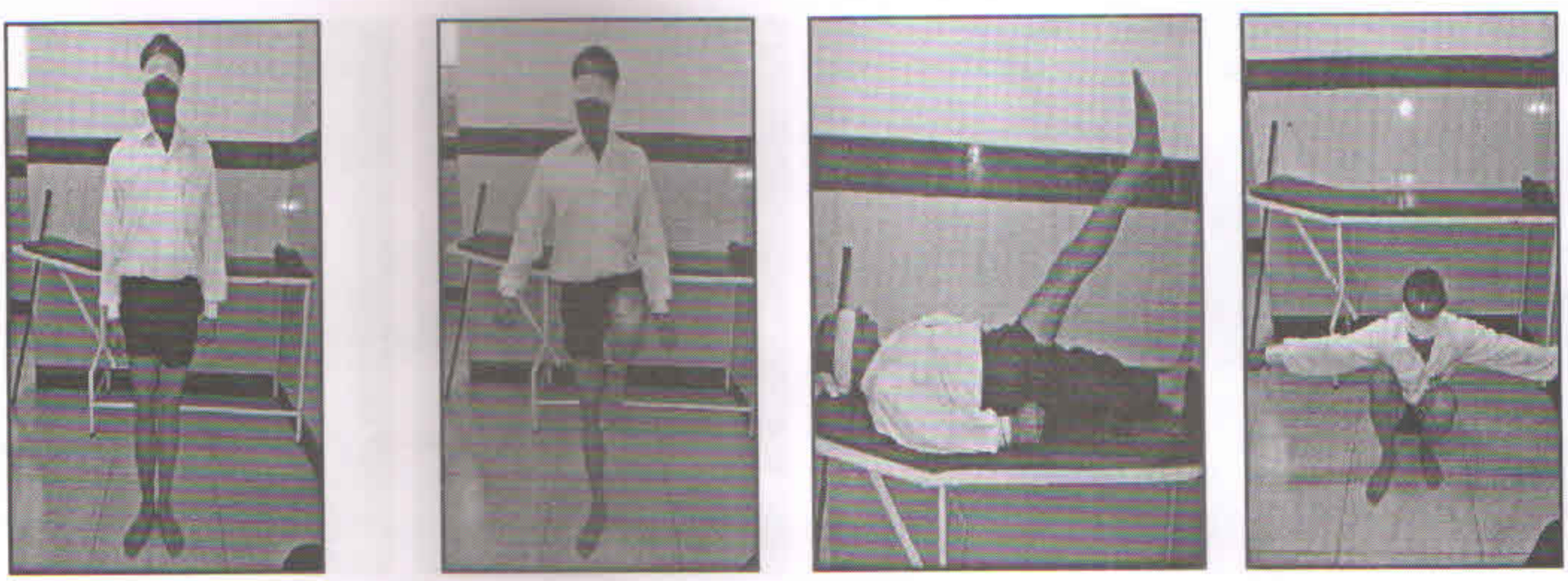

Figure 4 : Patient showing full weight bearing & movements after closed unreamed interlock nail

Figure 5 : X - ray - Broken screw in fracture tibia treated by unreamed closed intramedullary interlock nail

Duration taken for fracture to unite in both groups is same in the present study. The loss of endosteal blood supply in reamed group is probably set off by a three point fixation and marrow elements being deposited in the soft tissues around the fracture site during reaming. Similar views have been expressed by Bhandari et al (2004)[6] while conducting a comparative analysis of large series of reamed and unreamed tibial shaft fractures Lansen et al (2004)[7] however have held that reaming definitely gives an advantage in achieving faster union.

In the present study, a higher incidence of infection was seen after reaming. This may not be

the true incidence since infection incidence depends on the theatre set up and level of surgery. The duration of hospital stay is not reflective of the relationship to the type of surgery since uncontrollable variables could not be eliminated including (preoperative) stabilization time and time for other associated injury management.

Breakage of implant and interlocking screws has been frequently seen after unreamed nail. In the present small study, breakage of screw was seen in one case (4.16%) Goel et al (2011)[8] reported and incidence of 5.1% of screw breakage after unreamed nailing.

CONCLUSION

Even in this small group it can be concluded that unreamed interlocking nailing of tibia is less time consuming and can be done even in open fracture with any fracture configuration.

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COMPARISON OF THE PERCUTANEOUS VERSUS OPEN REDUCTION FOR DISPLASED SUPRACONDYLAR HUMERUS FRACTURES IN CHILDREN

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ABSTRACT

Background: Supracondylar fracture of humerus is one of the most common fractures in children and the most frequent before the age of 7 years. The peak age incidence is in the first decade of life. It is common due to direct fall on ground and indirect fall on outstretched hands. In this study we have compared the functional outcome and complications associated with percutaneous and open medio-lateral cross k wire fixation of Gartland type- 3 displaced supracondylar humerus fractures in children.

Material and methods: 87 patients were included in the study out of which 22 were lost during follow up. 65 patients were divided randomly into two groups - Group-A, close k wire fixation (32 patients) and Group-B, open k wire fixation (33 patients). This was a prospective study from June 2010 to December 2012. The average age of patients was 7 years (3-13 yrs). Patients were called for follow up at 2 wks, 3 wks, 4 wks & 3 months after the index procedure.

Results:- The results were assessed as per Flynn's criterion with reference to carrying angle and elbow range of movement at 3 months after the index procedure. The carrying angle was better in group B (no cubitus varus) as compared to group A (2 cases cubitus varus). Loss of motion was more in group B (>15 degrees in 12. 12% patients) than in group A (none). There was no deep infection but superficial pin tract infection in group B which resolved by oral antibiotics. There was one iatrogenic injury to the ulnar nerve in group A which recovered spontaneously.

Conclusion:- In our study we concluded that closed K wire fixation is associated with better functional outcomes and is the procedure of choice for fresh cases of fracture supracondylar humerus. Close K wire fixation being minimally invasive helps preserve fracture haematoma which aids in fracture healing. Complications associated with closed procedure being cosmetic (cubitus varus) and reversible (nerve injury) are well tolerated by patients than complications (stiffness) with open procedure.

Key words: Fracture supracondylar humerus, K-wire fixation.

INTRODUCTION

Supracondylar fracture humerus is one of the commonest fractures in children and the most frequent before the age of 7 years.[1] The peak age incidence is observed in the first decade of life. It is more common in boys than the girls[2] due to direct fall on ground and indirect fall on outstretched hand. The extension type is more common than the flexion.

Swneson AL as early as 1948 advocated use

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of K wire transfixation for treatment of displaced supracondylar fractures.[3] Ever since then the treatment of the supracondylar fracture humerus has evolved tremendously.

Percutaneous K wire fixation following closed reduction of the displaced supracondylar fracture humerus has now become a routine for treatment of these fractures. But there have been issues of improper reduction, loss of reduction and iatrogenic ulnar nerve involvement with close k wire fixation methods.[4]

Open reduction and K wire fixation gives excellent clinical and radiological alignment but is associated with increased incidence of loss of elbow range, myositis ossificans, infections, scars and soft tissue contractures (elbow stiffness).[5]

In this study we have compared the results of patients having displaced Gartland grade 3 supracondylar humerus fracture[6] treated by close K wire fixation and open K wire fixation. As mediolateral cross K wire fixation has been established to be the most stable construct for these fractures[7,8] we used the same in all our cases.

MATERIAL & METHODS

This prospective study was conducted in the Department of Orthopaedics and Traumatology, M.G.M. Medical College and M.Y. Hospital, Indore from June 2010 to December 2012

Total 87 cases were included in the study out of which 22 were lost during follow up. 65 cases with displaced supracondylar humerus fractures (Gartland type-3) treated by close and open medio-lateral cross K wire fixation were included in the study. These cases were selected on the basis of following criterion.

Inclusion Criterion

1. More than 3 yrs and less than 13 years of age.
2. Those presenting within 7 days of injury.
3. No previous fracture in either elbow.

Exclusion Criterion

1. Pre-existing nerve lesion and deformity at the elbow.
2. Cases with history of similar injury previously (re- fracture).
3. History of previous surgery of the involved elbow due to any reason.
4. Compound fractures.

The patients were randomly assigned to the following two groups

Group A : Closed reduction and medio-lateral percutaneous cross K wire fixation.

Group B : Open reduction and medio-lateral cross K wire fixation.

There were 34 male and 31 female patients with average age 7 years (age 3-12 yrs). 32 patients were treated by closed reduction and medio-lateral percutaneous cross K wire fixation while 33 patients were treated by Open reduction and medio - lateral cross K wire fixation.

The functional outcome was measure by using Flynn's criterion[9]

Flynn's Criteria

Results	Rating	Clinical	Parameters
		Loss of Carrying angle (Cosmetic factor) In degrees	Loss of range of motion (Functional factor) In degrees
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	10-15	10-15
Unsatisfactory	Poor	>15	>15

Surgical technique

Close K wire fixation : Patient was placed supine close to the edge of the operating table with counter traction around the patient's chest using a sheet. Procedure was done under suitable anesthesia (Brachial block or general anesthesia). After proper scrubbing, painting and draping, traction to the fractured limb was applied perpendicular to the table at 90 degree of shoulder abduction. In this position, the image intensifier was advanced over the elbow to show an AP view.

The reduction was done in the antero-posterior plane, keeping constant traction and doing the varus - valgus correction. Also, rotational deformity was corrected by holding the arm firmly and rotating the forearm under IITV guidance externally in postero-medial displacement and internally in postero-lateral displacement. The elbow was flexed by an assistant while maintaining traction on the wrist and counter traction on the anterior side of the arm. It was useful to push with the thumb over the olecranon while flexing the elbow, with both hands crossing the fingers at the anterior side of the arm and with both thumbs pushing. Maximum flexion of the elbow as possible with respect to the status of the limb swelling was done to obtain a good reduction in the lateral plane. To correct the internal rotation of fragments, the forearm was fully pronated and the shoulder externally rotated 90 degree while keeping the 90 degree abduction of the shoulder (and the maximum flexion of the elbow) Once this was completed, the fracture was fully reduced which was then checked in a lateral view using the image intensifier without moving the machine. Once good closed reduction was obtained, per-cutaneous fixation with K-wire was done. The fixation was done with the forearm in abduction and external rotation at shoulder. In this position, the lateral condyle lies facing the floor and the medial condyle is towards the roof. K-wires (1.5mm or 2mm depending on the age of the child) were passed in this position of the limb, checking with fluoroscopy that the distal fragment was aligned with the humeral diaphysis in a perfect lateral view (with the anterior and posterior cortices parallel right till the joint and teardrop forming acceptably). At the same time, the K-wire was directed obliquely towards the medial side of the humerus. It is important that both wires are divergent and not parallel or convergent.

To insert the K- wire from the medial side, the aforementioned technique was followed till the insertion of the first lateral pin. After the lateral pin was in position, it was necessary to move the elbow, hyper flexion was avoided by slightly extending the elbow and the thumb was pressed over the epitrochlea for 30 seconds to push the edema out of the way and enable the palpation of the anatomy better. Once it was clear where the epitrochlea was, the thumb was pushed posteriorly keeping pressure to protect the ulnar nerve, and the K- wire was inserted manually with a T- handle with alternate half turns to avoid twisting of the nerve even if it was in the way. The wires were checked on both AP and lateral views in the C arm so that they engaged the opposite cortex. Stability at the fracture site was assessed by moving the elbow under fluoroscopic imaging with C arm. If everything was satisfactory, the wires were cut so that their ends were outside the skin for ease of later removal. Sterile antiseptic dressing was applied and a plaster slab was given in 90 degree elbow flexion.

Open k wire fixation: There is a lot of debate in the literature as regards to the best approach for open reduction of supracondylar fracture humerus. Posterior approach elbow was used because of more familarity.[10] Incision starting from the tip of the olecranon extended for about 7cm in midline on posterior aspect of the arm. Same incision was increased distally about 5 cm laterally towards the head of the radius. Ulnar nerve was carefully identified and retracted. Aponeurosis of triceps muscle was split in midline and retracted. Periosteum was incised in midline and sub-periosteal elevation was done to expose the fracture site. The fracture was reduced; reduction was observed clinically and maintained. Then two Kirschner wires were introduced each from epicondyle with the angle of 60 degree with each other with the help of a hand drill crossing the fracture site to get engaged in opposite cortex of the diaphysis of the humerus. The distal ends of the wire were cut so that their ends remained outside the skin for future removal and wound was closed in layers. A sterile dressing and plaster slab with 90 degree elbow flexion was applied

Post operative protocol: Post operative x-rays were done and patient was discharged in the next 1-2 days. Patients were followed up at 2

weeks, 3 weeks and 4 weeks. Slab was removed at 3 weeks. At 4 weeks, the K-wires were removed and all support discarded and fully fledged physiotherapy started.

Patients were further followed at 2 weeks intervals for next month till three months. Follow-up x-rays were taken at the time of K- wire removal and at monthly intervals at the follow -up visits. Results of functional and cosmetic outcomes studied at the three monthly follow up were graded according to the Flynn's criterion and comparison between the per-cutaneous and open medio-lateral crossed K -wire procedures was done. For this, at the final follow-up, the range of motion of the affected and the unaffected elbows were measured with a goniometer and compared and the loss of range of motion on the affected side was totalled (adding loss in extension with loss in flexion). Also the carrying angles were measured on both the sides and taking the contralateral limb carrying angle to be the reference value, loss in carrying angle was calculated and noted. Using the observed values, the outcome grade was found out and the overall outcomes of the two fixation methods were compared.

RESULTS

Table 1
Functional outcome at 3 months

	Loss of Carrying angle				Loss of motion			
	0-5°	6-10°	11-15°	>15°	0-5°	6-10°	11-15°	>15°
Group A (close k wire)	15	10	05	02	20	09	03	00
Group B (open k wire)	23	08	02	00	13	10	06	04

Table 2
Outcome as per Flynn's criteria:

	Satisfactory						Unsatisfactory	
	Carrying angle			Loss of motion			Carrying angle	Loss of motion
	Excellent	Good	Fair	Excellent	Good	Fair	Poor	Poor
Group A	46.87%	31.25%	15.62%	62.05%	28.12%	09.37%	06.25%	00.00%
Group B	69.69%	18.18%	03.03%	39.39%	30.30%	15.15%	00.00%	12.12%

COMPLICATIONS OBSERVED

- Superficial Infection was observed in 5 cases of group B (pin tract infections) which healed with dressings and oral antibiotics. No case of deep infection
- 2 cases of Ulnar Nerve palsy were observed in group A which spontaneously recovered at the last follow up.
- 2 cases of Cubitus varus in group A which did not cause any functional problem to the patient.
- No incidence of myositis ossificans in any patient.

At the last clinical examination the carrying angle after surgery of the affected and unaffected extremity was measured. According to Flynn's criteria it was better in group B (no cubitus varus) as compared to Group A (two cases of cubitus varus).

Loss of motion was more in Group B (loss of motion more than 15 degrees in 12.12% of patients) than in Group A (none).

All these fractures healed within the expected time.

No patient had pain or symptoms related to the elbow. No residual vascular deficits were noted.

DISCUSSION

The aim of treatment of supracondylar fracture humerus is to gain a functional and cosmetically acceptable upper limb with a normal range of movement while minimizing the complications.[11] Closed or Open, each method has its own advantages and limitations. In this study we have compared open and close medio-lateral cross K wire fixation and evaluated our results in relation to earlier studies.

Siris[12] (1939) after reviewing 330 fractures suggested that open operation was not justified

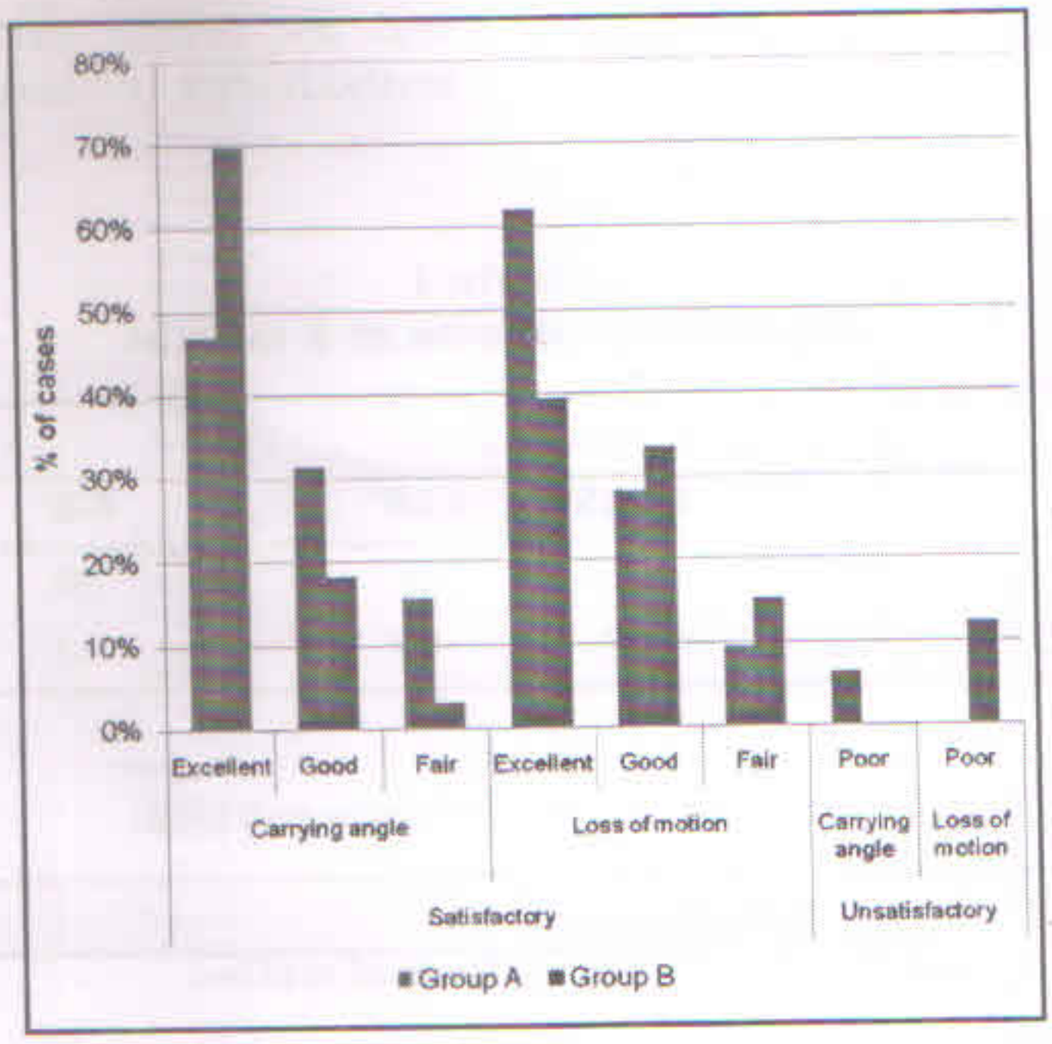

Figure 1 : Outcome at 3 months follow up using Flynn's criterion

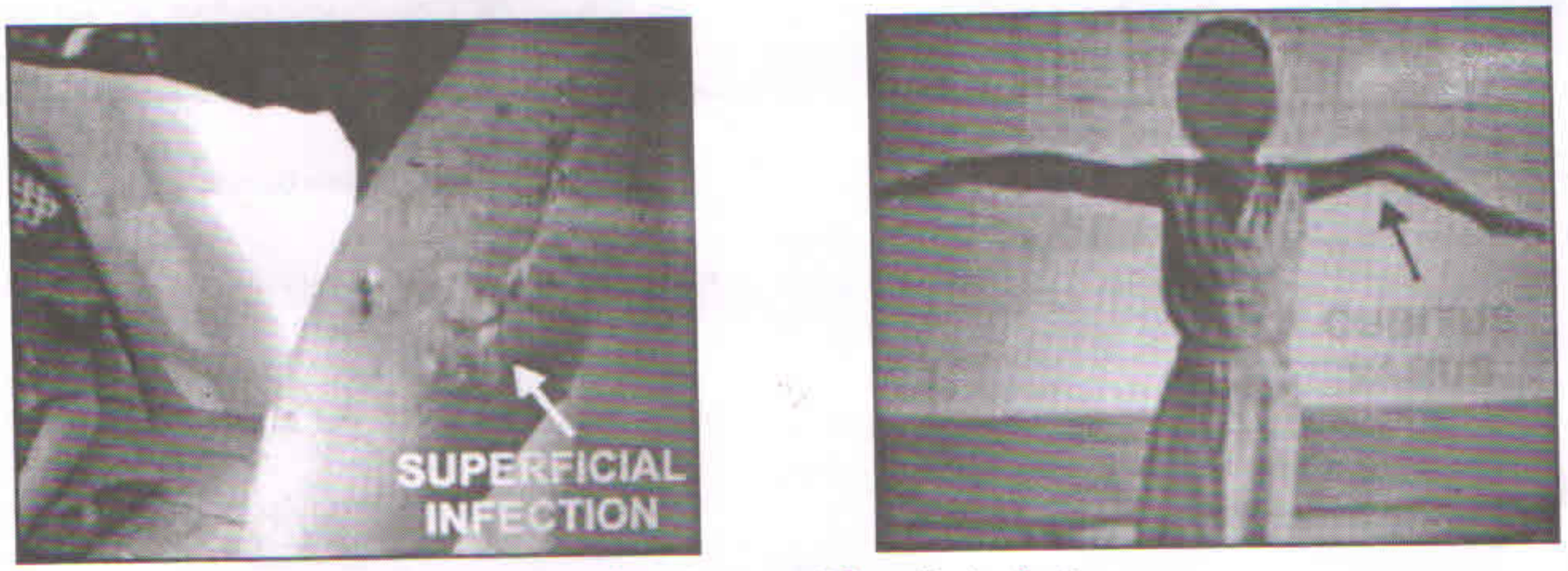

Figure 2 : Complications of Open K wire fixation

because of the uniformly good results of closed manipulation, even when accurate reduction had not been obtained.

In an article published in 1953, C.G. Attenborough,[13] said - "in the treatment of a supracondylar fracture of the humerus in childhood, the aim should be a perfect anatomical reposition of the fragments attained by closed manipulation. If for any reason it is not possible to achieve this ideal, there are two alternatives; open reduction or immobilization in the unreduced position". Open reduction was widely favored at that time. It is a common experience, however, that anatomical reduction gained by open surgery is followed by varying degrees of stiffness of the elbow, often severe, and permanent.[14,15] He goes on to report a number of cases treated by the second alternative and concludes that "Remodelling" is rapid and will restore almost normal anatomy and good function even with severely displaced fractures. The results are much better than in many case treated by open reduction.

Our study also supports these findings as Range of elbow motion is much better in group A (close K wire fixation) than in group B (Open K wire fixation). In our study, though 2 cases of cubitus varus deformity were present in closed k wire fixation group, no functional problem arose and patients were able to do all routine activities.

In our study two cases of neuropraxia of ulnar nerve occurred in Group A which resolved spontaneously at third month follow up. As Open reduction and K wire fixation requires careful isolation and retraction of the ulnar nerve, no nerve injury was seen in any of the patients in Group B.

Closed reduction and percutaneous K wire fixation is associated with 4% to 15% iatrogenic ulnar nerve injury.[17] The chances of ulnar nerve injury vary according to the position of the elbow at the time of operation. It occurs more when the pin was introduced with hyperflexed elbow.

Iatrogenic injury to the ulnar nerve may occur even when the medial epicondyle is palpable. Clinically it is not possible to accurately predict the location of the ulnar nerve prior to blind percutaneous crossed k-wire fixation of supracondylar fracture of humerus. So now there is discussion regarding the use of intraoperative nerve stimulation to localize the ulnar nerve prior to placement of the medial pin.

Ozcelik, Abdurrahaman; Tekcan, Aybars; Omeroglu, Hakan[16] in their study concluded that while the elbow is in hyperflexion, angular insertion of the medial pin in the sagittal plane not in the frontal plane may correlate with the occurrence of iatrogenic ulnar nerve injury. If the medial pin is inserted in the anterior to posterior direction in the sagittal plane, the risk of ulnar nerve injury seems to increase. We could not explain the exact mechanism of this situation as a posterior to anterior insertion of a medial pin seems also to be dangerous for the ulnar nerve. It was previously stated that while the elbow is in hyperflexion, the ulnar nerve may transpose anteriorly and the cubital tunnel retinaculum becomes taut.[17] We may speculate that, under these circumstances, a medial pin inserted at the medial epicondyle in the anterior to posterior direction may directly penetrate the nerve body or its sheath or more probably may cause tethering and constriction of the cubital tunnel retinaculum. Besides this, the entrance point of the pin on the skin is as important as the direction of the pin within the bone. The results of the present study have also revealed that there is no correlation between the occurrence of iatrogenic ulnar nerve injury and age, sex, initial fracture displacement direction and medial pin diameter.

We conclude that occurrence of iatrogenic ulnar nerve injury is multifactorial and insertion of the medial pin at the medial epicondyle in an anteroposterior direction in the sagittal plane seems to correlate with the occurrence of iatrogenic ulnar nerve injury.

Assuring a low cost of treatment and decreasing the hospitalization period are very important for both surgeon and parents of the

injured child. Closed K wire fixation causes less tissue damage and rapid healing as compared to open procedure. Open procedure causes periosteal stripping which decreases the blood supply and may delay fracture healing.

Reducing the closed manipulation attempts to maximum two or three, if unsuccessful open reduction to be done to reduce the incidence of myositis ossificans.

CONCLUSION

In our study after comparison of two groups one by closed K wire fixation and other by open K wire fixation of displaced fracture supracondylar humerus in children, we have found that closed k wire fixation is associated with better functional outcomes and should be the preferred initial treatment in fresh cases. This is because of minimal invasiveness, preservation of fracture haematoma which aids in fracture healing and preservation of soft tissues around joint. While loss of motion was more in Group B (loss of motion more than 15 degrees in 12.12% of patients) than in Group A (none) attributed to soft tissue dissection and was poorly tolerated by patients. Complications associated with closed procedure being cosmetic (cubitus varus) and reversible (nerve injury) are well tolerated by patients than complications (stiffness) with open procedure. Hence it can be concluded that closed K wire fixation is better than open K wire fixation for fracture supracondylar humerus in children and should be used as primary procedure. However open reduction should not be delayed after maximum 2 or 3 attempts of close reduction to reduce the possibility of Myositis ossificans.

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INCIDENCE OF TRAUMATIC FRACTURES IN CHILDREN

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INTRODUCTION

Fractures are extremely common in the paediatric age group, representing a major public health problem. Few data are available regarding the study of fractures in childhood. Most information comes from Scandinavian studies that have reported that the risk of sustaining a fracture from birth to 16 years of age is 42% among boys and 27% among girls. (3)

This study was undertaken to find out the incidence, and outcome of limb fractures in the pediatric age group in this part of country which is capital place in central part of India. The district is highly urbanized with nearly 80% of its population marked as urban; it also has a sizeable chunk of the population residing in villages many of whom retain their rural characteristics. According to 2011 census the population of Bhopal city is about 1, 795, 648.

AIMS AND OBJECTIVES

1. To study the incidence of different limb fractures in 2-15yrs age group in patients attending OPD and emergency in Department of Orthopaedics and Traumatology, in Gandhi medical college and associated Hamidia Hospital, Bhopal.
2. To study the pattern of distribution of childhood fractures in reference to age, sex, educational status, mode of injury.
3. To study the environmental factors which influence the pattern of childhood fractures.
4. To find out possible preventive aspects of paediatric fractures.

METHODS AND MATERIALS

This was a cross-sectional study conducted in the outpatient clinic and emergency in the Department of Orthopedics and Traumatology Gandhi Medical College and associated Hamidia Hospital, Bhopal.

The study commenced on 1 January 2011 and was completed on 31October 2012

887 trauma patients with 930 fractures aged 2 to 15 years presented to the accident and emergency or orthopaedic out-patient departments of our hospital. The hospital is a tertiary level trauma centre. It handles almost 20 to 30% of paediatric trauma cases, from minor damage to severe high velocity injuries. Resident doctors on duty recorded the characteristics of all patients and their fracture patterns in a prescribed proforma. Based on clinical and radiological findings, the resident doctors made the diagnosis, confirmed by the on call orthopaedic consultant.

A detailed history from the attending relatives

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of each child was obtained, clinical examination was done, and radiographs were advised. Findings were recorded in a formulated style in standard protocol proforma, which consisted of name, age, sex, C.R. No./OPD No., time of injury and admission, and other facts as mentioned in below proforma.

The inclusion and exclusion criteria are reported in Table below

Inclusion criteria	**Age 2-15 years**
Exclusion criteria	• Children < 2 years and >15yrs of age were not included. • presence of any specific pathologic process known toaffect bone. • presence of any specific treatment known to affect boneand mineral metabolism.

RESULTS

Table 1
Distribution of fractures according to age and sex

Age	Total Fractures	M:F	Clavicle	Hum. Shaft	s/c humerus	Condyle Humerus	B/B FA	Distal Radius & physis	Prox Radius/ ulna	Hand	Femur Prox/ shaft	Tibia/ fibula	Foot/ Ankle	Pelvis
2-3.9 Yrs	74	51:22	5	0	4	3	16	4	1	3	14	19	4	1
4-6.9 Yrs	185	142:55	10	3	40	19	32	14	7	9	19	21	11	0
7-10.9 Yrs	292	179:65	10	15	63	14	73	27	8	13	24	33	8	4
11-15 Yrs	379	252:121	12	18	19	16	91	63	14	33	36	44	25	8
	930	624:263	37	36	126	52	212	108	30	58	93	117	48	13

Table 2

Side Involved	No. of Cases	Precentage
Right Side	469	52.87%
Left Side	418	47.12%

Table 3

Limb Involved	No. of Cases	Precentage
1. Upper Limb	623	70.23%
2. Lower Limb	264	28.36%

In our study we grouped the number of cases into different age groups :

Children between 2-3.9yrs come under toddler category.

Children between 4-10 (further divided into 4-6.9yrs and 7-10.9 yrs) are the school going children.

Children between 11-15 yrs are the adolescents.

We, found that most of the fractures occurred between 11yrs to 15 yrs 379 fractures of

age(adolescent age group). In children aged 4 to 7years, the most common injured site was the elbow, whereas in children between 11-15 yrs it was forearm fractures.

In all age groups the number of limb fractures in boys outnumbered the fractures in girls

70.35% fractures sustained by boys while 29. 65% fractures sustained by girls. The number of boys was significantly larger than the girls (2.5:1). Overall the most common fracture was that of the radius/ulna.

Fractures shaft radius/ulna, around elbow& distal radius were the most frequently encountered types in that order. Supracondylar fracture humerus being the most common fracture in age group between 4-7 years while radius /ulna fracture being the most common in the age group between 7 -10. 9yrs & 11 -15yrs.

Total number fractures around elbow (supracondylar, lateral, medial condyle)=178

Distribution of side of limb involved Rt. (82) Lt. (96) Ratio 1.18-The upper limb being more commonly involved in children with 623 cases of upper limb fracture in this study while lower limb fracture occurred in 264 cases in this study. Overall ratio of the side of the limb fracture involved shows slight predominance of right side including 469 cases (52.87%). While the left side include 418 cases (47.12%).

Table 4
Geographic character of paediatric fracture cases

Type of Studied Population	No. of cases	Percentage
1. Bhopal City	492	55.4%
2. Surrounding Town	217	24.4%
3. Surrounding Villages	178	20.06%

In our studied group we found 55.4% of cases reported belong to the Bhopal city while 24.4% were the town near Bhopal while in the 20.06% of cases were from rural residents from the villages near Bhopal. It shows only few no. of cases of paediatric fractures in rural area reported for management. It had a hint of illiteracy and belief in indigenous system of treatment (osteopaths and other fracture setters), minor fractures being treated by local orthopaedic doctors at the village and town level, lack of transport facilities are also responsible for few number of patients from village.

Table 5
Educational status of parents of patients

Educational status	No. of cases	Percentage
1. Illiterate	337	38%
2. Semi Literate	406	45.7%
3. Literate	144	16.23%

In our study it was found that, in reference to educational status (literacy level) among parents of the children who sustained fracture that major proportion belongs to the illiterate 337 (38.7%) or semi/partially literate 406 (45%) group who have a ignorant behaviour towards the consequences of fractures and who still have strong belief in indigenous system of treatment (i.e. osteopaths and other fractures setters). Literate people were 144 (16.23%) in our study.

Table 6
Time interval between injury and presentation to hospital

Time Interval	No. of cases	Percentage
<6 hours	371	41.8%
6-24 hours	235	26%
>1 day	211	23.7%
>1 week	57	6.4%
>1 month	13	1.4%

In our study we found that 42% of patients were able to reach within 6 hours injury. 26% reported between 6-24 hours. Still, 23.7% of patients were able to reach the hospital > 1day while 6.4% of patients reached hospital at greater than 1 week and 1.4% of patients reported after 1 month.

Table 7
Mechanism of injury

1.	FALL	489	55.12%
	(A) Home	403	
	(B) School	862	
2.	RTA	243	27.39%
	(A) Two wheeler (driving)	122	
	(B) Pedestrian	46	
	(C) Four wheeler	12	
	(D) Passenger	57	
	(E) Train	63	
3.	Sports (Cricket, other ball games, running)	48	5.4%
4.	Others (Fall of heavy object, fall from tree, etc.)	107	12.06%

Most common mechanism of injury was fall at home and neighbourhood (peri-domestic) which accounted for (45.43%) while fall in the school environment (9.69%). Road traffic accidents being the second most common cause of fractures among children mostly in the adolescent age group accounting for 27.39%. other causes included are fall of heavy objects (12%), and sports activities (5.4%).

Table below shows the distribution of fractures and the incidence rates

Table 8
Distribution of fractures and the incidence rates

Radial/ulnar shaft	22.7%
Supracondylar humerus	13.54%
Distal end radius	11.61%
Proximal radius / ulna	3.26%
Humerus shaft	3.87%
Clavicle	3.9%
Lateral/medial condyle humerus	5.5%
Hand (carpals, metacarpals, phalanges)	6.2%
Tibia/fibula shaft	12.5%
Femur (neck and shaft)	10%
Ankle	1.5%
Foot (tarsals, metatarsals and phalanges)	3.6%
Pelvis	1.39%

In our study the incidence rate of fracture of shaft radius and ulna was found to be maximum 22.4% of which the most common site to be involved in fracture shaft radius and ulna was lower/distal end of the bones, these fractures were associated with low energy trauma, and mostly due to fall at home or peri-domestic premises. Supracondylar humerus fracture was the second most common paediatric fracture in our study.

Alternative fracture treatment prior to hospital presentation.

Table 9

Type of Treatment	No. of Cases
Massage	127
Bone Setting	42
Splintage	73
Hot Water Fomentation	7

249 children had been treated by traditional modalities prior to hospital presentation (all within 10 days of the injury). This reflects a high level of ignorant behaviour towards the consequences of fractures and shows that people still have strong belief in indigenous system of treatment (i.e. orthopaths and other fractures setters).

DISCUSSION AND RECOMENDATIONS

Study of incidence of fractures in children is important for planning the preventive measures and to rectify the misbeliefs regarding the management of childhood fractures in our community.

A detailed literature on the title was studied and a series of observations in terms of description, figures and tables were prepared after analyzing the facts, following conclusions may be drawn:

1. Most number of cases occurred between 11yrs to 15 yrs of age (adolescent age group).
2. In all age groups the number of limb fractures in boys outnumbered the fractures in girls. 70.34% fractures sustained by boys while 29.65% fractures sustained by girls. The number of boys were significantly larger than

number of girls. (2.5:1).

3. Major populations in our community still have an ignorant behavior towards the consequences of fractures and strong belief in indigenous system of treatment (i.e. orthopaths and other fractures setters).
4. Educational status of the parents accompanying children was found to be illiterate/ semiliterate in the majority of studied group.
5. Most common mechanism of injury was fall at home and neighbourhood (peridomestic). Road traffic accidents being the second most common cause of fractures among children.
6. The upper limb fractures were found to be more common as compared to lower limb fractures in our studied group.
7. The overall ratio of the side of the limb fracture involved shows slight predominance of right side as compared to the left side. In some fractures, however, especially those of supracondylar, lateral/medial condyles show slight increase in the incidence towards left side.
8. In children aged 2 to 7 years, the most common injured site was the elbow, whereas in children between 7-15 yrs it was forearm fractures.
9. Overall the most common fracture was that of the radius/ulna. Fractures shaft radius/ulna, around elbow & distal radius were the most frequently encountered types in that order.
10. Children in school going age group (4-10yrs) were affected by low energy trauma while adolescents (11-15yrs) were affected by high energy trauma (RTA).
11. Government interventions needed to keep an eye on local osteopaths and bone setters who are responsible for creating misbeliefs regarding fractures among the illiterate population.
12. It is important to develop and promote locally manufactured, cheap and effective measures to protect against childhood falls - such as window guards, roof railings and stair gates.
13. Parental supervision is an important aspect of prevention, particularly when combined with other interventions.
14. Local authorities should ensure that children have access to safe playgrounds and recreational spaces - thereby encouraging physical activity while at the same time reducing the risk of injury.
15. Education regarding traffic rules for pedestrians, use of helmets, age for driving two wheelers and four wheelers should be given to the children as well as parents for the control and prevention of road traffic accidents.
16. Acute care should be available at all levels and to be devised appropriately for children, so as to minimize the long-term consequences of fractures and prevent long term disability.
17. Community-based injury surveys that extend beyond assessments at health-care facilities are needed to obtain epidemiological data on childhood injuries in our country, for the purpose of injury control and prevention.

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RESULTS OF PCL AVULSION FRACTURE FIXATION AND REVIEW OF LITERATURE

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ABSTRACT

BACKGROUND Tibial avulsion fractures of the posterior cruciate ligament are not infrequent, a greater understanding of its role in stabilizing the knee joint, mechanism of injury and treatment has developed but nevertheless several operative techniques have been described for the fixation of the avulsed bony fragment. This prospective study was undertaken to study the results after fixation of the fragments by the 4mm cancellous screw.

METHODS Fresh patients with acute posterior cruciate ligament avulsion fracture of the tibial attachment were treated surgically at Sri Aurobindo Medical College And PG Institute, Indore between Jan 2011 to May 2012. A 4mm cancellous screw fixation was used in all the cases. The patients were followed for atleast 14 months; International Knee Documentation Committee rating system was used to assess the clinical results.

RESULTS At an average of 18 months after surgery (range 14-28 months), the preliminary clinical and radiographic results were satisfactory. According to the International Knee Documentation Committee rating system, 80% of the patients had normal or nearly normal ratings.

CONCLUSION Treatment of tibial posterior cruciate ligament avulsion fracture through open reduction and internal fixation with 4mm cancellous screw results in acceptable functional outcome in 80% cases. Our clinical experience suggests that it is a good choice for fixation with 4mm cancellous screw in cases of PCL avulsion fracture.

Keywords PCL avulsion fracture, fixation, cancellous screw.

INTRODUCTION

The PCL plays a major role in knee stabilization and it is the primary restraint to posterior tibial translation. The PCL resists 85% to 100% of a posteriorly directed knee force at both 30 and 90 degrees of the knee flexion. The PCL is also a secondary restraint to the external tibial rotation.[1,2]

Tibial avulsion fractures of posterior cruciate ligament have long been regarded as rare injuries.[3] A few mechanisms of PCL injuries have been proposed on the basis of the site of damage of the PCL. The most common mechanism of avulsion fractures of the PCL at the tibial insertion is a dashboard injury, in which the knee is in a flexed position, and a posteriorly directed force is applied to the pretibial area.[4]

Firstly an early diagnosis is usually possible on standard radiographs where a bony fragment may be visible, and secondly the treatment protocol is fairly standardised. Surgical fixation of the bony avulsion by either a screw or K-wire is advocated and it has given almost uniformly

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excellent results,[5] whereas non - surgical treatment has a significant incidence of morbidity in form of residual instability and early degenerative arthritis and increased risk of meniscal tears.[6,7,8]

However, in cases with the bony avulsion of PCL of the tibia, surgical treatment is strongly indicated to avoid the morbidities associated with the non union of this fracture.[9]

To our best knowledge, researches on outcome of PCL avulsion fracture fixation are few in literature. We decided to evaluate its functional results.

METHODS

Over a period of 17 months between Jan 2011 to May 2012, 10 cases with avulsion of the PCL were fixed in Sri Aurobindo Medical College And PG Institute, Indore. All the patient had fresh injuries and were treated within one week of injury. All the cases were diagnosed on radiographic finding of a bony fragment at the posterior intercondylar space. Standard AP and lateral views were taken in all cases, and MRI scan was done in all 10 cases to better confirm that PCL is intact or not and to assess any other derangement of the knee joint, no internal derangement of knee were found on MRI but 70% patients were found to have some associated injuries which include patella fracture (2 cases), Colle's fracture (2 cases), femur diaphyseal fracture (1 case), tibial plateau fracture (1 case), tibial diaphyseal fracture (1 case).

Open reduction and internal fixation was performed through Burks and Schaffer[10] approach in prone position. By developing bluntly the interval between medial gastrocnemius and semi-membranosus tendon and retracting gastrocnemius and popliteal neurovascular to lateral side, the level of the joint was identified by gently doing flexion-extension movements, and a longitudinal cut in the capsule gave good exposure of the avulsed fragment. The avulsed bony attachment of the PCL was reduced and was fixed with 4mm cancellous screw. After thorough wash capsule was sutured and skin was closed after approximating subcutaneous layer, sterile dressing was done and long knee brace with support over proximal tibia to relax the PCL was applied to keep the knee in 20 degree of flexion.

After 2 weeks sutures were removed and brace was continued for 6weeks, physiotherapy was started in form of straight leg raising and isometric quadriceps exercise post-operative period

Table 1

S. No.	Age/Sex	Associated fracture	Site	Final Follow-up (month)	Time between injury and surgery (days)	Time of fracture union (month)
1.	25y/m	Colles fracture	Contralateral	28	3	3
2.	50y/m	Patella fracture	Ipsilateral	20	5	4
3.	37y/m	---		14	1	4
4.	18y/m	Tibial plateau fracture	Contralateral	24	3	6
5.	46y/m	Patella fracture	Contralateral	14	4	5
6.	40y/m	---		15	1	5
7.	32y/f	Femur fracture (diaphyseal)	Contralateral	20	2	3
8.	22y/m	---		16	2	4
9.	31y/m	Colles fracture	Ipsilateral	14	7	6
10.	50y/m	Tibial fracture (diaphyseal)	Ipsilateral	15	4	5

m-male, f-female

and after 6 weeks dynamic quadriceps exercise was started and at the end of 7 weeks range of motion of knee was achieved to 90 degree of flexion in 80% of cases.

RESULTS

From January 2011 to May 2012 ten cases of PCL avulsion fracture were reduced and fixed with 4mm cancellous screw. There were 9 males and 1 female and their mean age was 35. 1 years (range 18-50 years). Associated fracture was present in 7 cases which include patella fracture (2 cases), Colle's fracture (2 cases), femur diaphyseal fracture (1 case), tibial plateau fracture (1 case), tibial diaphyseal fracture (1 case).

The duration between injury and surgery ranged from 1 day to 7 days. Routine lateral X-rays could identify the avulsed fragment in all cases, MRI scan was done as an adjunct to the X-rays in all the cases. No residual instability was noted in any case, and at follow-up of 6 months there was no pain.

We observed all the 10 patients regularly for an average of 18 months (14 month-28 month). All PCL avulsion fractures united at an average of 4.5 months (range 3-6 months). All the patients were assessed regularly according to the guidelines of the IKDC rating system. 80% (8 cases) of the patients had normal or nearly normal ratings, 10% (1 case) of the patient was abnormal, 10% (1 case) of the patient had residual severe abnormality (due to lack of both extension >10° and flexion >25°; and one leg hop distance <50% of opposite side) which had associated ipsilateral comminuted patella fracture which required partial patellectomy. The severe abnormal results may also be due to extension lag and decreased range of motion of the same knee developing because of extensor mechanism injury of the ipsilateral knee.

DISCUSSION

Avulsion fracture of the tibial insertion of the PCL represent a small subgroup of the spectrum of injuries to this ligament and are believed to occur more frequently in the younger patient.[11] Most authors agree that acute surgical reconstruction is the treatment of choice even for minimal displacement of the fragments. Conservative treatment, with distraction of the fracture components, commonly results in non-union and may predispose to late functional instability of the knee.[12]

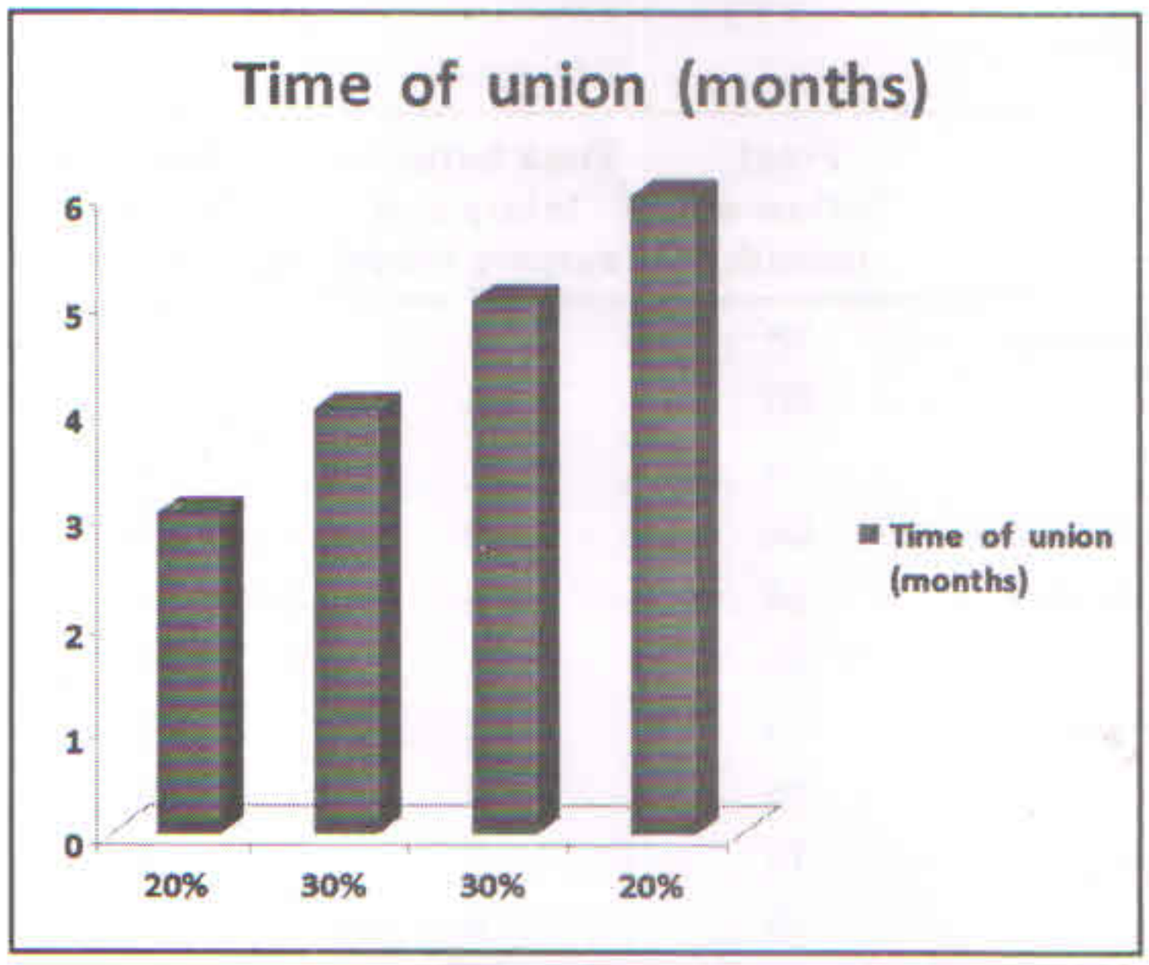

Figure 1

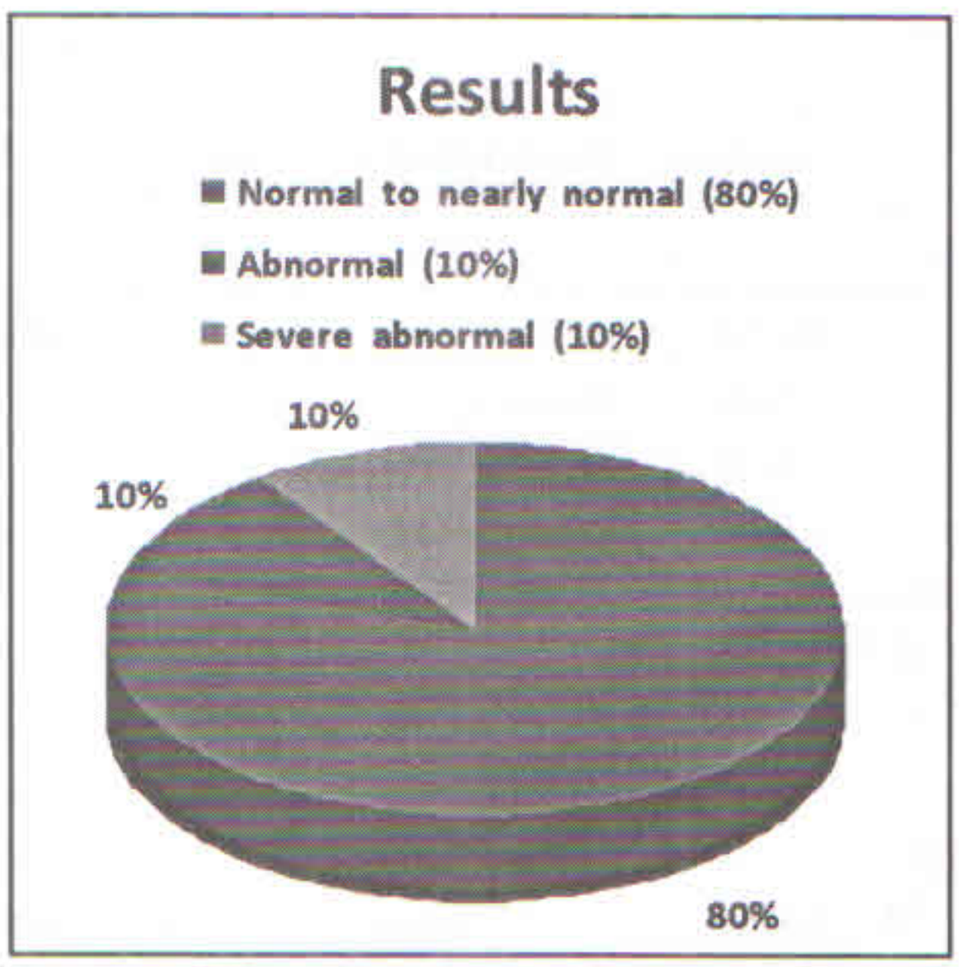

Figure 2

Although several fixation techniques have been reported in the literature, surgical fixation is usually recommended. Abbott et al used the screw fixation technique[13] and Torisu used the staples for fixation.[14] Seitz et al compared the results after the Kirschner`s wire or the screw fixation and he found that all the patients had excellent functional results with either fixation techniques.[15]

Injuries of the PCL are less common than those of its anterior counterpart, the chronic instability and early degenerative changes that arise from delayed diagnosis of this injury are just as debilitating.[16] Isolated PCL disruption most commonly occurs as avulsion at its tibial insertion (40%-55%), as opposed to its femoral origin or as a midsubstance tear. Owing to the mounting evidence that conservative management of PCL tears leads to chronic instability of the knee and early-onset degenerative arthritis, principally of the medial femorotibial and patellofemoral compartments, aggressive management of PCL avulsion fractures with surgical reinsertion and fixation is now becoming the standard of care.[17]

Nowadays, trend has been changed to minimally invasive techniques by arthroscopy. Although several arthroscopic techniques[18] have been introduced, but according to Nicandri et al,[19] arthroscopic techniques have several disadvantages including:

1. It cannot be used for patient with severe soft tissue injury.
2. Direct visualization is not feasible.
3. It cannot eliminate risk of neurovascular injury.
4. There is risk of impending compartment syndrome.

Moreover, all orthopedic surgeons are not familiar with arthroscopic techniques. On the other hand, Sasaki et al[20] showed in cadaveric knee, no differences in joint stiffness and displacement between open reduction and internal fixation of PCL avulsed fragment and arthroscopic suture fixation. Therefore, open reduction and internal fixation is and will remain an acceptable choice.

In our small study we found that fixation of PCL avulsion fracture with a single 4mm cancellous screw gives consistently good results without causing any injury to the popliteal neurovascular bundle and prevents future complication like instability and secondary osteoarthritis of knee.

Athough this being a small study with limited follow-up, the early results are consistent with the available long term studies and this being an uncommon injury larger study was not possible.

CONCLUSION

Treatment of avulsed PCL, especially large fragment, with direct visualization through open reduction and fixation by a cancellous screw results in acceptable functional, clinical, and radiographical outcomes. A high index of suspicion should be maintained in all dashboard injuries presenting with femoral shaft fractures, especially when the patella is also fractured. The diagnosis may be missed in the acute setting if the bony avulsion is not adequately appreciated; routine MRI in this situation is a good option.

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RECURRENT GIANT CELL TUMOR OF THE TENDON SHEATH - A CASE REPORT

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ABSTRACT

Giant Cell Tumour of the Tendon Sheath (GCT-TS) is a slowly progressing, benign solitary tumor which usually arises from the synovial cells of tendon sheaths of the limb extremities. It is the second most common benign tumor of the hand, after ganglionic cyst and with a tendency to recur after excision. We present a case report of a huge fungating, recurrent GCT-TS of the left middle finger in a twenty year old male patient. Radiological examination revealed calcified soft tissue globular swelling. The patient was operated under brachial block and the entire tumor was excised en mass along with the third metacarpal from the metaphyseal base. Biopsy confirmed the diagnosis of Giant Cell Tumor of the Tendon Sheath.

INTRODUCTION

Giant Cell Tumor of the Tendon Sheath (GCT-TS) is a slowly progressing, benign solitary tumor arising from the synovial cells of the tendon sheaths of the limb extremities. It is the second most common benign tumor of the hand, after ganglionic cyst.[1,2] It is also known as Nodular Tenosynovitis, Localized Pigmented Villonodular Synovitis, Fibrous Histiocytoma of Synovium, Xanthogranuloma, Benign Synovioma, Tendon Sheath Fibroma. Trauma, inflammation, metabolic and neoplastic diseases are the most common predisposing factors.[2,3] Usual age of presentation is between 30 to 50 years, with a peak incidence at 40 to 45 years and female-to-male ratio of 3:2.[4,5] Most common site of involvement includes hands, wrist, elbow, toes, ankle and knee.[6,7] Lesion is usually painless, with rare involvement of bone and joints. Recurrence is relatively common (in 40-45% of cases), dependent on many factors and remains an unresolved issue.

CASE REPORT

We report a rare case of a fair built 20 years old male patient, who presented to us with a past history of trauma by fall of a heavy object over his left middle finger around 1 year back. The patient experienced mild dull aching pain and a small nodular growth over his finger, which was resected after 2 months with no documented biopsy. Swelling reappeared and enlarged in size in 3 months period, for which an excisional biopsy was performed. Histo-pathological examination revealed fibrous tissue proliferation with mononuclear cell infiltrates, possibly GCT-TS.

Swelling reappeared again after a period of 2 months and presently, a rapidly growing fungating mass of size 18 x 11 x 10 cm is seen, associated with dull aching pain, tendency to bleed and derangements of hand function due to its weight. Radiological examination revealed a calcified, soft tissue globular swelling with no bony involvement.

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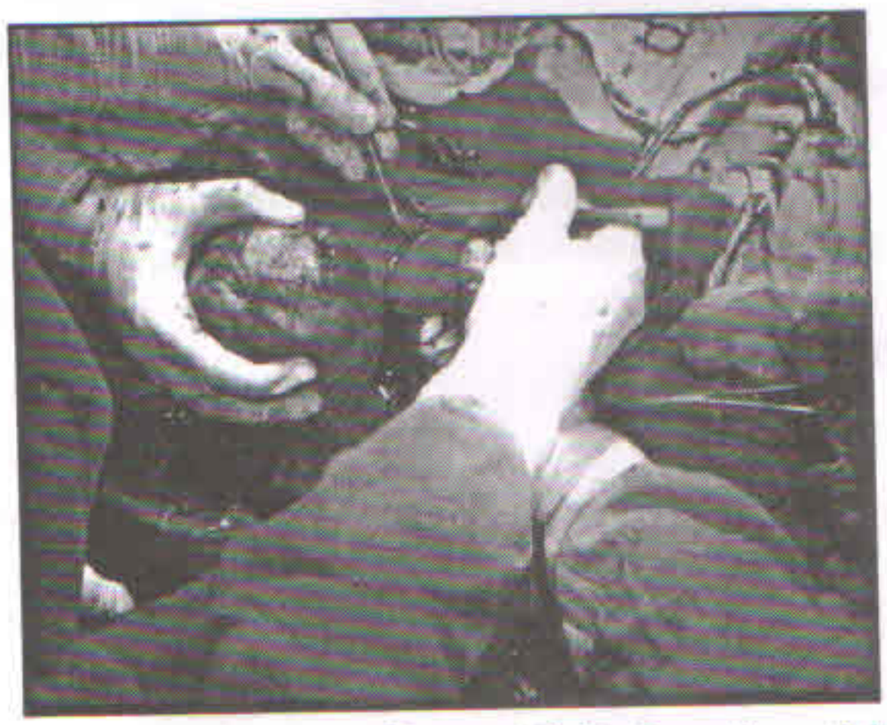
Figure 1 & 2 : The clinical appearance of the fungating mass involving left middle finger

Figure 3 : X-Ray showing a Calcified, soft tissue globular swelling without bony involvement

Proper preoperative planning and preparation was done. Wide Resection, along with Ray amputation of middle finger of left hand from the base of 3rd metacarpal was performed.



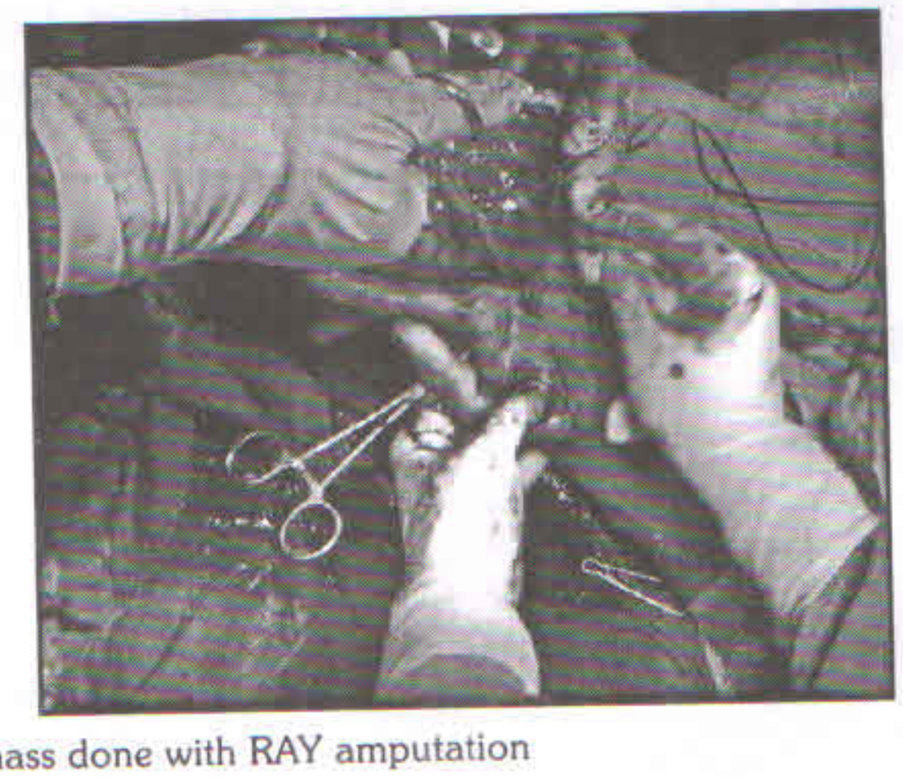


Figure 4 & 5 : Resection of the tumour mass done with RAY amputation

Reconstruction of the hand was done by dorsal and volar suturing of the skin after debulking.

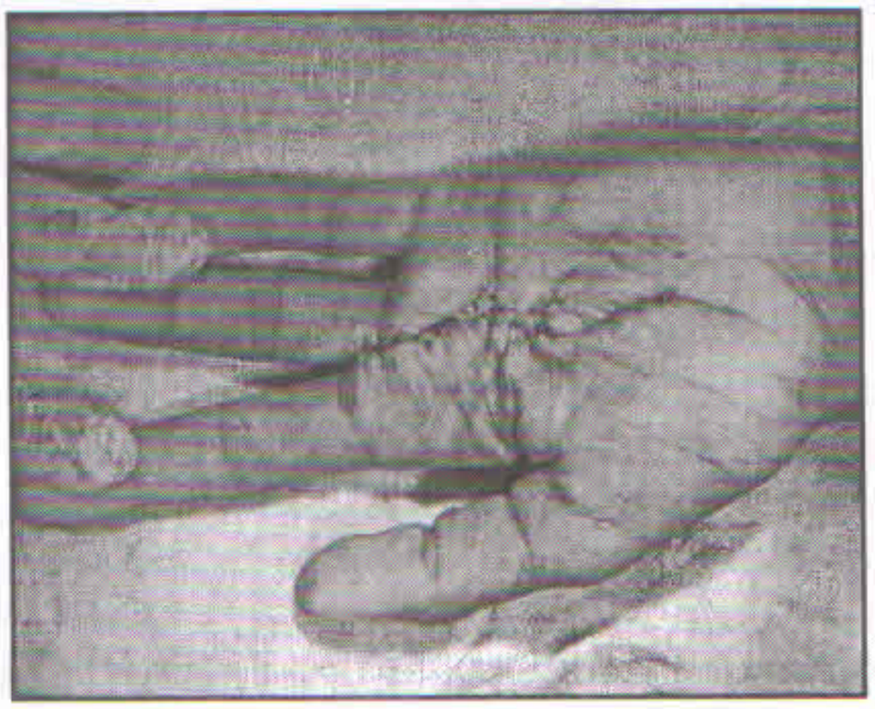


Figure 6 & 7 : Reconstruction of hand- Dorsal & Ventral aspect

Histopathological examination revealed a well-circumscribed, lobulated, gray-white mass of size 18 x 11 x 10 cm, grossly weighing arout 1060 grams.

Figure 8 & 9 : Gross cut section of the specimen

Microscopically, cellular tumor with a nodular architecture composed of multinucleated giant cell with varying amounts of pleomorphic infilterates of the small polyhedral histiocytes, fibrosis and haemosiderin deposites, mononuclear stromal cells admixed with osteoclast-like giant cells, xanthoma cells, and signs of inflammation was noted.

DISCUSSION

Jaffe, Lichtenstein and Sutro[8] regarded the synovium of the tendon sheath, bursae and joint as

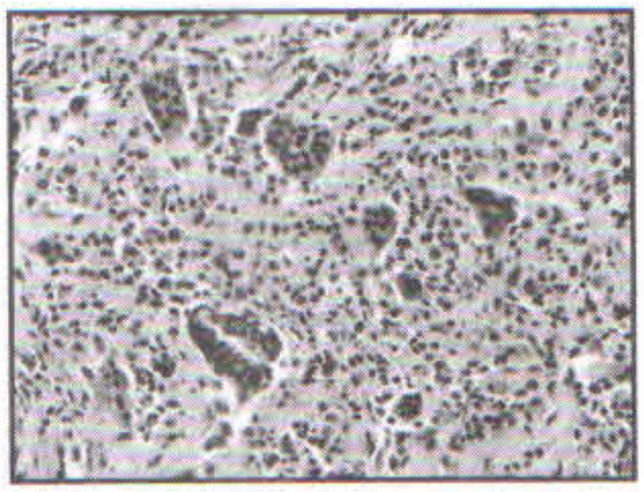


Figure 10 : Photomicrograph showing the histo-pathological appearance

an anatomical unit in which giant cell tumour of tendon sheath, also called pigmented villonodulous synovitis, may occur. GCT - TS is considered to be the counter part of the GCT of bone. They are benign soft tissue tumors of the extremities, which arises from the complex of tendon sheath and particularly soft tissue of the small joints.

Exact aetiopathogenesis of GCT-TS is still unknown, although various theories have been proposed. It has been reported to occur most commonly in the hand (77%) as a localized lesion and while in the ankle and foot in 3% case as a diffused type.[9] Affection in the hand (Most commonly, index finger f/b ring finger f/b middle finger).[10] The range of movements is decreased in the adjoining joints due to mechanical obstruction and rarely, bony erosion caused by the swelling. Neurological symptoms like numbness over fingers are rare.

A recurrence rate of 16-17% for GCT-TS has been quoted for adults. Rates differ between adults and children, with children experiencing less recurrence and better outcomes.

Al-Qattan devised a classification for GCT-TS in the hand to prognosticate lesions with a high chance of recurrence. Lesions were classified into 2 types dependent on whether the entire tumor was surrounded by a pseudocapsule (type I) or not (type II), and further subdivided into single, multilobulated, diffuse or multicentric nodules1. The classification was also enhanced by 5 potential factors that might lead to a high recurrence rate: poor surgical technique/incomplete excision; bony invasion; cellularity and mitotic activity; nm23 gene negative; and type II tumors. Grover et al. has found that absence of a gene nm23 is associated with high rate of recurrence. Rao and Vigorita has found high incidence of recurrence in tumors with increased mitotic activity. There was no relation between the number of mitosis found initially and recurrence, but all recurrent lesions showed increased mitotic activity.

Treatment of choice remains to be the marginal or local excision with a small cuff of normal tissue, so as to avoid recurrence. Adjuvant radiotherapy is recommended if there is high risk of recurrence or when there has been incomplete excision, dosage of which are 15 to 25 Gy given in divided doses of 1.5 Gy daily when treating recurrences.[10]

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BROWN TUMOR BILATERAL TIBIA - A CASE REPORT

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ABSTRACT

Hyperparathyroidism results in disorders of bone and mineral metabolism. The skeletal effects include massive bone resorption, bone fractures, and bone pain, as well as diffuse osteopenia, or circumscribed lytic lesions. The classic bone disease in hyperparathyroidism is osteitis fibrosa cystica. These lesions are termed "Brown tumor". We are reporting a case of Brown tumour which wrongly diagnose by general practitioner as bilateral osteoarthritis knee and later on metastasis. 52 years old female came with complain of pain upper part of both legs and knee for three months. The pain had been persistent and progressing with variable severity. She had diffuse swellings in proximal tibial shaft bilaterally. Besides this, patient had no symptoms of systemic illness. X-ray shows lytic lesion in mataphysis region of both tibia mimicking tumor. Patient had high serum calcium, low phosphate and high serum alkaline phosphatise label. These findings were suggestive of hyperparathyroidism so serum parathyroid easy was performed. This was many times higher than normal reference range. CT scan neck revealed well defined hypodense lesion near the inferior pole of thyroid possibility of parathyroid adenoma. Parathyroidectomy was performed. Two weeks postoperatively, the serum levels of calcium and PTH had declined to within their normal ranges. The patient became asymptomatic with no leg pain.

Keyword- Hyperparathyroidism, Brown tumor, Reparative granulomas, hypercalcemia

INTRODUCTION

Hyperparathyroidism results in disorders of bone and mineral metabolism.[1] Primary hyperparathyroidism (HPT) is a common disorder that mainly afflicts elderly women.[2] It can be diagnosed in at least 1% of all postmenopausal females.[3] The skeletal effects include massive bone reabsorption, bone fractures, and bone pain, as well as diffuse osteopenia, or circumscribed lytic lesions.[1] The classic bone disease in hyperparathyroidism is osteitis fibrosa cystica.[2] These lesions are termed "Brown tumor" due to the presence of old haemorrhage in the lesion.[1] Primary hyperparathyroidism is caused by a parathyroid adenoma, hyperplasia or carcinoma and occurs during the third to fifth decade of life.[1] Signs and symptoms of primary hyperparathyroidism are those of hypercalcemia.[2] Clinically, presents as "stones, bones and groans". Stones refer as renal stone nephrocalcinosis and diabetes incipidus (polyuria and polydipsia) or feature of renal failure. Groans means to describe gastrointestinal symptoms of nausea, vomiting, indigestion, peptic ulcer, and acute pancreatitis. Sign and symptoms due to effect on central nervous system may include lethargy, fatigue, depression, memory loss, psychosis, ataxia, delirium, and coma.

On occasion, a patient with undiagnosed hyperparathyroidism presents with a lytic lesion that may be mistaken for a tumor. We are reporting a case of Brown tumour where patient did not

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show any sign and symptoms of systemic illness, which wrongly diagnose by general practitioner as bilateral osteoarthritis knee and later on metastasis.

CASE REPORT

The patients gave the informed consent prior being included into the study. The study was authorized by the local ethical committee and was performed in accordance with the Ethical standards of the 1964 Declaration of Helsinki as revised in 2000.

Conflict of interest: None

52 years old female came with complain of pain upper part of both legs and knee for three months. Patient was all right three months back than she developed dull aching pain initially right and then left upper part of the legs. For these complain she was treated by general practitioner who diagnosed her as a case of early stage of bilateral osteoarthritis knee and gave her analgesic. Initially pain was subsides with analgesic but later on her pain remain persisted so she visited to our hospital. The pain had been persistent and progressing with variable severity. Visual analog scale pain score ranged from 4 to 6; the pain was exaggerated when walking or standing, but was slightly better when lying in bed. Besides leg pain patient did not had any other symptoms of systemic illness. No features of involvement of gastrointestinal, central nervous system, cardiovascular or renal system.

On Local examination, she had bilateral diffuse swellings arising from proximal tibial shaft. Local temperature slightly increased. Tenderness present.

X-ray shows lytic lesion in mataphysis region of both tibia mimicking tumor. The differential diagnosis includes giant cell tumours, reparative granulomas and aneurismal bone cysts, matastasis was made.

Laboratory studies, shows. Hb%-12g, TLC-9400mm^3, Neutrophils-68%, lymphocytes -26%, eosnophils-4%, monocytes-2% -ESR- 31mm^3, C-reactive protein 0.40mg/dl (non-reactive), calcium- 12.8mg%, serum phosphorus- 1.7 mg/dl, S Alkaline phosphatise- 376IU, blood urea- 19mg/dl, serum creatinine - 0.8mg/dl. Thus patient had high serum calcium, low phosphate and high serum alkaline phosphatise label. These findings were suggestive of hyperparathyroidism so serum parathyroid easy was performed. Which was-513. 50pg/mL (reference range- 15 to 68) - many times higher than normal reference range. Thus diagnosis of hyperparathyroidism was made

Biopsy was taken by tru-cut needle. There were foci of haemorrhage, accumulation of macrophages, fibroblast, and multinucleated giant cells. Marrow fibrosis and woven bone was present. These findings were suggestive of reparative Giant cell granuloma, fibrous dysplasia and true giant-cell tumors. In presence of hyperparathyroidism these finding were considered to be that of brown cell tumour.

To find out the source of excess parathyroid we performed CT scan neck. CT scan revealed well defined hypodense lesion of size 3. 8×3. 3×2. 5cms seen near the inferior pole of thyroid. The lesion displacing the right lobe of thyroid anteriorly and medially. Inferiorly the lesion is seen extending in the superior mediastinum. Parathyroid adenoma most likely.

A general surgeon was consulted and performed right-side parathyroidectomy. A transverse supraclavicular incision was given just like to expose thyroid in thyroidectomy. Inferior thyroidal artery was legated and thyroid puss medially to explore parathyroid gland. Right side parathyroidectomy was performed, making sure not to injured recurrent laryngeal nerve. Tumor was send for histological examination. Other parathyroid gland was explored to rule out the possibility of concurrent pathological process. Meticulous haemostasis achieved and wound was closed. Two weeks postoperatively, the serum levels of calcium and PTH had declined to within their normal ranges. The patient became asymptomatic with no leg pain.

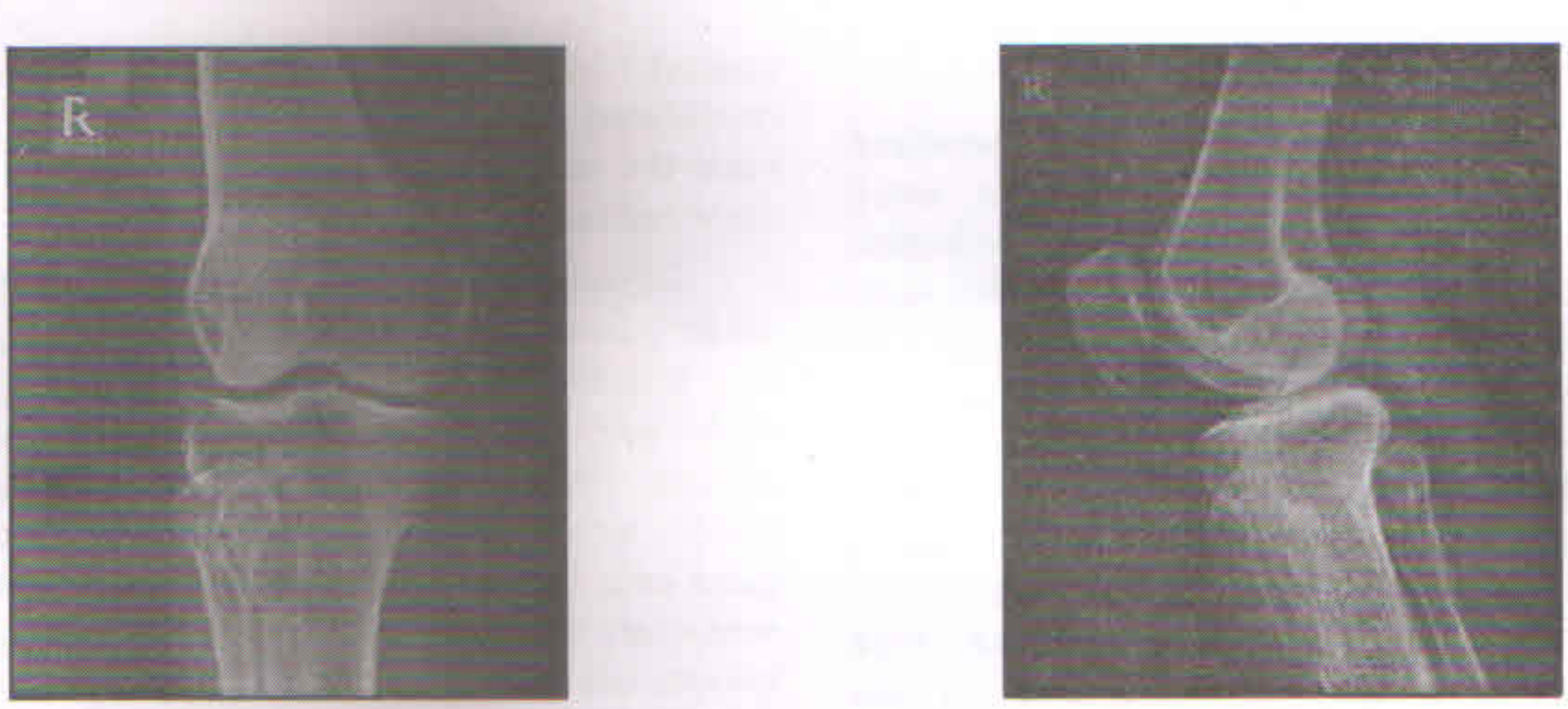

Figure 1a and 1b : Well defined osteolytic lesion in the metaphysic region of right tibia

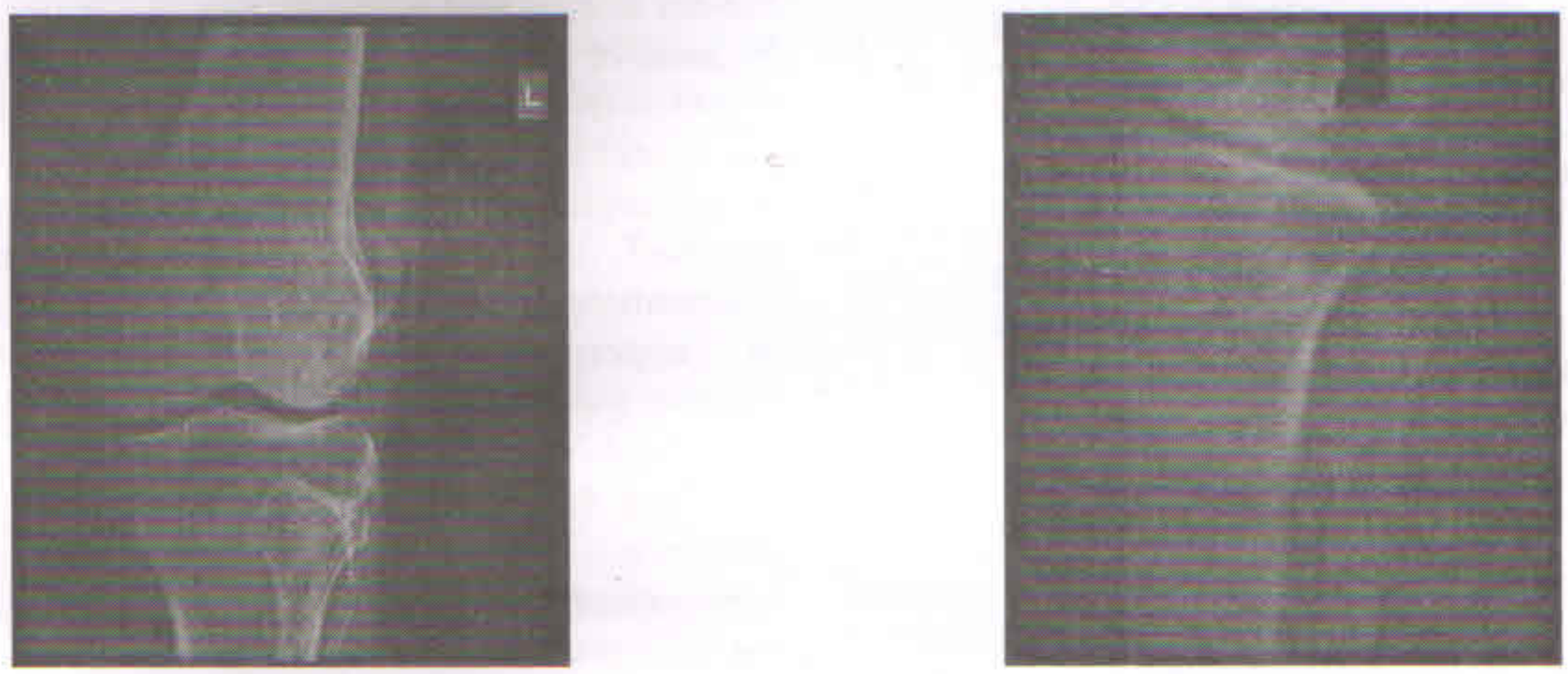

Figure 2a and 2b : Well defined osteolytic lesion in the metaphysic region of left tibia

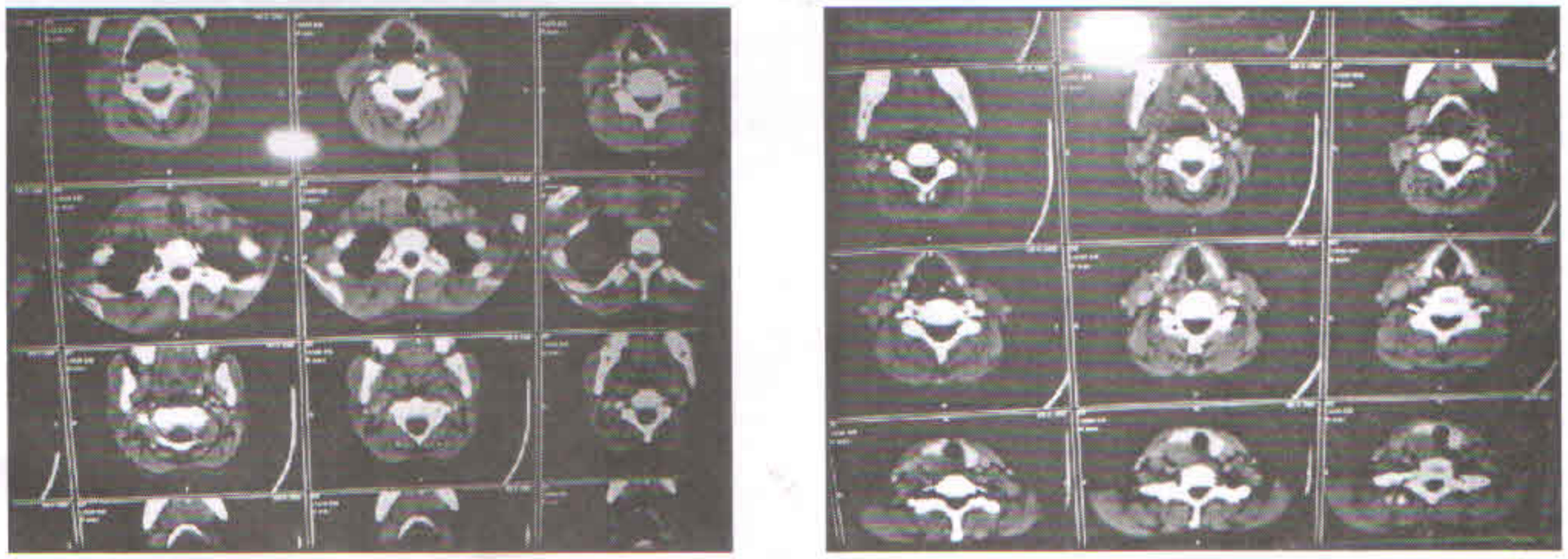

Figure 3a and 3b : CT Scan neck shows hypodense lesion near inferior pole of right thyroid suggestive of parathyroid adenoma

DISCUSSION

Brown tumor, also known as generalized osteitis fibrosa cystic comprises only a small percentage of osteolytic bony pathologies. Radiologic features sometimes be confused with tumors are the following: cortical desmoid, Brodie abscess, synovial herniation pit, pseudocyst, enostosis, intraosseous ganglion cyst, fibrous dysplasia, stress fracture, avulsion fracture (healing stage), bone infarct, myositis ossificans, brown tumour, and subchondral cyst.[4] These cases require careful clinical, pathological and some time histological examination to reach out on the definitive diagnosis.

Brown tumour is caused by hyperparathyroidism, which may be primary, secondary or tertiary. Primary parathyroidism due to parathyroid adenoma is one of the leading causes of brown tumour.[5] In our case, also parathyroid adenoma was responsible for hyperparathyroidism. Adenoma triggered high osteoclast turnover activity, leading to multiple pure osteolytic lesions. Secondary hyperparathyroidism is often the result of chronic renal failure.

Metastatic bone tumor was a rational consideration as patients had bilateral osteolytic lesion in tibia. But the significantly elevated serum calcium level was a clue that pointed toward metabolic bone disease. Hypercalcemia with high intact- PTH level and imaging evidence of parathyroid adenoma all indicated that brown tumour was highly possible. By histopathology it is difficult to differentiate between Brown tumour with those of other multinucleated Giant cell tumour. Brown tumors exhibit no pathognomonic histological changes.[6] Histopathological examination revealed presence of foci of haemorrhage, marrow fibrosis and woven bone, accumulation of macrophages, fibroblast, and multinucleated giant cells. Similar changes may occur in fibrous dysplasia, true giant-cell tumors, and reparative granulomas It is important to point out that brown tumors are non-neoplastic lesions that are very similar to giant cell tumors, but in the context of hyperparathyroidism, they are considered reparative granulomas and they do not have the malignant or neoplastic potential of real giant cell lesions.[6]

Differentiating between a brown tumor and other giant-cell tumors may be very difficult, even with histology. Fibrous dysplasia affects the bones of the face, and it is most common among young women. Histology reveals trabecular bone with a stroma rich in fibrous tissue and multinucleated giant cells that are visible in areas of hemorrhage secondary to focal degeneration.[7] True giant-cell tumors are more infiltrative than brown tumors. Histological analysis reveals giant cells around a fibrous stroma and some degree of cellular atypia.[7] Reparative granulomas are localized tumors detected in young patients. They primarily involve the mandible. Their cause is still unknown, but some investigators believe that they are a result of trauma.[7] A reparative granuloma can be differentiated from a brown tumor by the absence of hyperparathyroidism. Histologically, they contain giant cells, but their stroma is less dense and more vascularized.[7] Therefore, patients with giant-cell tumors should be investigated for the presence of hyperparathyroidism and hypercalcemia in order to differentiate these granulomas from brown tumors

Parathyroidectomy is the treatment of choice in such cases. A key component in the decision to perform surgery on patients with primary hyperparathyroidism is their skeletal status,[8] because fracture risk has increased in these patients.[7]

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ROLE OF PROXIMAL FEMUR NAIL ANTI-ROTATION FIXATION OF INTER-TROCHANTERIC FRACTURES IN THE ELDERLY

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ABSTRACT

Introduction - The treatment of unstable inter- trochanteric fractures continues to evolve. Fractures in elderly are difficult to treat due the ubiquitous presence of osteoporosis, antecedent medical co-morbidities and high risk of complications like implant cut out, varus collapse and shortening. There are a number of implant options available like Dynamic Hip Screw, Proximal Femoral Nail and Proximal Femur Nail Anti- rotation which all can be used to treat these fractures. We report our results of treatment of unstable inter-trochanteric fractures in the elderly by Proximal Femur Nail Anti-Rotation.

Material and methods- A prospective analysis was done to assess the results of treatment in 12 cases of unstable intertrochantric fractures treated by Proximal Femoral Nail Anti-rotation treated between August 2011 and December 2012. Patients were classified according to the AO classification (3 patients-AO; 31 A1 and 9 patients AO; 31 A2, 3). The patients were assessed during their hospital stay and at three and six months postoperatively. A visual analogue scale (VAS) pain score was recorded and functional mobility was assessed with use of the timed Up & Go test. The Harris hip score (HHS) was used to assess hip function more specifically at the final follow up. Radiographic findings as well as postoperative complications were recorded and analyzed.

Results - The mean age of this geriatric group of patients was 77. 5 years, there were 5 males and 7 females. Follow up ranged from 9-24 months (average 14. 9months). Clinico-radiological union was achieved in all patients. Change in position of the blade was significant in two patients; however the fractures united after collapse. Two patients expired due to other reasons after fracture union. All patients were able to ambulate independently after fixation. Harris hip score done at final follow up averaged 71. 4 in this group of patients.

Conclusion- Treatment of unstable inter-trochanteric fractures in the elderly by Proximal Femur Nail Anti-Rotation can result in significant restoration of pre-injury status in a large number of patients. Even patients with significant osteoporosis can be treated effectively and mobilized early. This small series needs validation by larger studies before meaningful conclusions can be drawn.

Key words: Helical blade, Inter-trochanteric fractures, PFNA.

INTRODUCTION

Various intramedullary and extra-medullary implants are currently used in the treatment of intertrochanteric fractures. The Dynamic hip screw remains the best documented implant, and in several randomized trials it has been associated with high rates of union with lower complication and reoperation rates compared with intramedullary nails.[1-3]

The intramedullary devices have been shown

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to be biomechanically superior to extra-medullary devices.[4] There has been a recent trend toward more widespread use of intramedullary nails for these fractures even though clear evidence to support this change is lacking.[5-7] The Proximal Femoral Nail Antirotation is a well-proven design and is indicated for fractures involving the proximal femur and is a recent addition in devices available for their treatment.[8,9] Elderly patients have significant osteoporosis and sustain these fractures with minimal trauma. PFN Anti-rotation has been designed to provide adequate fixation even in significantly osteoporotic bones. We are presenting our results of its use in a group of elderly patients.

Material and methods- A prospective analysis was done to assess the results of treatment in 12 cases of unstable intertrochantric fractures treated by Proximal Femoral Nail Anti-rotation treated between August 2011 and December 2012 at SGRRIM&HS, Dehradun. Patients were classified according to the AO classification (3 patients-AO; 31 A1 and 9 patients AO; 31 A2, 3). Inclusion criteria were age more 65 years, AO classification 3 1 A1-3 and Low velocity injuries. Exclusion criteria were high velocity injury, fall from height, Sub-trochanteric fractures, polytrauma patients and fractures more than 3 weeks old. Data was collected prospectively and analysed. The patients were assessed during their hospital stay and at three and six months postoperatively. A visual analogue scale (VAS) pain score was recorded and functional mobility was assessed with use of the timed Up & Go test. The Harris hip score (HHS) was used to assess hip function more specifically at the final follow up. Radiographic findings as well as postoperative complications were recorded and analyzed.

Standard technique recommended by the manufacturer of PFNA (Depuy Synthes) was followed in all cases. Initial reduction was attempted by placing the patient supine on a fracture table and applying traction. Formal open reduction was done if reduction could not be achieved by closed methods and the fracture fragments were held by appropriate clamps. After reduction was confirmed by two plane imaging, a guide pin was drilled 5mm medial to the tip of the greater trochanter. Care was taken to verify medial bony continuity by digital feel in case of doubt persisting on imaging.

The radiographic canal width estimator was placed perpendicular to the femur axis so that the diameter gauge is located over the isthmus for estimation of the canal diameter. Proximal femur was opened by 17 mm cannulated drill bit and protection sleeve, with care taken to confirm the direction of the reamer by imaging and avoiding excessive reaming of the lateral trochanter. A ball tipped guide wire was inserted followed by incremental medullary reaming 1mm more than the nail diameter decided was performed by reamers. The guide wire was changed and the nail (200 mm length for the short patients and 240mm for the taller patients) and the spiral blade was inserted according to the standard guidelines. The spiral blade was inserted up to 5-10 mm of the subchondral bone and locked. Distal locking was done by one screw in the static position.

Partial weight bearing was started on day two as tolerated. Low Molecular Weight heparins were used for I week in all patients. Follow up was done at the hospital at 6 weeks, 12 weeks and 24 weeks. Subsequently the patient was followed up by a telephonic questionerre at 9 months and 24 months.

Our primary outcome measure was pain at the 24 week follow up. The patients indicated the pain from the treated hip on a visual analogue scale (VAS) ranging from 0 to 10, with 0 implying no pain and 10 meaning unbearable pain. The results of the timed Up & Go test10, the complications and reoperation rates, and all other variables were defined as secondary outcomes. In the timed Up & Go test, the patient rises from a chair with arm rests, walks 3 m, turns around, walks back, and sits down again. Walking aids are allowed while the patient performs the test, but active assistance is not. The time needed for this exercise is the outcome which was measured by a stop watch. Additional secondary outcomes were Harris hip score (HHS) and mortality.

Radiographic assessment was performed postoperatively, at 6 weeks, 12 weeks and at 24 weeks. The quality of reduction was assessed as (good, acceptable, or poor) by criteria as described by Baumgaertner et al.[11] Also the implant position in the femoral head and tip-apex distance [TAD] were assessed.[12] In addition, shortening and medialization of the femoral shaft, changes in the femoral neck-shaft angle, changes in the position of the blade and fracture-healing were recorded.

RESULTS

The mean age of this geriatric group of patients was 77.5 years; there were 5 males and 7 females. The fractures were classified as AO Type A1 (Figure 1) in three (25%), AO Type A2 in five (41.6%) and AO type A3 in four(33.3%). Follow up ranged from 9-24 months (average 14.9 months). Two patients expired due to other reasons after fracture union nine to twelve months after the index procedure. 50% of the patients had significant medical co-morbidities like hypertension, Hemiplegia, bundle branch blocks, low ejection fraction, Hypothyroidism, Chronic renal disease, Diabetes Mellitus, cirrhosis, Portal Hypertension. Many patients had two or more medical co-morbidities. Mobility was assessed with use of the timed Up & Go test and averaged 15.5 seconds at final follow up (Range 9-24 seconds). VAS for pain ranged from 1-3 (Average 1.72).

Clinico-radiological union was achieved in all patients. All patients were able to ambulate independently after fixation. Partial weight bearing was started on day two as tolerated. Delayed weight bearing was resorted to in four patients due to significant co-morbid medical conditions. Harris hip score done at final follow up averaged 71.4 in this group of patients (Range 65-78).

Figure 1: Preoperative radiographs of a 80 years old male with AO 31 A1.1.
Notice the wide seperation of the fragments, significant osteopenia, low fracture and wide medullary canal.

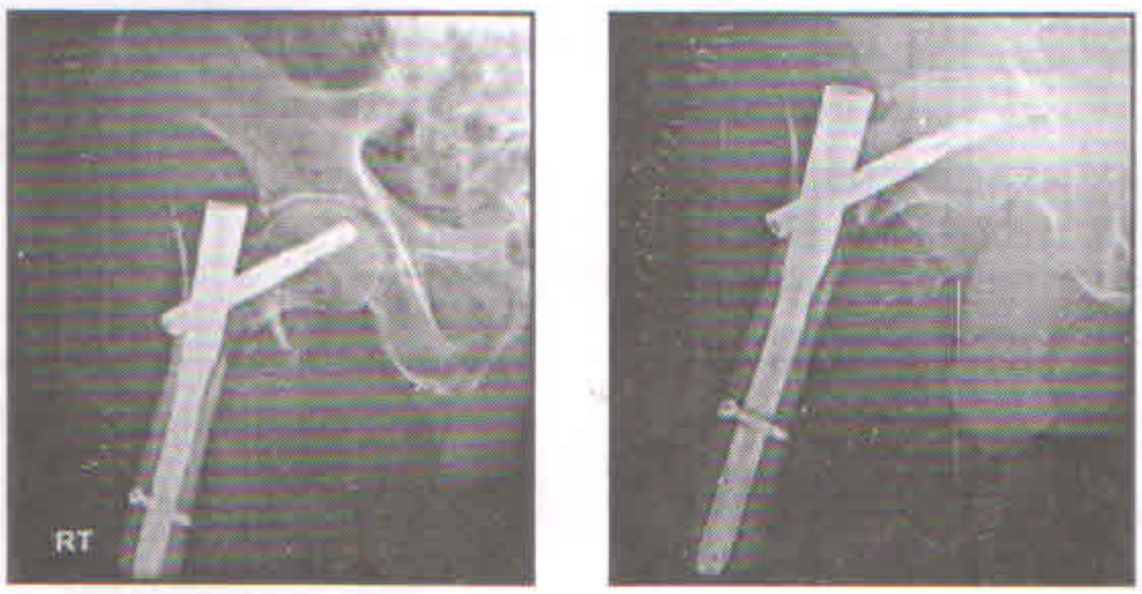

Figure 2 : Post operative Radiographs showing excellent reduction and ideal placement of the PFNA.

The Tip apex distance averaged 16. 5mm (Range 9-23mm) with 83.3% cases having TAD between 10-20mm which is considered to be ideal. In one patient the TAD was measured to be 9mm with the screw insertion error. However there was no perforation into the hip at final follow up and uneventful healing occurred.

Two complications were noted in our patients (16.6%) in the form of varus collapse which was documented if there was a greater than 5 degree change in neck shaft angle (Figure 4). However the fractures united uneventfully with 1 cm shortening as the only squeal. Known complications like implant cut out, perforation into the joint, excessive back out, delayed union/nonunion and infection were not encountered in our patients.

DISCUSSION

The anatomical design of the PFNA guarantees an optimal fit in the femur. The nail design has been well proven in over 450000 cases performed with the PFN and PFNA. The PFNA has a medial-lateral angle of 6° which allows insertion at the tip of the greater trochanter and make the implant suitable for minimally invasive surgery. The flexible PFNA tip eases insertion and reduces stress on the bone at the tip of the PFNA which were significant in older generations of nails like the Gamma nail and were responsible for fractures at the tip of the nail during insertion.[13]

PFNA blade provides significant rotational and angular stability with one single element. Compaction of cancellous bone during insertion of

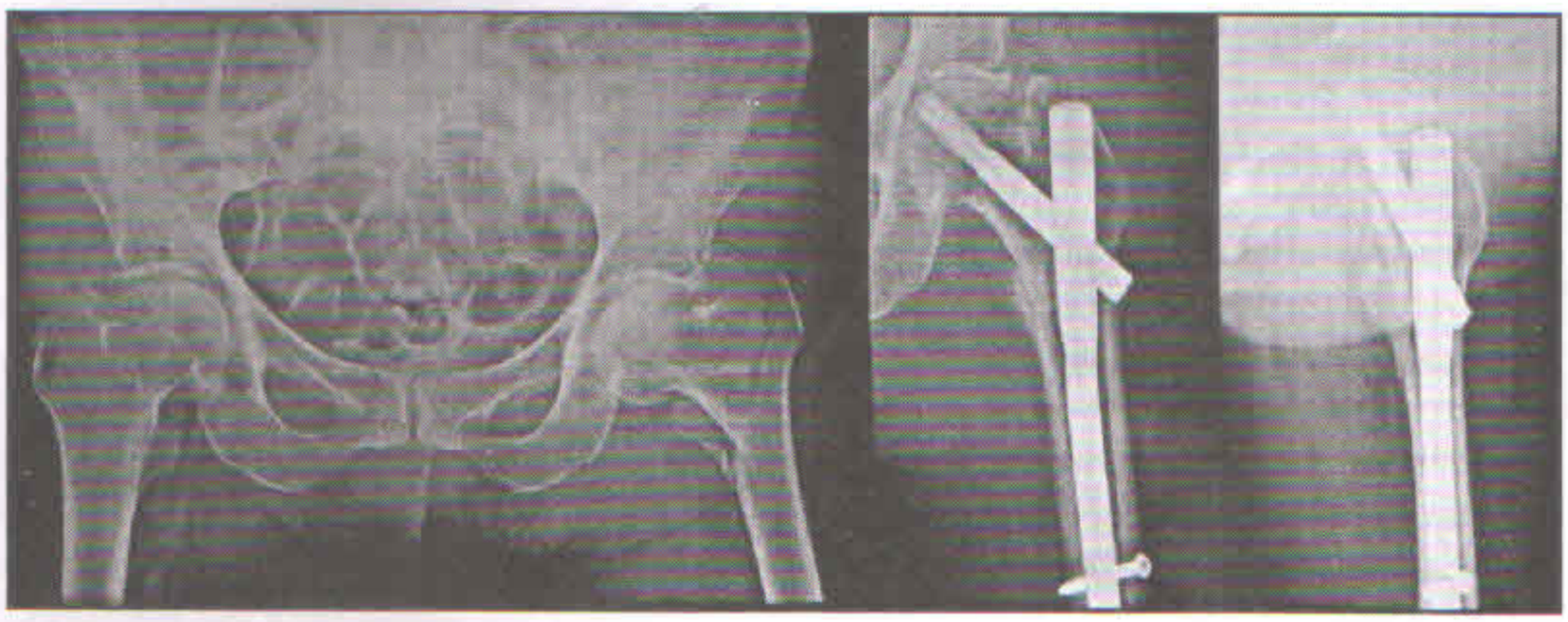

Figure 3 : Preoperative radiographs 78 years old female with AO -31 A2. 2 (left). Six months follow up showing fracture healing despite slightly longer blade positioning than ideal no perforation into the hip occured.

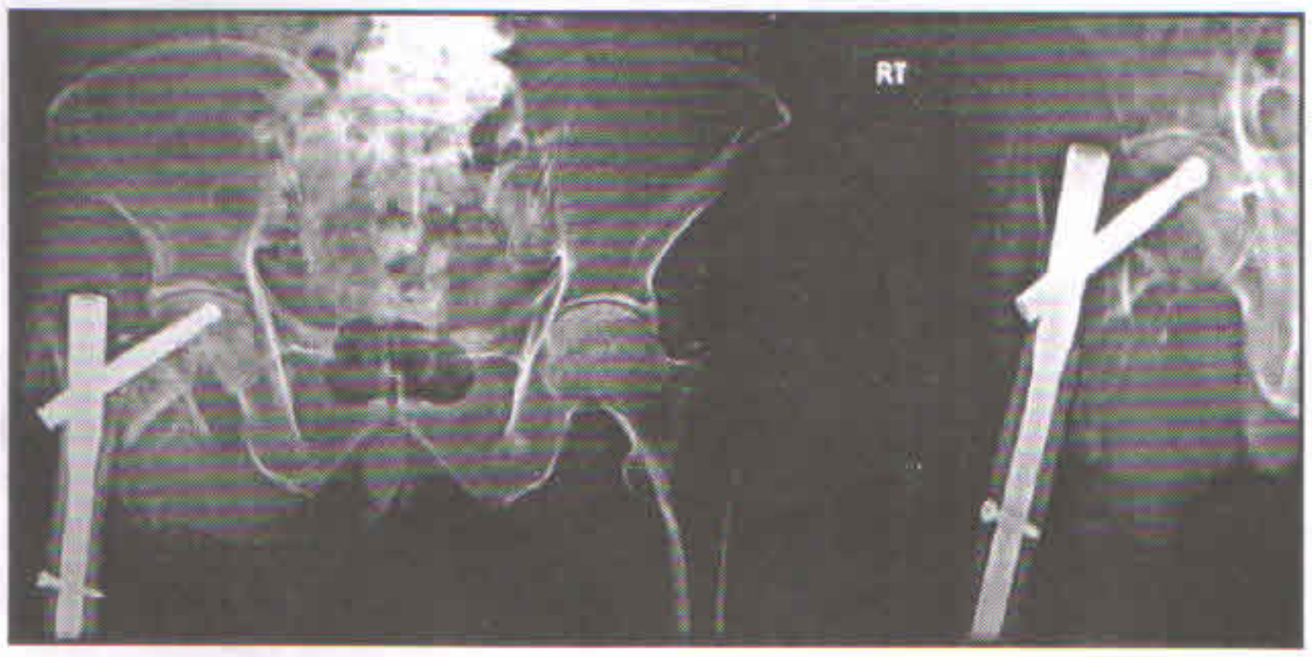

Figure 4 : Post operative varus collapse and superior migration of the blade in the head at 3 months after the index procedure in the same patient as in Figure 1.

the PFNA blade provides additional anchoring, which is especially important in osteoporotic bone. Increased stability caused by bone compaction around the PFNA blade has been biomechanically proven to retard rotation and varus collapse. Biomechanical tests have demonstrated that the PFNA blade had a significantly higher cut-out resistance in comparison with commonly-used screw systems.[14]

In our study good reduction was achieved in all cases due to careful attention to detail. No fracture was nailed until reduction was achieved. If the fracture could not be reduced by closed methods open reduction was done which was required in four cases. Care was taken to verify medial bony continuity by digital feel in case of doubt persisting on imaging.

Although some investigators have reported that intramedullary fixation is associated with decreased operative time and decreased intra-operative blood loss, it has not been shown to be superior to extra-medullary fixation for the treatment of extra-capsular femoral fractures. It still appears to be impossible to provide sufficient evidence to advocate one of the two basic treatment principles for the operative treatment of unstable proximal femoral fractures. The price for the important advantage of intramedullary osteosynthesis, ie, direct full weight bearing, is a higher rate of peri- and postoperative complications, including a higher number of reoperations. For a long time, it has been argued by the advocates of intramedullary osteosynthesis that this outcome is due to the fact that most reports have evaluated both treatment options in stable and unstable proximal femoral fractures, while it is already generally accepted that both options do well in stable fractures. However, even reviews on unstable fractures alone show the same outcome,[16] which gives rise to three questions:

1. Do the primary outcome measures currently used in treating proximal femoral fractures address the appropriate issues?

These fractures normally occur in the elderly female after a low-energy trauma. Generally, it is assumed that these patients want to have the fastest and least troublesome treatment in order to return to their pre-trauma situation as soon as possible. We are aware that a substantial number of these patients will die within a year of causes unrelated to the implant used. Therefore, it is important to learn which treatment option renders the highest level of postoperative quality of life in the short term, while skin-to skin time, anatomical restoration, fast consolidation etc are probably of lesser importance for the patient. Even more interesting would be to learn whether it is possible to adjust the treatment to the alleged length of survival after the operation in order to offer a tailored approach, depending on the condition and prognosis.

2. Is the term "unstable proximal femoral fracture" too vague?

Unstable fractures of the proximal femur include the 31-A2 and 31-A3 fractures according to the AO/OTA Fracture and Dislocation Classification and they are quite different in fracture pattern, subsequent dislocation tendency and therefore probably in surgical approach. There is evidence that the results of fixation of A3 fractures are generally worse than A2 fractures, irrespective the type of fixation chosen. This supports the usefulness of the AO/OTA Fracture and Dislocation Classification and should encourage investigators to split the group of unstable trochanteric fracture into these two distinguishable groups for comparing the results of different treatment options.

3. Do surgeons underestimate the potential hazards of this type of fracture?

This question almost cannot be answered, although there might be arguments to support a positive direction. As previously stated, covering two quite different fractures with the same term demonstrates a certain neglect of the specific problems of the two entities. Furthermore, mechanical tests on different

implants are rather simple regarding which parts of the femur are tested under straight cyclic loading, mostly in one direction. These tests do not take into account the possible differences of stress and strain vectors working on the implant-bone assembly in, for example, an elderly lady with osteoporosis and an edematous leg that moves-even without weight bearing- quite differently to the ones created during mechanical testing. Again, one should probably realize that patient characteristics in combination with a clearly defined fracture classification might be a more important denominator for the treatment choice than just the term unstable proximal femoral fracture. Finally, we should also realize that surgical skills are important in any operative treatment and in some papers it appears that poor results in proximal femoral fractures are often predictable because of insufficient reduction of the fracture with a subsequent suboptimal position of the implant.

CONCLUSION

Treatment of inter-trochanteric fractures in the elderly by PFNA results in significant restoration of pre-injury status in a large number of patients. Even patients with significant osteoporosis can be treated effectively and mobilized early. It is well known that poor reduction and implant position result in a poor prognosis in hip fracture treatment. An increased focus on surgical perfection is probably the best way to reduce complications and improve outcome. The stability of the bone-implant construct, which allows early weight bearing, may be more important than a low rate of iatrogenic problems related to the implant. Thus, also using an intramedullary device in this type of fracture may outweigh the potential harms and costs. This small series needs validation by larger studies before meaningful conclusions can be drawn.

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RESULTS OF CEMENTED BIPOLAR HEMIARTHROPLASTY FOR COMMINUTED INTER-TROCHANTERIC FEMUR FRACTURE IN OSTEOPOROTIC PATIENTS.

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ABSTRACT

We treated 25 osteoporotic patients with comminuted Inter-trochanteric femur fracture having mean age of 65. 5 years with Cemented Bipolar hemiarthroplasty and Tension band wiring for Greater trochanter through transtrochanteric approach. Mean Harris hip score at the mean follow up of 1. 8 years was 80. 76 and showed a statistically significant improvement as compared to preoperative scores. Mean blood loss during the mean operative time of 61. 35 min was 321 ml.

In our case series we came across complications like infection, non-union of greater trochanter and protrusion; however no fatalities occured. One of our patients underwent debridement for early infection and one underwent excision arthroplasty for delayed infection which could not be controlled by debridement. One patient underwent debridement, repeat tension band wiring and bone-grafting for non-union of greater trochanter nonunion.

From our study we would like to suggest that Cemented Bipolar hemiarthroplasty is a viable technique for elderly osteoporotic patients with Comminuted inter-trochanteric femur fracture using trnans-trochanteric technique with no trauma to abductors or external rotators of hip and sciatic nerve as we approach the hip through the fracture site itself and not posteriorly as in Southern Moore's approach. It also helps in faster rehabilitation and recovery in elderly osteoporotic patients. .

Keywords: Inter-trochanteric fractures, comminuted, unstable, elderly osteoporotic, cemented Bipolar, Hemiarthroplasty.

INTRODUCTION

Comminuted, unstable inter-trochanteric femur fractures are one of the most common fractures in elderly osteoporotic patients. Both extracapsular and intracapsular neck femur fractures constitute one of the major causes of mortality and morbidity in elderly population.[1] The mortality rates after occurrence of these fractures is as high as 20 percent in the first post-operative year.[2] These fractures are caused generally by trivial trauma like fall in bathroom or on floor, slipping while walking etc. Stable inter-trochanteric fractures have been treated successfully with open reduction and internal fixation using Dynamic hip screw, cephalo-medullary nail etc. But it has been a challenge treating unstable comminuted inter-trochanteric femur fractures (Evans type III and IV, AO/OTA type 31- A2.2 and 2.3) as in elderly osteoporotic patients, anatomical reduction and early rehabilitation both are essential.[3,4] Cut-out, excessive head collapse, implant breakage, plate pullout, Z-effect, reverse Z effects are few of the implant related complications especially with unstable type of fractures.[5,6] Intramedullary devices

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has shown better results with less cut-out rates in osteoporotic comminuted inter-trochanteric femur fractures but on the other hand endoprosthetic replacements have good mid to long term survivorship and have an advantage of early rehabilitation.[7,8,9] The main motive of performing surgery in a comminuted inter-trochanteric fracture femur was early ambulation and avoiding complications associated with open reduction and internal fixation in elderly osteoporotic patients.[10] This aim is fulfilled to some extent by cemented bipolar hemiarthroplasty.

The treatment of osteoporotic unstable comminuted inter-trochanteric femur fracture in elderly patients has still been a controversial debate. The aim of our study was to evaluate the efficiency of cemented bipolar hemiarthroplasty in such cases in terms of mid-term survivorship and functional outcome.

MATERIAL AND METHODS

25 patients underwent Cemented Bipolar hemiarthroplasty between Jan 2011 and Aug 2012 who had sustained comminuted inter-trochanteric fractures in osteoporotic bones. All patients were operated by primary author by Transtrochanteric approach. We selected this approach as in all our cases greater trochanter and lateral wall was fractured so in all cases femoral head was approached through the fracture site.

We had kept certain inclusion and exclusion criteria for our study.

Inclusion Criteria -

1. Age - More than 55 years.
2. All Patients were osteoporotic, as confirmed on Bone mineral Density as per WHO guidelines.[11]
3. All sustained Evans type III and IV, AO/OTA type 31- A2.2 and 2.3 of Inter-trochanteric Fractures. Unstable, Comminuted Fractures only.
4. No other fracture sustained, only isolated inter-trochanteric fracture
5. No head injury or other injury.

Exclusion Criteria-

1. Patients not willing to participate in the study.
2. Any transcervical, sub capital, basicervical or subtrochanteric fractures.
3. Non-comminuted inter-trochanteric fractures.
4. Stable inter-trochanteric fractures.

Anaesthesia -

Almost all the patients in our study were given hypotensive epidural anaesthesia.

Operative Technique -

With patient in lateral position, incision was taken on lateral aspect of hip, centred on proximal aspect of greater trochanter. Proximally incision was curved posteriorly towards posterior superior iliac spine. Tensor fascia lata was cut in the direction of skin incision. Proximally fibres of gluteus maximus were dissected along skin incision to expose fracture site. Now we carefully dissected fracture site and retracted fracture fragments of greater trochanter, so as to reach base of femur neck. We extracted femur head and the attached neck through this ? trans-troachanteric window. After extraction of femoral neck and head, acetabulum was inspected and cleared of any of remaining bone pieces. Then we started femoral canal preparation using reamer and serial broaches. After preparing femoral canal we drilled two holes on lateral aspect of proximal femur 5 cm below vastus ridge. 2 Holes were placed 2 cm away from each other. A stainless steel wire was passed from outside through one hole in the medullary canal and then taken out from another hole. Now the two free ends of the wire are lying on lateral aspect of femur. The implant placement is now started with special emphasis on-

1. Ante version which is decided by using long axis of the leg as guide.
2. Length of the implant to be inserted in the femur is decided by carefully judging soft tissue tension. Also tension is checked with help of shuck test showing less than 2-3mm of displacement, no dislocation of the trial implant with, 10 degree of extension, 50

degree of abduction, 40 degree of adduction, external rotation of 30 degrees, flexion 90 - 100 degrees and internal rotation of 40-50 degrees. Also Limb length was aimed to maintained almost same as that of other limb and the amount of stem to be sinked in was carefully observed and marked both on trial and final implant before cementing and then cementing was done.

3. No excess cement should spread on fracture site as it interferes with union of the fracture.

We had reconstructed the calcar with help of cement. Once the Final implant of adequate size is inserted, the hip is reduced. The fracture pieces of greater trochanter are now approximated to each other. A wire passer is passed above tip of the trochanter deep inside the abductors. Previously passed wire is now crossed over and passed through the wire passer, so as to complete figure of 8, which is now tightened. This achieves compression across the fracture site and restores the abductor mechanism of hip. Closure is done in layers carefully over a negative suction drain.

Post-operative and Rehabilitation Protocol -

All patients were kept under analgesic effect with help of epidural catheter till two days postoperative.

All the patients operated, except for those who had landed with few immediate complications were started with physiotherapy. All patients were trained for quadriceps strengthening exercises immediately post op and full weight bearing walking from the next day with the help of walker for first 6 weeks post-operative. Thereafter patients started full weight bearing with support of a stick. Patients were instructed to avoid activities involving squatting and cross legged sitting for the rest of their life as a precautionary measure to avoid dislocation of the bipolar hemiarhoplasty. Patients were followed up regularly at 2 weeks, 4 weeks, three months post-operatively and then yearly once.

RESULTS

Statistical Analysis was done by the statistician on Windows XP, Using Microsoft Word and Microsoft Excel by statistician.

Patients were evaluated serially pre-operatively, 3 months post-operatively and then at final follow up using Harris Hip score.

Variables -

We had 25 patients included in our study with 15 female and 10 male patients. 57.9% patients had suffered the injury due to trivial trauma like fall from chair/bed, slip in bathroom or in house on floor. Rest 42.1% of patients had suffered from major trauma like fall from significant height, road traffic accident or fall from stairs. The data regarding all the variables are as given in Table 1.

Table 1
Statistics of various variables among the 25 cases

Variables	No.	All cases			Minimum	Maximum
		Mean	SD	Median		
Age (years)	25	65.75	7.85	66.00	55.00	88.00
Harris hip score:Pre-op	25	12.49	3.78	10.00	8.00	20.00
Harris hip Score:3 months post-op	25	69.60	5.92	70.00	40.00	78.00
Harris hip score:Final follow up	25	80.76	4.70	80.00	60.00	88.00
Follow-up (years)	25	1.8	0.80	1.73	1.00	2.50
Blood Loss (ml)	25	321.0	122.2	300.00	200.00	800.00
Operative time (min)	25	61.35	15.72	60.00	40.00	100.00
Time between injury & operation (days)	25	3.56	2.65	3.00	1.00	13.00
Stay in Hospital post-op (days)	25	4.83	1.22	5.00	3.00	7.00

Above Table shows that we had total of 25 patients with mean age of 65 years and mean follow up of 1.8 years. Our mean operative time was 61.35 minutes with mean blood loss of 321 ml. We had operated all the patients within first two weeks of trauma with mean time between injury and operation being 3.5 days. The biggest advantage with this surgery was that all the patients were mobilized immediately on next day of surgery so the recovery and rehabilitation was quick with mean post-operative stay in hospital being 4.83 days. Mean Harris hip score at 3 months follow up and final follow -up showed significant improvement from pre-op mean of 12.49 to that of 69.60 and 80.76 respectively. This improvement was statistically significant. Of 25 patients we had 76.2% patients with good Harris hip score, 21.4% patients had fair and 2.4% patients had poor scores. Harris Hip score had no statistical significance or association with any of the variables used in our study.

Complications

In our study we had certain significant complication but no mortalities. We divided the complication into immediate (within 3 months post-operative) and delayed. We had 2 patients with immediate complication and 3 with delayed complication. Details of the same are shown in Table 2.

We encountered one patient with protrusion at 2 years follow-up. None of the complication was directly attributable to surgery statistically. But the Harris hip score was found to have statistical significance in patients with complications with poor scores.

DISCUSSION

It is beyond doubt that implants like Dynamic hip screw, gamma nail and other intra-medullary devices are the mainstay of treatment of Inter-trochanteric fractures.[12,13] But complications like screw cut-out, plate breakage, Z-effect, Reverse Z-effect are some of the implant related complication encountered in unstable comminuted inter-trochanteric femur fractures, mainly in osteoporotic and elderly patients.[5,6] Maintenance of fracture reduction which should be anatomical or near anatomical, proper positioning of the implant and monitored weight bearing are the pre-requisites to achieve good functional outcomes. But, in osteoporotic elderly patients with inter-trochanteric comminuted fracture femur the bone quality is poor, cut-out rates of implant is high, loss of reduction is a known fact which leads to poor functional results. Also ambulation is prevented in elderly patients with fear of such complications, which in elderly patients causes other complications like aspiration pnuemonitis, bed sores, deep vein thrombosis, atelectasis etc which gets further complicated with existing co-morbidities.[14] Hip fractures hence are most serious

Table 2
Complications

Complications	Immediate	Delayed	Measures Taken
Infection	1	1	Immediate infection - debridement and antibiotics given. It got cured. Delayed infection at 1. 5 years post-op despite repeated debridement and antibiotics did not heal so implant removal and conversion to excision arthroplasty done.
Non-union Greater trochanter		1	The patient was treated with ORIF with Tension band wiring and freshening of fracture edges of greater trochanter and bone grafting
Protrusio		1	The patient was left alone as she was neither symptomatic nor willing for revision surgery.
Shortening	1		Only shoe raise given that too if needed.

health care problems affecting elderly patients. There were an estimated 1.66 million hip fractures world-wide in 1990, this worldwide annual number is expected to rise to 6.26 million by the year 2050.[15,16] Failure rates between 6%-32% have been reported for internal fixation of both stable and unstable intertrochanteric hip fractures.[17,18] In our series we had very few implant related complication. Also we had no patients with complications like bed sore, aspiration pnuemonitis or atelecasis as all the patients were immediately mobilized on next day of operation. Every care was taken that those patients with immediate or delayed complication were given priority and needful was done to see to it that in them early mobilization was started.

Several studies in literature have shown that results with cemented bipolar hemiarthroplasty are good. It helps in early mobilization of patient with good and fast improvement in Harris Hip scores. Complications like pressure sores, aspiration pneumonitis are very rare with this surgery. Cemented bipolar hemiarthroplasty has given constant good results in terms of early ambulation and good mid-term survival rates in comminuted unstable inter-trochanteric fractures and results are constant as compared to variable results given by osteosynthesis.[19,20,21] Even our results were synchronous to the above studies in terms of early mobilization, less implant related complications and faster over-all rehabilitation.

There have been many case series and comparative studies which have compared results of osteosynthesis and cemented bipolar hemiathroplasty for similar unstable inter-trochanteric fractures. They have proved that final outcome in both the groups were more or less comparable except for the fact that there was early ambulation in hemiarthroplasty group. They have also stated that blood loss and need for transfusion was more in hemiarthroplasty group as compared to osteosynthesis.[22,23] We do agree that blood loss and need for blood transfusion is more in this surgery. We had mean blood loss of 321 ml with minimum of 200 ml and maximum of 800 ml.

The rate of repeat operation in case series with osteosynthesis in elderly patients has been reported to be as high as 8-16%. Repeat surgeries in elderly patients with other co-morbidities have shown more medical complications and implant related complications.[24,25] Our series had revision surgery 4.0% which is less than the osteosynthesis group.

We had used standard tension band wiring technique for fixation of greater trochanter as shown in case series by Zhang Q et al.[26] In our series we had encountered one non -union of greater trochanter which were treated with repeat open reduction and fixation with circlage wire and bone grafting. The patient presented clinically with pain at greater trochanter and decrease active abduction at follow-up of 4-5 months post-operatively.

Haentjens et al[27] and Geiger et al[28] in their case series showed dislocation rate in the patient group who underwent total hip arthroplasty was significantly higher (12% to 44.5%) than those who had bipolar arthroplasty(0 to 3.3%). We did not encounter any dislocation in any of our patients.

Study by George J et al[29] has shown ten-year survivorship of cemented bipolar hemiarthroplasty in inter-trochanteric fracture femur free of reoperation for any reason was 93.6%. We in our series have shown a good early to mid-term survivorship at our mean follow up of 1.8 years with minimum of 1 year and maximum of 2.5 years.

The literature supports that all three approaches have comparable dislocation rates when using the posterior approach augmented with soft tissue repair and it is apparent an adequate soft tissue repair when performing the posterior approach greatly reduces the relative risk of dislocation. But certain studies have also shown that there are higher rates of dislocation with posterior approach when compared with transtrochanteric and antero-lateral approach. Studies have also shown that former has less rate of ectopic ossification as compared to the latter

two. Also there is higher rate of non-union with trans-trochanteric approach thus affecting the abductor lever arm and can lead to lurching gait.[30] We in our case series had implemented a novel Transtrochanteric approach. We had selected all patients with comminuted inter-trochanteric fracture femur which has greater trochanter as a separate fragment. We had to repair greater trochanter with tension band wiring irrespective of the approach used. So we did not use Southern Moore's approach. As the greater trochanter fragment was elevated supero-posteriorly we saw the fracture neck and the head through the fracture site. So there was no need to cut external rotators which causes bleeding, nor we had to split gluteus maximum or any of the abductors. Since we were constantly on lateral aspect sciatic nerve was always safe posteriorly. Above mentioned were the advantages of this approach in comminuted inter-trochanteric fractures.

In the short term, bipolar hemiarthroplasty seems to give better results than open reduction and internal fixation in the treatment of unstable osteoporotic intertrochanteric hip fractures in terms of mortality and morbidity rates, complications, early rehabilitation and returning to daily living activities. Long-term problems such as loosening, protrusion, stem failure, late infections and late dislocations have been prevalent. Because life expectancy increases in all countries, long-term disadvantages of the hemiarthroplasty may outweigh its short-term advantages.[31,32]

Our results were comparable to study by Sancheti et al[33] and Elmorsy et al[34] which have shown that primary bipolar hemiarthroplasty in comminuted extra-capsular neck femur fracture gives advantages like early mobilization, stable and pain free hip with early rehabilitation and return to daily routine life with less re-operation rate over osteosynthesis in these fractures and is fairly economical especially for developing countries.

Our study is an Level 4 study, hence firm conclusions cannot be as ascertained. Finally we agree with The Cochrane Database analysis has also quoted insufficient evidence to prove superiority of osteosynthesis or primary arthroplasty in inter-trochanteric fractures. So for the same a very well co-ordinated multicentric randomized double blinded trial is essential to prove efficacy, feasibility and long term survivorship.

Also the use of this transtrochanteric approach in comminuted inter-trochanteric fracture both for total hip arthroplasty and hemiarthroplasty is yet to be established. Its comparative study with other approaches too needs further evaluation.

CONCLUSION

Although Bipolar Hemiarthoplasty has its set of long term complications questioning its long term survivorship, but it is an excellent and viable option for early ambulation and good early-midterm survivorship, with less implant related complication for elderly osteoporotic patients having comminuted inter-trochanteric fracture femur.

Also transtrochanteric approach needs further extensive study for its efficiency with respect to total hip arthroplasty and Level I/II studies comparing with other approaches. In our study this approach is a good technique without harming sciatic nerve, external rotators of and abductors of hip. This is used for endoprosthetic replacement in comminuted inter-trochanteric fractures with greater trochanter as separated fragment.

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COMPARISION OF ANTEROMEDIAL AND TRANSTIBIAL PORTAL TECHNIQUE IN ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH HAMSTRING GRAFT

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ABSTRACT

BACKGROUND- Anterior cruciate ligament (ACL) tear has very sharp increase in occurrence, because of increased awareness in health care professionals and availability of MRI scans.

AIMS & OBJECTIVE- We, hereby presenting the comparison of anteromedial and transtibial femoral tunnel drilling for arthroscopic ACL reconstruction with hamstring graft.

MATERIAL & METHOD- 80 patients of ACL injuries were operated by arthroscopic reconstruction of ACL using hamstring tendon. In 43 patients, anteromedial portal (AM Group) was used for femoral tunnel placement and in 37 patients transtibial (TT Group) femoral tunnel drilling was done. Fixation of graft was done using endobutton and mersilene tape on femoral side and suture post and interference screw on tibial side. 74 males and 6 females were included in the study. Average age of the patients was 33 (18 to 48 years) with mean follow up of 21 months (6-36 months).

RESULTS- Patients were followed up and results were assessed by Lysholm and International Knee Documentation Committee (IKDC) 2000 score. There were 100 patients but, 20 patients were lost to follow up. The average IKDC Score in anteromedial (AM group) was 92.3 points and in transtibial (TT Group), it was 90.2 points. The Lysholm score was in AM group 94.8 and in TT group, it was 91.4.

CONCLUSION- Anteromedial portal provides better rotational stability, good range of motion and lasts longer. Transtibial femoral tunnel drilling produces subjectively similar results but chances of graft elongation are more with it.

INTRODUCTION

Anterior cruciate ligament (ACL) injuries account for most of the injuries around knee joint and lead to significant difficulty, if left untreated. There are various methods of arthroscopic ACL reconstruction. Various options are available for fixation of the graft in tibial and femoral tunnel. Transtibial femoral tunnel drilling gives more vertical and non-anatomic femoral tunnel. Anteromedial portal for femoral tunnel drilling is less constrained and the tunnel is more anatomical.

The primary aim of our study was to investigate the differencing graft placed through anteromedial portal showed good results as compared to transtibial femoral tunnel. Our secondary aim was to investigate the difference in clinical outcome between the two modes of tunnel placement.

MATERIAL AND METHODS

Eighty patients who underwent ACL reconstruction between November 2008 and December 2012 by hamstring graft were included in this study and had completed the minimum follow up for 6 months. All patients underwent for

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careful clinical examination and MRI before surgery. After proper informed and written consent, ACL reconstruction was done by Hamstring graft for ACL deficient knee with endobutton, Mersilene tape and suture post. Out of 80 cases, 43 patients underwent graft fixation in femoral tunnel by AM portal (AM group) while other 37 patients through transtibial (TT Group) femoral tunnel drilling. All ACL reconstructions were performed by a single surgeon. The clinical outcome was assessed by postoperative IKDC (Intervention Knee Documentation Committee) and Lysholm scoring system.

OPERATIVE PROCEDURE

After spinal or general anaesthesia, diagnostic arthroscopy was done under tourniquet through standard anteromedial (AM) and anterolateral (AL) portal. All patients underwent single incision ACL reconstruction using Hamstring graft around 8-10 mm width and 25-35 mm length. Graft was harvested from 2 cm medial to tibial tuberocity by 2 cm incision The intercondylar notch and lateral wall were prepared. The tibial tunnel was prepared by serial drilling from 6-9 mm cannulated reamers over a guide wire exiting 7 mm anterior to the anterior fibres of posterior cruciate ligament, just medial to medial tibial spine in the posterior footprint of torn ACL fibres. With the knee at 80-90 degree of flexion, in TT group, transtibial portal was used for preparation of femoral tunnel, drilling of tunnel done over a guide wire which was kept 7 mm or 5 mm anterior to posterior edge of lateral femoral condyle depending on the graft size, at 11 o'clock position in right knee and in 1 o'clock position in left knee using a femoral offset of 6 mm. In AM group, AM portal was used for femoral tunnel preparation and drilling done on a guide wire at 9 o'clock position in right knee and in 3 o'clock position in left knee. Bi-cortical drilling was done with 4 mm cortical reamer. Then, 30 mm long femoral tunnel was drilled serially with 7-9 mm cannulated reamers. Then graft tied with endobutton by mersilene tape and inserted in femoral tunnel through the tibial tunnel over a beath pin which exited from anterolateral aspect of thigh. Endobutton is made vertical to horizontal on outer cortex of femur by threads attached to it. Forced flexion and extension of knee done with pulling the graft from tibial tunnel with ethibond sutures. Then, ethibond sutures are tied around a suture post inserted just lateral to tibial tunnel opening. After ACL reconstruction, Anterior Drawer, Lachman and Pivot shift test were done to see the adequacy of fixation. Anteroposterior and lateral X-ray taken on 1st postoperative day and physiotherapy started as per schedule.

OBSERVATION

Table 1
Age incidence

Age	No. of Patients
11-20	16
21-30	23
30-40	26
40-50	15

Table 2
Sex incidence

Total No. of Patients	Male	Female
80	74	06

Table 3
Mode of injury

Mode of Injury	No. of Patients
Vehicular	40
Farming	02
Sports Persons	37
Minor Trauma	01
Total	**80**

RESULTS

There were 74 males and 6 females. 47 patients underwent femoral tunnel fixation by endobutton through anteromedial portal (AM group) and other 33 patients through transtibial portal (TT group). Results were evaluated on the basis of IKDC (Intervention Knee Documentation Committee) and Lysholm scoring system. The

average IKDC Score in anteromedial (AM) group was 92.3 points and in transtibial tunnel (TT) group it was 90.2 points. The Lysholm score was in AM group 94.8 and in TT group, it was 91.4. The difference between the means was found to be statistically significant ($P<0.0001$) using independent sample test. Chi square test applied between the 2 groups was statistically significant ($P<0.0001$).

The mode of injury in the patients was: vehicular injuries - 50%; sports-46%; others-4%. Associated meniscal injury was found in 50% of patients (Medical meniscus 30%; Lat. Meniscus-15%; both-5%). Flexion deficit of 5-10 degree in 2 patients was found at 1 yr follow up. Complications included deep infection in tibial fixation device in 2 patients, septic arthritis in 1 patient, superficial wound infection in 3 patients, extension deficit with cyclops formation in 1 patient. One patient had a significant positive Lachman test at final follow up. One patient had post traumatic rupture of ACL graft at 16 months post op. 95% patients had a stable, pain free, functional knee joint. No patient had anterior knee pain at 6 months follow up. Diameter of Graft harvested in patients was: 8 mm-85%and 9 mm-15%.

Table 4
IKDC and Lysholm scores in AM and TT technique in knee injuries

Score	AM Technique	TT Technique
IKDC	92.3	90.2
Lysholm	94.8	91.4

Table 5
IKDC Scores

IKDC Score	AM Technique	TT Technique
91-100	24	23
81-90	14	11
71-80	05	03
Total	**43**	**37**

Table 6
Lysholm score

Lysholm Score	AM Group	TT Group
100-90	26	22
85-89	15	12
80-84	02	03
Total	**43**	**37**

DISCUSSION

Successful clinical outcomes following anterior cruciate reconstruction with a hamstring graft have been reported by many authors. There are so many methods of graft fixation i.e. Interference screw, endo button, transfix and rigid fix. Interference screw is associated with cut through of graft. Anatomic graft placement is critical to the success and clinical outcome of anterior cruciate ligament (ACL) reconstruction. Non anatomic bone tunnel placement is the most common cause of a failed ACL reconstruction. Single-incision ACL reconstruction has traditionally been performed using the transtibial tunnel technique. In the transtibial tunnel technique the ACL femoral tunnel is drilled through the tibial tunnel. Advantages of the transtibial tunnel technique are that it is familiar to most surgeons, it is simple and quick, and it does not require the knee to be flexed beyond 90° of flexion when the femoral tunnel is drilled. The major disadvantage of the transtibial tunnel technique is that it is not possible to independently drill the ACL femoral tunnel in the notch since the femoral tunnel is drilled through the tibial tunnel; therefore the two tunnels are linked. Anatomical and clinical studies have demonstrated that the transtibial tunnel technique tends to place the tibial tunnel too posterior and the femoral tunnel too high and deep in the intercondylar notch. These tunnel placements result in a vertical ACL graft. A vertical ACL graft may restore AP translation but often fails to control tibial rotation resulting in the patient having a positive pivot shift test and symptoms of giving way.

In the anteromedial portal technique, the femoral tunnel is drilled through the anteromedial portal. The anteromedial portal technique allows independent drilling of the ACL femoral and tibial tunnels which facilitates anatomic placement of the ACL graft.

Eduard Alentorn-Geli et al has shown in a blinded cross-sectional study at two- to five-year follow-up of anteromedial portal versus transtibial drilling techniques in ACL reconstruction. In which, forty-seven patients included (21 TT group and 26 AM group). The AM group demonstrated a significantly lower recovery time from surgery to walking without crutches ($p < 0.01$), to return to normal life ($p < 0.03$), to return jogging ($p < 0.03$), to return training ($p < 0.03$), and to return to play ($p < 0.03$). Knee stability values measured with KT-1000, Lachman test, pivot-shift sign, and objective IKDC score assessments were significantly better for the AMP compared to TT group ($p < 0.002$, $p < 0.03$, $p < 0.02$, $p < 0.015$, respectively). The use of the AMP technique significantly improved the anterior-posterior and rotational knee stability, IKDC scores, and recovery time from surgery compared to the TT technique.

The use of the anteromedial portal (AM) for drilling the femoral tunnel was suggested as a method to place the graft in an anatomical position and improve rotational stability, without increased complexity.

With the TT technique, the position of the femoral tunnel is dictated by the tibial tunnel, whereas the AM technique provides the surgeon with a greater freedom to place the graft in the anatomical position.

Twenty-one studies, involving a total of 859 patients (257 in the AM and 602 in the TT group), were included in one meta analysis. The AM group demonstrated significantly earlier return to run and significantly greater range of motion, Lachman test values, and KT-1000 arthrometer measurements in the 1-2-year follow-up, although no differences were found for both the 3-5 and the 6-10-year follow-ups for any of these parameters. In contrast, the TT group demonstrated significantly higher activity level for the 3-5 and 6-10-year follow-up. The use of the AM elicited greater knee stability and range of motion values, and earlier return to run compared to the TT technique. These results may indicate a potential benefit of the AM over the TT technique. However, as the benefits of the AM were not obtained in the mid and long-term follow-ups, overall there is no definitive evidence at this point to conclude that one technique is superior to the other.

The advantages that can therefore be attributed to the AM technique are: (1) the femoral and tibial tunnels are placed independently of each other; (2) the femoral tunnel can be drilled with knee in hyperflexion reducing the risk of posterior wall blow out; (3) the femoral tunnel is placed more anatomically on the ACL femoral insertion site; (4) the AM technique allows for easy augmentation by preserving the remaining ACL fibres; (5) the easy parallel placement of the interference screw to the bone plug with no lateral incisions; (6) the tunnel placement is independent of graft type or tunnel guides ; and (7) it is flexible enough so that revision procedures may be easily performed.

On the other hand, several limitations do exist when using the AMP technique: (1) the femoral tunnel needs to be created with 110-120° of knee flexion to avoid injury to the posterolateral structures and posterior "blow-out"; (2) visualisation is challenging when a leg holder is used; (3) several graft fixation techniques require guide instruments designed for TT insertion that may not be appropriate for the AMP technique.

However, Chong bum chang et al has reported in a series of 10 cadavers that a more horizontal femoral tunnel position, particularly via the anteromedial (AM) portal technique, will reduce femoral tunnel length, and a more horizontal femoral tunnel position and anterior-to-posterior pin insertion will increase the risk of Rigidfix pin protrusion.

Gadikota et al performed a study on 8 cadavers and concluded that a larger posterolateral bundle coverage is achieved by the AM portal.

Figure 1 : Patient preparation

Figure 2 : Diagnostic Arthroscopy

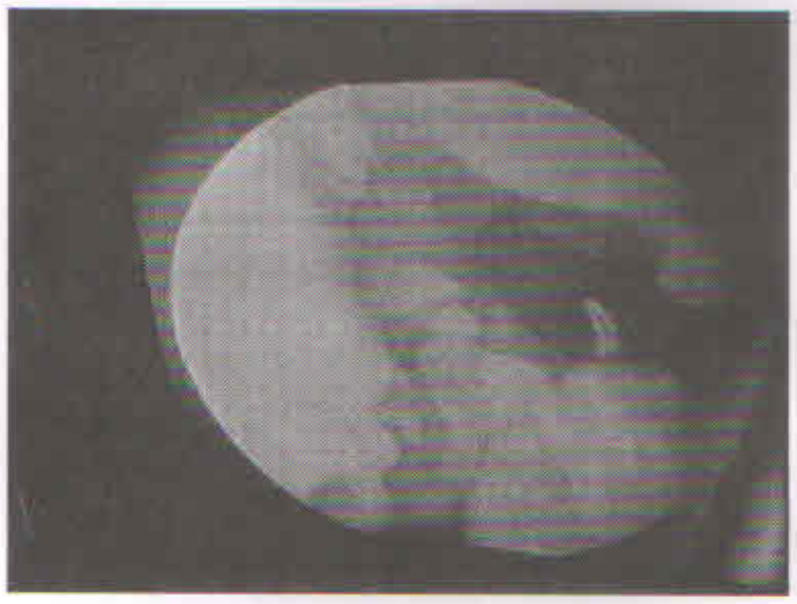

Figure 3 : Torn ACL foot print

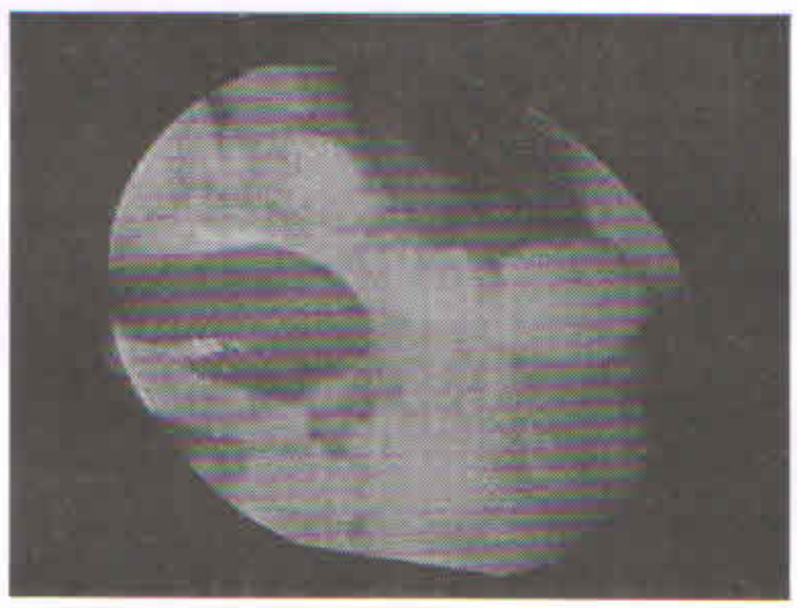

Figure 4 : Shaving of footprint

Figure 5 : Gracillis Graft Harvesting

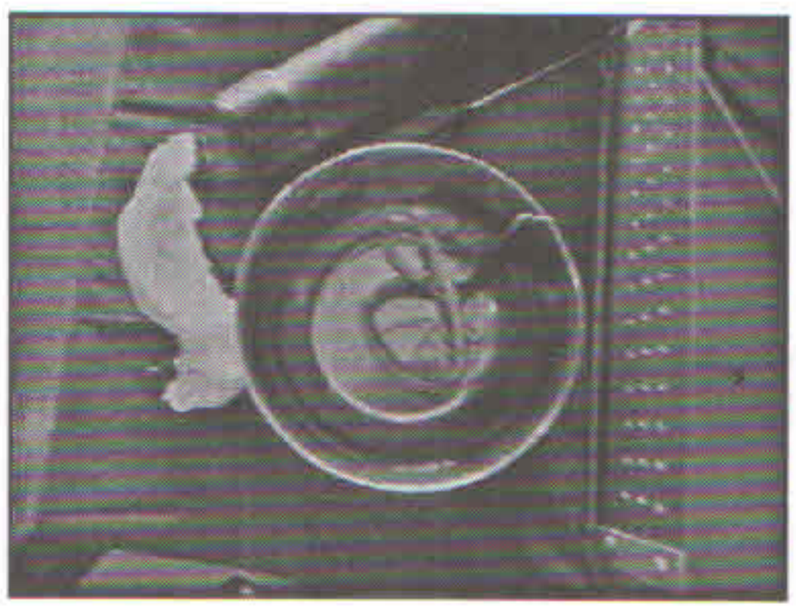

Figure 6 : Harvested graft

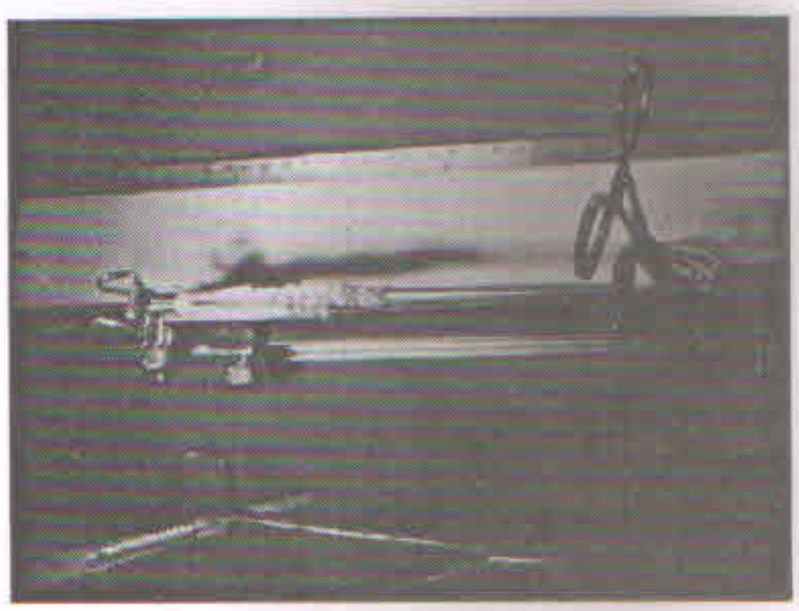

Figure 7 : Graft tensioning

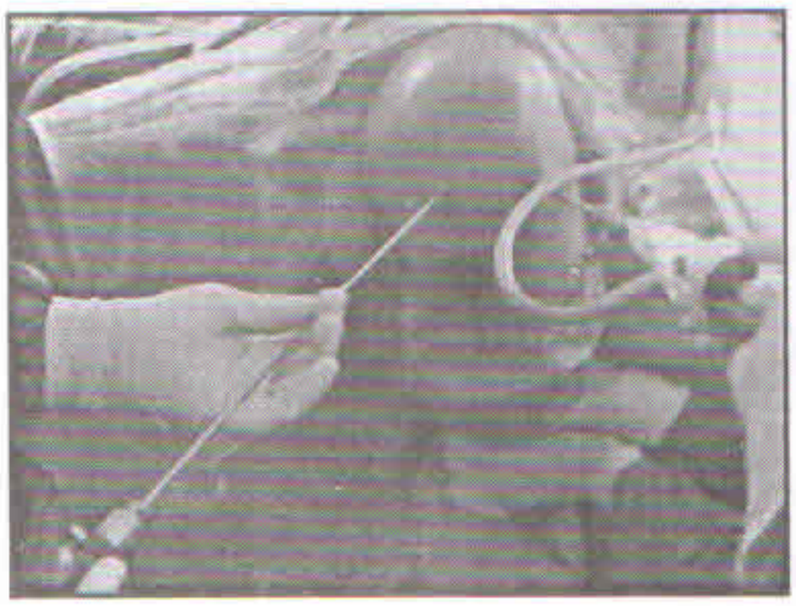

Figure 8 : Femoral tunnel drilling through Anteromedial portal

Figure 9 : Hyperflexion of knee

Figure 10 : Passing the graft through Anteromedial portal

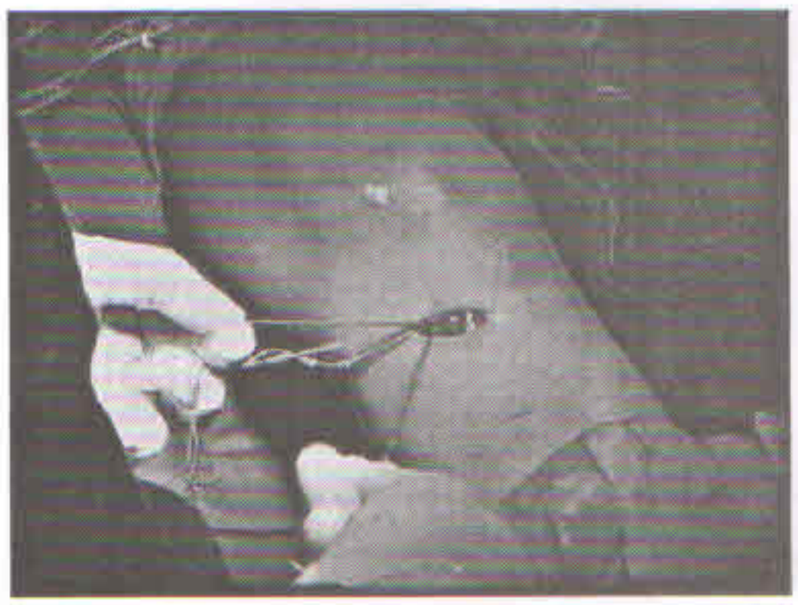

Figure 11 : Suturing of graft with suture post

Figure 12 : Closure of incision

Centres of the tunnels created by the AM portal were closer to the native ACL footprint centers than the centers of the TT technique tunnel.

Sim JA has performed a cadaveric study and concluded that Anterior cruciate ligament reconstructions by AM portal and modified TT techniques result in similar knee joint laxities. Technical perils and pearls should be carefully considered before choosing a tunnel creating technique.

Marc Tompkins, et al performed a cadaveric study in 20 cadavers and resulted that the AM technique placed 97.7% ± 5% of the tunnel within the native femoral footprint, significantly more than 61.2% ± 24% for the TT technique (P =.001). This study demonstrates that use of an accessory medial portal will facilitate more accurate placement of the femoral tunnel in the native ACL femoral footprint.

In a study of 32 patients of ACL reconstruction by three-dimensional computed tomography models to visualize and quantify the positions of femoral and tibial tunnels in patients who underwent traditional transtibial single-bundle reconstruction of the anterior cruciate ligament and to compare these positions with reference data on anatomical tunnel positions. Transtibial anterior cruciate ligament reconstruction failed to accurately place femoral and tibial tunnels within the native anterior cruciate ligament insertion site. If anatomical graft placement is desired, transtibial techniques should be performed only after careful identification of the native insertions. If anatomical positioning of the femoral tunnel cannot be achieved, then an alternative approach may be indicated.

Michael Hantes et al has shown in a study on 56 patients that using the AM portal technique, the ACL graft is placed in a more oblique direction in comparison with the TT technique in the femoral part. However, there are no differences between the two techniques in graft orientation in the tibial part. Normal sagittal obliquity is not restored with both techniques.

Jame et al reported that the AM arthroscopic portal technique for creating the ACL femoral socket has many advantage. In contrast to transtibial drilling, the AM portal technique allows unconstrained femoral socket positioning, which is essential for surgeons making a transition to all-inside retroconstruction or double-bundle reconstruction.

CONCLUSION

We found that anteromedial technique for ACL reconstruction is more anatomical and produces better results than transtibial technique. The use of the AMP elicited greater knee stability and range of motion values, and earlier return to run compared to the TT technique. These results may indicate a potential benefit of the AMP over the TT technique. However, as the benefits of the AMP were not obtained in the mid and long-term follow-ups, overall there is no definitive evidence at this point to conclude that one technique is superior to the other.

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DESMOPLASTIC FIBROMA OF PERIACETABULAR REGION - A CASE REPORT

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INTRODUCTION

Desmoplastic fibroma (DF) is an extremely rare, benign myofibroblastic tumor comprising of less than 1% of all tumors. Desmoplastic fibroma was first described by Jaffe in 1958 and represent osseus manifestation of aggressive fibromatosis. It is usually seen in young patients and involves mandible and long bones. World Health Organization describes it as 'benign' tumor characterized by the formation of abundant collagen fibers by the tumor cells. The tumor is poorly cellular and nuclei are ovoid and elongated. This tumor has tendency for local invasion and local recurrence.[1]

CASE REPORT

A 22 years old male presented with complaints of pain in right hip and gluteal region since one year. General physical and local examination was unremarkable. X-ray of the right hip region showed lytic lesion in periacetabular areas on the posterior aspect extending up to ischial tuberosity (Figure 1). MRI of the same region showed a well circumscribed lytic lesion with some periosteal edema (Figure 2). All haematological investigations were normal. Extended curettage was contemplated. Per-operatively, tissue excised from the lesion was taken and sent for frozen section examination. Grossly, tissue received was grey white elongated mass which was rubbery in consistency (Figure 3). Microscopic examination revealed ill defined spindle cell proliferation in a collagenous background with varying degree of myxoid change. The architectural arrangement of spindle cells varied with group of cells arranged in parallel fashion mixed with strong interlacing fascicles and intervening stroma (Figure 4). The spindle cells are generally uniform in appearance with occasional mitotic figure (1 per 10 hpf). The patient is symptom free at a follow up of one year after extended curettage.

DISCUSSION

Desmoplastic fibroma (DF) is a rare bone tumor accounting for only 0.06% of all bone tumors. Fewer than 200 cases have been reported worldwide in the literature. The majority of the patients are in their third decade with no sex predilection. Although the tumor has been described in various locations of the body but most commonly arises in the metaphyseal region of long tubular bones, mandible and pelvis. Radiologically, it appears as an expansile lytic lesion with cortical thinning. In general, the radiological features are non-specific. These include unilocular or multilocular, well demarcated and irregular translucency with variably expressed marginal sclerosis. Therefore it mimics other common as well as usual pathological conditions like osteoclastoma, ameloblastoma, odontogenic myxoma, aneurismal bone cyst, chondromyxoid fibroma and eosinophillic granuloma. The sun ray radiological presentation mimics osteogenic sarcoma. The rapid growth and bone destruction in association with

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Figure1 : X-ray showing lytic lesion in the left periacetabular region

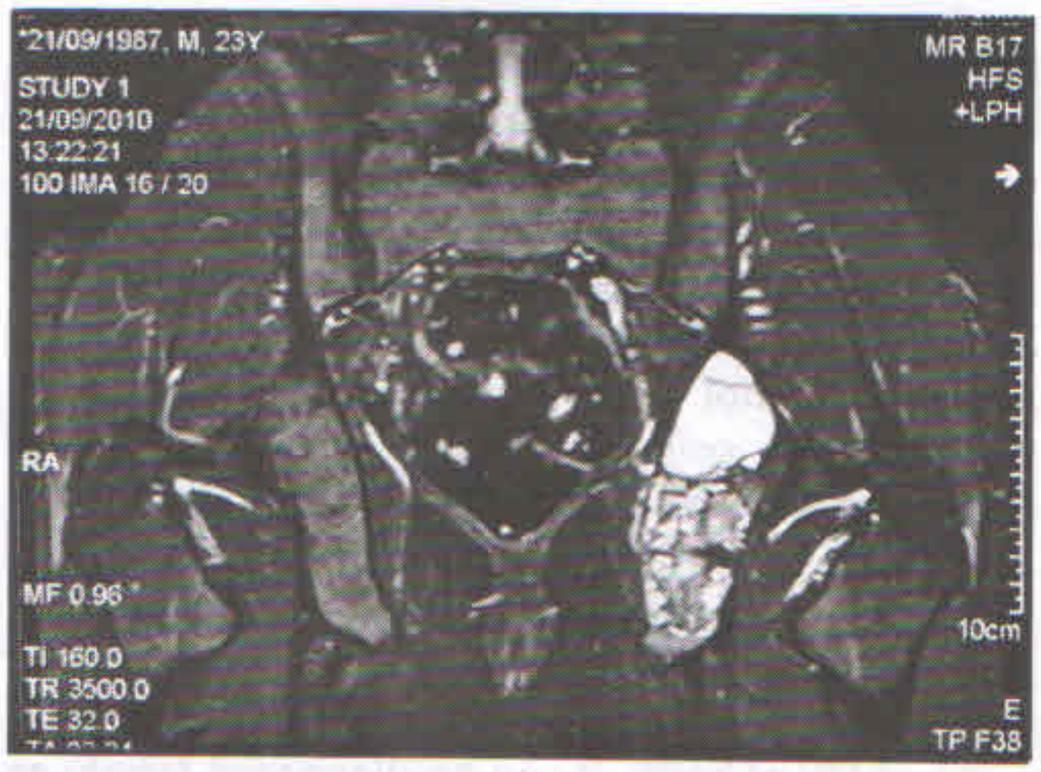

Figure 2 : MRI showing well circumscribed lesion

Figure 3 : The curetted material

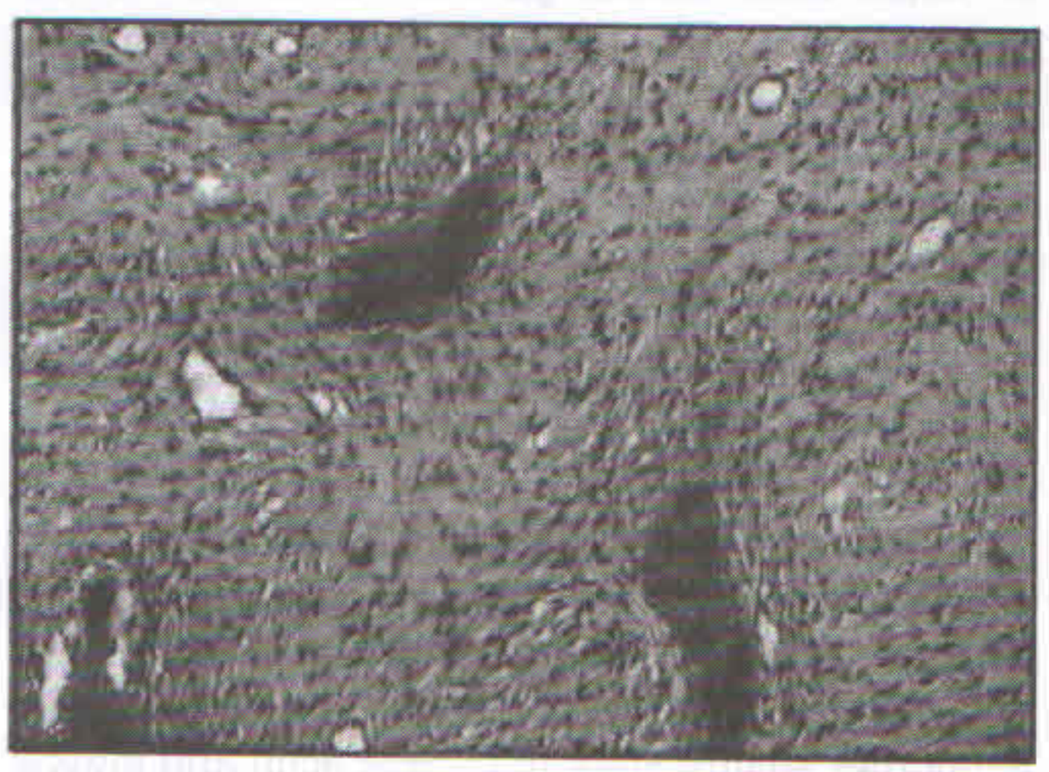

Figure 4 : Histopathology showing the densely packed spindle cell, arranged in storiform pattern with intermixed bony trabeculae

desmoplastic fibroma coupled with a spindle cell histological pattern may mimic low grade central osteosarcoma. MRI is most valuable in surgical planning while CT is superior to MRI in demarcating the cortical breakthrough. 1 The lesion in the young 22 years old male occurred I periacetabular region in pelvis which was well circumscribed lytic lesion on X-ray with sclerosis of margin and thinning of cortex. MRI showed lytic bone lesion with peri-lesional edema.

World Health Organization defines the histological criteria for desmoplastic fibroma as a benign tumor of low to variable cellularity and low mitotic rate with ovoid or elongated cells having uniform nuclei that lack atypia, pleomorphism and mitotic activity. The tumor cells are supported by a matrix of collagenized and variably hyalinized fibrous connective tissue. The etiology remains unknown, however trauma, endocrine and genetic factors have been suggested as possible etiological agents.[1]

The histological differential diagnoses include

spindle cell tumors and tumor-like lesions of bone. Low grade fibrosarcoma is the most difficult differential diagnosis. The typical fibrosarcoma is more cellular with a herring bone pattern showing more pleomorphism and a higher mitotic activity. However in some cases of low grade fibrosarcoma, mitosis is not manifested and areas with predominant collagen tissue may make the distinction extremely difficult. In such cases, only after follow-up is final diagnosis established. DF of bone can imitate morphological pattern of low grade intraosseus ostrosarcoma but DF lacks osteoid formation. If biopsied from peripheral areas of DF of bone, it can be diagnosed falsely as fibrous dysplasia. Therefore enough material must be taken from central part of tumor for correct interpretation. The non-ossifying fibroma i.e. metaphyseal fibrous defect is more cellular with storiform pattern, multinucleate giant cells, xanthoma cells and haemosiderin laden phagocytes. The developmental metaphyseal fibrous defect is related to periosteal desmoids but can be differentiated by its localization in periosteum and superficial cortex and its histological features.[2,3]

The immunohistochemical stains may not always be helpful in distinguishing this neoplasm from the spindle cell tumors and tumor like lesions. The tumor cells may not be reactive with antibodies against smooth muscle actin and muscle specific actin but immunoreactivity with vascular marker anti CD34 and CD31 has been occasionally reported. In patients of desmoplastic fibroma of bone, various treatment modalities include wide surgical excision, radiation therapy and chemotherapy with or without additional procedures. Radiation is not recommended since it has shown to be only rarely successful and may lead to post radiation sarcoma.[5-8] Some surgeon prefer curettage, other prefer wide local excision or recommend resection with a wide margin. Iwai et al reported that patients treated with resection or wide excision showed no recurrence. The recurrence in those treated with simple excision or enucleation was 20-40% as compared to 70% recurrence when treated with curettage only. 1 Kwon et al reported that tumors with high cellularity have higher recurrence than those with low cellularity. Given the recurrence rate of desmoplastic fibroma, the current accepted minimum follow up period of no less than 3 years is recommended.[9]

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A NEGLECTED CASE OF KLIPPEL TRENAUNAY WEBER SYNDROME - A CASE REPORT

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ABSTRACT

This congenital vascular disorder is described by a "triad" of symptoms affecting one or more limbs. The "triad" constitutes varicose veins, cutaneous hemangioma, with bone and soft tissue hypertrophy. The cutaneous hemangioma presents as a substantial port-wine stain or nevus. Varicose veins are often very numerous. Bone and soft tissue hypertrophy is variable in presentation and the affected limb may be either larger or smaller than the normal limb. This disorder is generally reported in childhood or adolescent age groups. We herein present a neglected case of Klippel Trenaunay Syndrome with all the classical clinical and radiological findings. A 30 year old man reported with the classical triad. On clinical examination substantial Port wine stain was seen and radiographs showed multiple bony outgrowths whereas MRI showed multiple varicosities displaying heterogeneous hyper intense signals on T2 Weighted Images and T1 hypo intensity with hypertrophy of soft tissue in left lower limb.

Keywords: Klippel Trenaunay Weber syndrome, abnormal venous channels, varicose veins, bony hypertrophy

INTRODUCTION

Kliipel Trenaunay Syndrome was first described by French physicians Klippel and Trenaunay in the year 1900. They had termed the syndrome as "nevus vasculosus osteohypertrophicus". Park Weber in 1907 coined the same condition as "hemangiectatic hypertrophy". It has an incidence of about 2-5 in 100,000. It is an idiopathic and generally a sporadic condition, although suggestions of paradominant inheritance pattern have been there. Usually patients present in the first decade of life. Males are predominantly more affected than females. Klippel Trenaunay syndrome constitutes of a congenital circulatory disorder having cutaneous capillary hemangioma, bone and soft tissue hypertrophy and varicose veins. Several theories have been postulated for its pathogenesis but none have been proved so far. This is a case report of a neglected Klippel Trenaunay syndrome showing the classical triad.

CASE REPORT

Male patient, 30 years old presented to us with complaints of dilated veins over outer aspect of left limb since birth. Dilatation over his limb aggravated on standing and walking and relieved on lying down or raising his limb.

On clinical examination cutaneous hyper pigmentation with raised margins (port wine stains) was seen on outer aspect of his left lower limb extending from mid-thigh to mid-calf region (Figure 1). Multiple varicose veins were seen on his left lower leg. The differences between both limb measurements were striking as Length 31 inches/33 inches, Calf girth 12 inches/15 inches, mid-thigh

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girth 16 inches/18 inches in right and left lower limb respectively, showing left lower limb hypertrophy. Incompetent saphenofemoral junction was seen on Trendelenberg test.

On X-ray left leg showed a bony outgrowth arising from upper end of tibia laterally with deformed fibula. The deformity of lower shaft of left Fibula consisted of areas of cortical thickening with irregularity and marrow sclerosis. There was cortical thickening noted in left lower tibia (Figure 2). Ultrasonographic analysis revealed multiple abnormal dilated venous channels within subcutaneous & intramuscular planes in left leg predominantly in lateral aspect with dilated perforator in popliteal region along with associated hypertrophy of soft tissue of left leg with incompetent left sapheno femoral and popliteal junctions. Magnetic resonance imaging of left lower limb was performed which revealed marked hypertrophy of soft tissues of left leg (Figure 3). The hypertrophied soft tissue showed heterogeneous signals hyper intense on T2 Weighted Images. Multiple abnormal vascular channels with T2 hyper intensities & T1 hypo intensities suggestive of varicosities were seen within soft tissue of all compartments involving subcutaneous and muscular planes. Pressure over the underlying bones tibia & fibula with focal areas of sclerosis & bone edema in shaft of left fibula mainly in lower half was also seen.

On the basis of above triad of clinical, port wine stain and limb hypertrophy, and Radiological, lateral varicosity diagnosis of Klippel Trenaunay Weber syndrome was made. No active management was done for the patient as the patient was asymptomatic. Limb elevation along with elastic bandage application was advised and the patient was called for regular follow up to check for any complications like AV Fistula and bony impingement of the soft tissues.

DISCUSSION

Klippel Trenaunay syndrome is a sporadic mesodermal abnormality. It consists of combined vascular malformations of capillary, venous and lymphatic type, varicosities of unusual distribution and limb enlargement. Presenting age is at birth or during early infancy or childhood. In this case report the presenting age of the patient is 30 years. The lower limb is involved in about 95% and upper limb involvement is seen in 5%.

Capillary haemangioma has a distinct border and is often seen on lateral aspect of limb and has a deep violet color. It may be limited to skin or extend deep to subcutaneous tissue including muscle and bone. It is usually unilateral, segmented and never crosses the midline. It increases in proportion to the child's growth with the maximum increase during the growth spurt and stops once the growth of the body stops. It may involve any part of the body, although face and cervical region are the most commonly affected areas. The lesion was present on the lower limb in the patient. Lesions may change colour from being light pink in infancy to become progressively darker (dark red) as the child ages. The patient's lesion was deep violet in colour. The patient also develops varicose veins which may be present at birth as large superficial vein extending from buttocks to the foot. They might be extensive, and generally spare the saphenous distribution. These areas of vascular malformations may remain stable or enlarge gradually, causing pain, lymph edema, thrombophlebitis and ulcers.

Limb hypertrophy is seen secondary to increased length and/or increased girth. In the beginning it may affect the digits only causing macrodactyly, syndactyly, polydactyly or oligodactyly. Increase in the limb girth is the only feature where soft tissues rather than bones are primarily affected. Lengthening of the limb may initially present as gait disturbances. In rare cases, the affected limb may show atrophy rather than hypertrophy. Other features which might be associated are spina bifida, hypospadias, hyperhidrosis, hypertrichosis, paresthesia, decalcification of affected bone, chronic venous insufficiency, dermatitis, poor wound healing, and venous ulceration.

Radiological analysis plays an important part

Figure 1 : Clinical photograph of both the lower limb shows cutaneous hyper pigmentation with raised margins (port wine stains) over the lateral aspect of left lower limb extending from mid thigh to mid calf region. Multiple varicose veins are seen on his left lower leg. There is increase girth of involved limb. Also a close up of the lesion showing the texture of the lesion.

Figure 2 : Antero-posterior and lateral radiograph of left leg showing a bony outgrowth arising from upper end of tibia with deformed fibula. Areas of cortical irregularity and thickening with marrow sclerosis are seen in lower shaft of left fibula.

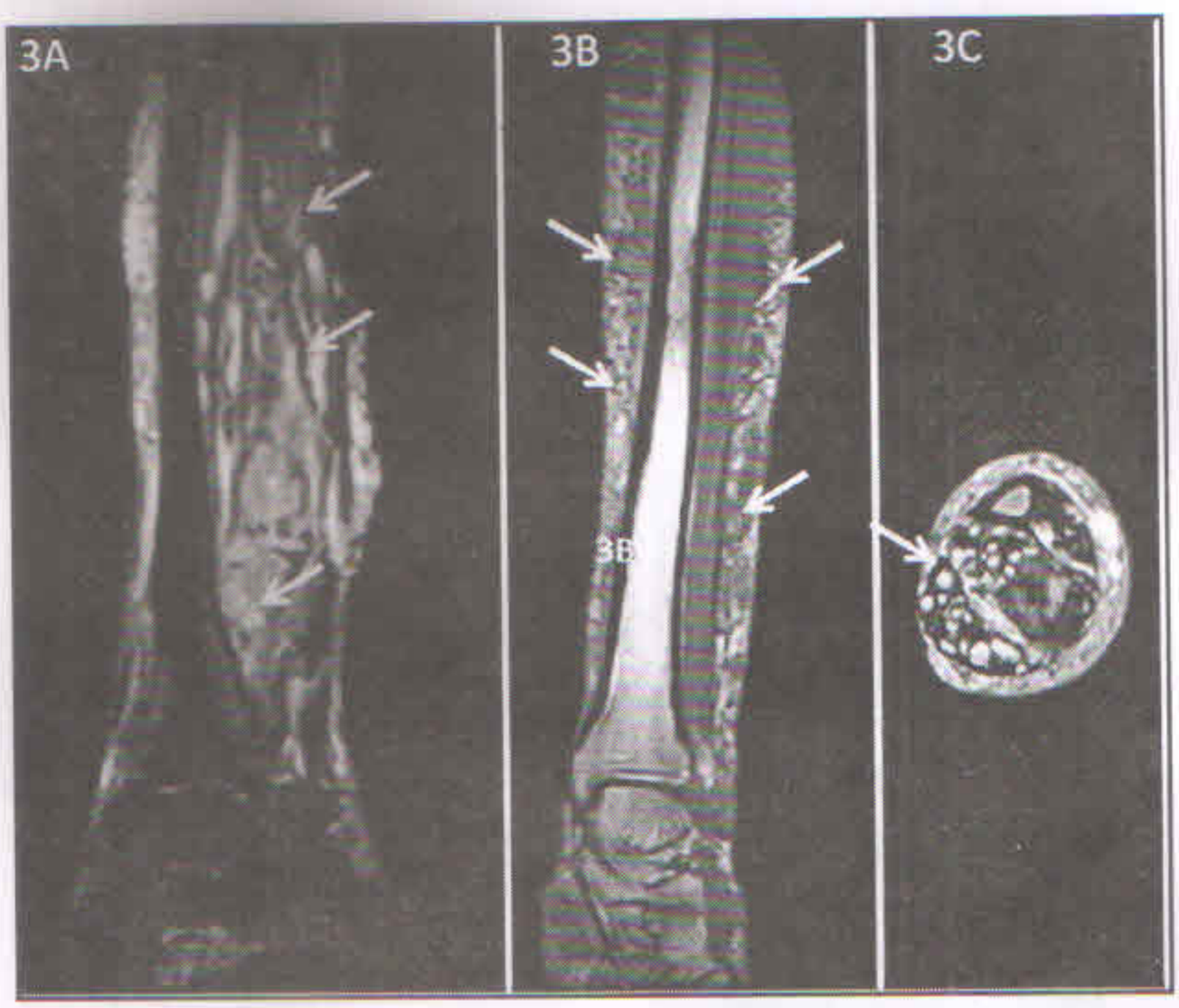

Figure 3 : Sagittal TIRM (3A), coronal T1W (3B) and axial T2W (3C) MR images showing hypertrophy of soft tissues of left leg displaying heterogeneous signals hyper intense on T2 and hypo intense on T1WIs. Multiple abnormal vascular channels (thin white arrow) with T2 hyper intensities & T1 hypo intensities suggestive of varicosities are seen within soft tissue of all compartments, subcutaneous tissues and in muscular planes.

in diagnosis of KT Syndrome. X-Ray shows bone elongation, soft tissue thickening. USG shows extensive dilatation of superficial veins and segmental absence or hypoplasia of deep venous system. Magnetic Resonance Imaging [MRI] may show hypo intense on T1 and hyper intense signals on T2 which suggests clear delineation of venous and lymphatic malformation. MRI is also useful for studying the extensions of lesions and relationship to adjacent organ and structure.

Treatment may include surgery, sclerotherapy and compression therapy. Compression Bandages help to reduce the effect of chronic venous insufficiency in the affected limb. Limb elevation also helps. Cellulitis and thrombophlebitis may be managed with antibiotics, limb elevation and analgesia. Prophylactically aspirin with or without anticoagulants may be given in patient who have recurrent thrombophlebitis or before surgery. Different types of surgical intervention including vein ligation, vein stripping, vein resection and amputation may be performed.

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PERIARTICULAR MULTIMODAL DRUG INJECTION FOR PAIN MANAGEMENT IN TOTAL KNEE ARTHROPLASTY

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INTRODUCTION

Total Knee Arthroplasty (TKA) is one of the most commonly done orthopaedic surgical procedures, and the utilization of TKA has increased over the last two decades, especially among younger patients including India. However, TKA may result in severe postoperative pain and bleeding. Adequate post-operative pain relief following TKA is very important to optimal post-operative recovery. Adequate management of postoperative pain following TKA poses a significant challenge, as 30% of patients experience moderate or severe pain after surgery. The International Association for the Study of Pain (IASP) has defined pain as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage". The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has made adequate pain management a priority and has deemed monitoring pain as the "fifth" vital sign. Although a number of options are available for control of postoperative pain in TKA, a gold standard has not been established. Various options available for pain control in TKA are:

- Peripheral nerve blocks
- Epidural analgesia
- Parental (IV) analgesia (e.g., patient controlled analgesia) etc

Incidently, all of these techniques have shortcomings like suboptimal pain control and unwanted side effects. Currently, multimodal pain management protocols have evolved in joint replacement surgeries as they provide better pain control and patient satisfaction, lower overall narcotic consumption, reduce hospital stay, and improve function while minimizing complications.,, Multimodal pain management involves the use of multiple agents that act at different sites of the pain pathway. One important aspect of multimodal analgesia is local infiltration analgesia (LIA). This technique involves the infiltration of a large volume of dilute solution of a long-acting local anaesthetic agent often with adjuvants throughout the wound at the time of surgery. The technique was developed specifically to avoid sedation and facilitate rapid physiological recovery after lower limb arthroplasty in order to enable early mobilization and discharge. The existing literature provides evidence that the use of LIA as part of a multimodal analgesic regimen reduces short-term post-operative pain and length of hospital stay and improves joint function after knee joint replacement.

In this double blinded and randomized controlled study, we had combined local analgesic solution consisting of an opioid (Morphine), a non-steroidal anti-inflammatory drug (Ketorolac), a long-acting local anesthetic (Bupivacaine), and an antibiotic (Gentamycin), with Adrenaline and Normal Saline as a 'cock tail' to determine the

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overall effect of this intra-operative local anaesthetic wound infiltration on acute post operative pain, joint function and length of hospital stay after primary TKA.

MATERIAL AND METHODS:

This study was conducted in the Department of Orthopaedics, Indraprastha Apollo Hospital, Sarita Vihar, New Delhi from may 2012 through December 2012 and all the patients were followed for 4-7 days after surgery.

Participants:

After institutional ethics committee (IEC) approval and informed written consent, 100 consecutive patients with unilateral degenerative arthritis of the knee and who were the candidates for unilateral TKA were assessed for eligibility and enrolled for the study. During the course of the study, 20 patients were excluded from the study for not meeting the required criteria (Figure 1). Thus, 80 patients completed the criteria for this randomized double-blind controlled study. Acetyl salicylic acid, clopidogrel or any of the drugs containing salicylates and NSAIDS were stopped 5-7 days prior to the surgery if being taken by the patients. Pre-operative haematology profile assessment [haemoglobin (gm/dl), platelet count (thousands/dl), haematocrit (%), prothrombin time (PT), international normalized ratio (INR), activated partial thromboplastin time (APTT)], were carried out in each of the recruited patient.

Inclusion criteria:

1. All the participants who meet the clinical and radiological criteria for unilateral primary TKA

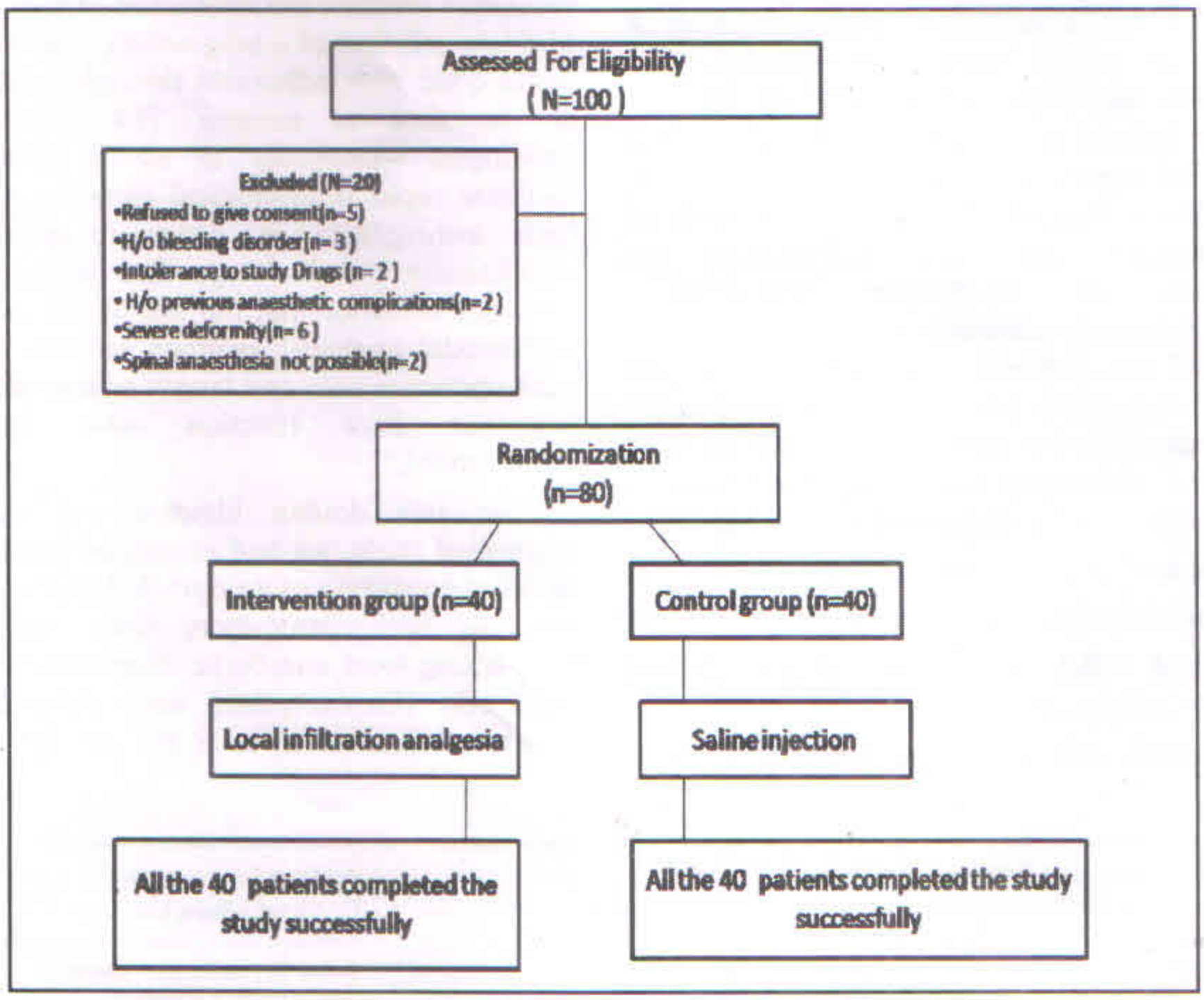

Figure 1 : Events during the study

and being willing and able to provide fully-informed consent (Figure 2).

Figure 2 : Intraoperative photograph of an arthritic knee

2. American society of anaesthesiologists (ASA) physical status I-III, and mobility indicating normal preoperative mobilization.

Exclusion criteria:

1. Known allergy or intolerance to one of the study drugs.
2. History of stroke or a major neurological deficit, or uncontrolled angina and bifascicular block with prolonged QT interval.
3. Previous drug dependency.
4. Hepatic, cardio-respiratory and renal insufficiency, congenital or acquired. Coagulopathy and recent history of thromboembolic episode were excluded from the study.
5. Any medical co-morbidity that precludes spinal anaesthesia, regional blocks or the use of strong analgesics post-operatively.
6. Severe dementia or psychiatric illness such that they are unable to complete the questionnaires or provide informed consent.
8. Severe anaemia (Hb<9 gm/dl).
9. Uncontrolled hypertension.
10. Patients with severe deformity (>than 20° varus and flexion) and restricted range of motion (<90°) were excluded to avoid implications related to any major surgical dissection and possible consequent increase in blood loss and to exclude any possible implication with postoperative assessment of range of motion.

Study design:

Randomization and blinding:

A random number table was utilized to generate the simple randomization sequence. Participants were randomly assigned to the two treatment groups: intervention group and control group. A randomization table was created with SPSS 10.04 software (SPSS, Chicago, Illinois). Forty patients were assigned to one group called the intervention group (to receive an intraoperative periarticular injection of analgesic drugs) and another forty patients were assigned to another group called the control group (to received simple saline injection). To ensure blinding, the local infiltration and control solution (both colourless) were prepared and provided in identical disposable syringes tagged with number codes for allocation concealment and blinding by an independent hospital pharmacist. The patients, the study investigator, the pain management team, and all the staff concerned with the postoperative care of the patients were blinded.

Group A (intervention):

Received a multimodal injection intraoperatively while

Group B (control):

Received saline injection intraoperatively as detailed below.

Surgery:

Anaesthesia:

The anesthetic regimen was standardized. No long-acting analgesics were used. All the patients received spinal anaesthesia with 3 mL of 0.5% bupivacaine heavy with preservative free Fentanyl

25micograms. Spinal anaesthesia was not possible in two patients, one in each group, and both patients were excluded from the study. We did not use epidural anaesthesia in any of our patients during the study.

Surgery:

The operations were performed by a single surgeon with the use of a pneumatic tourniquet, which was inflated just before giving skin incision and was released after the implant was fixed with cement. All operations were performed using anterior midline (Modified Insall's) approach. The same technique was used in both groups, and all patients received posterior stabilised total knee system (Scorpio®, Stryker® Howmedica Osteonics; Mahwah, NJ, USA) fixed with cement (Simplex-P Bone Cement ; Stryker) (Figure 3). The wound was closed after adequate haemostasis and vacuum drain was inserted before joint closure. Drain was removed on the 2nd postoperative day.

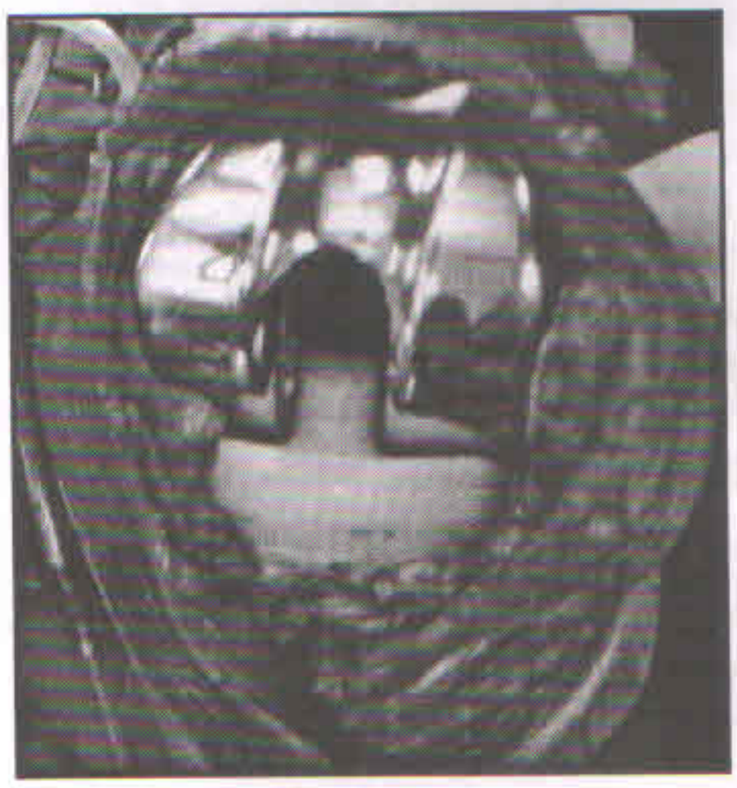

Figure 3 : Intraoperative photograph with implant in situ

Pain management:

Group A (intervention group): In group A, local infiltration injection 'cocktail' was given (Table 2). The cost of all the six drugs used was Rs. 152 (<$ 3)

Table 2
Composition of 'Cocktail'

S. No.	Drug	Dose (conc.)	Volume (ml)
1.	Bupivacaine	0. 25%	20
2.	Morphine	15mg	1
3.	Ketorolac	30mg	1
4.	Adrenaline	1mg (1:1000)	1
5.	Gentamycin	80mg	2
6.	Normal Saline	0. 9%	50
	Total cost Rs 152 (< $3)		**75 ml**

The drugs were mixed with sterile normal saline solution to make up a combined volume of 75 mL in the operating room under sterile conditions.

The first aliquot of 20 mL of the mixture was injected prior to implantation of the component, into the periarticular soft tissues medially and laterally in flexed position of knee (Figure 4). Special care was taken to avoid accidental infiltration in the area of the common peroneal nerve and popliteal fossa to avoid injury to vessels and sciatic nerve by not infiltrating the drugs in the midline posteriorly. Then, while the cement was curing, the quadriceps mechanism and the retinacular tissues were infiltrated with an additional 20mL of the mixture. Finally, before wound closure, the subcutaneous tissues were infiltrated with remaining 35ml solution (Figure 5). A negative-pressure vaccum drain was also placed in all knees.

Group B (Control group):

In the control group same amount of saline injections was given intraoperatively.

Both the groups received

1. PCA morphine pump, which was used as rescue medication by all patients.
2. Injection Amoxicillin and clavulanate 1.2 gm given intravenously three times a day.
3. Injection Paracetamol 1 g orally three times a day.

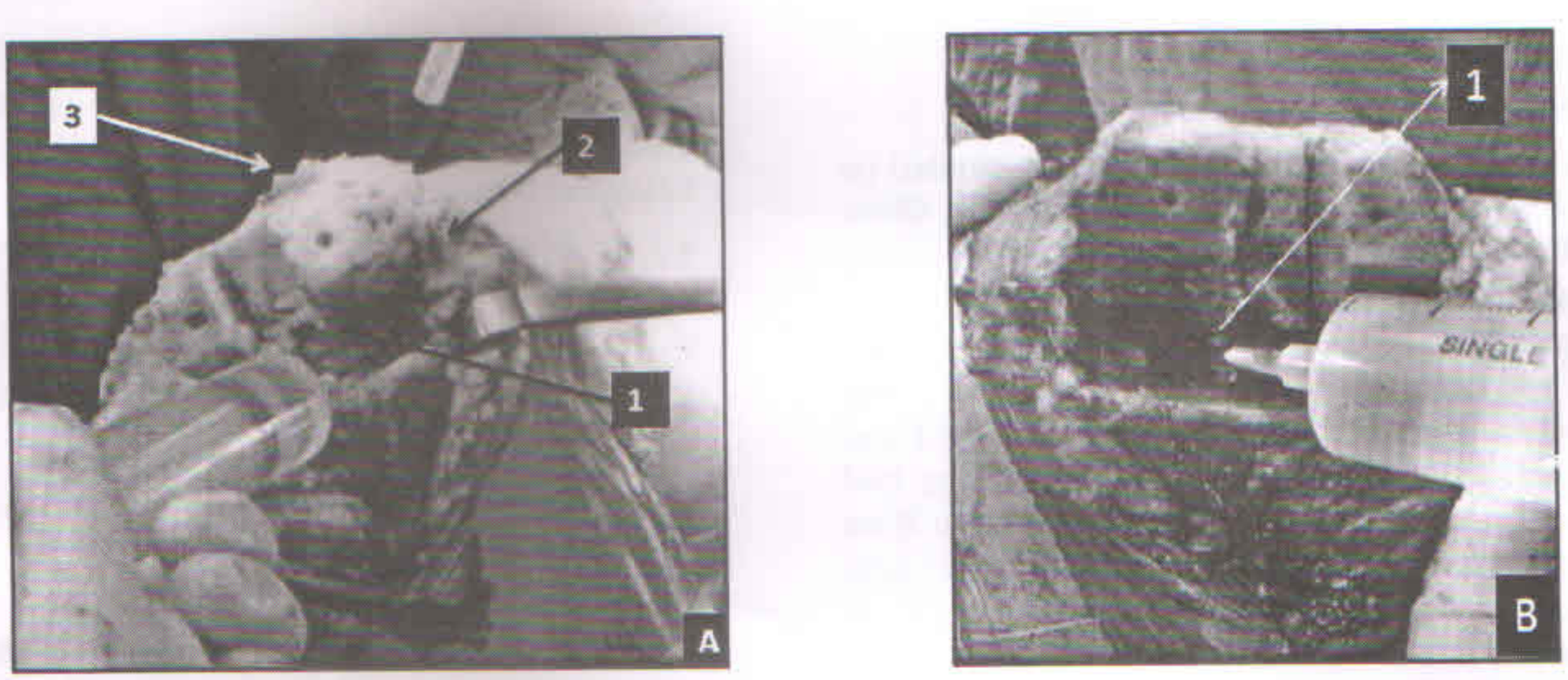

Figure 4 (A and B) : Intraoperative photograph showing the locations for deep intraoperative injection: posterior capsule (1); posteromedial structures (2); periarticular synovium (3).

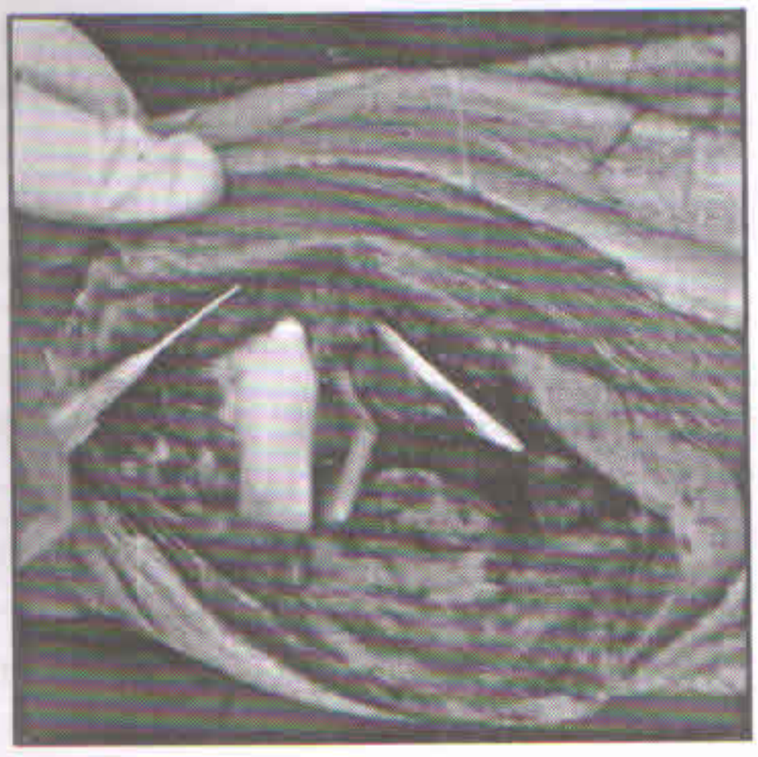

Figure 5 : Intraoperative photograph showing the locations for superficial intraoperative injection.

4. Injection Diclofenac 75mg given intravenously two times a day.
5. Injection Enoxparin 0.4ml subcutaneous once a day.

Patients were allowed to become mobile as tolerated beginning on the day of surgery under the supervision of a physiotherapist.

Outcome measures:

Assessment times:

Participants were followed-up for 4-7 days after surgery. Assessment was conducted post-operatively, daily during the hospital stay. Outcomes were assessed using VAS score, opioid consumption, drain output, pre and post op Hb, length of hospital stay, and joint examinations.

1. Primary outcome measure:

Primary outcome measures included quality of analgesia and amount of bleeding in the postoperative period.

A. Post operative pain:

Quality of analgesia was assessed by visual analogue scale (VAS) and by measuring

consumption of opioid for pain.

i) VAS:

The postoperative pain level was estimated by using a visual analogue scale at 6hrs, 24hrs, 48hrs and 72hrs after surgery during rest and during movement. Participants were asked to verbally rate their pain severity on a 0-10 scale. The patients were told that the left end of a 10-cm line represented the absence of pain and the right end represented the most extreme pain that they had ever felt, and then they were asked to put an X on the line in the place that best estimated their pain level at that moment. From the day after surgery to discharge participants complete a 10 mm VAS for pain severity (Figure 6).

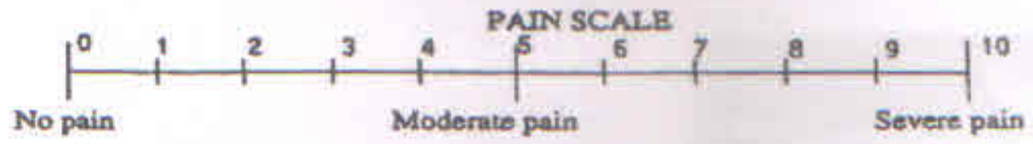

Figure 6 : VAS scale

ii) Opioid (Morphine) consumption:

The total amount of morphine (opioid) consumed was recorded by means of PCA pump over the first seventy two hrs after the surgery. All patients received PCA (a morphine bolus of 1.5 mg, a lock-out of six minutes, and a maximum of 15 mg/hr) for seventy two hours after the surgery. The consumption of PCA was measured at different time-points 0-6 hrs, 6-24 hrs and 24-72 hrs during the seventy two hrs postoperative period and the patient's overall analgesic consumption was measured.

2. Secondary outcome measures:

(i) **Satisfaction with in-patient pain relief:** At the end of stay, participants completed a 10 mm VAS to indicate their satisfaction with their pain relief and compared in the two groups.

(ii) **Length of hospital stay:** This was calculated from participant's admission and discharge dates. The time to discharge (where day 0 was the day of the operation) was assessed by a physician and the physiotherapist (who were unaware of the group randomization) according to the following criteria:

- mild pain (VAS <3) sufficiently controlled by oral analgesics
- able to walk with support (crutches or walker)
- able to eat and drink, and
- No evidence of any surgical complication.

(iii) **Range of Motion:** This was assessed by measuring postoperative knee flexion with a goniometer by the physiotherapist. The first attempt at mobilization was made 6 hrs postoperatively, when the patient was encouraged to stand up and to walk 2-3 steps. If unsuccessful, mobilization was attempted again on the following day. Patients were discharged when they fulfilled the discharge criteria (as mentioned above). The physiotherapist recorded the ability to flex the knee on 3rd postoperative day and compared in the two groups.

Complications:

The patients were observed closely for any medication related side effects, especially those associated with the use of opioids which included pruritus, nausea, gastrointestinal effects, urinary retention and respiratory depression.

Statistical analysis:

The study-related data were revealed to the investigators at the end of the study. The statistical technique included quantitative and qualitative analysis. The statistical analysis of the data set was performed with use of the Kolmogorov-Smirnov test ($p < 0.05$) for normality and subsequently an unpaired t test was used to compare the mean of the group for the significance of the differences of the outcome variable. Dichotomous data were analyzed using the chi-square test or Fisher's exact test, as appropriate. A p-value of < 0.05 was considered to be statistically significant.

OBSERVATIONS AND RESULTS

One-hundred consecutive patients who were planned for unilateral TKA at our institute were identified during the period of May 2012 to December 2012. Among these 100 consecutive patients, the 80 consenting and eligible patients were recruited and all the recruited patients completed the trial (Figure 1).

Demographic data

Demographic (age and gender), pre-operative haemoglobin concentration and time variables (tourniquet and operative) were comparable for the two groups (p value 'ns') (Table 3).

Table 3
Demographic and perioperative data

Variables	Intervention group (n=40)	Control group (n-40)	p value	Result
Demographic				
Age (years)	64.13±1.14	64.68±9.33	0.768	Ns
Gender				
Male	08	13		
Female	32	27		
(M:F)	8:32 (20%:80%)	13:27 (32.5%:67.5%)	0.2039	Ns
Side Involved				
Right	21	24		
Left	19	16		
BMI	27.12±2.78	26.88±1.96		ns
Tourniquet time	41.47±5.64	42.25±6.40		Ns

the values are given as the no. of patients. the values are given as mean and standard deviation; ns-not significant.

1. **Age:** Mean age in the intervention group was 64. 13 years and in the control group it was 64.68 which was comparable for the two groups (p=0.768) (Figure 7).

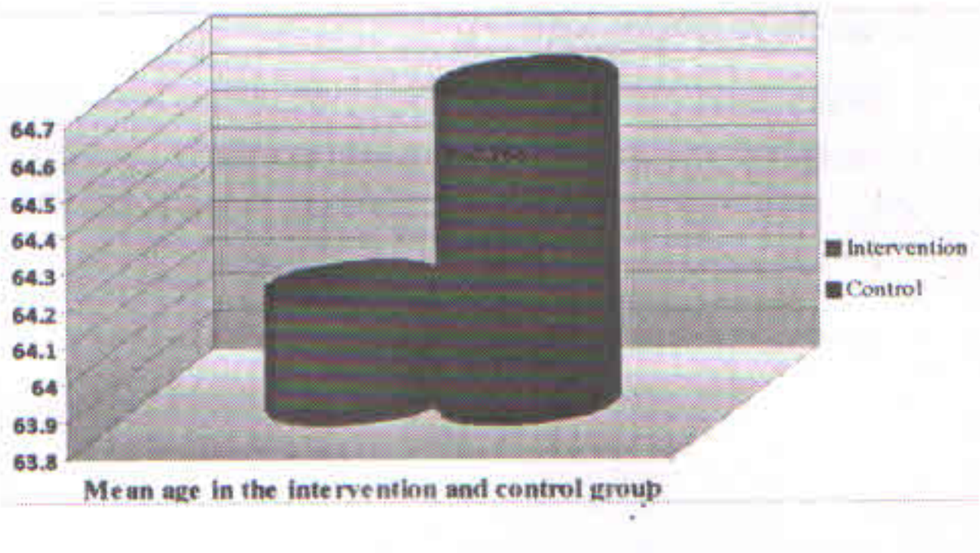

Figure 7 : Mean age in intervention and control group

2. **Gender:** The male to female ratio was comparable in the two groups (p=0.2039) (Figure 8).

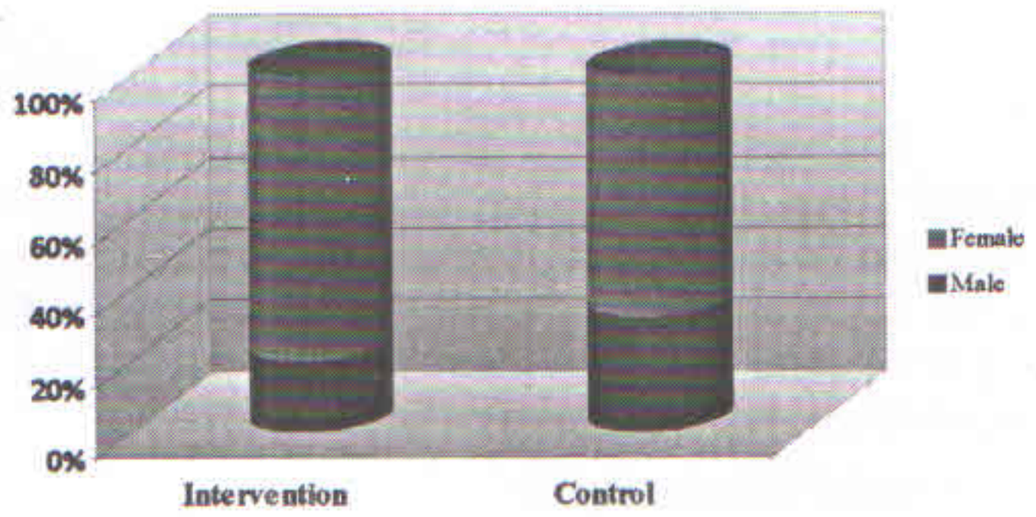

Figure 8 : Sex distribution in intervention and control group

1. Pain relief:

a. VAS

VAS at rest

Mean VAS pain score at rest was lower in intervention group than in control group (p < 0. 001) at 6 hrs, 24 hrs, 48hrs and 72hrs (Figure 9).

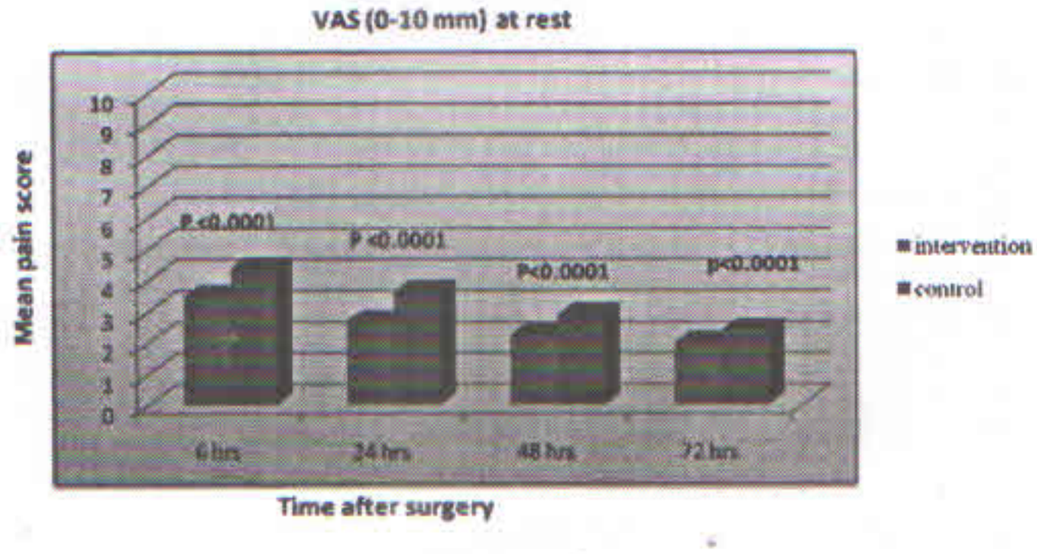

Figure 9 : Mean VAS score at rest

VAS with movement:

With movement VAS pain scores were lower in intervention group than in control group at 6, 24, and 72 hrs ($p < 0.001$) and at 72 h ($p = 0.001$) (Figure10).

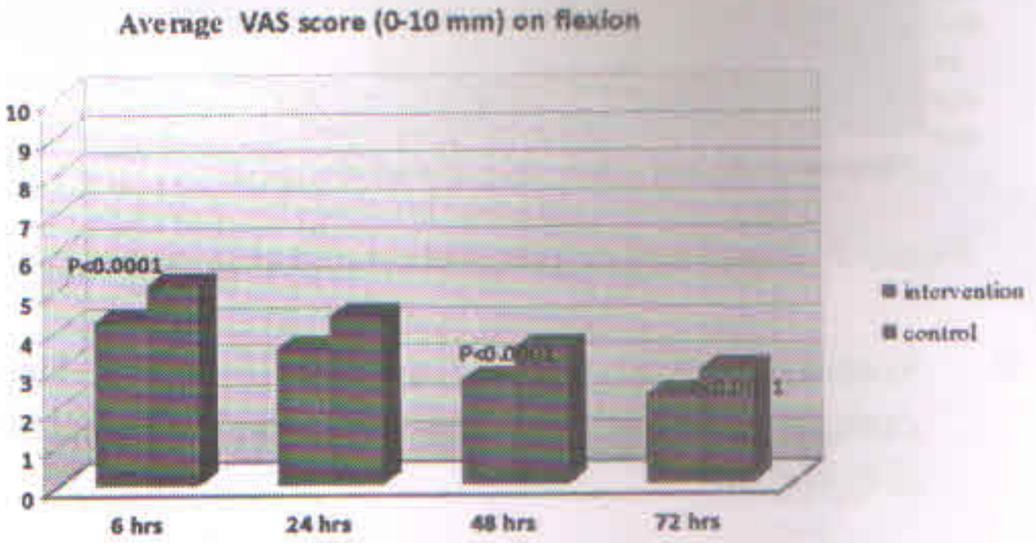

Figure 10 : Mean VAS score on movement

The local analgesia group had a significantly lower mean visual analogue score for pain during exercise than did the control group (3. 5 compared with 4. 32) on the first postoperative day ($p < 0.0001$, Figure 10) as well as a significantly lower score for pain at rest ($p = 0.0001$, Figure 9).

b. Opoid Consumption :

Analysis of data revealed that the total mean morphine consumption (Table 4) was significantly lower in the intervention group during the seventy two hours postoperatively compared to control group (31.612±21.18mg; 47.25±19.39mg, p/ 0.0009). It was also significantly lower during the first six hours after surgery in the intervention group (4.95±2.88) mg compared with (10.92± 3.30mg) in the control group; $p < 0.0001$), from six to twenty-four hours postoperatively (11.8375 ±7.49 mg) compared with 15mg±6.375 mg; p =0.0455), at twenty-four to seventy-two hours (14.825±10.801 mg compared with 21.325±16.561 mg; p /0.0409) (Figure 11).

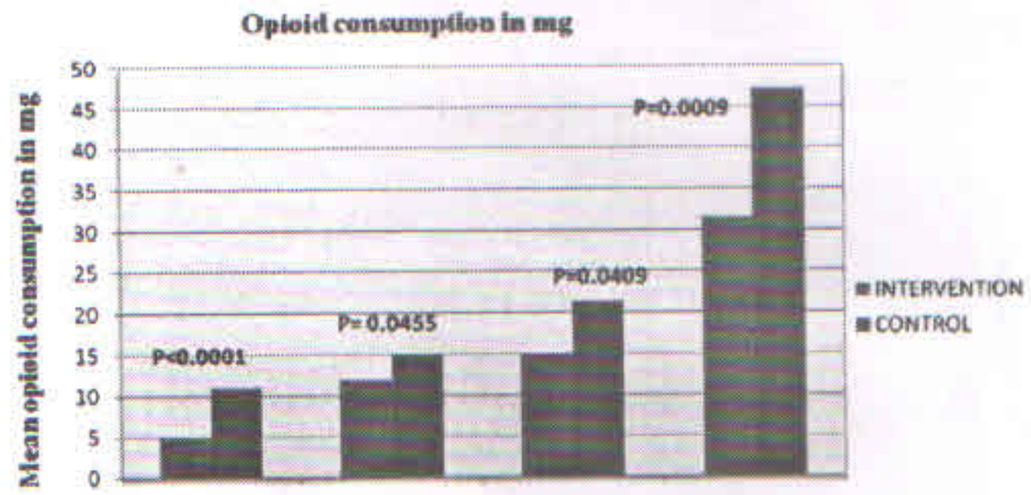

Figure 11 : Mean opioid consumption

Table 4
Morphine consumption in intervention and control group

	Morphine consumption (Mean and standard deviation)				
	Intervention		Control		
	Mean	Sd	Mean	Sd	p value
0-6hrs	4.95	2.880538	10.925	3.304448	<0.0001
6-24hrs	11.8375	7.497823	15	6.375735	0.0455
24-72hrs	14.825	10.80194	21.325	16.56108	0.0409
Total	**31.6125**	**21.1803**	**47.25**	**19.38782**	**0.0009**

From the data it can be seen that there was significant difference in opioid consumption in Ist 6 hrs compared to 6-72 hrs period.

Secondary end points:

1. Hospital stay:

Analysis of the results revealed that average length of stay was significantly lower in intervention group compared to control group (Table 5).

Table 5
Length of Stay in the intervention and control group

	Mean length of stay		
	Intervention group	Control group	p value
Hospital Stay	4.575±0.67	5.7±0.64	<0.0001

In the intervention group, 21/40 patients were discharged during the fourth postoperative day, 15/ 40 on 5th postoperative day and 4 on 6th postoperative day as compared to 16/40 on 5th postoperative day, 20 on 6th and 4 on 7th postoperative day. (Figure 12).

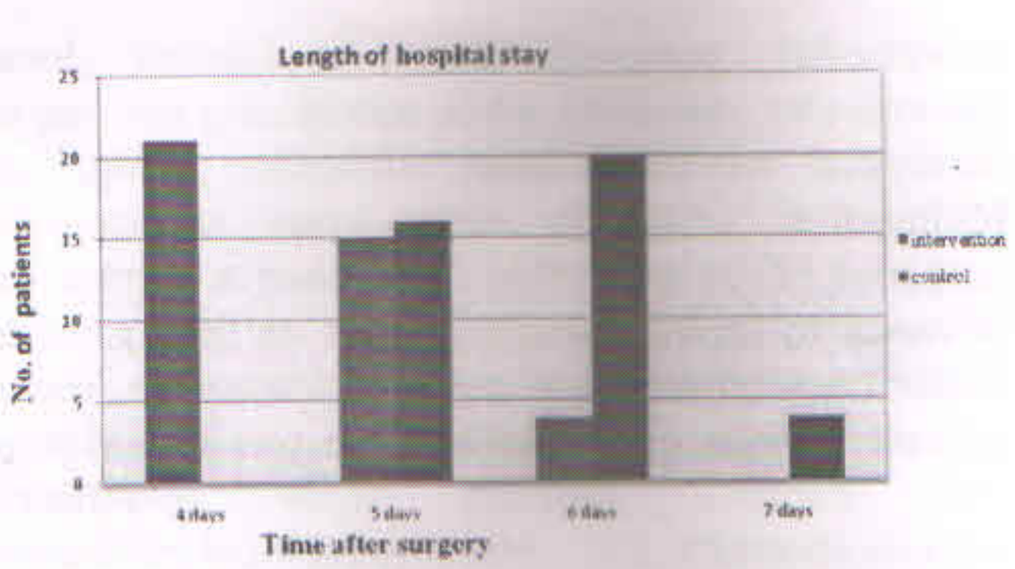

Figure 12 : Duration of hospital stay

2. Range of motion:

Postoperative knee flexion on 3rd postoperative day was improved in the infiltration group than in the control group (Table 6 and Figure 13). There was a statistically significant difference between intervention group and control group in the mean knee flexion achieved 72 hrs postoperatively (mean 90.125±12.009 degrees) vs. (mean 59.25±22.97degrees) p value less than 0.0001 (Figure 14).

Table 6

Range of motion on 3rd postoperative day

Range of motion (Flexion)	Intervention group (n =40)	Control group (n=40)
90-120 degrees	19	5
61-90 degrees	19	12
< 30 degrees	2	23

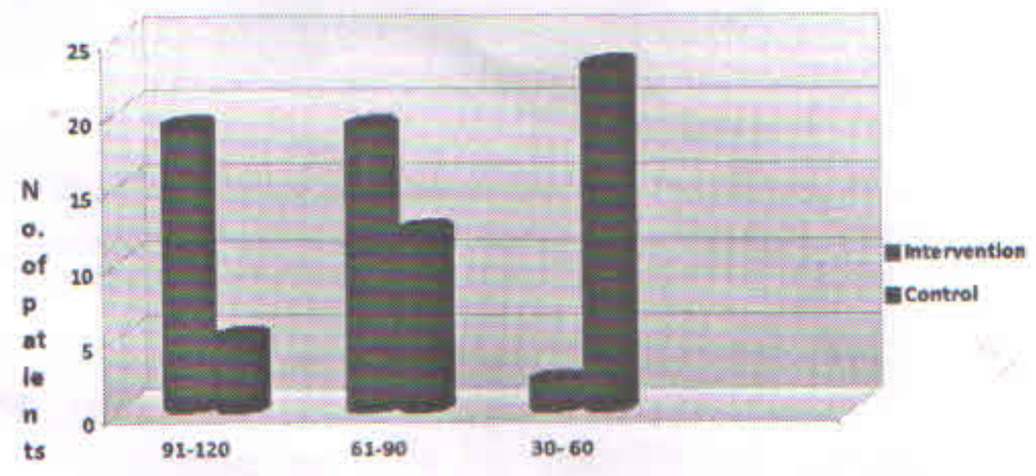

Figure 13 : Range of motion on 3rd post operative day

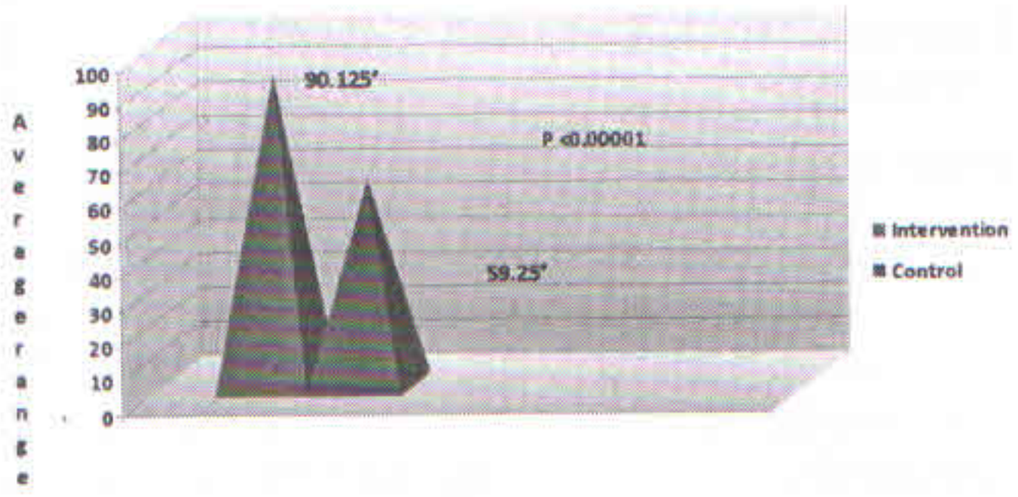

Figure 14 : Mean range of motion on 3rd postoperative day

3. Patient Satisfaction with pain:

The median values of patient satisfaction scores varied between 2 and 4 and there was significant difference between the two groups at 72h (Figure 15).

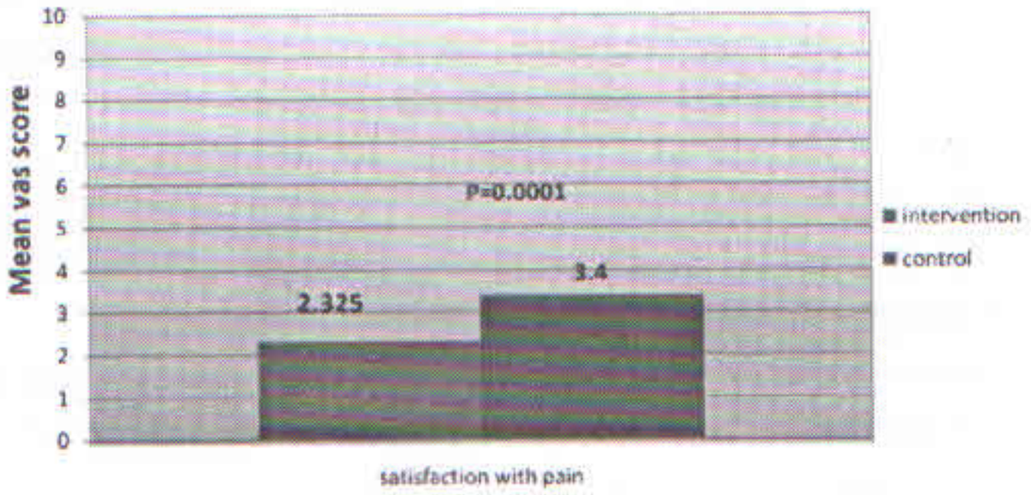

Figure15 : Patient satisfaction with pain

4. Complications:

No serious side effects or complications directly attributable to the LIA technique were recorded postoperatively. In particular, we observed no major toxicity involving cardiac arrest, cardio toxicity (including widening of the Q-T interval and QRS complex in the ECG). We also observed no wound infection related to the wound infection. Minor adverse events noted included transient mild to moderate nausea, vomiting, and dizziness-usually associated with postural hypotension on the first attempt to walk at about 4-5 h postoperatively or with the use of supplementary morphine. Evaluation of complications revealed that in Intervention group: 3 patients had nausea, 1 patient had dizziness, 1 patient had vomiting and 1. patient had tachycardia. Control group: 5 patients had nausea,

2 patients had dizziness and 1 patient had urinary retention.

DISCUSSION

TKA is associated with significant pain that is severe in approximately 60% of patients and moderate in approximately 30% of patients. The pain may be as a result of trauma to the bone or surrounding tissues during surgery or due to hyperperfusion following tourniquet release. Surgical trauma during TKA modifies the responsiveness of the nervous system in two ways. It causes peripheral sensitization and increases the response to noxious stimuli and decreases the pain threshold at the site of the injured tissue as well as the surrounding uninjured tissue and it causes central sensitization by increasing the excitability of spinal neurons. Together these changes contribute to postoperative pain. Optimal pain relief is a major concern and challenge for treating doctors after TKA. The optimal form of pain relief is one that is applied preoperatively, perioperatively, and postoperatively to avoid the establishment of pain hypersensitivity and allows effective postoperative rehabilitation and hence a good overall outcome.

Although many analgesia protocols for TKA have been evaluated, none is optimal and narcotics still play a major role in post operative pain control. Epidural infiltration although effective but it can be associated with side effects (nausea, pruritus, hypotension, urinary retention, poor muscle control, and delayed mobilization), and moreover, the risk of epidural hematoma with concomitant thromboprophylaxis is still a concern, 59 Besides specialised monitoring is mandatory with its use. Nerve blocks do reduce the occurrence of side effects and complications related to epidural or self-administered analgesia, however, to effectively control pain, it may be necessary to block the sciatic, femoral and obturator nerves together; besides the danger of injuring the nerves. Moreover it is technically difficult procedure which can only be performed by an experienced anaesthetist.

Currently practice has evolved to using a multimodal protocol that emphasizes local periarticular injections while minimizing the use of parenteral narcotics (local infiltration analgesia). Multimodal protocols after joint replacement surgeries (THA and TKA) have been a substantial advance in replacement surgeries as they provide better pain control and patient satisfaction, lower overall narcotic consumption, reduce hospital stay, and improve function while minimizing complications20, 21,, . Multimodal local infiltration analgesia (LIA) technique involves infiltration of a large volume of dilute solution of a long-acting local anaesthetic agent (Bupivacaine or Ropivacaine), often with adjuvants (e. g. Epinephrine, Ketorolac, an opioid), into the soft tissues at the time of surgery all having different mode of action on the pain pathway (Figure 16). This technique was developed specifically to avoid sedation and facilitate rapid physiological recovery after lower limb arthroplasty in order to enable early mobilization and discharge. LIA into soft tissues following TKA has shown to provide pain relief while permitting accelerated rehabilitation besides reducing requirements for postoperative analgesia and allowing earlier discharge from the hospital 38.

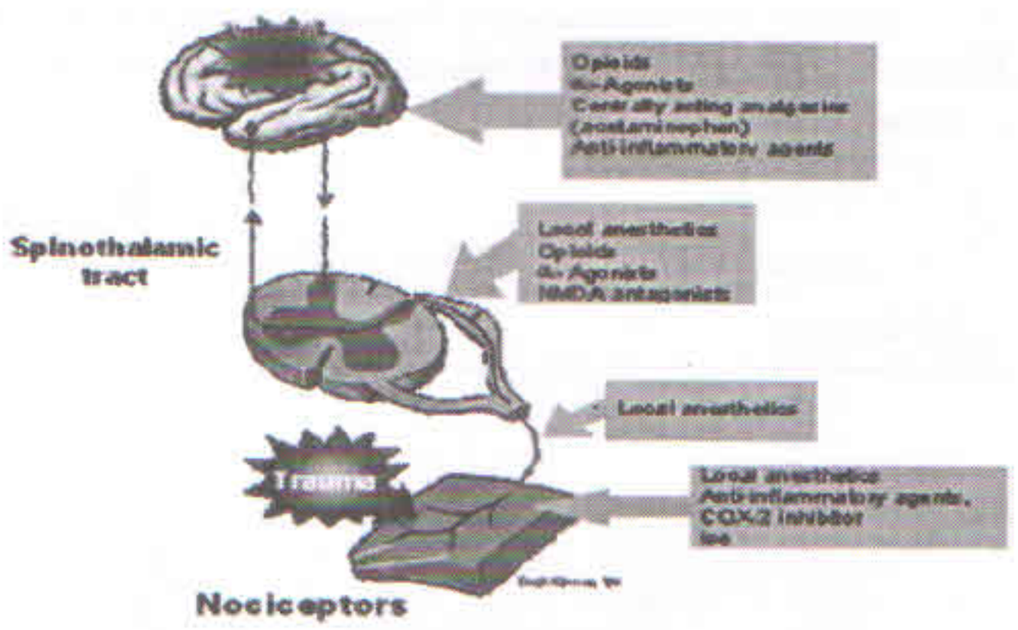

Figure 16 : Pain pathways and multimodal analgesic therapy. (Taken from: Kehlet H, Dahl JB. The value of "multimodal" or "balanced analgesia"in postoperative pain treatment. Anesth Analg. 1993; 77:1048-56.)

Our study was specifically designed to investigate the efficacy of LIA on postoperative pain management and bleeding control in TKA. Secondarily we noted its effect on range of motion,

length of hospital stay and overall patient satisfaction with pain. The four active ingredients of the infiltration mixture that we used in our study were Bupivacaine, Ketorolac, Morphine, Adrenaline and Gentamycin administered intraoperatively. In contrast to other studies, we have tested the LIA technique in a double-blind study. We used this combination of drugs for LIA after considering the merits and demerits of the popularly used drugs in other published studies.

In this study the intraoperative infiltration resulted in a significant degree of pain relief during the initial postoperative period (Figure 9 and 10) in the study group (p, 0. 0001 at 6hrs, 24hrs and 72hrs; which was consistent with other published studies (Bianconi et al 200333, Lombardi AV et al, 200431) which perhaps resulted in an increased range of knee movement (Figure 13 and 14) and early discharge from the hospital (Figure12). Lombardi et al31 used 80 ml of 0.25% of Bupivacaine in single knee to achieve good analgesic effect which is higher permissible dose of Bupivacaine that can be used at one time. At higher doses, Bupivacaine induced arrhythmias, which are difficult to manage is a danger. In our study we used only 50mg (20ml) of Bupivacaine along with 30mg of ketorolac to achieve the same analgesic effect. Although many techniques can be used to achieve optimal analgesia following TKA, it is important that the time in hospital is not prolonged. The main aim of our study was to achieve adequate pain relief and early mobilization without prolonging recovery or length of stay. Since hospital discharge (length of stay) can be affected by several other factors, we used an objective method to assess whether the patient was ready to be sent home. These criteria have been used by other authors as a way of objectively assessing recovery and discharge (Gupta et al, 2009). With the numbers available, there was significant difference in the average hospital stay ($p<0.0001$) and significantly greater mean visual analog scores for patient satisfaction ($p=0.0001$) (Figure 15) in our study. Most of published series did not studied effect on length of hospital stay. Lombardi et al31 did not found any significant difference in length of stay and range of motion despite claiming good pain relief after LIA. The reason for this discrepency had not been discussed by them. We believe that adequate pain control in immediate postoperative period is one of the main factors in reducing length of stay. Our findings show that there was a substantial reduction in hospital stay without having a negative effect on patient satisfaction. Other authors have reported similar results (Bianconi et al 200333, Reilly et al. 2005).

In addition to improved pain relief, we also found that the total consumption of opioid analgesics was lower in the LIA group than in the control group (Figure 11), which was our primary endpoint, during the 72hrs test period ($p<.0001$), which in turn resulted in a lower incidence of opioid-related side effects (including sedation, pruritus, and nausea) when LIA was used rather than saline only. This observation is also similar to other published studies (Table 8). The other important finding of this study was the effectiveness of locally administered intra-articular solution on reduction in loss of blood in suction drain. To our knowledge, no other published studies have studied combined effect of LIA on postoperative pain and blood loss in TKA. Repicci and Eberle have reported on the use of soft tissue injection of Bupivacaine and Epinephrine for haemostasis and pain relief in Unicompartmental knee arthroplasty. In a study by Padala et al, patients having TKA, a substantial benefit in terms of blood loss was shown with soft tissue injection of Epinephrine alone. Karaoglu et al studying hemodynamics and the quality of the arthroscopic picture in patients having knee arthroscopy compared intra-articular injection using a Bupivacaine and lidocaine solution with and without the addition of Epinephrine. They found the use of Epinephrine at the portal incisions alone sufficient to reduce blood loss and improve observation. Likewise, we were able subjectively to detect diminished blood loss on release of the tourniquet after soft tissue infiltration with LIA.

Complications in our study were minimal and not serious. In infiltration group only 3 patients had nausea, 1 patient had vomiting which may perhaps be related to morphine use. Only 1 patient had tachycardia which was temporary and fully reversible. This was correlated to the use of adrenaline. Although may published studies have used Ropivacaine in their infiltration mixture (less cardiotoxic etc) but in our study we didn't encounter any complication directly related to bupivacaine.

Comparing our studies with other published studies (Table 9) showed that in most of these studies the control group either had no infiltration or with iv morphine. Hence there was an apparent bias in these RCT, as the user (surgeon) already knew which patient is having LIA or not. But in our study since both the groups had similar looking infiltration of LIA or saline this bias was avoided.

Pain is not only an unpleasant feeling for the patient but its control can be quite difficult and expensive as it involves the use of various drugs, treatment of side effects related to the use of pain relieving medication, additional manpower, excessive length of stay in hospital etc. Hence, it is essential to use a protocol which can address all these issues. Our LIA mixture was highly cost effective as it only costed < $3 and moreover it reduced the requirement of other pain killers, blood transfusion etc which further reduced the hospital cost to the patient. To our knowledge none of the published studies so far have studied the cost effectiveness of LIA.

Table 9

Study	Study design/ Patients/ Longest follow up	Intervention	Control	Result
Bianconi et al 2003	RCT, N = 37, 72 h	Wound infiltration with ropivacaine followed by wound perfusion for 55 hrs.	Baseline intra-venous infusion of morphine plus ketorolac for 24 hrs.	Pain at rest and on mobilisation and length of hospital stay reduced significantly reduced in the intervention group. Patient satisfaction greater in the intervention group.
Anderson LA et al, 2009	RCT, N=37	Injection of bupivacaine with epinephrine.	No injection	The study group 32% or 195 mL, less drain output (P =.006), no statistically significant differences in the transfusion rate or bleeding indices.
Lombardi AV et al, 2004.	RCT, N=309	Perioperative infiltration of bupivacaine, epinephrine and morphine.	No injection	Postoperative pain, blood loss, and bleeding indices were reduced with injection besides more control patients required rescue doses of narcotics.
Venditoli, 2006 Canada.	RCT, N = 42, 24 hours.	Perioperative infiltration of local anesthetic.	Patient controlled morphine	Morphine use and the incidence of nausea significantly lower in the intervention group.
Busch 2006 Canada.	RCT, N = 64, 6 weeks.	Perioperative infiltration of ropivacaine, ketorolac, epinephrine and morphine and standard care	Standard care with no infiltration.	Morphine consumption reduced and pain scores improved in the intervention group in the first 24 hrs. No significant complications.

Andersen 2008 Denmark.	RCT, N = 12, 48 hours	Infiltration with ropivacaine and epinephrine.	Similar procedures with saline.	Pain at rest and movement significantly reduced in the intervention group.
Zhang 2007 China.	RCT, N = 60, 72 hours.	Intraoperative periarticular injection of bupivacaine, epinephrine and morphine.	No drug infiltration.	Pain at rest and activity reduced and range of motion improved in intervention group. Reduced post-operative tramadol use in intervention group.
Our study	RCT, N = 80, 7 days	Intraoperative periarticular injection of bupivacaine, ketorolac, epinephrine, morphine and gentamycin	Similar procedures with saline.	Pain at rest and on mobilisation, morphine consumption, drain output and length of hospital stay significantly reduced in the intervention group. Patient satisfaction greater in the intervention group.

CONCLUSION

LIA technique with multimodal drugs after TKA

- can significantly improve pain control both during rest and on movement and hence improved patient satisfaction.
- can significantly reduce the requirements for patient-controlled analgesia and hence opioid related side effects.
- allows improved range of motion and early discharge from the hospital
- is cost effective, the whole mixture of drugs costing only Rs. 152(<$3).

Hence we conclude that multimodal perioperative analgesia protocol in TKA is a safe and cost effective technique that offered improved pain control and good range of motion with minimal side effects to patients.

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