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Editorial

RESEARCH PUBLICATION IN AN INDEXED JOURNAL/ NATIONAL JOURNAL/INTERNATIONAL PUBLICATION

Agrawal A.C.*

Recently there has been a lot of discussion amongst the academic medical fraternity as to what constitutes a Research Publication in Indexed Journal/ National Journal/International Publication etc. This is more after Medical council of India making it compulsory for service and promotions. More and more journals have come up after this decision and are daily coming up with indexing in one or other indexing service. This brings out the relevant question as to what is a quality research and what are just a study but not research.

Indexation of a journal may be considered a reflection of its quality. Indexed journals can be considered to be of a higher scientific quality as compared to non-indexed journals. However indexation of medical journals has become a debatable issue. For a long-time since 1879 Index Medicus had been a comprehensive index of medical scientific journal articles till 2003 when it's role was taken up primarily by the online database-Pubmed. Over the years, many other popular indexation services have developed. These include MedLine, PubMed Central, EMBASE, SCOPUS, EBSCO Publishing's Electronic Databases, SCIRUS among others and are used as Indexing services by different journals.

Another controversial issue is that of impact factor (IF).[1] IF is used as a proxy for the relative importance of a journal within its field. IF is awarded to the journals indexed in Thomson Reuters Journal Citation Reports. IF has been criticised for manipulation and incorrect application.[2] There are multiple factors that could bias the calculation of the IF.[3] These include coverage and language preference of the database, procedures used to collect citations, algorithm used to calculate the IF, citation distribution of journals, online availability of publications, negative citations, preference of journal publishers for articles of a certain type, publication lag, citing behaviour across subjects, and possibility of exertion of influence from journal editors.[4] Interestingly, IF is not available for all indexed journals. In fact, not all journals indexed even in Index Medicus/MedLine/PubMed are indexed in the Thomson Reuters Journal Citation Reports. Similarly, not all journals indexed in Thomson Reuters Journal Citation Reports and consequently have an IF are listed in Index Medicus/PubMed/ MedLine.[5]

This brings us to the question which indexation is best and most valid? How to compare the quality of articles published in journals indexed with different indexation services? These questions are of particular relevance for the following reasons. First, importance of publications is being increasingly recognised by the academic institutions. MCI guidelines also recommend indexed publications for teaching faculty in medical colleges. Consequently many more authors would be publishing than ever before.[4] Selection of high quality journal becomes a difficult decision for the

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authors as there is no clarity on the issue. Should one aim at only the journals indexed in Index Medicus/MedLine/PubMed? Is it appropriate to make submissions to journals having a high impact factor although they are not indexed with Index Medicus/MedLine/PubMed?

Second, recently many more indexation services have come up. These include Caspur, DOAJ, Expanded Academic ASAP, Genamics Journal Seek, Hinari, Index Copernicus, Open J Gate, Primo Central, Pro Quest, SCOLOAR, SIIC databases, Summon by Serial Solutions, Science citation Index, Ulrich's International Periodical Directory. Are these indexations services equally relevant? Would a journal indexed with any of these databases be considered "indexed"?

The third criteria as to what constitutes an International publication is also not that important. Many Orthopaedic journals published from outside India areneither indexed nor peer reviewed. A publication in these journals can not be given a credit similar to an Indexed and peer reviewed journal.

The fourth criteria as to what constitutes a research publication is also important. The federal policy is to protect human subjects from investigations that contribute to generalized knowledge about a disease or condition. This requires an Institutional review board clearance. Certain publications as a review article, case report, letter to editor etc. are actually meant to share information of a medical or educational subject and do not need an IRB approval and so although published but are not considered a research publication. However a case report (one, two or three cases) needing IRB approval for the investigation, procedure or management may be considered a research publication.

These are some questions that warrant discussion. Associations of editors of medical journals such as International Committee of Medical Journal Editors could play a pivotal role in such discussion.[5] Currently if not PubMed then a peer reviewed, open access journal with online manuscript submission and revision system and with transparency at all steps may be considered an ideal journal.

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FEMOROACETABULAR IMPINGEMENT AND PRINCIPLES IN IT'S MANAGEMENT

Agrawal A.C.* **Saraf K.K.**** **Kalia R.B.*****

Femoroacetabular impingement (FAI) is an increasingly recognized cause of hip pain. It is defined as a pathologic mechanical process by which morphologic abnormalities of the acetabulum and/or femur combined with vigorous hip motion lead to repetitive collisions that damage the soft-tissue structures within the joint itself. Based on cross-sectional studies in which FAI morphology was studied before the presence of radiographic osteoarthritis (OA), and on prevalence studies in younger, asymptomatic persons, it is clear that FAI and its morphologic risk factors are common in young adult hips and predispose to the later development of OA. Longitudinal studies support the assertion that, in middle-aged adults, the presence of cam deformities at baseline substantially increases the risk of developing OA and the need for total hip arthroplasty (Fig. 1 and 2).

Management of femoroacetabular impingement is both conservative and operative. Surgical management of femoroacetabular impingement (FAI) is indicated after the trial of nonsurgical treatment. The surgical planning is done to asses the labrochondral pathology as well as of the acetabular and proximal femoral bony deformity. Advanced articular cartilage disease generally is associated with poorer outcomes. Surgical hip dislocation and hip arthroscopy have been used, with favorable early outcomes and low complication rates The early outcomes of both open and arthroscopic surgical techniques demonstrate significant improvement in most patients, with relatively low rates of complications. Because poorer clinical outcomes are associated with more advanced articular cartilage degeneration, improved strategies for the earlier identification and disease staging may enhance the long-term outcomes of both nonsurgical and surgical management.

NONSURGICAL MANAGEMENT

Limited information exists regarding nonsurgical management of symptomatic femoroacetabular impingement (FAI).[1,2] Like the initial management of many musculoskeletal disorders, the management of symptomatic FAI can begin with a period of relative rest and a trial of a nonsteroidal anti-inflammatory drug. Therapeutic exercise is used commonly, and an understanding of the implications of the structural deformity on range of motion and muscle activation is important. Hip range of motion improvement should not be a goal of treatment. Initially geared toward symptom reduction, treatment can include avoiding positions during activities that provoke symptoms. Next, correcting movement impairments is addressed within the limits of pain. This can include a wide variety of methods, such as the correction of muscle-length deficits, concentric and eccentric strengthening, manual techniques to assist muscle activation, and neuromuscular retraining. Once the movement impairments are corrected or improving, progression to strengthening in the planes of motion that mirror the activities included in the goals of the individual

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Figure 1 : Xray pelvis with both hips showing combined CAM and PINCER femoroacetabular impingement

Figure 2 : Xray lateral view of right hip joint showing femoroacetabular impingement and intraarticular erosion produced by it

patient's treatment is prescribed and later advanced to a maintenance home program. Prior to release from care, the patient should review with the healthcare provider a timeline for return to work, exercise, and sports activities.

SURGICAL MANAGEMENT

SURGICAL PLANNING

The surgical management of symptomatic FAI is performed to address the labrochondral pathology and the underlying bony deformity.[3] This requires intervention in the central compartment (ie, acetabular rim, labrum, acetabular cartilage) and the peripheral compartment (ie, the femoral head-neck junction). Open surgical dislocation of the hip was the initial description of the management of FAI by Ganz et al,[4] and arthroscopic techniques have gained rapidly in popularity.[5] The choice of surgical approach is influenced significantly by patient characteristics, disease patterns, and surgeon preference.

The location, extent, and severity of cam deformity have important implications for the ease of arthroscopic access to the lesion. Deformity extending posterior to the lateral retinacular vessels, which course across the posterolateral femoral head-neck junction,[6] generally is not accessible arthroscopically by most surgeons and may be more amenable to open treatment. More complex proximal femoral deformities, such as residual Legg-Calvé-Perthes disease, can be managed more precisely with open surgical dislocation. The additional development of a retinacular soft-tissue flap adds further treatment options, such as relative neck lengthening, true neck osteotomies, and trimming or transposition of the greater and lesser trochanter.[7]

Similarly, the type of pincer deformity should be characterized, when present, including the degree of retroversion or global overcoverage. Severe retroversion with deficient posterior coverage, including a positive crossover sign and a posterior wall sign, may be treated best with an anteverting periacetabular osteotomy (PAO),[8] with an additional femoral head-neck osteoplasty in most cases. A positive crossover sign in the presence of a negative posterior wall sign (ie, normal posterior coverage) indicates focal

anterosuperior overcoverage and generally can be treated with acetabular rim trimming, with labral takedown and refixation. Management of the acetabular deformity in these patients generally can be performed open or arthroscopically. The amount of lateral and anterior coverage should be noted using preoperative AP pelvis and false-profile radiographs to avoid causing iatrogenic instability by creating a dysplastic acetabulum. Postoperative subluxation and dislocation have been reported after acetabular rim trimming[9] and may be catastrophic. Hips with global acetabular overcoverage may have acetabular protrusio or lateral center-edge angles >40°.[10,11] Global overcoverage generally has been managed with open surgical dislocation, although less severe cases may be amenable to arthroscopic treatment. Inadequate correction of the underlying deformity remains a common cause of failure after hip arthroscopy[12,13] and open techniques.[14]

SURGICAL DISLOCATION

Ganz et al4 developed the technique that enabled the safe surgical dislocation of the hip based on a detailed understanding of the vascular supply of the femoral head. This technique protects the vascular supply from the medial circumflex femoral artery and its lateral retinacular branches. A digastric trochanteric osteotomy is performed, preserving the attachments of the gluteus medius muscle and the vastus lateralis muscle. The trochanteric fragment is mobilized anteriorly, and the hip is dislocated anteriorly, allowing circumferential access to the acetabulum and proximal femur.

HIP ARTHROSCOPY

Hip arthroscopy was introduced into clinical practice in the late 1970s, before the recognition of FAI, and commonly was used to manage labral tears and other intra-articular pathology. Since the recognition of FAI, hip arthroscopy has been used routinely to address proximal femoral and acetabular bony deformity in addition to labrochondral pathology.

ARTHROSCOPIC AND LIMITED OPEN COMBINED APPROACHES

Limited anterior exposures have been used to access the peripheral compartment and address the cam deformity and anterolateral acetabular rim. Although the approach provides excellent visualization of the anterolateral femoral head-neck junction, acetabular visualization is limited to the anterior rim. Limited open exposures can be combined with arthroscopic access to address the central compartment. Early outcomes of combined hip arthroscopy and limited open osteoplasty generally are similar to those of hip arthroscopy.[14-17]

The limited open approach can be complicated by injury to the lateral femoral cutaneous nerve. Other complications generally are similar to those of arthroscopic surgery.

ANTEVERSION PERIACETABULAR OSTEOTOMY

Some patients with major acetabular retroversion may be best treated with an anteversion (ie, reverse) PAO.[8] Severe retroversion generally is indicated by the presence of a large crossover sign (ie, retroversion index >50%) and a positive posterior wall sign, indicating deficient posterior coverage, on an AP pelvis radiograph with appropriate pelvic tilt and rotation. A prominent ischial spine sign also is noted and together with the posterior wall and crossover signs indicates the relative deformity of the entire hemipelvis. Anteversion PAO allows reorientation of the acetabular surface to eliminate retroversion and restore normal posterior coverage. Coexistence of a cam-type deformity also should be noted and can be addressed through an arthrotomy at the time of PAO.

HIP INSTABILITY

Case reports of iatrogenic instability after hip arthroscopy highlight two areas that are poorly understood. First, FAI deformities are common in association with acetabular and/or femoral

dysplasia, but arthroscopic surgery without correction of the underlying dysplasia can be associated with poor clinical results from persistent structural instability.[18] Second, patients with capsular laxity and/or surgical compromise of the capsule during exposure of the peripheral component may be at risk for persistent symptoms from capsular incompetency. Some surgeons feel that subtle instability may occur postoperatively, potentially contributing to a prolonged recovery and possibly negatively influencing the outcome. As a result, some surgeons repair the arthroscopic capsulotomies;[19] however, this approach has not been uniformly adopted.

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SPONTANEOUS OSTEONECROSIS OF THE KNEE

Agrawal A.C.* **Sonkar D.**** **Bhagwat S.V.***** **Kalia R.B.******

Spontaneous osteonecrosis of the knee is mainly seen in women over 60 years of age. This condition is distinguished from secondary conditions such as corticosteroid-induced osteonecrosis. It was originally described and is most common in the medial femoral condyle but can also occur in the tibial plateaus and on the lateral side of the femur also. The radionuclide bone scan will show focally increased uptake before the radiographs are abnormal. Magnetic resonance imaging can also be diagnostic, but the findings may be normal early in the course of the disease. The etiology remains unknown, but it is speculated that primary vascular ischemia or microfractures in osteoporotic bone are causative. Many patients have a benign course followed by resolution of symptoms. Therefore, conservative management is indicated initially. If progressive collapse accompanied by severe symptoms occurs, high tibial osteotomy, unicompartmental replacement, and total knee replacement are therapeutic alternatives. Recognition of this entity is important to avoid needless surgical intervention.[1] The case is being reported to sensitize orthopaedic surgeons to the fact that with a normal knee X-ray if the patient complains of severe pain then he may be having a spontaneous osteonecrosis of the knee which can be diagnosed early by a radionuclide scan or a MRI of the knee joint.

CASE REPORT

A 53 year old female presented to the Orthopaedic OPD with severe pain in her right knee since 2 months. (Figure 1) She had no history of trauma, fever or steroid intake. On examination there was a fixed flexion deformity of 10 degrees, wasting of the thigh muscles, a normal straight leg rising test, and knee flexion and normal local temperature around the knee. She had severe bony tenderness on her medial femoral condyle.

AN X-RAY OF THE KNEE REVEALED NO BONY PROBLEMS.

In view of severe pain not responding to NSAIDS the patient was advised a MRI scan of the knee which revealed a spontaneous osteonecrosis of the medial femoral condyle with early osteoarthritic changes and an asymptomatic osteonecrosis of adjacent proximal medial tibial condyle. (Figure 2 and 3) She was diagnosed as a case of grade 3 spontaneous osteonecrosis of the knee and was advised non-weight bearing mobilization. NSAID and rest for the next month along with active physiotherapy to the knee. In view of early osteoarthritis the patient was started on S- Adenosyl Methionine 200 mg twice daily for the next 6 weeks as a DMOAD (Disease modifying osteoarthritic drug).

DISCUSSION

Osteonecrosis of the knee entails three distinct pathologic entities: secondary ON, spontaneous ON, and postarthroscopic ON. Spontaneous osteonecrosis of the knee involving the medial femoral condyle was first described by Ahlback et

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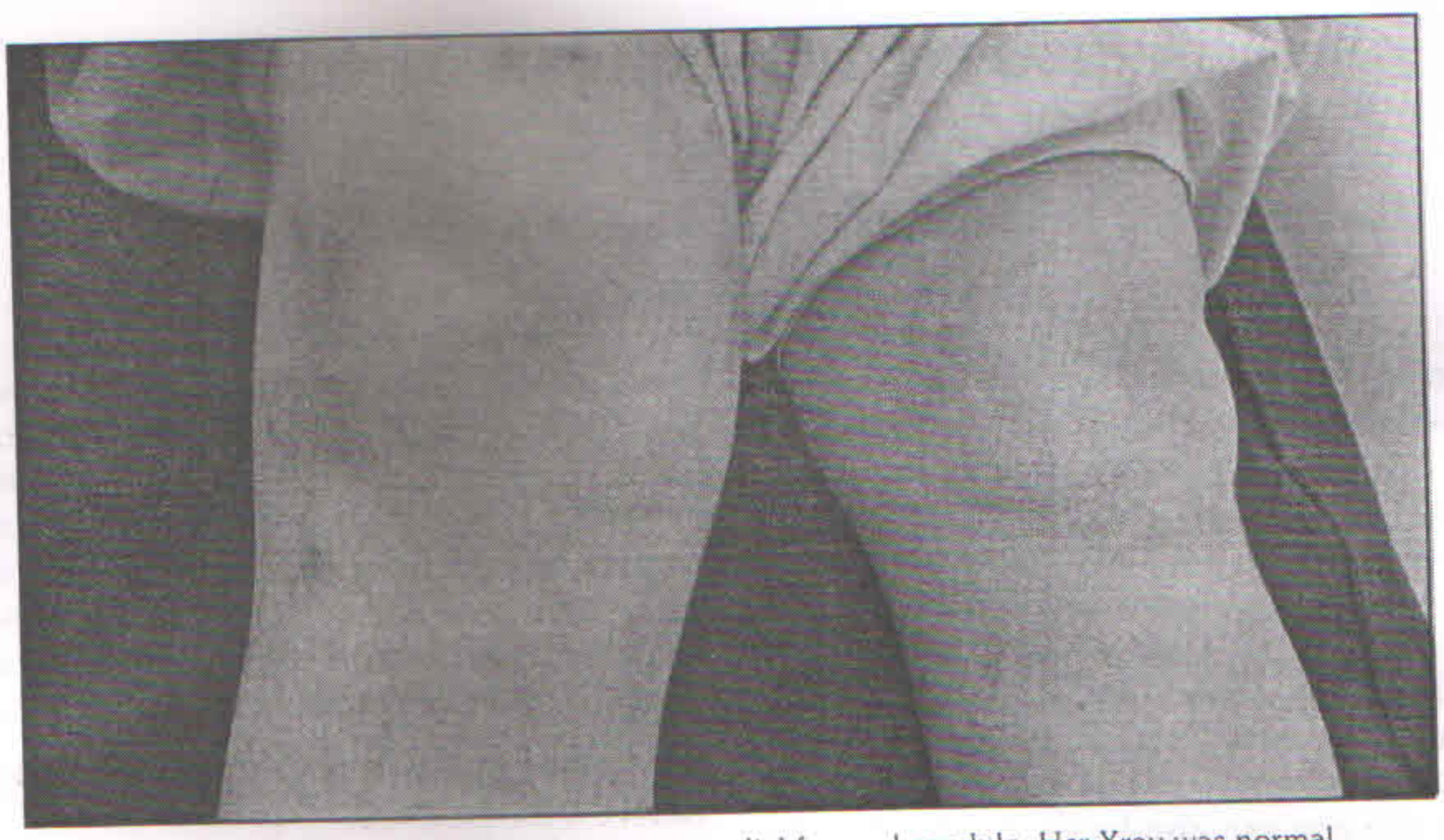

Figure 1 : 53 year old lady with pain on medial femoral condule. Her Xray was normal

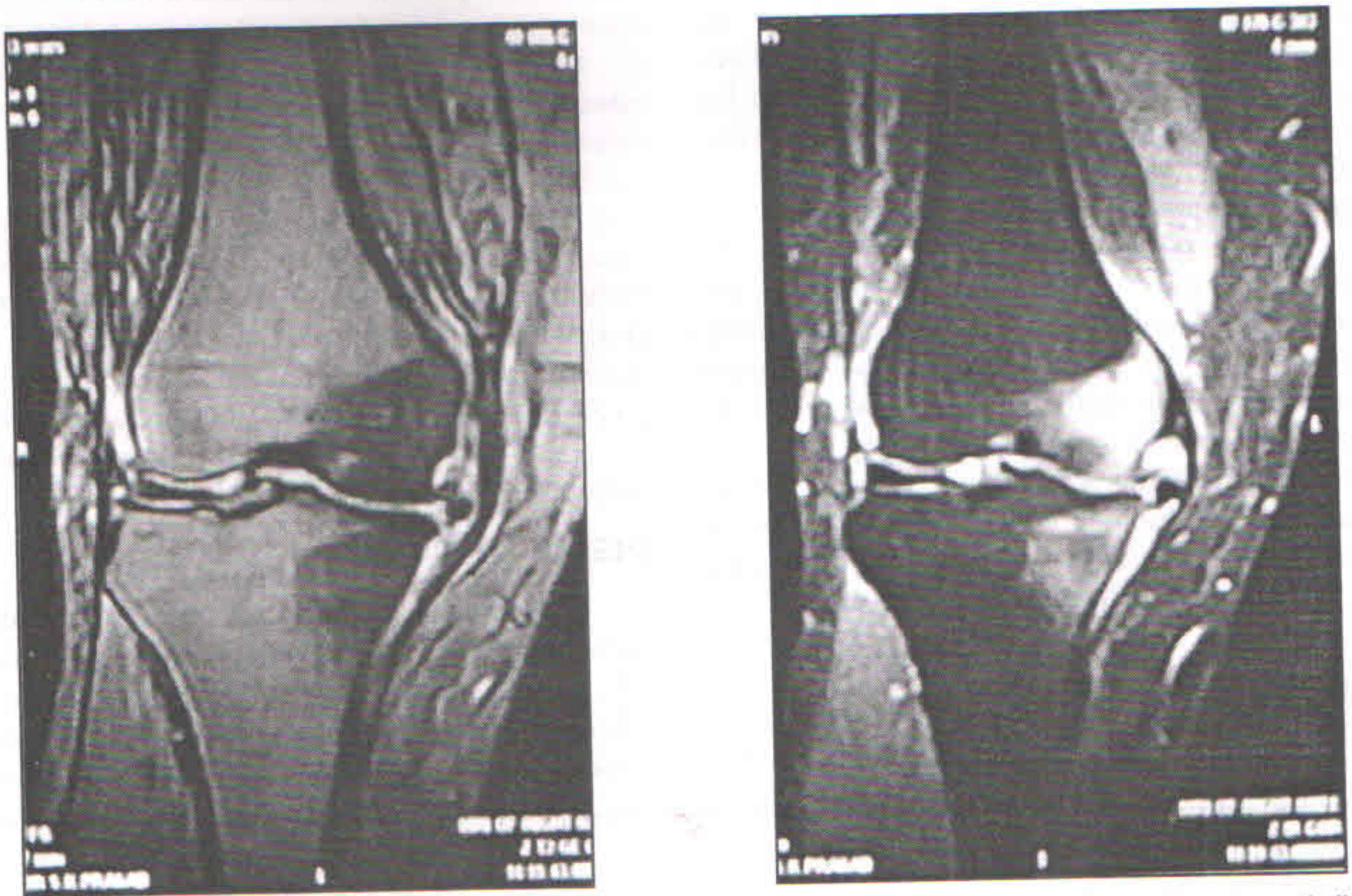

Figure 2 and 3 : MRI of the left knee shows spontaneous osteonecrosis of the femoral and tibial condyle medially

all in 1968. It is called spontaneous, idiopathic, or primary osteonecrosis to distinguish it from secondary osteonecrosis, which is associated with corticosteroid therapy. Secondary osteonecrosis is associated with higher incidences of bilateral knee involvement, multiple joint involvement, and involvement of the lateral compartment of the knee than is primary osteonecrosis. Osteonecrosis of the knee is three times more common in women than in men, and most patients are more than 60 years old. The usual complaint is the sudden onset of pain on the medial aspect of the knee, which may have been precipitated by a specific activity or minor injury. The pain is frequently worse at night during the acute phase, which may last 6 to 8 weeks after the onset of symptoms. Depending on the size and stage of the lesion, the severe pain of the acute phase may either resolve gradually or become chronic. Physical examination shows an area of well-localized tenderness over the affected condyle, which is most commonly medial. Mild synovitis accompanied by a small effusion is common. The radionuclide bone scan is performed with technetium-99m and must be positive to make the diagnosis of osteonecrosis. Radiologically the plain-radiographic presentation is devided into five sequential stages. [2,3]

In stage 1 the radiograph is normal. Diagnosis in this stage depends on the radionuclide bone scan.

In stage 2 there is subtle flattening of the weight-bearing portion of the affected condyle, which may easily be missed.

In stage 3 The typical lesion of osteonecrosis is seen. It consists of a radiolucent area of variable size located in the subchondral bone and bordered proximally and laterally by a sclerotic halo..

In stage 4 the sclerotic halo thickens, and the subchondral bone begins to collapse.

Stage 5 shows the osseous collapse of stage 4 accompanied by secondary degenerative changes in the femoral condyle (i. e., osteophyte formation, jointspace narrowing, and sclerosis).

Magnetic Resonance Imaging Magnetic resonance (MR) imaging has shown the involvement of the condyle to be more extensive than can be appreciated on plain radiographs. The high-intensity signal on the T1-weighted image normally produced by the fat in the marrow is replaced by a discrete subchondral area of low signal intensity, sometimes surrounded by an area of intermediate signal intensity. On the T2-weighted image, an area of low signal intensity is surrounded by a variable high-intensity signal, which is thought to be caused by edema surrounding the lesion.

Microscopy shows a segment of dead bone in the weight-bearing portion of the femoral condyle associated with subchondral fracture and collapse.[12] The osteonecrotic center has dead bone with empty lacunae and fatty degeneration. The surrounding area shows reparative bone formation, osteoblastic activity, cartilage formation, and bands of fibrovascular granulation tissue.

The etiology of spontaneous osteonecrosis is unknown, but either a vascular or a traumatic cause has been theorized. The vascular theory supposes interference with the microcirculation to the subchondral bone of unknown cause, producing edema in a nonexpandable compartment. The resultant increased pressure in the bone marrow further diminishes the circulation and results in osseous ischemia and the low signal intensity of the marrow seen on the MR study. If the dead bone collapses, the typical radiographic appearance develops. If revascularization occurs before collapse, the lesion may heal, and the symptoms may resolve. The traumatic theory takes into account that most patients are elderly women, in whom osteoporosis is common and in whom, therefore, minor trauma might cause microfractures in the weaker subchondral bone. At this stage, the radionuclide study would be positive, but the MR imaging study could still be normal. It is postulated that fluid eventually enters the marrow space, increasing the pressure and causing ischemia. At this point, the MR image shows an area of low signal intensity. The lesion may then progress or resolve.

Spontaneous osteonecrosis should always be considered in the elderly patient with a painful knee that appears normal radiographically, so that inappropriate arthroscopy and meniscectomy can be avoided. In stages 1 and 2, the treatment of osteonecrosis should be conservative until the size of the lesion and its progression have been defined which may take as long as 6 months. Management consists of analgesics and protected weight-bearing. Antiinflammatory medications are often prescribed, but there is no evidence of an inflammatory component. Small lesions do well, although mildly symptomatic degenerative changes may slowly develop. Surgical treatment options for the patient with larger lesions that progress to the more advanced stages of osteonecrosis include arthroscopic debridement, drilling or core decompression (with or without bone grafting), proximal tibial osteotomy, allografting, and prosthetic replacement.[4]

Secondary ON often involves both femoral condyles, with multiple lesions in the epiphysis, metaphysis, and diaphysis of the bone. Patients are typically younger than 45 years. Secondary ON is bilateral more than 80 percent of the time. Direct risk factors for secondary ON include radiation, chemotherapy, and trauma. Conditions such as sickle cell disease or other myeloproliferative disorders also increase the risk for secondary ON. One indirect risk factor is a certain level of corticosteroid use, (ie, taking more than 1 gram per month of prednisone or equivalent for 2 or more months, or approximately 30 mg per day). In fact, secondary ON got its name because it was said to be secondary to corticosteroid use. Other factors that can lead to this disease include alcoholism and an inherited coagulation disorder. [5]

The case is being reported to sensitize orthopaedic surgeons to the fact that with a normal knee X-ray if the elderly patient complains of severe pain then he may be having a spontaneous osteonecrosis of the knee which can be diagnosed early, progression delayed or treated in a better manner.

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FUTURE ORTHOPAEDICS: ROLE OF STEM CELLS

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INTRODUCTION

Today great hope is set on regenerative medicine in all medical fields. Leland Kaiser introduced the term "Regenerative medicine" in 1992. He forecasted that "a new branch of medicine will develop that attempts to change the course of chronic diseases and in many instances will regenerate tired and failing organ systems"[1] Since then, scientists all over the world try to develop cell-based approaches to regenerate damaged tissues, or even substitute whole organs[2].

Of course, regenerative medicine has developed to be of interest in orthopaedics. There, great hope was set on regenerative medicine to develop alternative therapies for cartilage damage, arthritis, large bone defects, or atrophic tendon ruptures during the last decade. These are all indications, which are treatable only insufficiently with conventional implants and surgical procedures[3-10]. Therefore, they frequently result in decreased function of the musculoskeletal system or even loss of patients' mobility. In the worst case, the mentioned diseases even result in a loss of autonomy for the patient.

In the field of Orthopaedics, autologous stem cells such as mesenchymal stem cells (MSCs) are readily available and are amenable to harvesting and isolation from the bone marrow and other tissues of mesodermal origin. MSCs are already pre-programmed to differentiate into musculoskeletal tissue types. But Despite rapid progress, significant challenges remain in the translation of these stem cell therapies for clinical applications.

In this review, a brief description of stem cells is provided, and the current status of stem cells in orthopaedic practice is discussed.

STEM CELLS

Stem cells have the capacity for self-renewal and the ability to differentiate into various types of tissues under certain conditions. Stem cells are classified based on their source into embryonic stem cells (ESCs), foetal stem cells (FSCs), and adult stem cells. Embryonic stem cells (ESCs) are only found in early developmental stages of the organism. They represent the only cell type, which has the ability to renew itself indefinitely and it can differentiate into cells of all three germ layers. Adult stem cells are much more limited in their regenerative capability and are usually restricted to the tissues they reside in. The stem cell niche is an extracellular microenvironment in which the cell resides. The niche is an important regulator of the biochemical and physical signals that a stem cell receives, thereby impacting key aspects of activity, such as cell survival, proliferation and differentiation.[11-13] tissues such as bone, cartilage, and muscle naturally have distinct moduli,[14] and stem cells will preferentially differentiate toward certain cell types depending on the mechanical properties and nanostructure of the extracellular environment.[15-18]

From a legal and ethical point of view, research involving human embryonic cells is highly controversial. Besides the ethical concerns, the use of embryonic stem cells is problematic, as the

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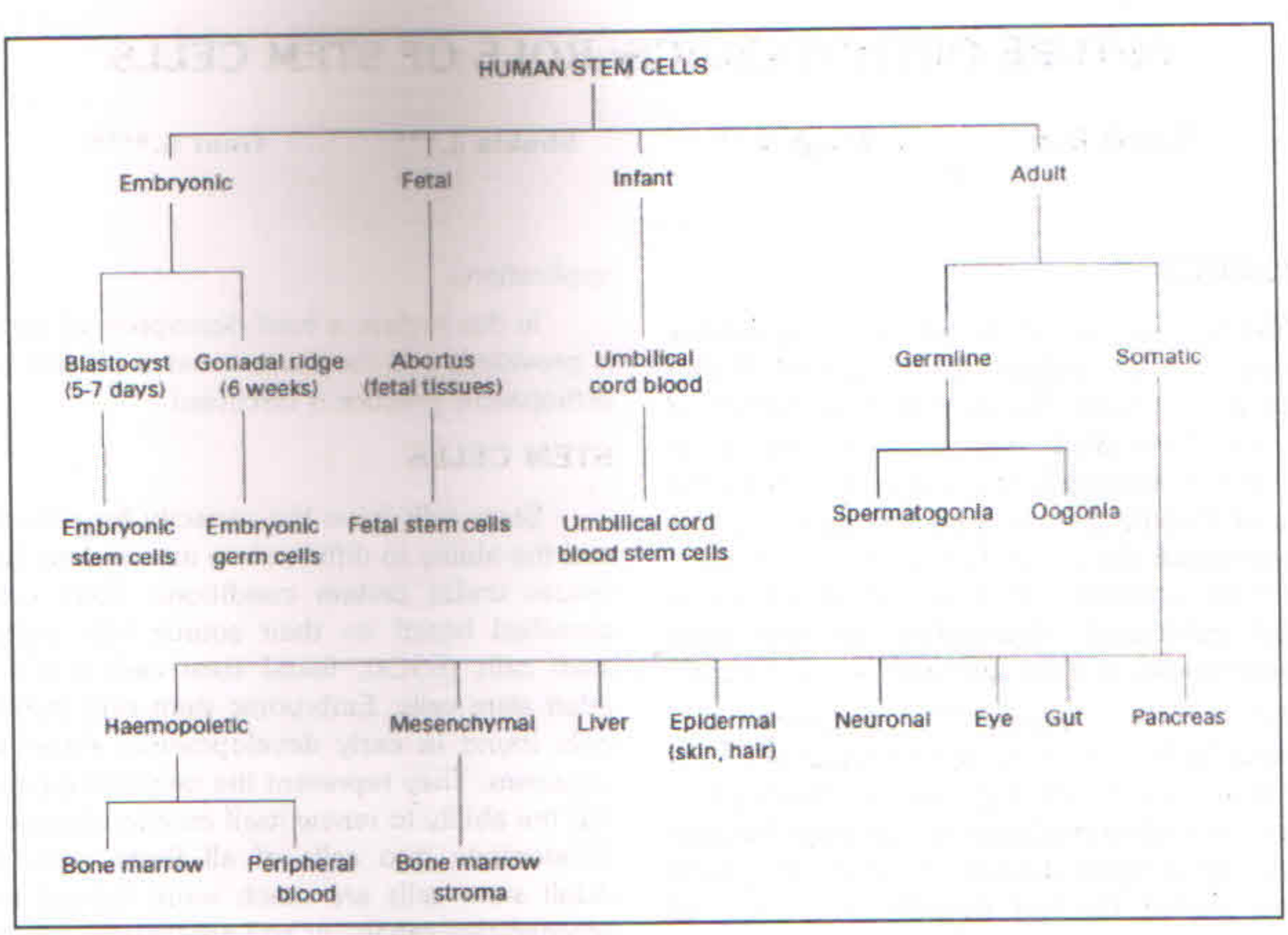

Figure 1: Differentiation of human stem cells

application of pluripotent cells inheres a distinct oncogenic potential, teratogenicity and immune reaction in the recipient. One technique for reducing thepossibility of teratoma formation is to convert the pluripotent ESCs to multipotent mesenchymal stem cells (MSCs). Takahashi and Yamanaka have been able to create a pluripotent stem cell (iPSC) by the insertion of four transcription factors (Oct4, Klf4, Sox2 and c-Myc) into mouse skin fibroblasts[19]. Although these cells would be autologous and presumably non-immunogenic, there are still many potential problems as the induction is performed with viral vectors and the issue of teratogenesis still remains.

The use of adult stem cells raises less ethical concerns and has proved to be much safer than pluripotent stem cells. In addition, these cells have further advantages compared to ESCs, for example, a use for autologous cell therapies, using patients' own cells to reduce possible immune responses, is easier to realize. Nonetheless, the limited differentiation potential of adult stem cells narrows their applicability. Typically, adult stem cells can differentiate into the cell types of the tissue in which they reside. Mesenchymal stem cells have been found to be the most promising candidates, as they show good differentiation potential towards cartilage, tendon and bone cells. They can be isolated from a number of mesenchymal tissues as for example bone marrow, fat, synovial membrane, periosteum, and others[20]. Interestingly, these mesenchymal stem cells have been found to differ regarding their differentiation potential dependent on their tissue source[21].

ETHICAL CONSIDERATIONS IN THE USE OF STEM CELLS

There are different views regarding

therapeutic cloning and ESCs research. Many countries allow the use of ESCs derived from discarded or excess embryos from invitro fertilisation (IVF). However, there are differences of opinion regarding the derivation of new stem cell lines from embryos created specifically for research purposes. The United States does not allow the use of federal funds for research to create new ESC lines, but allows work on the ESC lines currently stored in the National Institute of Health (NIH). However, there is no regulation of research on ESCs carried out with private funding, resulting in the establishment of privately funded research centres.

Despite the discrepancy between the approaches of different governments, scientists from various countries havecome together to form the International Stem Cell Forum (ISCF). This was initiated in January 2003 by Sir GeorgeRadda when he was the Chief Executive of the Medical Research Council (MRC) of the United Kingdom. The ICSF aims to forge international collaboration in stem cell research by trying to establish the standardisation of techniques, the sharing of cell lines, training, conferences, and the exchange of information. It has also set up various subcommittees to discuss issues of scientific, ethical and intellectual property.

In May 2004 the United Kingdom set up a stem cell bank. This regulates the storing, characterisation and supplyof ethically approved quality-controlled stem cell lines for research. It includes all cell lines derived from embryonic, foetal and adult tissues and is hosted by the National Institute of Biological Standards and Control in South Mimms, Hertfordshire.

As ethical and safety concerns currently forbid application of iPSCs and ESCs in patients, we will focus on adult mesenchymal stem cells within the rest of the paper.

MESENCHYMAL STEM CELLS

The most commonly used stem cells are MSCs. These are nonhematopoietic, stromal cells that exhibit multilineage differentiation capacity, and are able to give rise to diverse tissues, including bone, cartilage, adipose tissue, tendon and muscle. These cells can be isolated from bone marrow or obtained under culture from various other sources, such as the periosteum, fat and skin[22,23]. Under controlled conditions, these cells can differentiate into multi-mesenchymal lineage (such as osteoblast, chondrocyte and adipocyte) and myoblast lineages, making them useful for cell and tissue engineering as well as gene therapy for Orthopaedic applications.

Two main types of MSCs have been used. Bone marrow derived and Adipose tissue derived. Bone marrow derived MSCs are more adept at Bone repair, Cartilage repair, and soft tissue repair[24,25]. Other Advantages of MSCs over ESCs are that they are Autologous hence no major ethical issues are there with their use. These can be expanded in vitro hence an unlimited supply of therapeutic cells is ensured. MSCs do not express HLA II antigens hence allotransplantation is possible.

APPLICATION IN ORTHOPAEDICS

Cartilage

Injured articular cartilage has poor potential for repair due to its avascular nature. Articular cartilage damage leads to Osteoarthritis. Procedures directed at the recruitment of stem cells from the marrow by penetration of the subchondral bone have been widely used to treat localised cartilage defects. The 'microfracture' technique is often used, but the fibrocartilage which results from these techniques has poor mechanical properties compared with normal cartilage[26]. More recently, attempts to 'regenerate' normal articular cartilage have been introduced in clinical practice with autologous chondrocyte implantation (ACI).

For autologous cartilage repair various two- and three-dimensional constructs are available. Most of the matrices consist of natural polysaccharides and proteins, such as alginate and collagen. Furthermore, synthetic polymers are also available for example, polyethylene glycol (PEG) or polylactic acid (PLA). Successful outcome of a

stem cell-based cartilage tissue engineering also depends on the design of extracellular matrix for a proper differentiation of MSCs into chondrocytes. Wakitani et al.[27] reported a series of three cases of repair of articular cartilage defects in the patello-femoral joint with autologous bone marrow MSCs. They expanded the MSCs harvested from iliac crest in vitro for 4 weeks and then transplanted them to the site of defect using collagen gel and covered the defect with a periosteal flap. They reported satisfactory clinical and macroscopic results. The small sample size decreased the impact of the study. A cohort study was performed by Nejadnik et al.[28] on a total of 36 patients. The patients underwent autologous cartilage transfer or MSCs implantation. At 24 months post-operatively, no significant difference of functional knee scores between the groups was noted.

Buda et al.[29] used MSCs for treatment of osteochondral lesions of the femur and talus. They reported satisfactory clinical results and integration of cells in defects in both types of osteochondral lesions. Thus, use of MSCs in cartilaginous lesions has come to the clinical stages from experimental stages and the results have been encouraging.

Bone

MSCs can be used to enhance bone regeneration and union in cases of critical bone defect, non-union, physis regeneration in children and to improve bone quality in osteogenesis imperfecta. For non-union cases, even though iliac crest bone grafts are still considered to be the gold standard due to their osteogenic, osteoinductive and osteoconductive properties[30], loading MSCs on an injectable carrier have been tested for efficacy as an alternative for open surgical procedures[31,32]

In critical bone defect there is loss of a portion of bone that then fails to heal and requires bone reconstruction to prevent a non-union. MSCs could facilitate osteogenesis in these settings, if loaded in scaffolds of predefined dimensions and shape to fit in the defect.

Physeal Injuries

Physeal injury in a growing child often results in formation of bony bridges that eventually lead to angular deformities or shortening. Excision of bony bridges and insertion of fat, polymeric silicone[33] or muscle[34] have been described to prevent bony bridges from reforming. However, these interposition techniques are only useful when the bony bridge is small (<30%). More recently, cultured autologous chondrocytes[35-37] and MSCs from bone marrow have been shown to repair large physeal defects leading to significant reduction in growth arrest[38,39].

Osteogenesis imperfecta (OI) is a genetic disorder caused by defects in type I collagen. Ideally, the treatment of OI should be directed toward enhancing bone strength by improving the structural integrity of collagen[40]. Pereira et al. infused bone marrow-derived MSCs from a normal mouse into irradiated transgenic recipient mice with an OI phenotype. Several months after transplantation the recipient mice demonstrated the presence of donor-derived MSCs in various organs, including bone, cartilage, lung and spleen. MSCs that homed to the bones differentiated into osteocytes and produced normal levels of collagen type I, with partial ablation of the Osteogenesis Imperfecta phenotype.[41] MSCs transferred in a bone marrow graft may play a potential role in the cure for OI.[42]

Non-Unions

MSCs have osteogenic potential; they tend to differentiate along the osteogenic pathway in response to chemical stimulation.[43] MSCs have been shown to be the source of endochondral bone formation. The method of application of MSCs, which are usually harvested from the iliac crest, is usually by percutaneous injections to the non-union site.

Percutaneous injection of MSCs has shown to promote union in non-unions by Connolly et al.[44] Garg et al.[45], Kettunen et al, Hernigou et aland Goel et al[46] The application by these investigators has been on non-union of long bones especially tibia and also for diagnosed cases of pseudo-arthrosis. Fernandez et al[47] studied the effects of

autologous bone marrow mononuclear cells combined with allogenic bone graft for repair of pseudo-arthrosis of long bones. Bone marrow mononuclear cells (BM-MNCs) comprise of progenitor and stem cells with pro-angiogenic and pro-osteogenic properties. They concluded that, "Combination of autologous BM-MNCs and allogenic bone graft could constitute an easy, safe, inexpensive and efficacious attempt to treat long-bone pseudoarthrosis and non-union by reproducing the beneficial properties of autologous bone grafting while restricting its disadvantages"

Tendons & Ligaments

Once injured, tendons and ligaments produce inferior quality repair tissue due to their limited regenerative ability. Use of biological grafts such as autografts, allografts and resorbable biomaterials can result various complications such as donor site morbidity, scar formation, risk of infection and tissue rejection. Application of a collagen gel loaded with MSCs in a rabbit Achilles and patellar tendon defect resulted in improvement of structure, biomechanics, and function.

Another challenging issue is the healing of the tendon graft to the bone (graft-host junction) in instances such as anterior cruciate ligament (ACL) is the healing of the tendon graft to the bone. The normal anatomy of the insertion site of the ACL is fibro cartilaginous and consists of four distinct zones: ligament substance, unmineralised fibrocartilage, mineralised fibrocartilage and bone.[48] Conventional free tendon transfers are unable to restore this complex anatomy within the first six months.[49] Lim etal50studied the role of MSCs at the tendon-bone junction during reconstruction of the ACL in the rabbit. They showed that applying MSCs to tendon grafts at the tendon bone junction results in a zone of fibrocartilage at the junction which more closely resembled that of the normal ACL. These enhanced grafts have improved biomechanical properties compared with controls, and have exhibited a rapid and significant increase in load to failure and stiffness in the first eight weeks after reconstruction of the ACL.[50]

Another recent study saw the use of synovial MSCs in the insertion of the Achilles tendon graft of rats into a bone tunnel from the tibial plateau to the tibial tuberosity. It was observed histologically that implantation of synovial MSCs into the bone tunnel accelerated healing and showed early remodelling of tendon-bone junction.

Meniscus

Tears in the avascular inner third of the meniscus have limited or no potential for repair as the reparative process cannot occur without the presence of vascularity. Meniscectomy has been shown to have a strong association with the subsequent development of osteoarthritis. Centeno et al[51] conducted a study to determine if isolated and expanded human autologous MSCs could effectively regenerate cartilage and meniscal tissue when percutaneously injected into knees[51]. MSCs isolated from bone marrow aspiration of the iliac crest of a consenting volunteer were cultured ex-vivo and percutaneously injected into the subject's knee with MRI proven degenerative joint disease. At 24 weeks post-injection, the subject had statistically significant cartilage and meniscus growth on MRI, as well as increased range of motion and decreased modified VAS pain scores. A recent study tested a cell-scaffold combination for the repair of a critical-size defect of the rabbit medial meniscus, by comparing a hyaluronan/gelatin composite scaffold, and also scaffolds loaded with autologous marrow-derived MSCs, and empty scaffolds in the contra lateral knees to untreated contra lateral defect as control. Untreated defects had a muted fibrous healing response. Pre-cultured implants integrated with the host tissue and eight of 11 contained meniscus-like fibrocartilage, compared with two of 11 controls ($p < 0.03$). The mean cross-sectional width of the pre-cultured implant repair tissue was greater than controls ($p < 0.004$). This has significant future implications for minimally invasive treatment of osteoarthritis and meniscal injury.[51]

Avascular necrosis (AVN)

Avascular Necrosis of femoral head leads to

the death of osteocytes present in the sub-chondral region and causes collapse of the femoral head; it alters the shape of the femoral head and produce pain, limp and restriction of movements. Treatment options available till date primarily focus on reducing the intra osseous pressure by drilling channels into the head through the neck if presentation is early. In advanced disease, replacement arthroplasty is commonly opted for.[52] MSCs have been applied for the re-growth of the dead area of the femoral head. A common method of application has been by the injection of bone marrow concentrate. Wang et al.[53] reported debridement, autogenous bone grafting and bone-marrow mononuclear cells im-plantation as an effective procedure in patients with small lesion, early-stage AVN of the femoral head. Limitation for the use of stem cells in this condition is the stage of presentation as once the collapse has started, the shape of femoral head cannot be returned back to normal by the stem cells.

Stem cells as fillers of bony voids

In cases of benign bone tumours such as simple bone cysts for which curettage has been done and in cases where there is a bone defect, a void is left behind in the bone. Marcacci et al.[54] used autologous MSCs that were expanded in vitro and seeded on hydroxyl-apatite scaffolds for filling of diaphyseal bone defects and reported good integration of the graft 7 years post-op without any secondary fractures.

Muscular Dystrophy

In Duchenne Muscular Dystrophy (DMD), which is characterized by progressive muscular weakness and muscle wasting eventually leading to paralysis and death, intravenous injection of MSCs in models of immunodeficient mice with DMD has shown differentiation of MSCs into muscle fibres and partial restoration of dystrophin expression. Wakitani et al[55] found that under certain conditions, in vitro bone marrow differentiates into contractile myotubes. Gussoni et al[56] showed that in immunodeficient mice a marrow-derived cell can migrate into areas of induced muscle degeneration, undergo myogenic differentiation and participate in the regeneration of the damaged fibres. The study showed that bone marrow- or muscle-derived stem cells appear to provide a means for systemic, rather than local, repair of muscle, as a consequence of the delivery of the cells throughout the vascular system. It is possible that in future the procedures for stem cell transplantation could be optimised to provide levels of engraftment of muscle that would be useful clinically.[57]

Spine & Neural Tissues

Degeneration of the intervertebral disc is a leading cause of back pain and morbidity. After failure of conservative management the surgical options for discogenic back pain are limited and usually invasive. Cell-based tissueengineering offers considerable promise for a more biological alternative by transplantation to the intervertebral disc of mature autologous disc cells, chondrocytes or stem cells. Cell transplantation can potentially increase proteoglycan production, induce disc regeneration or slow the process of degeneration. Recently, Crevensten et al[58] explored the use of MSCs for intervertebral disc regeneration. They used an in vivo model to investigate the feasibilityinjected cells was observed, and their viability was 100%.

Repair of the spinal cord is a very complex process that includes restoring or enhancing local spinal reflex arcs and reconnecting regenerating axons.[59] Akiyama et al have demonstrated that MSCs isolated in culture from the mononuclear layer of bone marrow can remyelinate demyelinated spinal cord axons after direct injection into the lesion.[60] However, the results of animal studies should not be directly extrapolated to human subjects. Strategies for repair of the human spinal cord will, of necessity, be multifaceted, entailing enhancement of axonal growth and reconnection, replacement of cellular elements, and the reversal of demyelination as necessary steps for success. The connective tissue matrix, the degree of glial scarring and the central myelin inhibitory factors, the elimination of which is required for axon outgrowth, are all important. Balance of these factors is necessary.

OTHER APPLICATIONS OF STEM CELLS IN ORTHOPAEDICS

Along with the above-discussed applications of the stem cells, some other conditions are also being investigated for their suitability for stem cell application. Enhancement of spinal fusion has been tried by applying the stem cells by Neen et al.[43] and Gan et al.[44] Gan et al. reported 95.1% of their patients to have had good fusion after 34.5 months but Neen et al. reported similar healing capacity as autologous cancellous bone grafting in posterolateral fusion and poor results in interbody fusions of the spine.

Dallari et al.[45] have used lyophilised bone chips with platelet-enriched plasma with bone marrow aspirate in high tibial osteotomy and found an enhancement of healing.

CONCLUSION

Stem cell therapy is as an attractive option for the treatment of intractable diseases. Its use is based on sound biological principles. However, whether one should accept the stem cell therapy in all the conditions discussed above is questionable. Many of these studies have shown good results but at the same time many have shown failures. This might also be linked to the patient selection, the type of cells used, the concentration of cells used, the method of application, duration of follow up and evaluation tools among others. Many more long-term prospective ran-domised human trials need to have good results before one may actually recommend the use of these cells. Establishing the safety profile of these is equally important, for many of the iPS cells have been shown to be teratogenic. Thus, one should tread with caution the path of stem cell application but wherever a suitable case is available a trial should be taken of this treatment modality.

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OUTCOME ANALYSIS OF VARIOUS MODALITIES OF FIXATION FOR EXTRACAPSULAR HIP FRACTURES IN ELDELRLY

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ABSTRACT

Introduction: Fracture distal to the capsular attachment, that is pertrochanter area of hip called as a extracapsular hip fracture. Fracture of the proximal femur are a big challenge in traumatology. Over the past 50 years a wide variety of implants and fixation strategies have been utilized for this type of fractures. Dynamic hip screw is gold standard, proximal femoral nail longer version and proximal femoral locking compression plate is new weapon in the orthopaedic surgeons armamentarium for fixation of this challenging fractures.

Aim of Study: This study is undertaken to assess the various modalities of surgical stabilization of extracapsular hip fractures in elderly and their clinical outcome in our institute.

Material and Methods : This is a prospective study from august 2013 to September 2014. The study included 98 patients (mean age 76 years) who underwent various modalities of surgical stabilization for extracapsular hip fractures in elderly. Out of 98 patients 32 underwent Dynamic Hip Screw fixation, 38 underwent Proximal Femoral Nailing, 12 underwent Proximal Femoral Locking Compression Plating and 16 patients underwent Dynamic Condylar Screw fixation. Final clinical outcome was made using the kyle's criteria.

Results: This study evaluated implant cost, familiarity of surgeon with procedure, surgical exposure, operation time, blood loss and blood transfusion, wound complication, reoperation and mortality in every group. Group II (PFN) found better results by comparing.

Conclusion : Optimal reduction of the fracture and positioning of the nail and screw, plate and screw remains the crucial importance and should be obtained in all times. We have concluded that group II (PFN) was good and effective to treat these extracapsular fractures in elderly with highest clinical outcome.

Key words : Dynamic Hip Screw, Dynamic Condyler Screw, Extracapsular Hip Fractures, Elderly, Proximal Femoral Nail, Proximal Femoral Locking Compression Plate, Kyle's criteria

INTRODUCTION

Fracture distal to the capsular attachment, that is peritrochanteric area of hip called as a extracapsular hip fracture involving intertrochanteric and subtrochanteric area. Incidence of fracture intertrochanter among all proximal femur fracture is 50% and subtrochanteric hip fracture accounting 10-34 % of all hip fractures.[1-3] In India the incidence is estimated to double by 2040. This fracture have high compact over society because making person to not perform daily activities and prone for bed ridden. Hip fractures was reported with a mortality rate ranging from 15-30% in America.[4] These fractures may be very difficult to fix, and the risk of failure has been high regardless of the fixation method,[5] especially

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in high subtrochanteric fracture with loss of the lesser trochanter and the medial buttress.[1-6] Fracture of the proximal femur are a big challenge in traumatology. Over the past 50 years, a wide variety of implants and fixation strategies have been utilized for the surgical stabilization of extracapsular hip fracture. The introduction of the sliding compression hip screw and side plate in the 1950 was considered a major advance over previous nail-plate devices.[7-8] The DHS is most commonly used and still remains the "Gold Standard" for stable extracapsular hip fractures. In the early 1990s, a new fixation device was introduced that consist of a short intramedullary nail that was placed through the greater trochanter, with a large diameter proximal interlocking screw that was inserted in a retrograde fashion up the femoral neck. The proposed advantage were insertion through a so called minimally invasive incision and improved fracture fixation biomechanics.[9-10] Vertical fractures in extracapsular area too can be effectively treated with DCS fixation.[11] The PFLCP is a new weapon in the orthopedic surgeon's armamentarium for treatment of unstable trochanteric fracture. Most of the currently available internal fixation devices can be expected to yield satisfactory result. However, each devices has its own set of advantages and disadvantages. The goal of operative treatment of extracapsular hip fracture is the stabilization of fracture and early patient mobilization, restoring the function of the limb. Although there were several reports showing benefits of PFN,[12] it was still associated with technical failures. Advantage and Disadvantage about PFN has less data available, since most previous studies are retrospective and lack a control group.[13-14] Therefore, we conducted a study to asses significant differences on basis of clinical outcome between DHS, PFN, PFLCP and DCS fixation for treating extracapsular hip fractures in elderly.

MATERIAL AND METHODS

Between August 2013 and September 2014 at Gandhi Medical College and Hamidia Hospital, Bhopal, Madhya Pradesh. We randomized 98 patients with extracapsular hip fractures (AO category 31 -A)[15] to be treated with DHS/PFN/ PFLCP/DCS fixation and under fluoroscopy control. Based on selection of implant design the patients were divided in four groups. Patients who underwent with DHS fixation were recruited into group I, PFN fixation recruited into group II. PFLCP fixation recruited into group III and DCS fixation recruited as group IV. There were 32, 38. 12 and 16 patients recruited in group I, II, III and IV respectively(figure 1). Patients were have age from 60-96 years and mean age was 76 years. 40 pateints were that less than 70 years and 58 patients were more than 70 years (figure 2). Sex wise males were 35 and females were 63(figure 3). Injured side - wise right hip involved in 26 patients and left hip involved in 72 patients (figure 4).

The ethics committee of our hospital approved the study plan and informed consent was obtained from all patients before the operation. Every patient admitted in our hospital of age more than 60 years with isolated extracapsular hip fractures included in study and those with less than 60 years, history of previous fracture, multiple injuries and nonconsenting patients were excluded from study. This study enrolled patients with extracapsular hip fractures classified as AO/OTA classification[15](table 1).

Implant design was based on surgeon's choice, as he was comfortable irrespective type of fracture pattern. Preoperative parenteral antibiotics administered 1hr before surgery.[16] All surgeries done under spinal anaesthesia and on traction table under fluoroscopy control. Intraoperative haemorrhage, surgical exposure, surgeon's familiarity with procedure, implant cost, implant related complications and wound related complication was observed and compared. Plain radiographs (anteroposterior and lateral view) were obtained on the first post -op day and analysed for reduction of fracture and position of implant. Total

operative time was defined as the duration of the surgery from skin incision to skin closure and compared in every group. Reduction was considered good if the cortical congruence at the calcar region was restored, and if the displacement between the fragments did not exceed 2mm in any projection, acceptable (5-10 degree varus/valgus and or ante or retroversion), or poor (>10 degree varus/valgus and or ante or retroversion). The rehabilitation programme was uniform for all. Follow up at 6 weeks, 3 months, 9 months and 1 year of period done and compared. Statistically analysis was made using the chi-square test. Clinical outcome was evaluated using Kyle's criteria[17] at final follow up.

Kyle's Criteria

Outcome	Criteria
Excellent	No/ Minimal Limp No Pain Full ROM
Good	Mild limp Mild occasional Pain Full ROM
Fair	Moderate Limp (Using 2 Sticks) Moderate Pain Limited ROM
Poor	Wheelchair Bound Complete Bedridden Non- Ambulatory

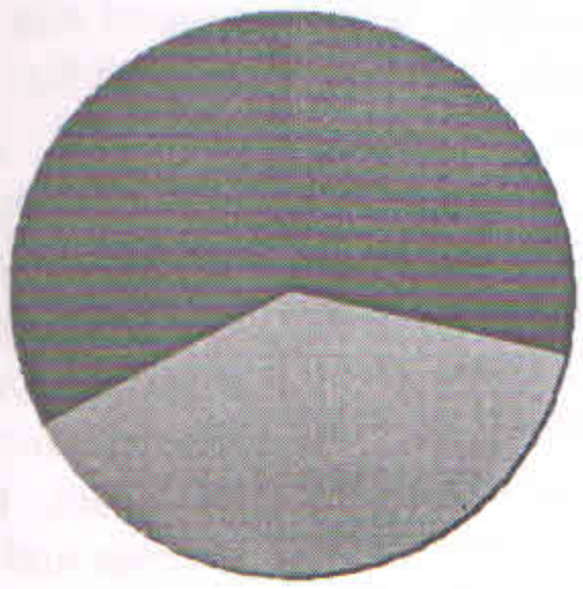


Figure 1 : Groupwise distribution of patients

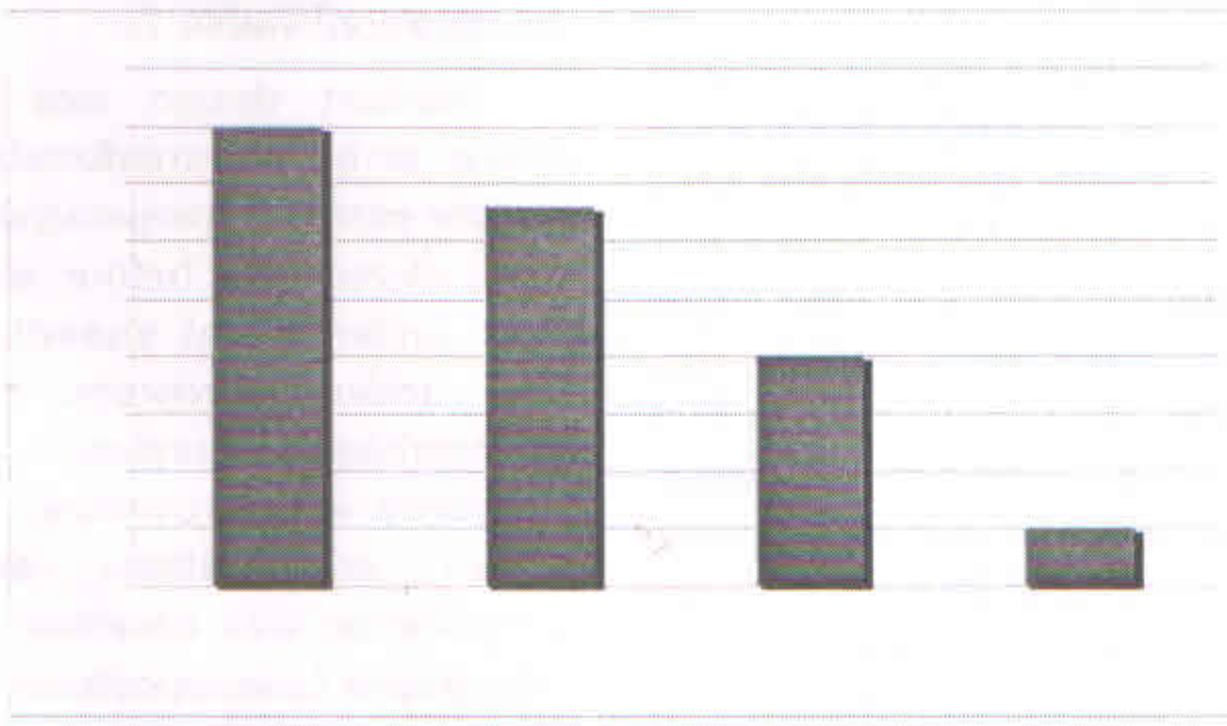


Figure 2 : Age wise distribution of patients

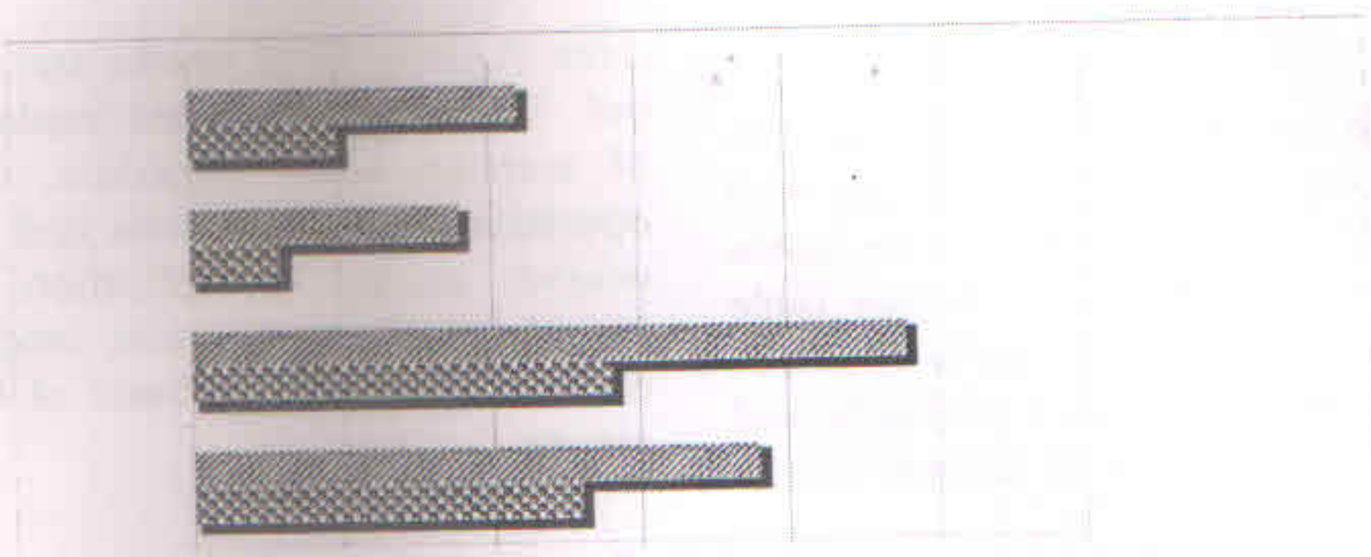


Figure 3 : Sex wise distribution of patients among all

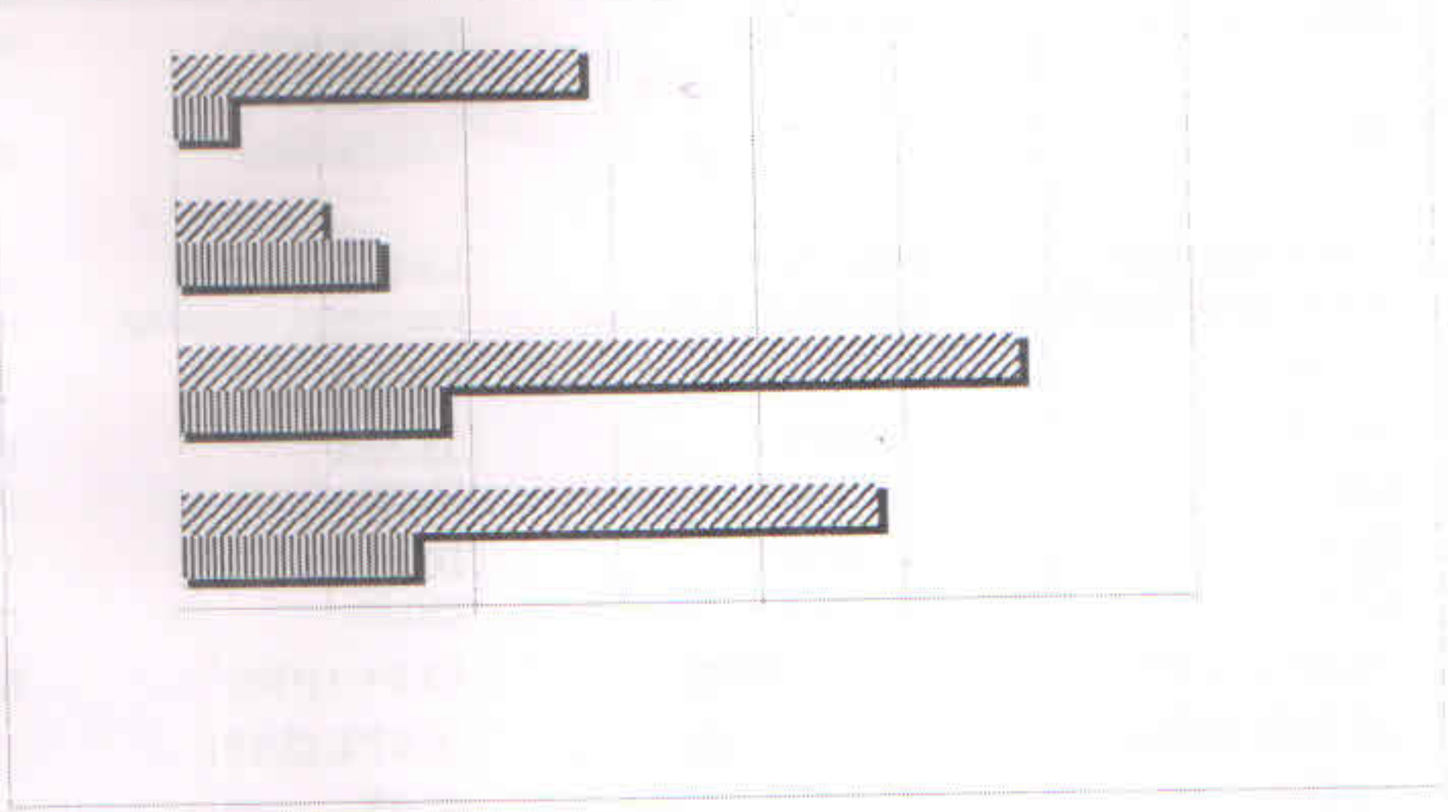


Figure 4 : Side wise distribution of Hips among all groups

Table 1
Distribution of Patients according to fracture type

Fracture Type	Group I DHS	Group II PFN	Group III PFLCP	Group IV DCS	Total
A1. 1	4	2	0	2	8
A1. 2	4	4	0	3	11
A1. 3	2	2	1	4	9
A2. 1	3	4	1	2	10
A2. 2	6	3	2	2	13
A2. 3	5	3	1	1	10
A3. 1	5	6	3	0	14
A3. 2	2	8	2	2	14
A3. 3	1	6	2	0	9
Total	**32**	**38**	**12**	**16**	**98**

RESULT

Randomization provided similar groups with regard to patient age, gender distribution and fracture type. According to AO classification stable fractures were 38 and unstable were 60 (See Table 1). During the follow - up five patients were lost in group I (five deaths), four in group II (3 deaths and one lost follow up), two in group III (2 deaths) and three in group IV (2 deaths and one lost to follow - up). This study evaluated implant cost, familiarity of surgeon with procedure, surgical exposure, operation time, blood loss and blood transfusion, wound related complication, implant related complication, reoperation and mortality. Final outcome assessed on basis of kyle' criteria in all groups.

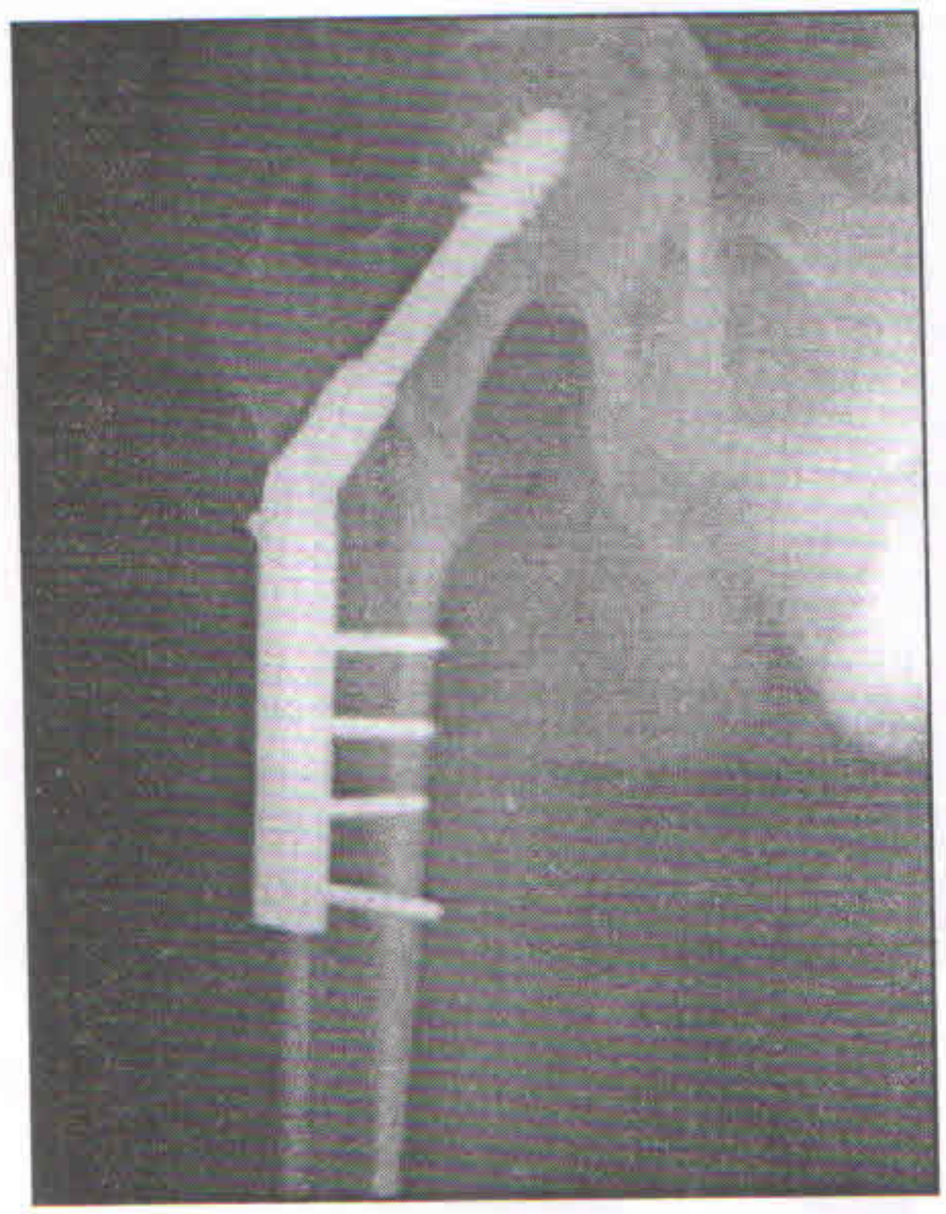
Table 2
Comparative results among groups

	Group 1 (DHS) 32	Group 2 (PFN) 38	Group 3 (PFLCP) 12	Group 4 (DCS) 16
Implant cost	Less expensive	Two to four times expensive	Five to seven times expensive	Same as DHS
Familiarity with procedure	More familiar	Less familiar	Less familiar	More familiar
Surgical exposure	Large exposure, more tissue handling	Less exposure, less tissue handling	Large exposure, less tissue handling	Large exposure, more tissue handling
Operation time	1 hour	1. 30 hours	2 hours	1. 15 hours
Blood loss and transfusion	46.88% (15/32)	31.58% (12/38)	33.33% (4/12)	56.25% (9/16)
Wound complication	21.90% (7/32)	10.50% (4/38)	16.67% (2/12)	18.75% (3/16)
Reoperation	18.52% (5/27)	8.82% (3/34)	10.0% (1/10)	38.46% (5/13)
Mortality	15.63% (5/32)	7.89% (3/38)	16.67% (2/12)	12.5% (2/16)
Clinical Outcome	74.07%	91.18%	80.0%	61.54%

Table 3
Final Outcome

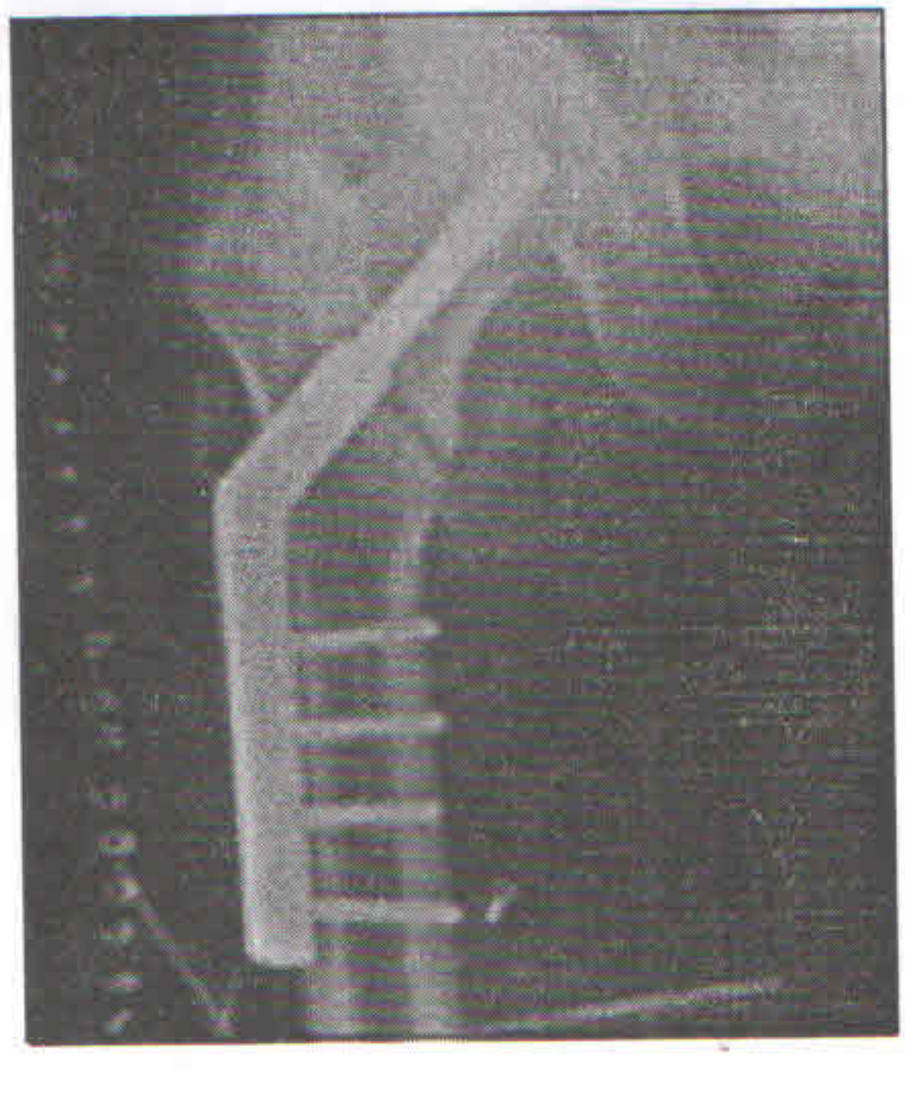
	Group 1 DHS	Group 2 PFN	Group 3 PFLCP	Group 4 DCS	Total
Total follow. pts	27 (32-5)	34 (38-4)	10 (12-2)	13 (16-3)	84 (98-14)
Excellent	6	13	3	4	26
Good	12	14	5	2	33
Fair	2	4	0	2	8
Poor	7	3	2	5	17

Pre op Xray



Post op Xray

Pre op Xray



Post op Xray

Pre op Xray

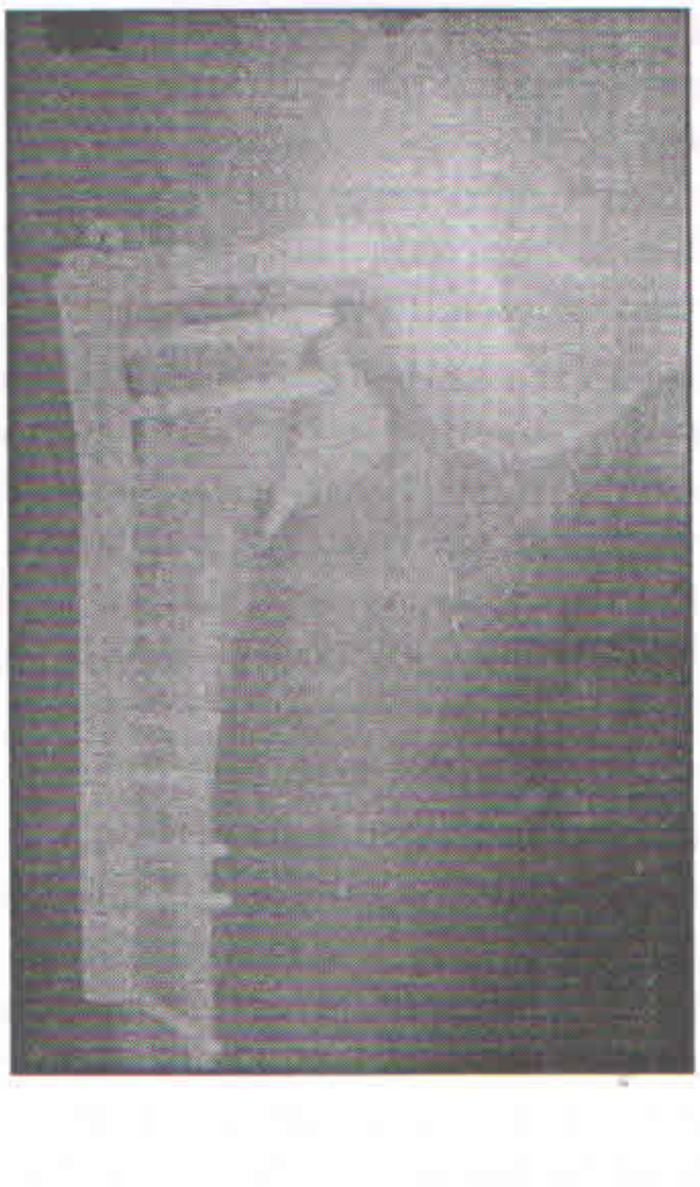
Post op Xray AP view

Post op Xray Lat. View

Pre op Xray

Post op Xray

PFLCP



DCS

3.1 Implant cost : Implant cost were estimated to be two- four times higher for group II (PFN), five -seven times higher for group III (PFLCP) as compare to other groups. Total operation cost increased significantly in group II and group III which was sensitive (p value < 0.05).

3.2 Familiarity with the procedure : DHS has been the gold standard implant in the treatment of extracapsular hip fractures. Surgeon are using it since very long time so easy to use by everyone. PFN was introduced in 1998 so some surgeon are using it. PFLCP also introduced too late for treating this kind of fractures in elderly so only few surgeons are habitat to use it. Surgeons are more familiar with DHS/DCS rather than PFN or PFLCP.

3.3 Surgical exposure : DHS/PFLCP/DCS require usually a longer incision with more tissue handling and soft tissue damage with more blood loss and wound complication as compared to PFN.

3.4 Operation time : There were 98 fractures included, 38 patients with DHS fixation, 32 patients with PFN, 12 patients with PFLCP fixation and 16 patients with DCS fixation. Group I(DHS) taken less operaton time(see Table 2) from skin incision to skin closure as compared with other groups.

3.5 Blood loss and blood transfusion : Blood loss was found to be more in group I (DHS) and IV (DCS) due to large tissue exposure, more tissue handling, long incision and more soft tissue injuries as compare to group III (PFLCP). No significant difference in the amount of blood transfusion between group II and III was found (see Table 2).

3.6 Wound related complication : Wound complications including wound infection, delayed healing, hematoma and drainage were documented in 16 patients out of 98 patients (Table 2). Minimal wound related complication wereobserved in group II which was 10.50% and considered for PFN fixation.

3.7 Mortality : Out of total pateints, 12 patients were lost follow up due to deaths. Maximal percentage of death was observed in group III (PFLCP) which was 16.67% and minimal in group II (PFN) which was 7.89 % (p value < 0.05). (see Table 2)

3.8 Reoperation : The reasons for reoperation mainly were cut out of screw from femoral head, redisplacement of fracture, breakage of implant and nonunion. The average follow-up duration was 7.5 months (3-12 months). Maximum reoperation done in group IV which was 38.46% and minimum in group II which was 8.82%. (see Table 2)

3.9 Clinical analysis : The final clinical outcome observed at final follow up on the basis of kyle's criteria in all groups. Clinical outcome was maximum 91.18% was observed in group II (PFN) and minimum was 61.54% in group IV (DCS) (see Table 3).

DISCUSSION

While a wide range of proximal femoral fracture fixation devices have been employed over the years, the sliding hip screw and side plate, which has a blunt end to decrease femoral head penetration and screw threads to increase head purchase, became the implant of choice for fixation of intertrochanteric fracture in the latter half of the twentieth century.[12,17-21] However, according to the study by Saarenpaa et. al,[22] Sliding Hip Screw used in the treatment of Unstable trochanteric fracture have a very high failure rate with a reoperation rate of 8.2% which is unacceptable in the present day scenario.

Antegrade intramedullary nailing of intertrochanteric fracture with use of short nail through which a large screw was inserted into the femoral neck and head for interlocking was introduced by Halder in the 1980s in the form of the Gamma nail,[9] This device was designed by Grosse and Kempf in Strasbourg, France. Early reports suggested some substantial advantage in association with this type of fixation, including a minimally invasive surgical technique, shortened

operating time, decreased blood loss, improved biomechanics, greater stability of fixation, earlier patient mobilization and short hospital stay.[23-26] The Proximal Femoral Nail system[27] (PFN), developed by AO/ASIF, has some major biomechanical innovation to overcome the previously mentioned limitation of the Gamma nail. In 2003, Christian Boldin et. al[28] in his study concluded that PFN nail can be applied with a smaller incision with minimal tissue handling for unstable trochanteric fractures. A longer full length version of the nail was also developed and used in our study to avoid peri-implant fracture.

Yang YY et al.,[29] reported that functional recovery of PFLCP was better than DHS, and complication are fewer than that of DHS and other Intramedullary fixation devices in the management of unstable fractures.

DCS has traditionally been used in the treatment of unstable extracapsular hip fracture. However, various studies using this implant have contradictory results. Haidukewych et al.[30] noted that the DCS performed significantly better than DHS in their series of patients with reverse oblique type of unstable proximal femoral fractures. However similar study by Sadowski et al.[31] on similar fracture pattern showed an inferior outcome with these (DHS) implants when compared with intramedullary nail.

Sliding compression hip screw have been directly compared with intramedullary fixation in many studies. The results have often been contradictory; for example some studies have demonstrated a longer operating time in association with nail fixation,[32-37] whereas others have been demonstrated a shorter operating time in association with nail fixation.[38,39] The only consistent differences found between the two fixation technique seem to be an increased rate of complications(particularly intraoperative and postoperative fractures) and a higher rate of reoperation in association with intramedullary nailing.[10,32,33,40-41]The PFN has been developed as an alternative to the Gamma nail, and it seems to be associated with a lower incidence of complication.[45] But in our study we found less reoperation rate(8.82%) along PFN group.

The optimal fixation device for extracapsular hip fracture is still controversial at present. Jones et al[46] compared the intramedullary nail (IMN), which involved gamma nail, intramedullary hip screw (IMHS), and PFN, with sliding hip screw for treatment of extracapsular proximal femoral fractures. They concluded that there was no statistically significant difference in the cut-out rate between the IMN and SHS while total failure rate and reoperation rate were greater with IMN. Parker and Handoll[47] also compared gamma and other cephalocondylic intramedullary nails with extramedullary implants for extracapsular hip fractures in adults. In their systematic review the author enrolled four studies which included PFN and Targon PF nail compared with SHS.

We enrolled studies of Pan et. al[48] and Pajarinen et. al[37] for analyzing blood loss and studies of Pan et. al,[48] Pajarinen[37] et. al, Parker et. al,[49] and Saudan et.al[50] for blood transfusion. A sensitive test was performed, which showed that, in blood transfusion, the two groups were still similar in their study. But in our study group I(PFN) and IV(DCS) have high percentage 46.88% and 56.25% respectively as compare to other group II(PFN) and III(PFLCP).

CONCLUSION

Optimal reduction of the fracture and positioning of the nail and screw, plate and screw remains of crucial importance and should be obtained at all times. A skilled surgeon may treat the demanding unstable extracapsular hip fracture with any type of fixation device, as long as he or she remembers that the fixation devices will never make up for surgical failure. Therefore improvements of treatment of extracapsular hip fracture will predominantly be in the hands of surgeon, rather than in hands of industry. Although the high drop out rate may bias the outcome when the overall recovery from the operation is assessed, it does not change the interpretation of the result when the four methods are compared, if the rate is

not much differentiating between groups.

The purpose of this study was to compare the results four implants in treatment of extracapsular hip fractures in elderly. We have concluded in our study that group II (PFN) was good and effective because it reduces surgical exposure, blood loss during operation, wound complication, mortality, chances of reoperation with highest clinical outcome.

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RECONSTRUCTION OF FEMUR NECK IN NEGLECTED STAGE 3 FRACTURES IN YOUNG PATIENTS. WITH DOUBLE FREE FIBULAR GRAFTS

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ABSTRACT

This case series reports the functional out come after femur neck reconstruction in young patients after neglected femur neck fracture with free fibular grafts.

7 young patients of age 14-21 yrs with stage 3 (Sandhu et al) neglected femur neck fracture were treated with double free fibular grafting and DHS fixation. On long term follow ups all united well with good reconstruction and radiological consolidation of femoral neck on 12 months follow up with good to excellent Harris hip score. 1 patient presented with excellent, 5 with good and 1 with fair result.

This series is presented to further validate free fibular grafting in neglected femoral neck fractures in young patients, particularly those with large bone gap and to strengthen the available database.

Key words: femoral neck, neglected fracture, young, free fibular graft.

INTRODUCTION

Neglected femoral neck fracture in young patient is one of the most challenging situations among the treating surgeons. It is not rare to see such patients in our country. Most of these are from rural and semi urban areas with economic restraints and requirement of ability to squat and sit crossed leg. These patients require salvage of their own femoral head.

Femoral neck fracture is assigned neglected when more than 21 days old. Various factors come into play in planning treatment of such patients.

1. Replacement arthroplasty is not the preferred treatment in young ones, though reserved as secondary salvage procedure. High physical requirements defer the use of artificial implant at young age, preservation of own hip joint is desirable.
2. While planning fixation, following changes make planning difficult-
   - Neck getting resorbed over time creating gap at fracture site.
   - Fracture surface becomes smooth obscuring the guiding marks of reduction.
   - With absorption of bone proximal fragment becomes smaller (especially if the fracture had been trans-cervical or sub-capital) making fixation difficult.
   - Anticipated vascularity of head.

Based on these changes the fracture can be allocated to one of the following 3 stages (Sandhu et al).

Stage I

(a) Fracture surfaces are still irregular (Fresh)

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(b) The size of proximal fragment is 2.5 cm or more

(c) Gap between the fragments is 1 cm or less

(d) Head of the femur is viable. There is no sign of avascular necrosis on X-ray picture or MRI or CT Scan.

Stage II

(a) Fracture surfaces are smoothened out

(b) The size of the proximal fragment is 2.5 cm or more

(c) The gap between the fragments is more than 1 cm but less than 2.5 cm

(d) The head of the femur is viable.

If either of the feature a or c is present it is allocated to stage II.

Stage III

(a) Fracture surfaces are smoothened out

(b) The size of the proximal fragment is less than 2.5 cms

(c) The gap between the fragments is more than 2.5 cms

(d) The head of the femur shows signs of avascular necrosis

If any of the feature b, c or d is present the fracture is allocated to stage III.

Most challenging situation is met with absorption of femur neck with delayed presentation when virtually no neck is left.

Femoral neck fractures presenting late with large gap at fracture site should be treated as per the principles for any other site i. e. bone grafting and stable fixation. Cancellous Iliac grafts are not suitable for this particular site as synovial fluid tend to dissolve the soft grafts. Fixation methods like multiple screws or DHS have additional consideration like small size of head, large gap at fracture site, and poor bone stock of both proximal and distal fragments and so, fixation requires additional strengthening.

Free fibular graft has been widely studied as a method to introduce both structural support and graft framework in neglected femoral neck fractures. The free fibular graft has the advantage of being technically simple with minimal donor site morbidity, providing additional rotational stability because of its trephine shape and ease of passing it over a guide wire as it has medullary canal.

This case report included young (age 14-21 yr) patients of neglected femoral neck fractures with absorbed neck (bone gap being > 2.5cm). 6 patients were of paediatric age group (14-16 yr) and 1 adult (21 yr) who was a case of gunshot injury of hip.

We used two free fibular strut grafts with DHS to achieve good stability and adequate bone to fill the fracture area.

OPERATIVE TECHNIQUE

Patient positioned on fracture table. Anatomical reduction was not possible due to large bone gap, hence alignment of fracture fragments was done maintaining limb length and valgus angle in AP view and ante-version and alignment in lateral view under fluoroscopic control.

8 cm long lateral incision given starting from tip of greater trochanter and distally. Base of greater trochanter exposed with splitting of fascia and muscles. Three guide wire passed from base of trochanter at 135° passing through neck into the head and transfixing to acetabular wall (to get rotational stability as head fragment is usually inadequate for good hold of wires). First wire is placed centrally in both AP and lateral view. Second wire is placed proximal and parallel to first and third wire, distal and parallel to first wire. Reaming with triple reamer done over first wire appropriate size DHS screw passed over this wire.

Length of required fibular struts was calculated by measuring the protruding ends of second and third wires (and deducting from total length). Calculated length of fibula removed from the ipsilateral leg anddivided to make two struts of appropriate length. Reaming with 10 mm drill done over second and third wires, up to subchondral bone of head and fibular struts passed over respective wires and gently tapped until they

engage into subchondral bone. Any protruding length of struts trimmed out. 135° barrel plate placed over hip screw and fixed to shaft. Guide wires removed and trochanteric end of fibular strut is secured with small cancellous screw / k-wire and wound closed.

Absolute non weight bearing was advised for 3 weeks then non weight bearing crutch walking started. Weight bearing was permitted only after radiological consolidation of grafts.

Patients were reviewed at 3 weeks and 2, 4, 6, 8 and 12 months.

RESULT

Out of all 7 patients treated in this way, all healed well with consolidation and incorporation of fibular grafts at 12 month follow up. Out of 7, one had excellent functional outcome while 5 had good and one (with most delayed presentation) had fair functional result. (Table).

Patient No.	Age (yr.)	Sex	Duration of fracture, At presentation	Harris hip score (at 12 mth. Post-op)	Grade
1	14	M	4 mth	85.45	Good
2	14	F	7 ½ mth	72.9	Fair
3	16	F	2 ½ mth	92.65	Excellent
4	12	F	3 mth	87.45	Good
5	15	M	5 mth	82.9	Good
6	16	F	4 ½ mth	83.45	Good
7	21	M	1 ½ mth	85.7	Good

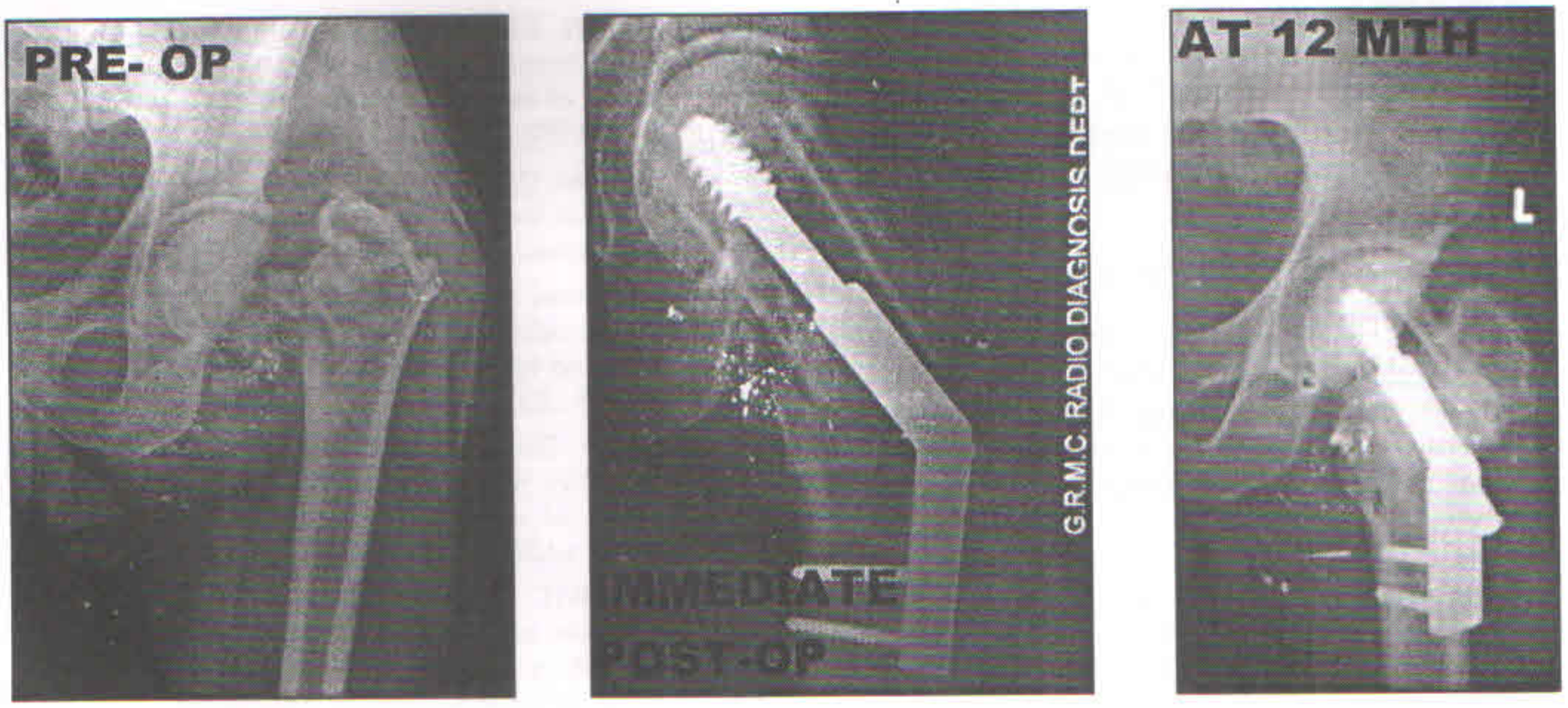

Figure 1 : Xray of a patient with neglected fracture of femur neck treated with osteosynthesis and double fibula

DISCUSSION

Neglected femoral neck fracture in young ones is difficult situation with very limited treatment options and unpredictable outcome. Furthermore, we lack in any definitive guideline to surgically treat young particularly paediatric

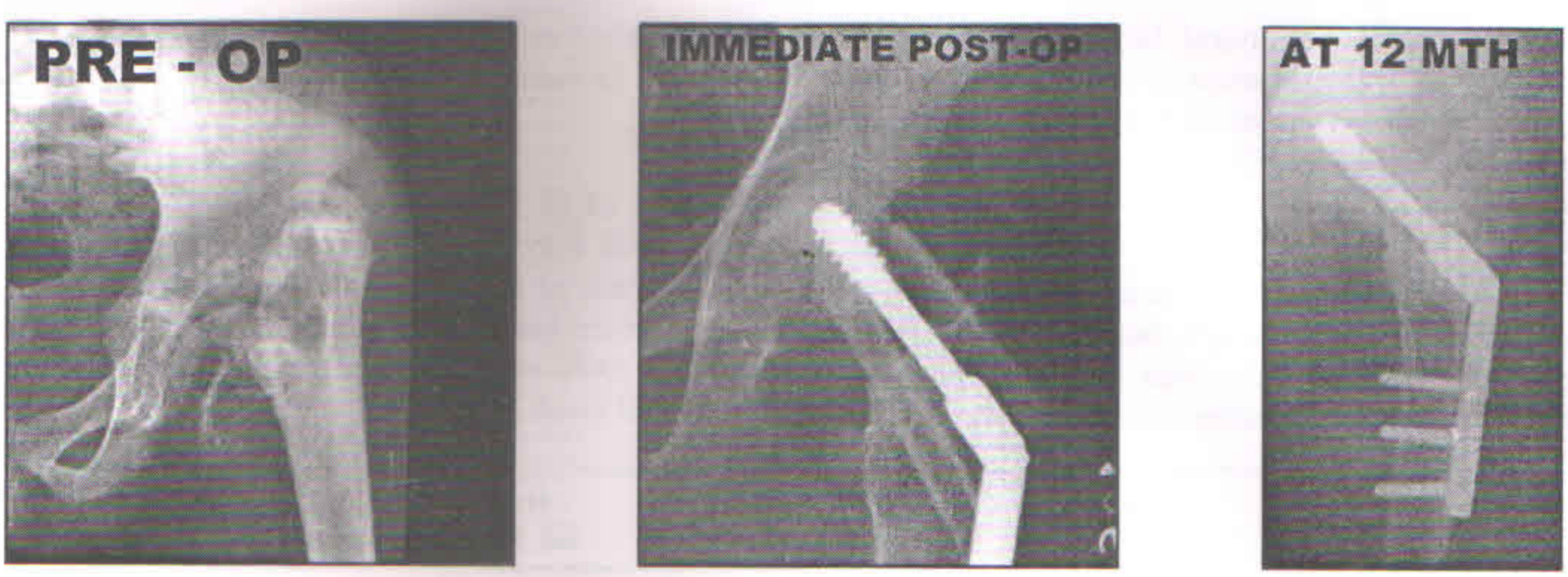

Figure 2 : Xray of a patient with neglected fracture of femur neck treated with osteosynthesis and double fibula

patients with stage 3 neglected fracture neck of femur. Free fibular grafting and internal fixation is a dependable procedure to treat such fractures. The procedure does not require special expertise and does not involve increased morbidity.

Further follow ups are awaited in present case series and more number of such cases may definitely help us further to strengthen this method as definitive treatment strategy in stage 3 fracture neck of femur.

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COMPARISON OF TOTAL HIP ARTHROPLASTY PERFORMED WITH AND WITHOUT CEMENT

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ABSTRACT

Since the introduction of total hip arthroplasty both components of THA were commonly being cemented. There has always been a controversy regarding which one fixation method is superior between cemented and uncemented THA. Most of the literature shows that better clinical and functional outcome were obtained from cemented femoral fixation. Other studies (Keijot et al. 2011,)1 finds no significant difference between cemented and uncemented fixation. Till now no study has been able to draw conclusive result because conclusion was often limited to its own study method and result.

Background : The choice of optimal implant fixation in total hip replacement (THR) with or without cement has been the subject of much debate.

Materials & Methods : In this study, patients received either cemented or uncemented THA on the basis of prevalent current recommendations and patient's statistics. Assessment of functional results, complication, self reported quality of life assessed by Harris hip, WOMAC, SF-12 score preoperatively and at each follow-up. Postoperative follow-up done at 6 week, 6 month, 12 month, 18 month and then at 1year interval.

Results : Total 15 patients were evaluated upto final follow-up. In uncemented THA 62.5% of cases were in between 31-50 yrs (average age 33. 3 yrs) while in cemented group 57.2% cases were in 41 to 60 yrs (average age 39. 7 yrs) age. At 6 month follow up the mean Harris hip score for hips having cemented prosthesis was 86.38 ±6. 10 and at 1 year it was 94.5±3. 10 points; for the hips having uncemented prosthesis allowing ingrowth of bone it was 87. 26±6. 06 at 6 month and 92.33±5. 49 at 1 year. There was no significant difference between these two groups at 1 year (p value =0. 44). Mean WOMAC score for pre-operative patients in cemented and uncemented series was 42. 02±12. 07 and 41. 66±9. 26 respectively which increased to 88. 06±2. 88 and 81. 45±6. 08 at 6 month respectively. The WOMAC score for cemented series was 91. 58±2. 81 and for uncemented series it was 88. 66±3. 2 at 1 year of follow-up. Scores at 1 year were statistically not significant (p value=0.13). In SF-12 MCS score preoperative mean MCS score was 30.6 for cemented and 37.57 for uncemented group which increased to 50.85 and 57.02 respectively at 6 month follow-up. At 1 year mean MCS score for cemented series was 55. 24 and for uncemented series it was 53.28.

Conclusions : We couldn't find any significant difference between cemented & uncemented THA. No statistical significant difference found in our study. In the view of small sample size and short duration of follow up, this study needs to be analysed with other multicentric trials having large number of patients.

Key words : Cemented; total hip arthroplasty; uncemented

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INTRODUCTION

Total hip arthroplasty (THA) is one of the most successful orthopaedic procedures performed today. The femoral head (ball) articulates with the acetabulum (socket), allowing smooth range of motion and any condition that affects either of these structures can lead to deterioration in function. Pain continues to be the main reason patients choose joint replacement. Through understanding of the procedure and the anticipated outcome is an important part of the decision making process.

The comparative outcome, advantages and indications of cemented vs. uncemented fixation remain unsolved. The superiority of either fixation method has not been proved conclusively because of influences of confounding variables such as patient age, sex, weight and diagnosis. This problem further increased by type of implant, randomization methods, differences in study design, surgical approach, lack of a universal method to evaluate clinical results to draw a conclusive result. Most of the literature shows that better clinical and functional short term outcome were obtained from cemented femoral fixation. Other studies (Keijot et al. 2011)[1] finds no significant difference between cemented and uncemented fixation. In current time trend is to use uncemented fixation in younger population and cemented fixation in older age group. Till now no study has been able to draw conclusive result because conclusion was often limited to its own study method and result. We therefore compare cemented and uncemented total hip replacement to draw short term clinical and functional results using Harris hip, WOMAC, SF-12 scores.

MATERIALS AND METHODS

Present work has been conducted in department of orthopaedics, S. N. Medical College and Hospital, Agra, from April 2012 to march 2014. The cases have been selected among the patients attending emergency as well as outdoor patients aged 20-70 years including arthritis of various causes, avascular necrosis of femoral head, failed reconstruction, excluding patients having actives infection of hip joint or any other region, neuropathic joint, progressive osteopenia, inadequate bone mass, insufficiency of abductor musculature, elevated ESR.

Preoperative patient evaluation done by taking detailed history, general examination, examinationof spine, gait, both upper extremity and local examination where incision to be made, strength of the abductor musculature by the Trendelenburg Test. Skiagram of pelvis with both hip antero-posterior view in internal rotation of 15 degree with 15 degree abduction used for pre operativetemplating to select implant type and determining neck length. Taking into consideration all the above mentioned factors and, prevalent current recommendation (Cemented THA done in light weight, low activity level, more osteoporotic bone, elderly patients and uncemented THA done in heavy weight, high level of activity, with good bone quality young patients), patients were segregated into cemented &uncemented THA group. Patients were given general/ epidural / spinal anesthesia as per choice of anaesthetist, painting and draping done thereafter. We used Gibson's modification of moore's approach because it gives good exposure with a relatively small incision and less intra-operative blood loss.

In the postoperative period patients kept at physiotherapy and assisted walking regime. At each follow-up results measured in both cemented and uncemented cases with Harris hip score, WOMAC score, SF-12 score done at six week postoperatively, 6 month, 12 month 18 month and then at 1year interval.

RESULTS

In uncemented THA 62.5% of cases were in between 31-50 yrs age while in cemented group 57.2% cases were in 41 to 60 yrs age. Average age incidence was 33.3 yrs in uncemented group and 39.7 yrs in cemented group (Table 1). In uncemented cases 50% of cases were followed up to 1 year or more (maximum up to 18 month) while in cemented cases 42.8% cases were followed up to 1 year or more (maximum up to 18 month), overall 46.7% cases were followed up to

1 year or more(maximum up to 18 month) (Table 2). At 6 month follow up the mean Harris hip score for hips having cemented prosthesis was 86.38±6. 10 and at 1 year it was 94.5±3. 10 points; for the hips having uncemented prosthesis allowing ingrowth of bone it was 87.26±6. 06 at 6 month and 92.33±5. 49 at 1 year. There was no significant difference between these two groups at 1 year (p value = 0.44) (Table 3). Mean WOMAC score for pre-operative patients in cemented and uncemented series was 42.02±12. 07 and 41.66±9.26 respectively which increased to 88.06±2.88 and 81.45±6.08 at 6 month respectively. The WOMAC score for cemented series was 91.58±2.81 and for uncemented series it was 88. 66±3.2 at 1 year of follow-up. Scores at 1 year were statistically not significant (p value=0.13) (Table 4). In SF-12 scores preoperative mean PCS score was 23.57 for cemented and 24.67 for uncemented group which increased to 43 and 39.16 respectively at 6 month follow-up. At 1 year mean PCS score for cemented series was 50.09 and for uncemented series it was 45.4 which also remain almost at these values at 18 month follow up with not much difference. In SF-12 MCS score preoperative mean MCS score was 30. 6 for cemented and 37.57 for uncemented group which increased to 50.85 and 57.02 respectively at 6 month follow-up. At 1 year mean MCS score for cemented series was 55.24 and for uncemented series it was 53.28. The PCS & MCS scores in both series shows constant increase and the results does not show significant difference they are comparable at 1 year follow-up (Table 5). During surgery in cemented group splitting of calcar occurred in 1 (14.28%) case, during postoperative period 1 (12.5%) cases for deep vein thrombosis in uncemented group and 1 (14.28%) case in cemented group found (Table 6). In cemented series 14.28% patients had anterior thigh pain at 6 months and 14.28% patients at 1 year while in uncemented series there are 25.0% patients had anterior thigh pain at 6 month and 12.5% patients had at 1 year (Table 7).

Table 1
Age incidence

Age group•	Uncemented No. of cases	%	Cemented No. of cases	%	Total No. of cases	%
20-30	3	37.5%	2	28.6%	5	33.3%
31-40	3	37.5%	1	14.2%	4	26.7%
41-50	2	25.0%	2	28.6%	4	26.7%
51-60	0	0.0%	2	28.6%	2	13.3%
Total	**8**	**100%**	**7**	**100%**	**15**	**100%**
Average age (yrs)	**33.3**		**39.7**			

Table 2
Duration of followup

Duration months	Uncemented No. of cases	%	Cemented No. of cases	%	Total No. of cases	%
6 weeks	0	0.0%	2	28.6%	2	13.3%
6 week - 6 month	0	0.0%	1	14.3%	1	6.7%
6 - 12 month	4	50.0%	1	14.3%	5	33.3%
12-18 month	4	50.0%	3	42.8%	7	46.7%

Table 3
Harris hip score (Mean)

Groups	Pre-op	6 weeks	6 months	12 months	18 months
Cemented	33.75	55.65	86.38	94.5	89.83
Uncemented	36.44	62.98	87.26	92.3	93.76

Table 4
Womac score (Mean)

Groups	Pre-op	6 weeks	6 months	12 months	18 months
Cemented	42.02	67.22	88.06	91.58	89.37
Uncemented	41.66	63.47	81.45	88.66	90.18

Table 5
SF-12 Score (Mean)

Groups	Pre-op		6 weeks		6 months		12 months		18 months	
	PCS	MCS	PCS	MCS	PCS	MCS	PCS	MCS	PCS	MCS
Cemented	23.57	30.6	31.8	44.39	43	50.85	50.9	55.24	49.5	49.2
Uncemented	24.67	37.57	33.62	31 95	39.16	57.02	45.4	53.28	47.56	53.58

Table 6
Operative & post-operative complications

Complications	Cases in uncemented group	Cases in cemented group
During surgery		
Cardiac arrhythmias	0	0
Fracture femur	0	0
Splitting of calcar	0	1 (14.28%)
Sciatic nerve injury	0	0
Post operative		
Pulmonary embolism	0	0
Shock	0	0
Superficial and deep wound sepsis	0	0
Dislocation of prosthesis	0	0
Sinking of prosthesis	0	0
Implant/cement failure	0	0
Deep vein thrombosis	1 (12.5%)	1 (14.28%)
Death	0	0

Table 7
Pain in thigh

Group	No. of cases	6 months No.	6 months %	1 year No.	1 year %
Cemented	7	1	14.28	1	14.28
Uncemented	8	2	25.0	1	12.5

DISCUSSION

DYT Fong et al. 2005[2] in their review article reported that cemented femoral component provide superior short term outcome in pain reduction, thigh pain, hip scores, walking with support and gait analysis. Chiu, KY and Fong DY et al 2005[2] performed a systematic literature review of 29 articles. Most of the articles showed that better clinical and functional short term outcome obtained from cemented femoral fixation than uncemented fixation. These results were less clear for mid term clinical outcome though, in general cemented fixation appeared to show a superior clinical outcome. This study recommended cemented fixation for duration of short term and mid term but other study done by Andreas Laupasis et al.[3] (on two hundred and fifty patients who received a Mallory-Head total hip prosthesis) shows that all health-related quality-of-life

measures improved postoperatively in both groups. In our study both type of fixation have excellent results with no difference at a shorter follow-up. In our study results at 1 year are statistically inconclusive but patients in cemented group have better Harris hip scores than uncemented group.

With respect to pain in thigh most studies reported increased pain for uncemented prostheses (Door 1986[4], Emery 1991[5], Harper 1994, Sonne - Holm 1982[6]). Three studies reported better mobility in cemented group (Door 1986, Emery 1991, Sonne - Holm 1982) but Santini 2005[7] not found difference in walking in either group. Callaghan et al[8] reported in uncemented series pain in 18% cases at 1 year and 12% in 2 year. Malachau and Herberts et al.[9] reported 18% cases having pain at 1 year in uncemented cases. Engh et al.[10] reported pain in thigh in 14% cases at 2 year in uncemented series. In our study it was 12.5% in uncemented cases at 1 year. The variation in these incidences may be due to differences in operative technique or in the way how the pain was perceived and reported by the patients. They also stated that in all these studies pain tended to decrease with time, not caused disability and was generally associated with prolonged and unusual activity. The thigh pain reported by patients in this study has same characters and tended to decrease with time. Total hip replacement after perthe's disease done by Pietrzak K et al.[11] showed that total hip replacement allow regaining good lower limb function. The results of THR by using WOMAC score system were good regardless of the type of prosthesis and the type of fixation. Study done by Yim SJ et al 12 to evaluate the results of ceramic-on-ceramic bearing primary total hip arthroplasty (THA) using cemented and cementless femoral stems showed that results on mean WOMAC score were superior in cemented stems. In study done by Andreas Laupasis et al.[3] when outcome assessed in respect to health-related quality of life by WOMAC score at three, six, and twelve months and yearly thereafter it improved postoperatively in both groups. In our study at 1 year follow-up WOMAC score was 91. 58 in cemented and 88. 66 in uncemented series (p=. 13) These results show no significant differences in both group at a short term follow up of 1 year.

A study "Surgical approach and patient-reported outcomes after total hip replacement" done by Alison J. Smith, Vikki Wylde, et al 13between April 2004 and April 2006, evaluated 1, 401 patients who had a primary THR done 3 year earlier the study. At the time of the postal survey, 911 patients returned a completed questionnaire. Hip pain and functionwere assessed using the disease-specific WOMACosteoarthritis index; in addition mental health status was measuredwith the SF-12 mental component summary (MCS). In this study SF12 (MCS) score was 49.1 at 3 year follow up. In our study preoperative mean MCS score was 30.6 for cemented and 37.57 for uncemented group which increased to 50.85 and 57.02 respectively at 6 month follow-up. At 1 year mean MCS score for cemented series was 55.24 and for uncemented series it was 53.28. The MCS scores of our study in both series show constant increase with time.

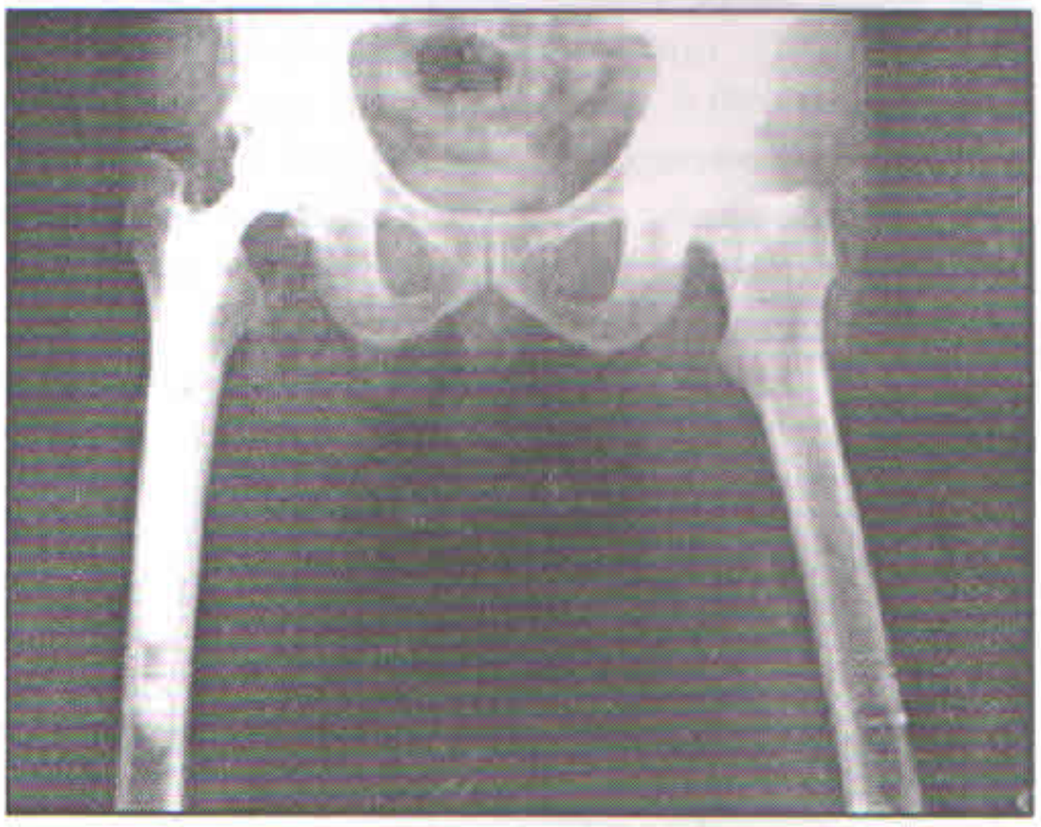
Case 1

(Uncemented)

6 months post-op

12 months post-op

Case 2 (Cemented)



12 months

18 months

CONCLUSION

Overall result were better in cemented total hip replacement in terms of

- Functional quality of life in short term period
- Early weight bearing
- Less incidence of thigh pain

but these are not statistically significant. This was a short term study so long term conclusions cannot be drawn at this stage. Our study cannot conclude that if cemented or uncemented prosthesis give better short term clinical and functional results than the other one.

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PEDICLE SCREW FIXATION OF TRAUMATIC THORACOLUMBAR SPINE FRACTURE - COMPARATIVE STUDY BETWEEN CONVENTIONAL AND COMPUTER ASSISTED NAVIGATION TECHNIQUE

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ABSTRACT

Background : Pedicle screw placement is a commonly used technique for posterior stabilization in the fracture of thoracolumbar spine. Incorrect placement of pedicle screw may adversely affect the reduction of spinal fracture and can lead to neurovascular injury, so the position of pedicle screws is critical in fixation of thoracolumbar and other spine fracture. Computer navigation technique has been applied as a means to improve the accuracy of the pedicle screw placement.

Method : Computed Tomographic (CT) based image guided navigation system and Conventional C-ARM were used for pedicle screw insertion. The accuracy of the pedicle screw placement was analyzed according to 'Heary Classification For Pedicle Screw Malplacement' with a review of postoperative radiograph and CT scan image.

Result : Under the guidance of CT based navigation 52 pedicle screws were inserted, out of which 48 screws (92.32%) shows no breach, 03 screws (5.76%) shows lateral breach, 01 screw (1.92%) shows anterior breach of the cortex and medial perforation of screw was nil whereas in 52 pedicle screws inserted by conventional technique, 44 screws (84.63%) shows no breach of the cortex, 04 screws (7.69%) shows lateral breach, 03 screws (5.76%) shows anterior breach of vertebral body and 01 screws (1.92%) shows medial pedicle cortex breach.

Conclusion : Pedicle screw fixation byfree hand technique in conventional method will be safe and accurate when it is in the hands of an experienced surgeon. Computer Navigation technique increases the accuracy of pedicle screw placement, with negligible intra-operative radiation exposure.

Key words : Pedicle screw, computer navigation, thoracolumbar spine

INTRODUCTION

The thoracolumbar injuries are the most common spinal injuries occurring due to fall from height, road traffic accident and sports injuries. Spine injuries are reported to occur in approximately 6% of trauma patient. The goal of the treatment of the unstable thoracolumbar injuries is neural decompression, while providing stable internal fixation over the least number of spinal segments. The pedicle screw fixation has been commonly used for spinal stabilization in spine surgery. The biomechanical advantage of transpedicular screw fixation for spinal fracture includes three-column control of vertebral segments and fixation of vertebral segment in the absence of posterior elements. Screws are passed one level above and one level below the fractured vertebra via posterior approach. Incorrect placement of pedicle screw may adversely affect the reduction of spinal fracture and can lead to neurovascular injury, so the position of pedicle screws is critical in fixation of thoracolumbar and other spine fracture.

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Figure 1 : Computer navigation system

Spinal Navigation uses computer vision technology to plan and guide surgical interventions (Fig. 1). Current software can use either a 2-D or 3-D image data set acquired intraoperatively by a fluoroscopy monitor high resolution computer tomography (CT) scanner. Navigation system requires a pre-registration process which is critical in linking image data to spinal anatomy. This automatic registration process improves the anatomical localization accuracy and eliminates the need for manual point based or surface based registration.

Components of a Navigation System

Fixed reference point - For spine procedures affixing a fixed bony reference point on the patient is the initial step in registration in computer navigation system.

Tracking system - With optical tracking system, camera track the position of the instruments relative to the fixed reference point through an active or passive method. Active tracking entails LEDs on the instruments emitting light and passively involves the reflection of infrared light from the camera to the reflective spheres on instruments. This requires a direct line of view between the camera and the tracked instruments, to link surgical anatomy to the 3-D data set in the computer workstation.

Computer work station - After the intraoperative image data is obtained, this data set will be automatically uploaded to the computer workstation. A 3-D image is created in the workstation relative to the patient's anatomy.

MATERIAL AND METHOD

The study was conducted in the Department of Orthopaedics along with Department of Radio-diagnosis, DR. Bhim Rao Ambedkar Memorial Hospital Raipur. The objective wasto compare the accuracy of the pedicle screw fixation by conventional and computer navigation technique in traumatic thora-columbar spine fracture of patients more than 18 years of age. Spinal instability due to congenital abnormality and pathological fractures were excluded. Total 26 cases of fracture thoracolumbar spine were evaluated and managed during the study period. Patients were divided in two groups, 13 cases operated by conventional methodand 13 cases under navigation method, from Sep- 2012 to Sep- 2014.

Free-hand pedicle screw placement is essentially a blind technique that relies on correct identification of anatomical landmarks, surgeon experience and intra-operative assisted fluoroscopy that allows surgeons to view screw trajectory. Fluoroscopy often utilizes a C-arm to take AP and lateral images and is used so often during pedicle screw placement that it has been referred to as the "conventional" method. In the conventional group, screws were implanted according to the technique of Roy- Camille. The pedicles were identified i. e. the point of intersection of a horizontal line along the centre of transverse process and vertical line along the centre of superior facet. Under C-arm guidance, identification of the entry point was done. After opening the pedicle with awl, pilot hole is made with use of Kirschner wires and their positions were confirmed in both AP and lateral view in C-arm (Fig. 2). Pedicle probe is then inserted while rotating it clockwise and anticlockwise so that it enters the pedicle at the region of least resistance, which indicates the centre of the pedicle. After tapping, pedicle screws of appropriate lengths and size were selected and inserted and their placements were assessed by C-arm.

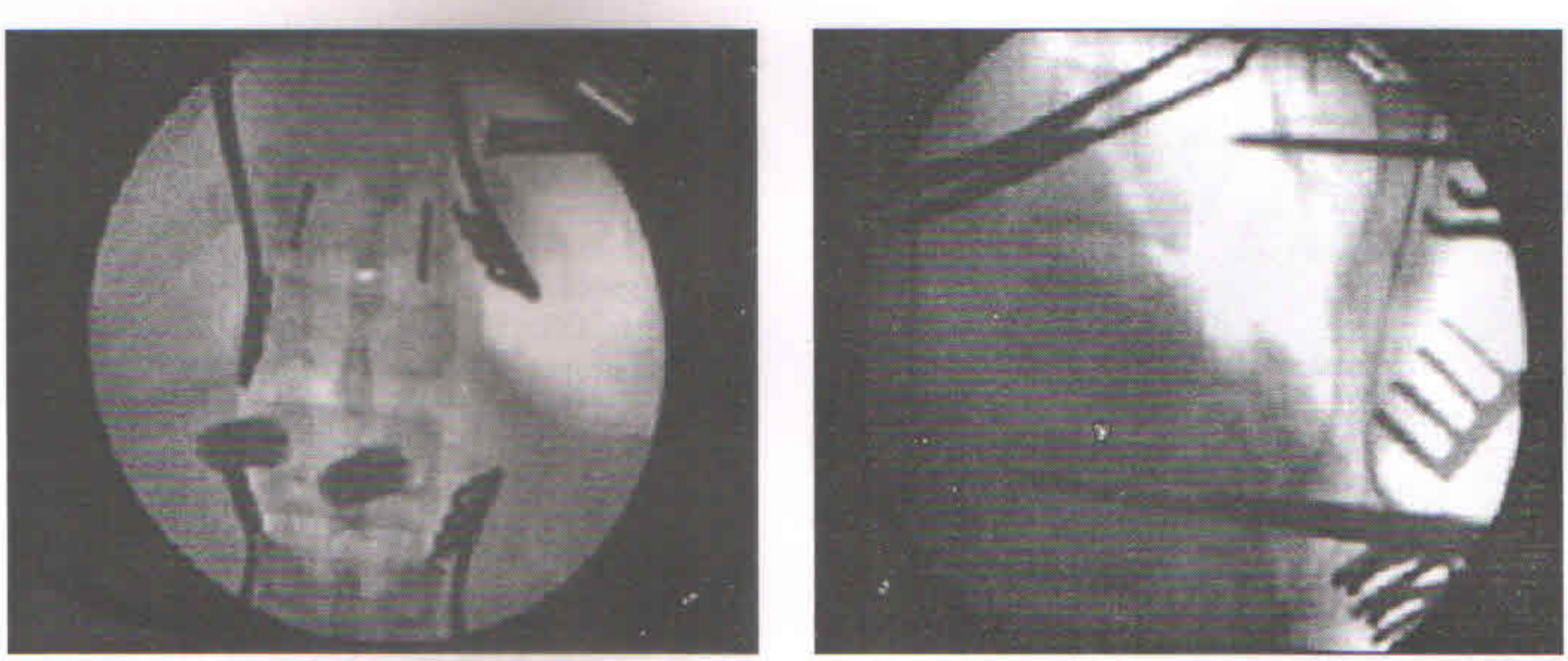


Figure 2 : Entry point of pedicle screw(AP & Lateral) under conventional fluoroscopic technique

In the navigation group, apart from MRI, preoperative 3D CT of spine with 2mm thick film was done which was then uploaded in navigation machine. In spinal navigation, patient registration is required to provide correlation between image displayed by the navigator and the operative anatomy (Fig. 3).

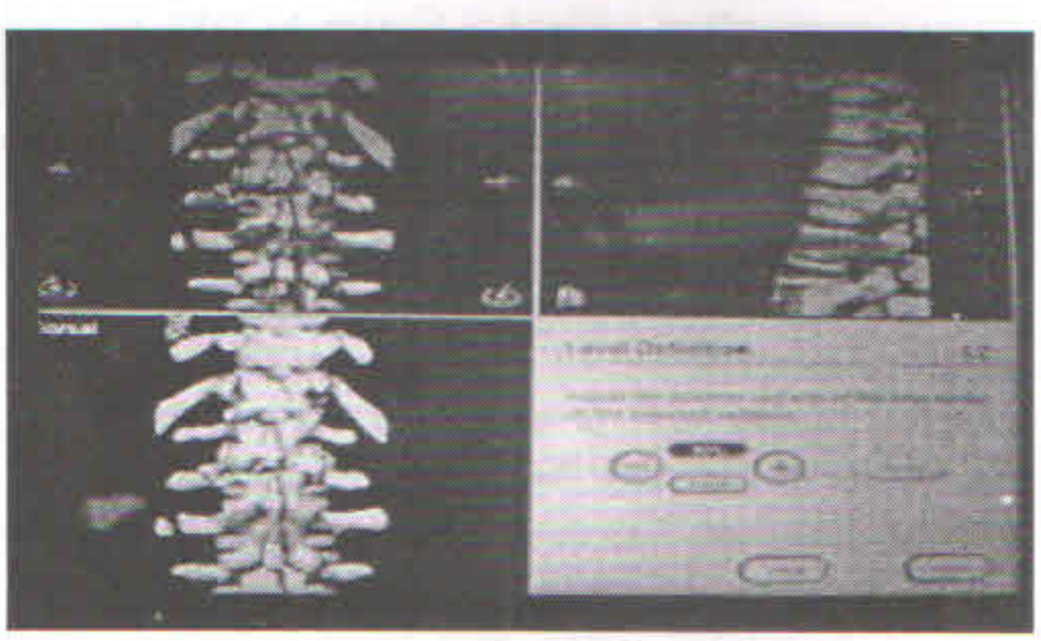


Figure 3 : 3D CT picture seen in computer navigator

Spinal reference clamp equipped with three infrared diodes was attached to the spinous process of the vertebra that was to be instrumented (Fig. 4). With the help of pointer equipped with two infrared diodes registration was done by touching the anatomical areas on the exposed spine which can be 4 points in paired registration and 12 points in unpaired registration. Accuracy was accepted when it was found to be less than 2mm and the virtual reality correspond to the surgical reality.

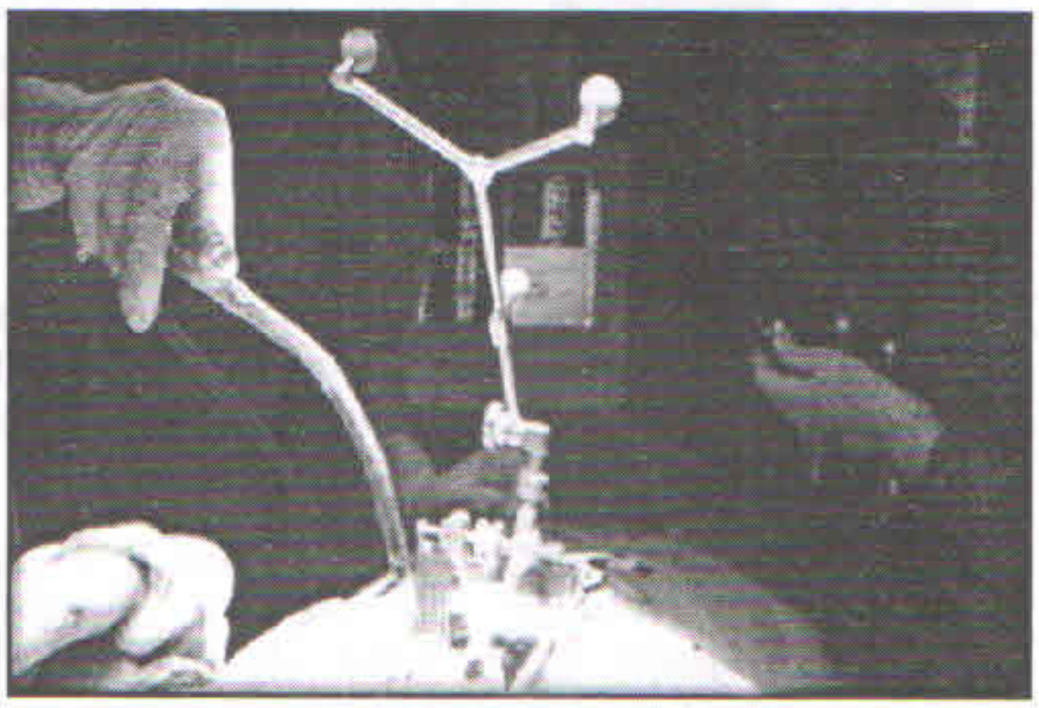


Figure 4 : X- clamp and Y- array for registration process

Entry point of the pedicle screws and the angle of insertion was determined in the monitor as it displays the axial, saggital and coronal image. The navigation monitor gives the exact entry site and accurate screw trajectory which guides the operating surgeon to correctly place the pedicle screw .in center of the pedicle (Fig. 5). Size and length of the screws were determined and placed as guided by the monitor (Fig. 6).

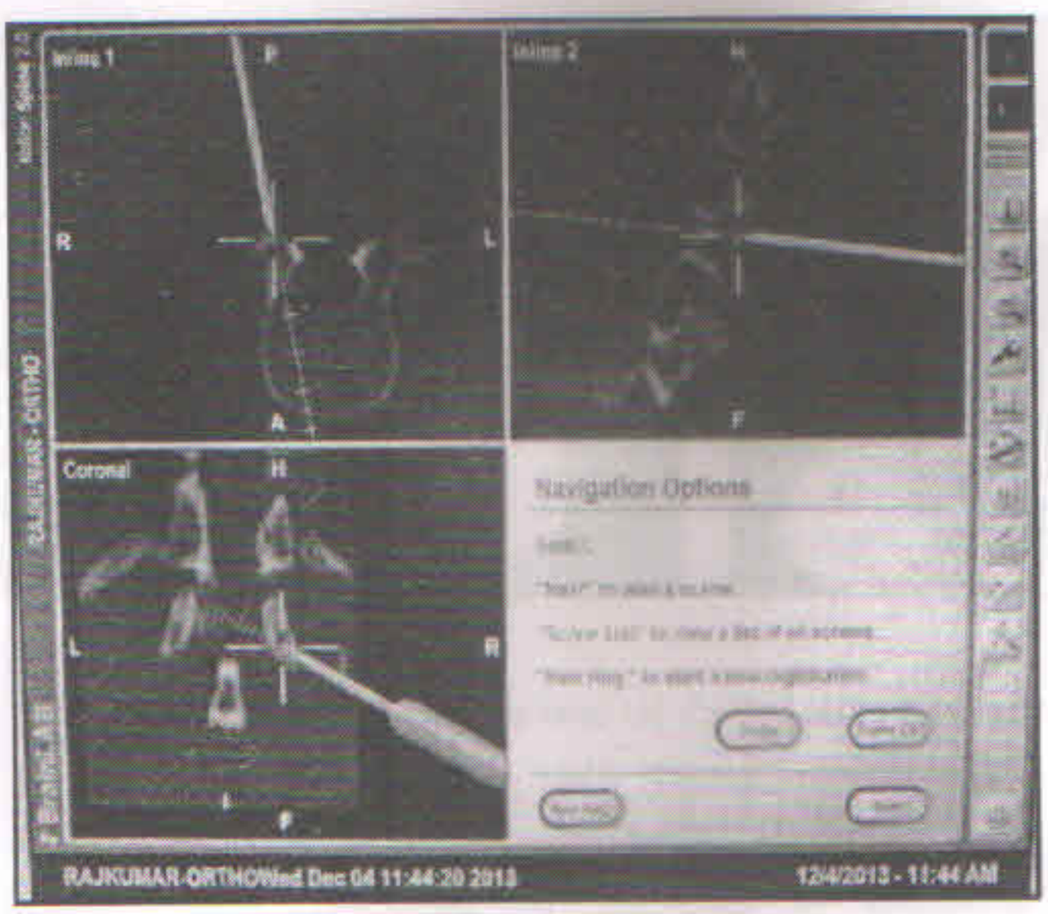


Figure 5 : Pedicle screw trajectory

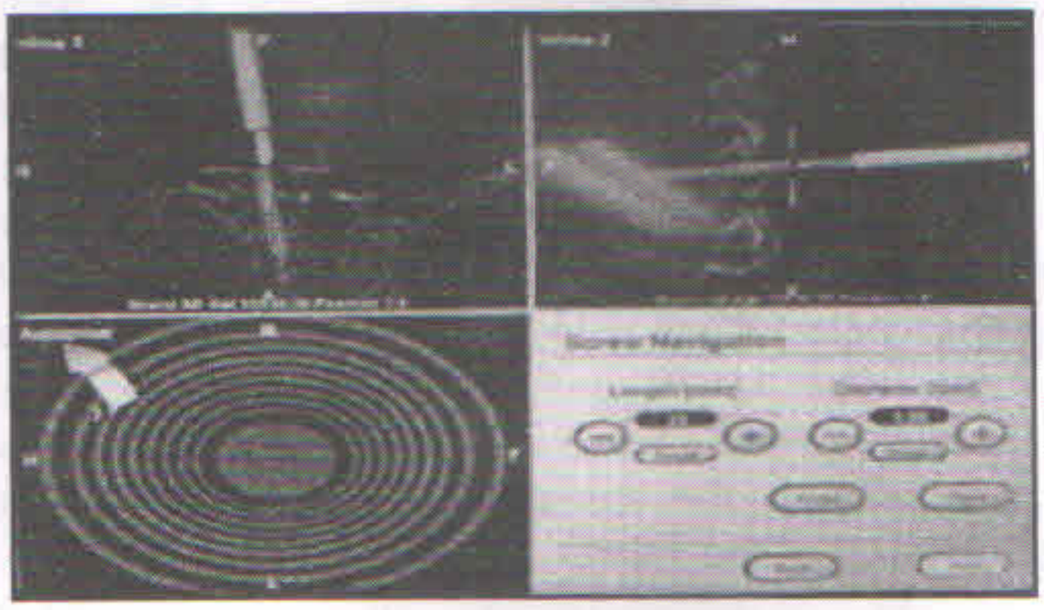


Figure 6 : Planning of screw length and size

A contoured appropriate sized connecting rod is placed into the slots of the pedicular screws. A rod pusher straight or curved can be used to push the connecting rod into implant slots. Using angled spreader, adequate distraction is applied for correction of deformity and the top screw is tightened with long hex screw driver and the assembly is constructed. In case of inappropriate accuracy of registration, the direction of pedicle screw can be misguided during surgery. All the patients were subjected to post-operative 3D CT scan to evaluate the position of screws.

RELEVANT ANATOMY OF PEDICLE

Pedicles are the strongest part of the vertebra and integrity of the pedicle is an important factor in the selection of the screw and its placement. Pedicles serve as the load transmitting struts between the neural arch and the vertebral body. Anteriorly they attach to superior portion of the lateral aspect of the posterior surface of the body. Posteriorly they are attached at the pars interarticularis. It consists of outer cortical bone and inner cancellous medulla. Pedicle isthmus width in transverse plane is widest at L5 pedicle level with a mean width of 18.0 mm and narrowest at T5 level with 4.5 mm mean width. In sagittal plane it is widest at T11 with a mean value of 17.4 mm and narrowest at T1 with a mean of 9.9 mm.

RELATIONSHIPS WITH IMPORTANT STRUCTURES

Pedicles are closely related to important structure on all sides. Knowing these structures helps the surgeon to avoid penetrating pedicle cortex during surgery.

(1) Medial to pedicles are epidural space, nerve root and dural sac.

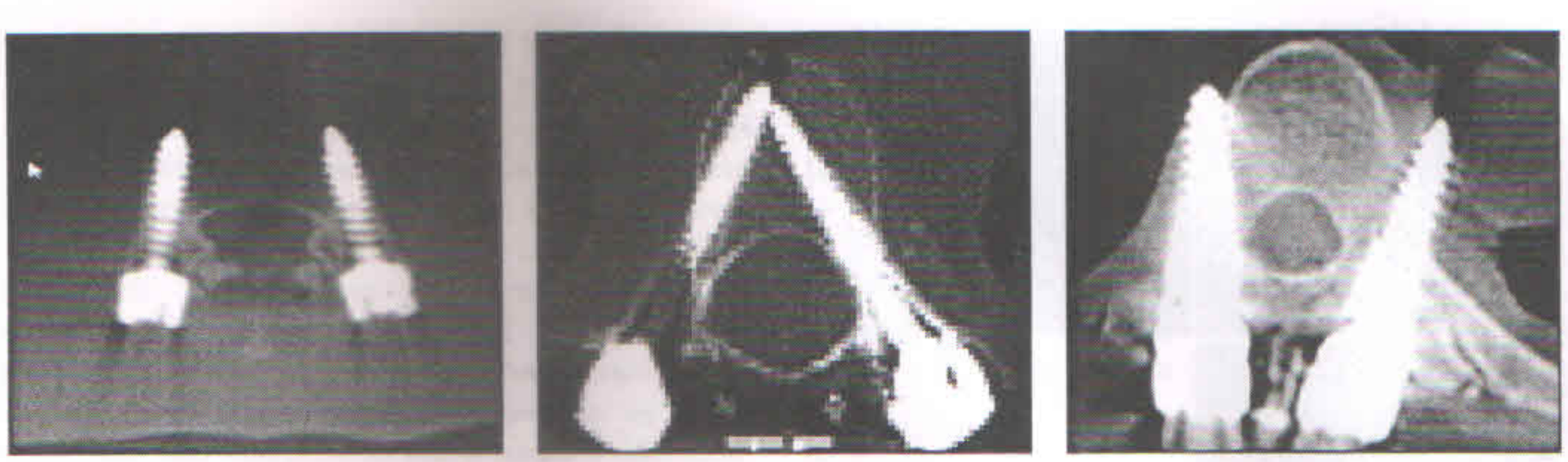
(2) Caudally exiting nerve root from the same level.

(3) Laterally and superiorly nerve root from the level above lies closely. At sacral level great vessels and their branches lie lateral to sacral ala.

(4) Anteriorly: At L3 and L4 levels, common iliac artery and veins lie directly anterior. In the sacral region variable sacral artery can lie directly anteriorly

Malplacement of pedicle screw as per Heary classification (Fig. 7)

Grade	Breach
1	no breach
2	lateral breach, screw tip within the vertebral body
3	lateral or anterior breach of screw tip
4	medial or inferior breach
5	breach that require revision



(a) (b) (c)

Figure 7 : Post operative CT Scan showing (a) no breach (b) medial breach (c) lateral breach of screw tip

RESULT

In our study most number of patients with thoracolumbar spine fractures were in the 2nd and 3rd decade of life with an average age of 36 year and 29 years in conventional and navigation method respectively. There was a significant male predominance with 69.23% male patients in conventional method and 84.61% male patientsin navigation method. Most common mode of injury wasfall from height, 84.61% in conventional method and 92.31% in navigation method. In our study we had 92.13% patients with AO Type A fractures, 7.69% with AO Type C fractures in both conventional and navigation method. Accuracy of pedicle screw placement was 84.61% in conventional method and 92.31% in navigation method. In conventional technique 15.39% of pedicle screws were malplaced; four screw breaching lateral cortex, three anterior pedicle cortex and one screw showing breach of medial pedicle cortex. In navigation technique, malplacement of pedicle screw was seen in 7.68%, three screws showing lateral pedicle cortex breachand tip of one screw lies anterior to the vertebral body; 7.69% patient were noted with wound infection in both navigation and conventional technique.

DISCUSSION

Pedicle screw insertion in thoracic spine is technically demanding as the pedicles are smaller and vary in size, intra-operative fluoroscopic imaging is difficult to perform and reliable anatomic entry points and screw trajectory are unavailable. Chang-Hyun Lee et alin their studystated that upper thoracic spine was the most frequent location of screw breach (10.8%). Lateral breach (2.3%) was more frequent than any other direction. The potential risks of screw misplacement which includes significant neurological damage to the spinal cord, aorta vena cava, iliac vessels and azygos veins, are higher because of the smaller size of the pedicle and its proximity to the spinal cord and neurovascular structures of the spine.

The conventional fluoroscopic-guided technique tends to be less expensive than navigation assisted technique. However, it has disadvantages of radiation exposure, rib cage interference and bulky apparatus. Rick C. et al in their study of computer-assisted Spinal Navigation Versus Serial Radiography and Operative Time for Posterior Spinal Fusion demonstrated that with modern spine image navigation techniques operative times are not longer, and in fact the times are less. Rampersaud et al. demonstrated that the dose of radiation exposure was 10-12 times higher for surgeons and patients in thoracolumbar pedicle screw placement as compared to other fluoroscopically assisted non-spinal musculoskeletal procedure. Fu et al have indicated the limitation of fluoroscopy as it does not provide axial plane view

and 5 out of 74 screws exhibited pedicle breach in axial plane with no violation in sagittal plane. So the conventional flouroscopy provides only the 2D image of complex 3D spine structure.

Table 1
Accuracy of pedicle screw in different studies

Author	Accuracy pedicle of screw
Carbone et al (conventional method)	86.5%
Schizas et al (conventional method)	88.3%
Gertzbein et al (conventional method)	71.9%
Vaccaro et al (conventional method)	60%
Yasser Allam et al (conventional method)	89.8%
Yasser Allam et al (navigation method)	99%
Chih yun fan chiang etal (navigation method)	97.1%
Waschke et al (navigation method)	95.5%
Present study	
Conventional method	84.61%
Navigation method	92.31%

In our study we had 84.61% accurately placed pedicle screw in conventional method whereas 92.31% accurately placed pedicle screw was noted in navigation method.

Table 2
Mal placement of screw (Heary classification)

Grade	Conventional method		Navigation method	
	No. of screws	Percent	No. of screws	Percent
Grade 1	44	(84.63%)	48	92.32%
Grade 2	04	(7.69%)	03	5.76%
Grade 3	03	(5.76%)	01	1.92%
Grade 4	01	(1.92%)	00	0%
Grade 5	00	(0%)	00	0%
Total	**52**	**(100%)**	**52**	**100%**

In our study we found that 15.39%of the screws were misplaced with lateral and medial pedicle cortex breach in conventional method. In navigation technique, 7.69% screws shows malplacement of pedicle screw with lateral pedicle cortex breach and no medial cortex breach. No neurologic complications were noted in the patient with misplacement of screws. Ashish Jaiswal et al found thatpostoperative CT scan revealed ideal placement of screws in 63 pedicles (94%), grade 1 cortical breaches (<2 mm) in 3 pedicles (4.5%) and grade 2 cortical breach (2-4 mm) in one pedicle (1.5%). Laine et al in their comparative study of 100 patients with posterior pedicle screw fixation found that pedicle perforation rate significantly decreased from 13.4% with conventional technique to 4.6% with computer assisted surgical system. Amiot et al proved that the navigation technique was significantly superior to conventional procedure as the perforation rate decreased from 15% (83 of 544 screws) to 5% (16 of 294). No revisions were required in computer assisted group while 7 patients undergone reoperation because of neurological problems.

CONCLUSION

Pedicle screw fixation byfree hand technique in conventional method using image intensifier will be safe and accurate when it is in the hands of an experienced surgeon. Computer navigation technique can increase the accuracy of pedicle screw placement up to 100 percent with nearly zero intra-operative radiation exposure as compared to conventional technique. The software of the navigationsystem and the surgical tools are easy to use and the computer generated 3D CT reconstruction provides critical anatomical information for pedicle screw placement. However, factors such as registration errors, hardware problems and of lack of technical familiarity may produce errors in screw placement. It is not recommended that the surgeon rely solely upon the virtual information from the navigation system without his own verification. Computer navigation

techniqueneeds further more training to get better result.

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PILON FRACTURE TREATED BY ILIZAROV

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ABSTRACT

Tibial pilon fracture remains one of the most challenging of intraarticular fracture. They constitute 1% of all lower limb fractures and 5-10% of tibial fractures. Patient of tibial pilon fracture attending orthopaedic OPD/Emergency in S.N. Medical College Agra were included in this study. Sixteen consecutive patients with complex tibial pilon fractures were treated with percutaneous reduction and fixation with the Ilizarov apparatus fromJuly 2009 to december 2011. Patient were called every fortnightly depending on desired objectives & patient cooperation & look for pin site infection, joint movement, degree of pain, weight bearing status, physiotherapy & x ray to know status of fracture site. Fixator removal was based on clinical & radiological Parameter & followed by patellar tendon bearing cast for 6-8 wks and physiotherapy. The result was assessed based on objective result & subjective result as advocated byOvadis and Beals, 1986. We conclude from study that ilizarov is an excellent minimally invasive method for management of pilon fractures. It not only obviates the need of open reduction and internal fixation, skeletal traction and plaster but also gives better results.

INTRODUCTION

Tibial pilon fracture remains one of the most challenging of intraarticular fracture. They constitute 1% of all lower limb fractures and 5-10% of tibial fractures.[1] For many years the fracture was not considered amenable to surgery and patient were forced to accept the usually poor result as a matter of bad luck because of the complex nature of the fracture. The long period of recumbency and severe socioeconomic burden imposed by these fractures necessitates the constant to develop the methods of treatment that reduce the period of hospitalization recumbency and ankle stiffness. with regard to successful treatment of pilon fracture, two challenges are faced by the orthopaedic surgeon first the articular anatomy must be restored to provide a chance for adequate ankle function, and second the soft tissue damage by the injury and surgery must heal without complication.

Limited internal fixation along with external fixation has become the favourite choice of many surgeons in cases of complex or open fractures of the tibial pilon.[2,3] However many surgeons prefer open reduction with rigid internal fixation of these fractures and report good clinical outcomes.[4]

The use of this ilizarov ring fixator allows anatomic joint construction without the soft tissue stripping required for plate application. Initial external fixator crosses the ankle joint there by limiting the joint motion necessary to optimally heal articular defect. More recently circular frames using tensioned transfixation wires in the distal fracture segment that do not cross the ankle have been introduced. These fractures allow for early joint motion. Early motion is thought to be an important factor in promoting cartilage nutrition and healing. Pin tract problem and loosening are much less compared to the conventional external fixator; the patient can start the function very early. Functioning

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is an integral part of ilizarov method of treatment.

MATERIAL AND METHOD

Patient of tibial pilon fracture attending orthopaedic OPD/Emergency in S.N. Medical College Agra were included in this study. Patients were subjected to routine clinical, radiological and specific investigations. Sixteen consecutive patients with complex tibial pilon fractures were treated with percutaneous reduction and fixation with the Ilizarov apparatus fromJuly 2009 to december 2011. Ten of the patients were males and six were female. The average age was 34±5.6 years (range 28-52 years). Thirteen patients had sustained leg trauma in road traffic accidents, while the remaining three had fallen from a height. Nine of the patients had open fractures (two types I, four type II, and three type IIIA). In cases of open fractures, the wound was debrided early, repeated after 48-72 h if necessary.

On the day of admission, all patients were put on calcaneal pin skeletal traction with elevation of the lower limb over a Bohler-Braun splint, and measures were taken to avoid oedema. Anteroposterior, mortise, and lateral view radiographs were carefully analysed, and paper tracing of the fracture fragments was done. The patients were operated after an average delay of 3-5 days once the tissue swelling started to subside.

SURGICAL TECHNIQUE

Under spinal/ general anaesthesia after cleaning and draping the limb was supported on a frame that allows movement of ankle and also helps in building the construct on the leg. The tibial shin and tuberosity, fibular head were marked. The 2 type of wire tips were used- by for diaphyseal region and trochar for metaphyseal region. Wire diameter of 1.5-1.8 mm inserted with a drill by a start stop technique to avoid heat necrosis infection and pin loosening.

Following principal were followed while inserting wire in the bone (9)-1. avoidance of neuro vascular bundle, skin care by taking a stab incision, avoidance of tendon tethering. Once the wire was drilled through both cortices the wire was hammered to prevent the soft tissue winding over the wire, the space between ring and limb was kept 2 cm on either side.

POST OP MANAGEMENT

Check x ray immediate post operatively and ensure for elevation of leg, toe movement, proper antibiotic coverage, and neurovascular status, inspect for tendon tethering, footplate to prevent equinus & wound dressing.

Allow mobilization with support, taught for daily wire care & method of compression & distraction after 7 days.

FOLLOW UP

Patient were called every fortnightly depending on desired objectives & patient cooperation & look for pin site infection, joint movement, degree of pain, weight bearing status, physiotherapy & x ray to know status of fracture site.

Fixator removal was based on clinical & radiological Parameter & followed by patellar tendon bearing cast for 6-8 wks and physiotherapy.

Table 1

Criteria for assessment of results (Ovadis and Beals, 1986) objective results

Rating	Ankle/subtalar motion	Tibiotalar alignment	Tibial shortening	Chronic swelling	Pronation supination	Equines deformity
Excellent	>75% normal	normal	None	None	normal	None
Good	50-75%	normal	None	minimal	normal	None
Fair	25-50%	<5" angulation	< 1 cm	moderate	Moderate decreased	None
Poor	<25%	>5" angulation	> 1 cm	Severe	Moderate decreased	Present

Table 2
Subjective results

Rating	Pain	Return to work	Recreational activity	Limited walking	Pain medication	Limp
excellent	None	Same work	Normal	No	None	None
Good	Mild	Same work	Mild modification	No	None	None
Fair	Moderate	Moderate	Significant modification	Yes	None narcotic	Occasional
Poor	Severe	Unable	None	No	Narcotic	Yes

RESULT

The result was assessed based on objective result & subjective result as advocated by Ovadis and Beals, 1986

Table 3
Objective Results

Rating	Ankle/subtalar motion	Tibiotalar alignment	Tibial shortening	Chronic swelling	Pronation supination	Equines deformity	No of cases
Excellent	>75% normal	Normal	None	None	Normal	None	13
Good	50-75%	Normal	None	Minimal	Normal	None	2
Fair	25-50%	<5° angulation	< 1 cm	Moderate	Moderate decreased	None	1
Poor	<25%	>5° angulation	> 1 cm	Severe	Moderate decreased	Present	0

Table 4
Subjective results

Rating	Pain	Return to work	Recreational activity	Limited walking	Pain medication	Limp	No. of cases
Excellent	None	Same work	Normal	No	None	None	13
Good	Mild	Same work	Mild modification	No	None	None	2
Fair	Moderate	Moderate	Significant modification	Yes	None narcotic	Occasional	1
Poor	Severe	Unable	None	No	Narcotic	Yes	0

All the fractures united without the need for secondary bone grafting. There was no neurovascular injury following Ilizarov fixation in any of the patients in this study. The patients demonstrated full weight bearing walking without crutches at an average of 21±4.4 weeks (range 18-26 weeks). The fixator was removed at an average of 26.6±4.2 weeks (range 20-34 weeks).

According to objective results, 13 patients were excellent result with more than 75% normal ankle /subtalar motion and normal tibio talar alignment & no tibial shortening, no chronic

swelling & normal pronation & supination & no equinus deformity. 2 patient having good objective results with 60% of normal ankle & subtalar motion, normal Tibiotalar alignment no tibial shortening & no chronic swelling & normal Pronation & supination & no equinus deformity. 1 patient having fair objective results with 40% ankle /subtalar motion and normal tibio talar alignment, less than 1 cm tibial shortening, with limited pronation & supination & no equinus deformity (Table 3).

According to subjective result finding were same as in objective results 13 patients were having excellent result, return to same work, normal recreational activity, no analgesics were taken without limp. 3 patients were having a good rating & 1 of them having fair result (Table 4).

During radiographic follow up assessment, osteoarthritic changes at the tibio talar joint were seen in one patient.

The average total arc of motion for ankle joint was 37° (15°-55°). Dorsiflexion average 12° (range 0-20°) and planter flexion avg 25° (range 15°-35°). in a various valgus plane the final alignment was neutral +/-5° for all 10 fractures (Table 4).

COMPLICATIONS

Following complication were seen during this work: Ankle stiffness was initially seen in 100% patient but functional recovery was seen in all cases. Kneestiffness initially seen in all cases & was mainly because of non-cooperation of patient but recovery seen in all cases. There were three superficial pin tract infections, which were treated with empirical oral antibiotics and daily pin-tract dressings. One patient developed deep-seated pin tract infection of the proximal tibial pin at the 3-month follow-up, which settled after the infected pin was removed. None of the patients had joint contractures.

DISCUSSION

Intraarticular fractures of the distal tibia secondary to axial loading present a great challenge to the orthopaedic surgeon. These high-energy injuries often result in significant soft tissue damage, bone comminution, & periatricular surface disruption. Until recently, treatment has followed the a. o principle of open reduction and internal fixation with plate & screws to permit early motion. For many of these fractures, the risk of complication from orif outweighs the potential benefit. For these reason the principal of tibial plafond fracture treatment are rapidly changing. Technique utilizing external fixation are associated with satisfactory result and appear to significantly decrease the incidence of soft tissue complication.

The most commonly used classification is that of RUEDI & ALLGOWER, in which plafond injury are divided into ty I, II, III on the basis of the size & displacement of articular fragments.

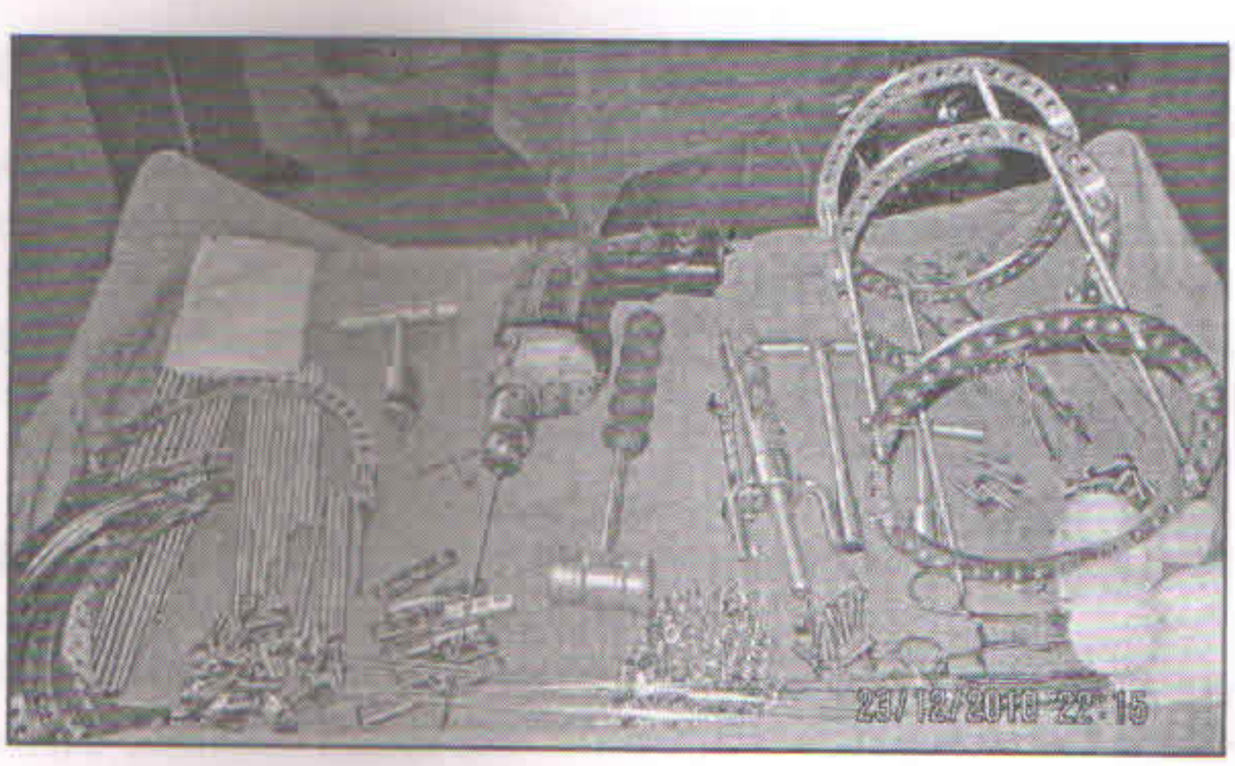
The treatment options for fracture of the tibial plafond include non-surgical care, internal fixation, and external fixation with or without limited internal fixation & primary arthodesis and treatment option has the best chance for an optimal result for each fracture subtype. Other factors must also be considered such as surgeon's preference and experience, patient characteristic and most important the amount of soft tissue injury present.

Until recently standard of care FOR TIBIAL PLAFOND FRACTURE has been ORIF following a. o principals, as described by ruedi & allgower with early range of motion exercises with prolonged non-weight bearing.

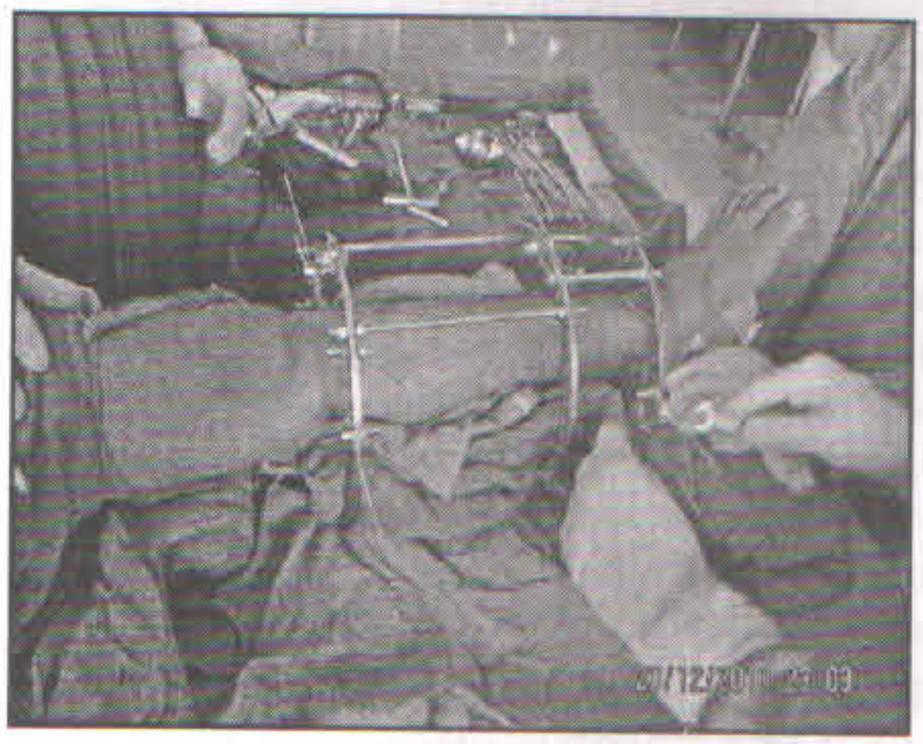
WADDLE, JOHNSON & MEIDRE (1981) reported an inability to control the fracture alignment by traction because of the metaphyseal fracture component.

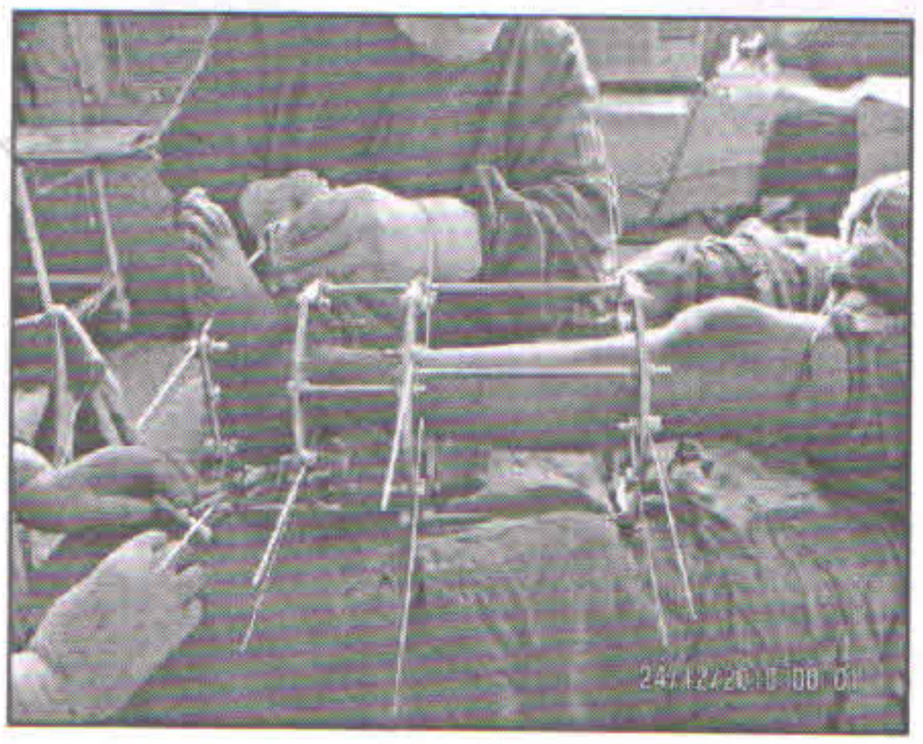
In a prospective randomized trial of plating versus external fixation of tibial pilon fractures, Wyrsch et al. concluded that external fixation of these fractures is associated with clinical outcomes similar to those obtained with traditional methods of open reduction and internal fixation but with significantly fewer complications.[5]

A retrospective study of 107 tibial pilon fractures by Watson et al. has shown that there is a

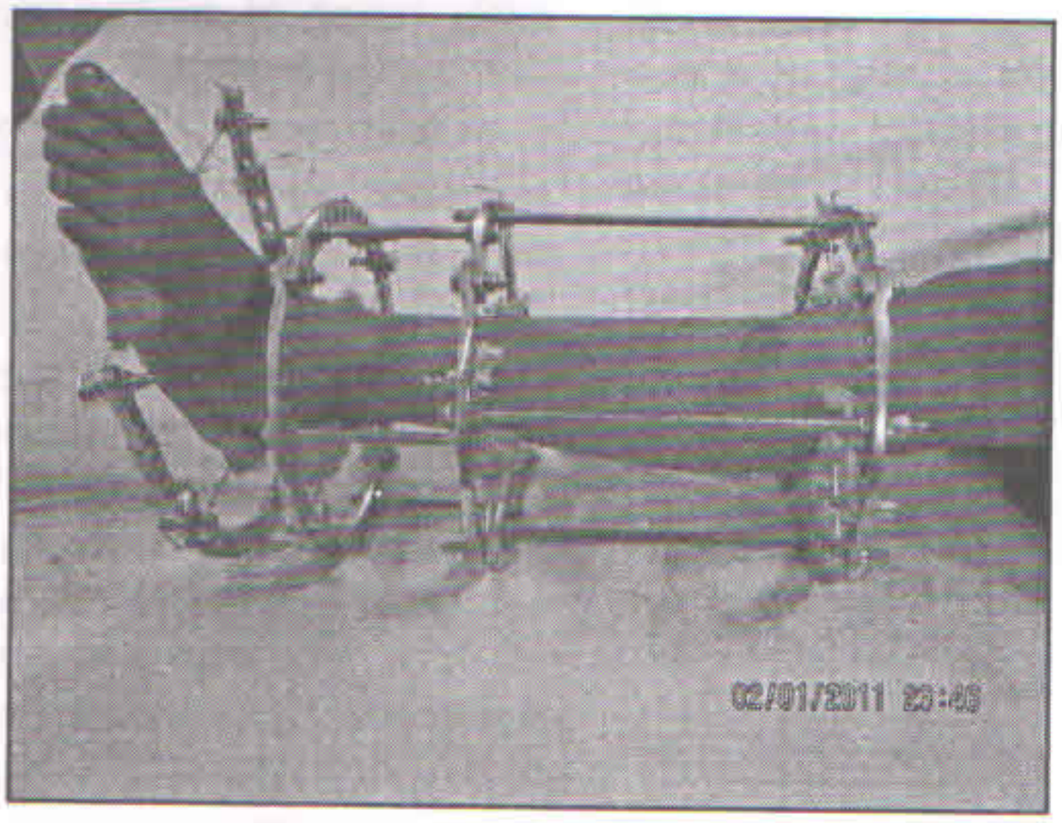


Implants and Instruments





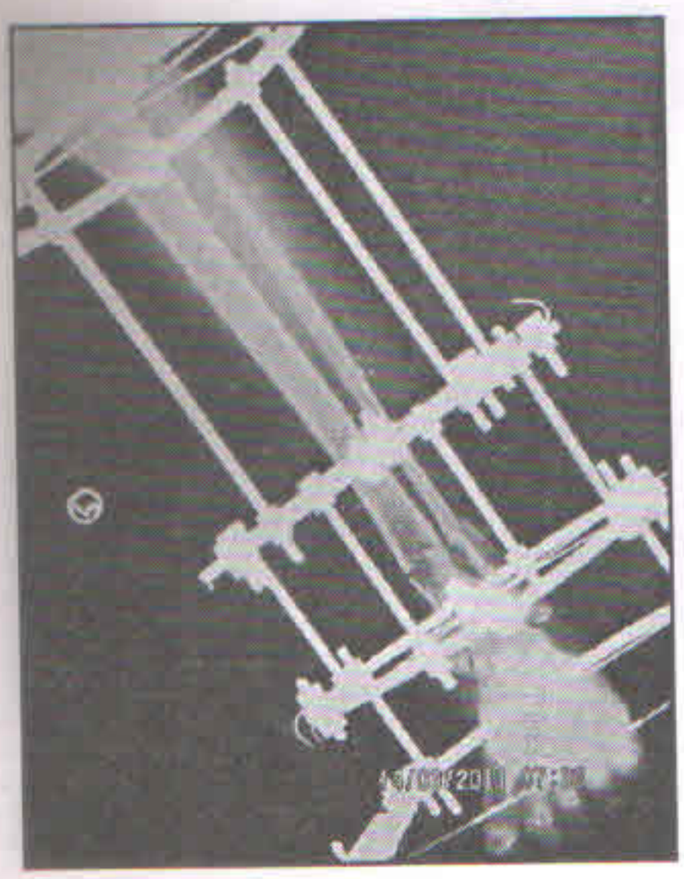
During Operative Procedure

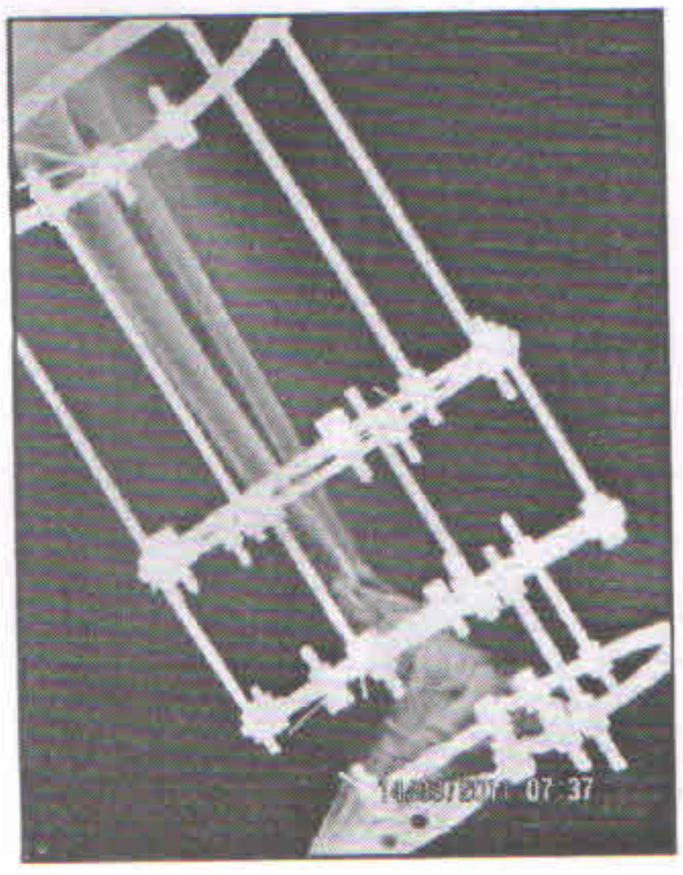


Post Operative Construct

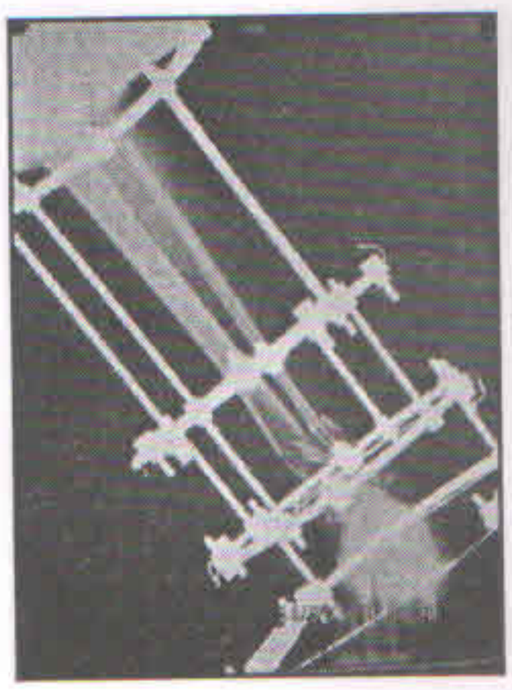
Case 1

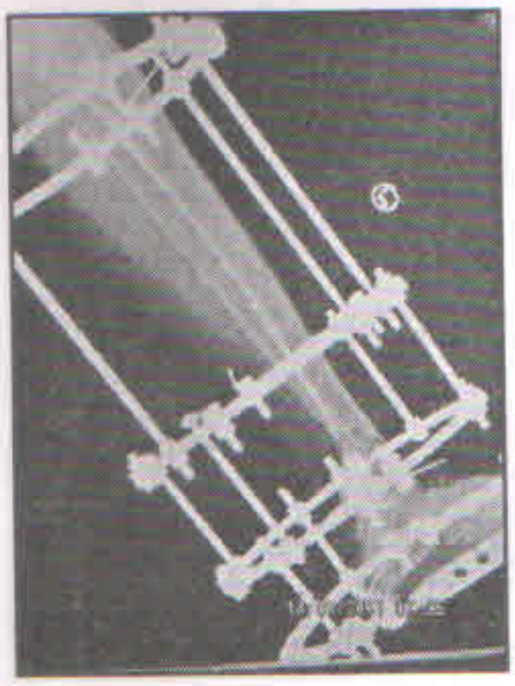
Pre Operative X-Ray



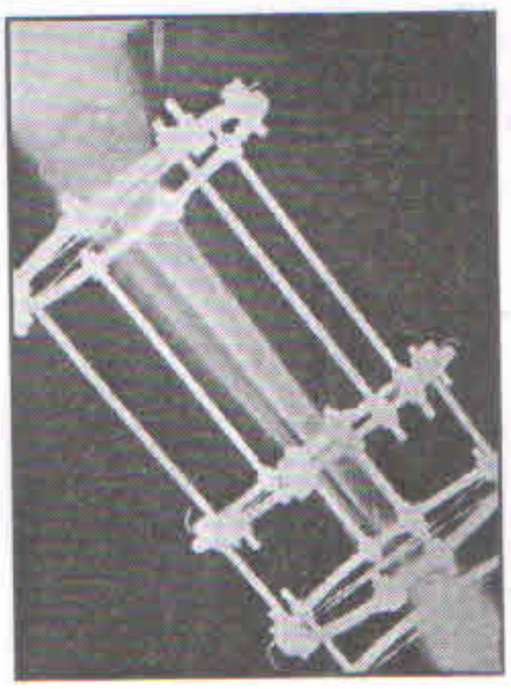


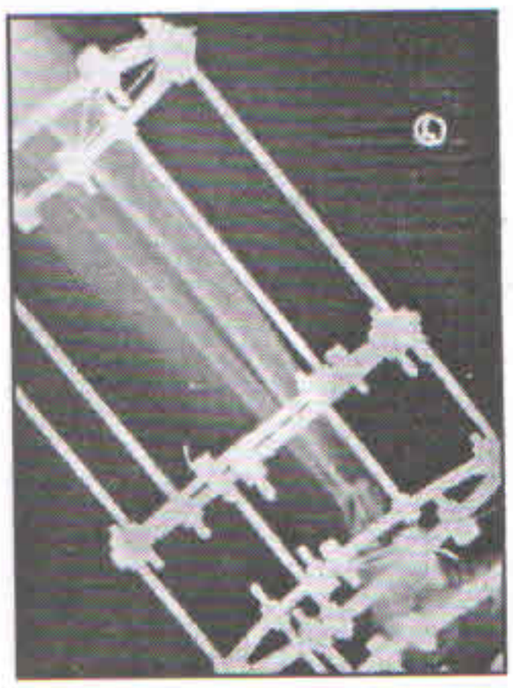
Immediate Post Operative X-Ray



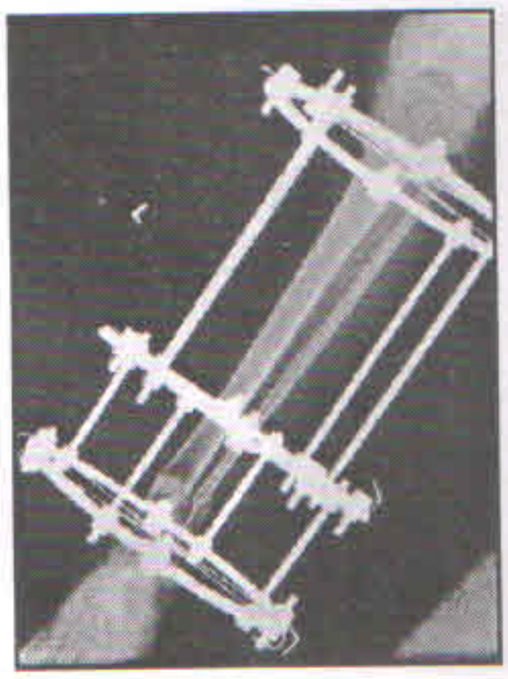


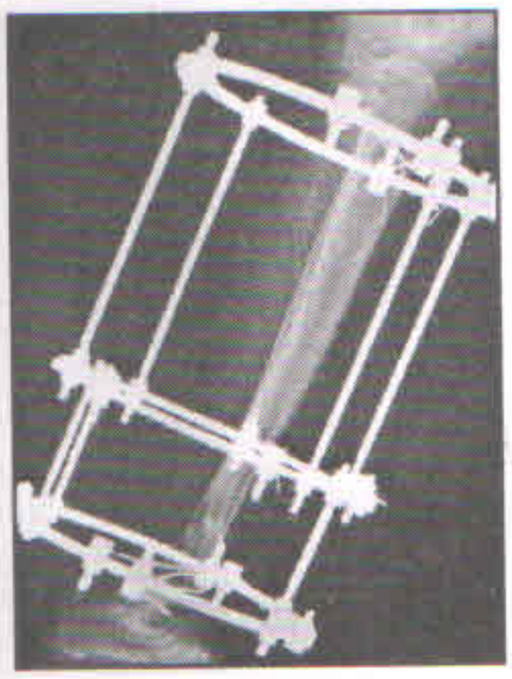
X-Ray after 2 Months



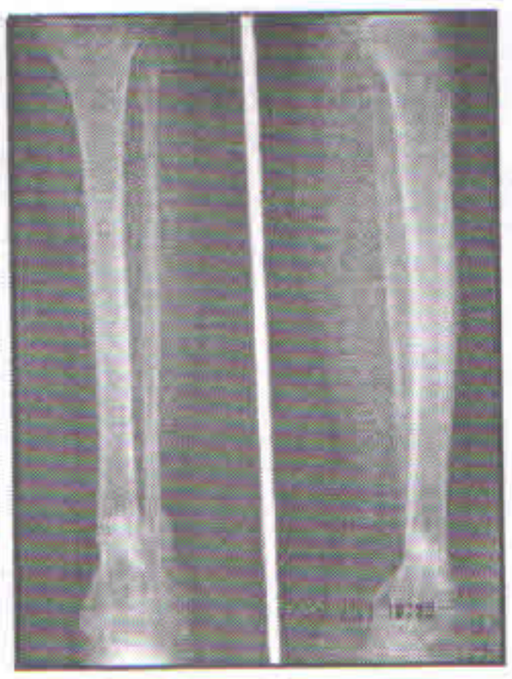


X-Ray after 4 Months



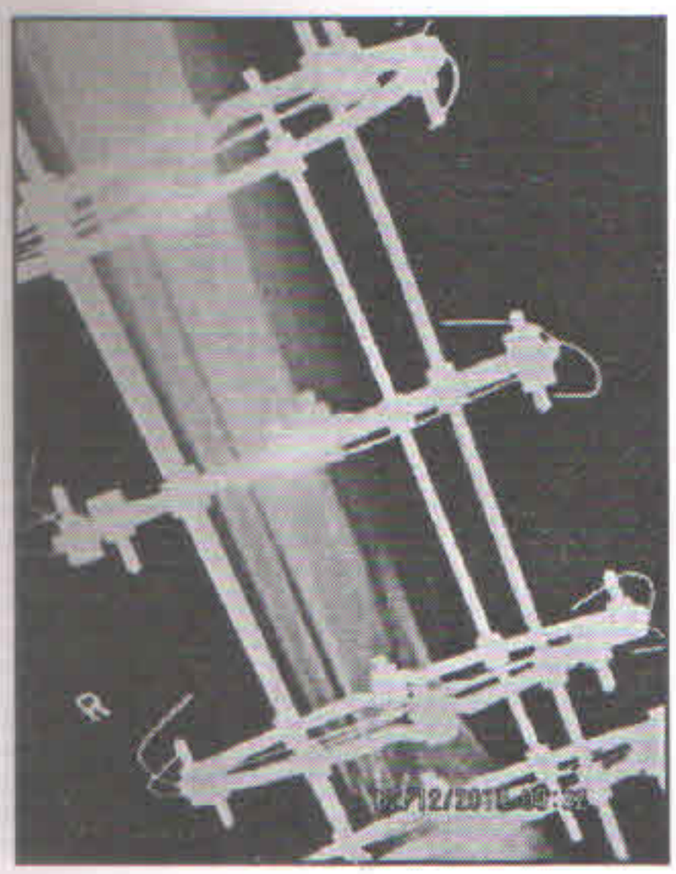


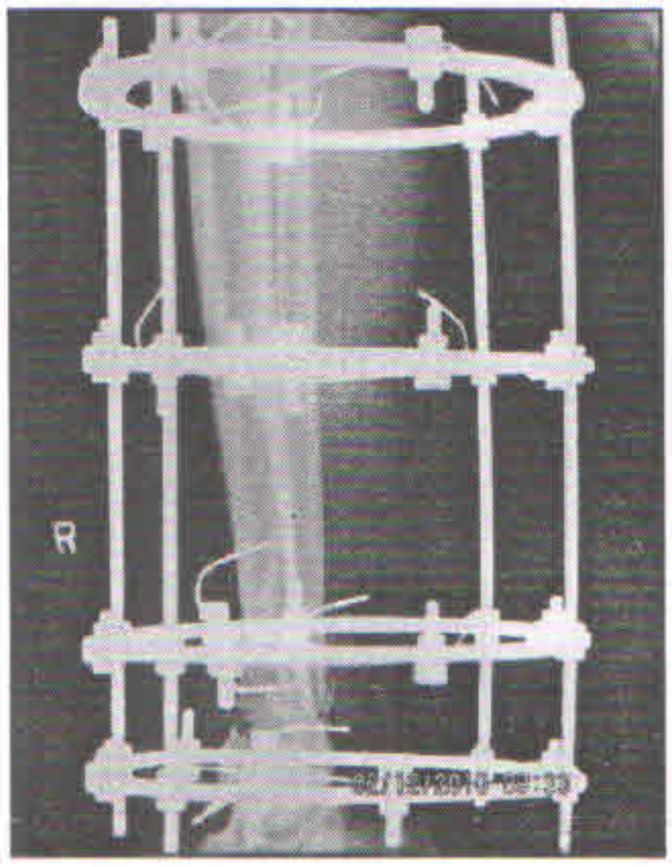
X-Ray after 6 Months



X-Ray after Implant Removal

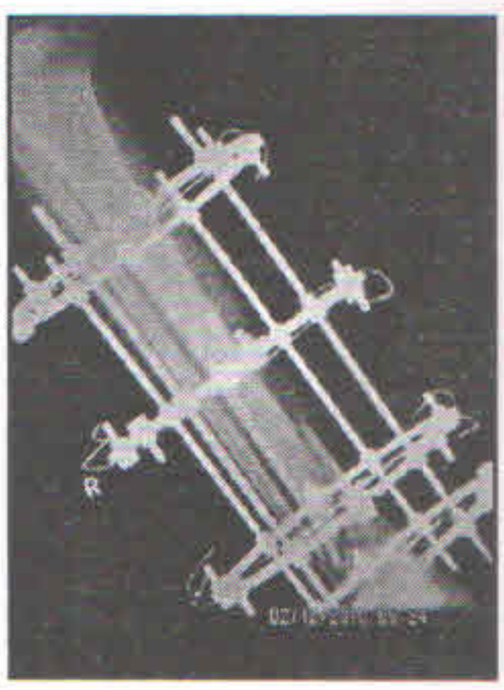
Case 2

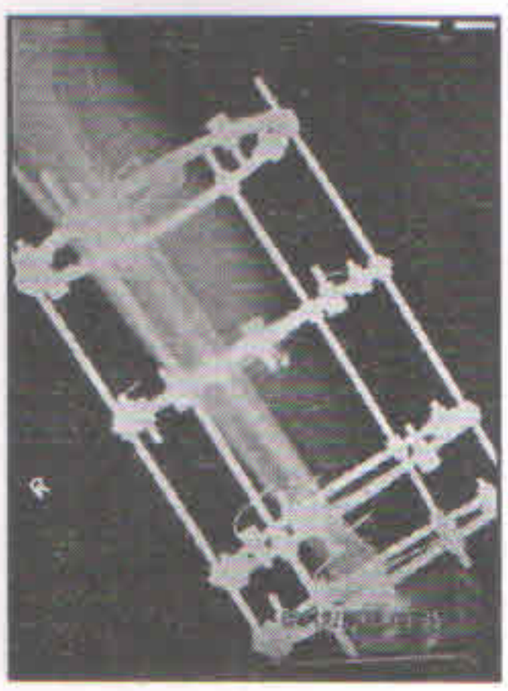




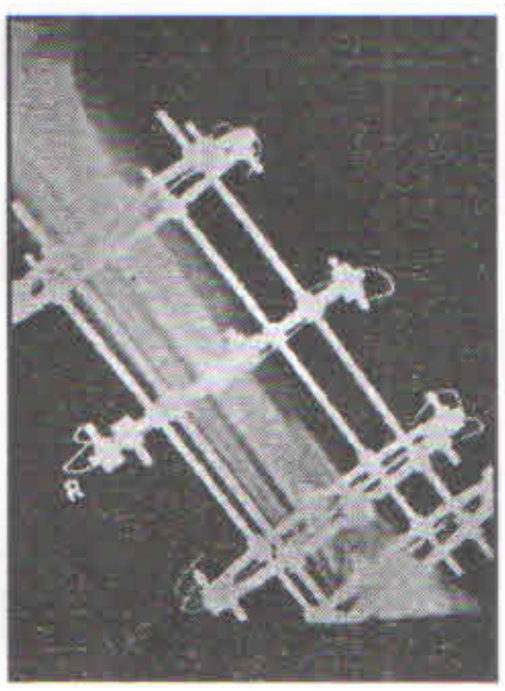
Pre Operative X-Ray

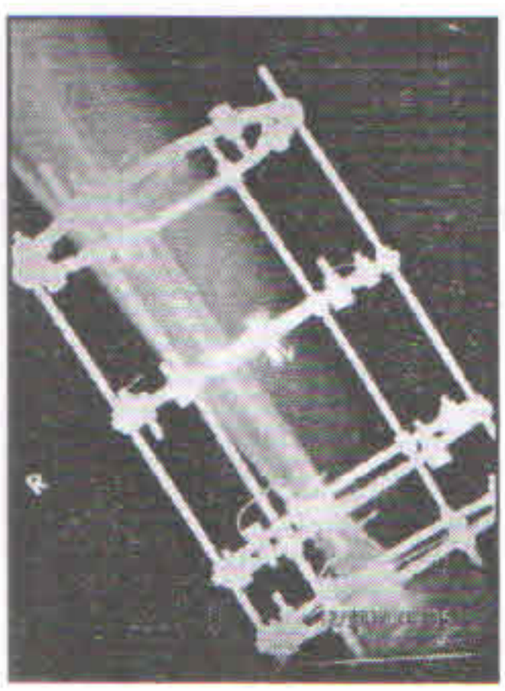
Immediate Post Operative X-Ray



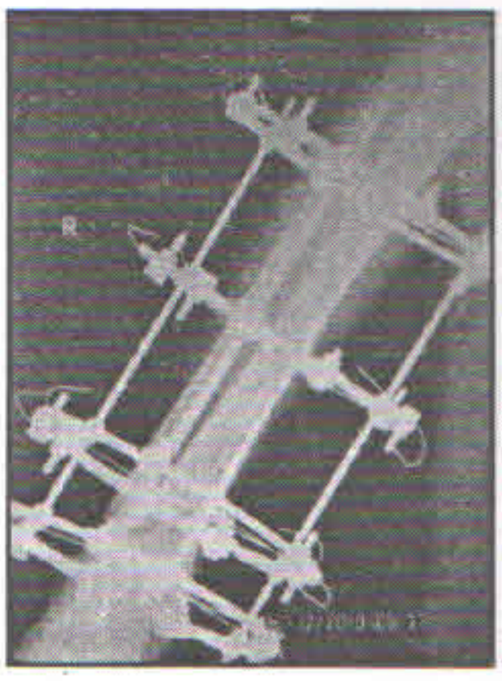


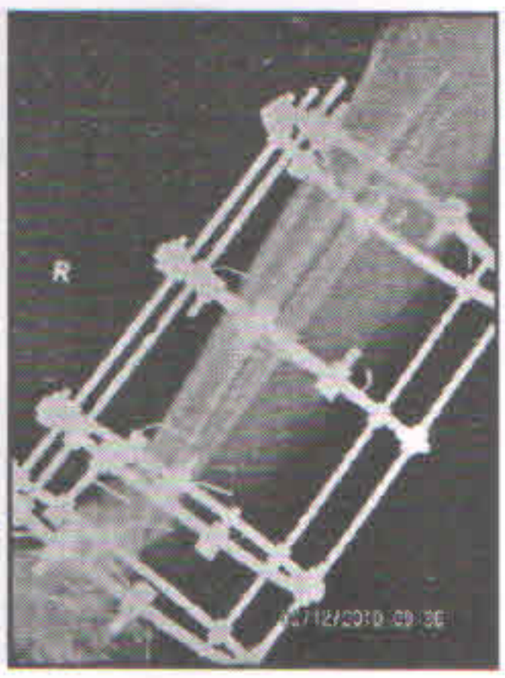
X-Ray after 3 Months





X-Ray after 6 Months





X-Ray after 8 Months

X-Ray after Implant Removal Squatting

significantly higher complication rate with the use of open plating techniques in AO type C fractures of the distal tibia, and this is probably related to the amount of dissection and stripping of soft tissues needed to achieve reduction and plate fixation.[6] Interestingly, it was felt that the worse the initial soft tissue injury was, the poorer the overall function tended to be, regardless of the initial fracture pattern. With this in mind, the authors felt that any treatment method should try first to limit soft tissue damage and avoid additional complications.

DECOSTER, NEPOLA & EL-KHOURY (1988) found that cast bracing after preliminary traction produced poor results in the patients with complex fractures. These authors abandoned conservative method in favour of open reduction & internal fixation. However, result of surgery has also been disappointing. Anatomical reduction & rigid internal fixation of a comminuted joint surface with an unstable Meta -diaphyseal require an extensive exposure that further traumatizises the soft tissue and devitalize bone fragment creating a high-risk environment for infection. In the present study, ring fixator did not require extensive soft tissue dissection, thereby reducing risk of infection. The complication associated with open operative treatment of pilon fracture are wound dehiscence, skin sloughing, deep infection, delayed union & malunited joint stiffness and reflex sympathetic dystrophy

According to current concept prerequisite for early healing of a fracture are:

1. Cyclical axial micromation;
2. Preservation of fracture exudates-containing bone morphogenic protein(bmp)
3. Vascularity preservation of periosteal & endosteal structures;
4. Stability of fracture
5. Function of limb
6. Preservation of infection

ILIZAROV 1950 gave theory of "tension stress effect". Based on this he developed an external ring fixator with the help of which many unsolved problem of complicated fracture, fractures with bone loss, fracture with non-union, infected fractures, deformity, now can be solved with more accuracy and perfection. Advantage of ring fixator include less invasive surgery, immediate weight bearing, less infection, less blood loss, prevention of disuse osteoporosis and atrophy, prevention of limb function, no need of bone grafting and requirement of second surgery, non union, bone defect can be treated simultaneously. These complication are totally avoided after application of ring external fixator & patient are encouraged to move there ankle with pain tolerance. If they are unable to cooperate with this, a footplate is placed to keep the ankle in dorsiflexion.

The disadvantage of ilizarov technique are risk of neurovascular injury at the site of pin insertion, transfixation of wires may lead to fixation of muscular & facial structures leading to limitation of active & passive joint motion. Pin tract infections are another problem

In the present study all, the above complication has been avoided, since the method was exclusively percutaneous. The key to success lies is appropriate preoperative planning & making a correct pre operative construct. Post operatively guarded suspension and encouragement of patient to do physiotherapy and weight bearing is mandatory to get a good result.

CONCLUSION

We conclude from study that ilizarov is an excellent minimally invasive method for management of pilon fractures. It not only obviates the need of open reduction and internal fixation, skeletal traction and plaster but also gives better results.

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ELASTIC INTRAMEDULLARY NAILING OF FRACTURE BOTH BONE FOREARM IN CHILDREN AND ADOLESCENTS - A PROSPECTIVE STUDY

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ABSTRACT

We present the results of 25 consecutive children and adolescents with displaced fractures of the forearm treated by elastic stable intramedullary nailing with a mean follow-up of 7.2 months. Among the 25 patients 19 were boys and 6 were girls with the mean age is 11.72 years. Seven (28%) had open fractures and 18 (72%) had sustained closed fractures of both bones. Most of the fractures healed within 6 to 8 months (64%). There was one case of delayed union and one case was lost to follow up after 16 weeks for his delayed union. An excellent functional outcome was achieved in 20 patients (80%). A limited or open reduction was required in 11 fractures (44%). Complications included two (8%) cases of transient palsies of the superficial radial nerve and two (8%) cases had tendon injury. At final follow-up, patients in which implant removal has been done were pain-free and without limitation of daily activities.

Our findings indicate that the functional outcome following fracture of forearm in children and adolescents can be treated by elastic stable intramedullary nailing. It can be considered as a good method as it is less time consuming, having lower complication rate and preserves good functional outcome.

INTRODUCTION

The majority of displaced paediatric diaphyseal fractures of the forearm can be treated by closed reduction and casting.[1] Operative treatment is indicated for irreducible, unstable or open fractures and those which redisplace in a cast. There is a rising trend for operative fixation of paediatric fractures, especially of the forearm, without a firm evidence base for this change in practice.[2] Though plating provides a good rigid fixation, it is associated with prolonged hospital stay, a large scar and large periosteal stripping and interosseous membrane damage. Elastic nail provides a 3 point contact 9 and adequately prevents rotation. It acts as internal splint and maintains alignment. The elastic nature of the nail maintains the radial bow throughout the bone healing process. Elastic stable intramedullary nailing (ESIN) has become a popular treatment[3] and although there are several small series reporting results, few have prospectively assessed the functional outcome.[4-6] The purpose of this study was to determine the functional outcome, cosmesis and hospital stay with the incidence of complication.

PATIENTS AND METHODS

A prospective study was done from September 2012 to October 2014, 25 paediatric & adolescent patients with displaced diaphyseal forearm fracture were treated with titanium elastic nail at S.C.B. Medical College, Cuttack. The study group included 19 boys and 6 girls with mean age of 11.72 years, with the mean follow up of 7.2

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months. The cases included in study group were, displaced diaphyseal forearm fracture, open forearm fracture. Older children more than 19 years age and those having physis injury were excluded from the study. For radius, retrograded titanium elastic nailing at 2nd dorsal extensor compartment lateral to lister tubercule, just proximal to physis and for ulna, the olecranon entry was done as described by Lascombo etal.[3]

In forearm fracture of children 2mm, 2.5mm, 3mm nail diameter was used after calculating the medullary diameter.[10] The proper nail diameter was not more than 40% of the width of the medullary canal. The forearm nail size=2x medullary canal diameter in mid shaft of forearm/ 3. The nails wese prebent to match the radial bow.

The following points were looked for in the radiographs: The location of fracture, the morphology of fracture, fracture orientation in saggital and frontal plane.

RESULT

Of the 25 patients in this cohort, 4 were treated with ESIN fixation following failure of non-operative treatment.[3] Seven were open fractures due to RTA and the remainder were closed fracturesdue to fall on outstretched hand and were irreducible or deemed to be of an unstable configuration requiring stabilisation. Among the open fractures, 3 were either open for radius or ulna. The mean age of presentation was 11.72 years. 810 cases were right sided fractures and 15 were left sided fractures. 22 cases presented early i.e, within seven days and 3 cases presented late i.e, after 1 week. The mean diameter of nail was used was 2.5 (72% cases). CRIF was done for 14 cases and ORIF was done for 11 cases. 12 Fractures presenting late were reduced by ORIF with limited opening and all compound fractureswere reduced by ORIF. The average radiological union time was 6-8 weeks (64%).[11] In one case there was non-union at 16 weeks and the patient was lost to follow up. The fracture was communited and was compound grade iii b. Functional outcome was analysed by measuring the range of movment around elbow and wrist. Flexion around elbow was >120 degrees in 20 (80%) of patients.[10,13] Extension deficit in elbow was found in 4 patients ; in three patients, it was <15 degrees and in one case, it was >15 degrees. The supination was >60 degrees in 14 (56%) patients and the pronation was >60 degrees in 13 patients. In 10 patients, it was 45-60 degrees. The flexion and extension around wrist was good in 21(84%) patients. The pain in 3rd postoperative day was compared with preoperative pain in terms of VAS score. The pain was relieved in most of the cases (64%).

COMPLICATION

2 (8%) cases presented with neuropraxia involving the radial nerve (tourniquet palsy), 2 cases with rupture of extenser pollicis brevis tendon and were repaired 2 weeks later. 2 patients presented with protruded nail at entry point which was responsible for restriction of extension of wrist.[14] 1 case presented with delayed union.

The functional outcome was analysed by modified Flynn's criteria.[15]

Table 1
Functional outcome by modified Flynn's criteria

Functional out come	Number of cases	Percentage
Excellent	20	80%
Good	3	12%
Fair	1	4%
Poor	1	4%

20 (80%) cases had excellent functional outcome in present study. 3 (12%) cases had good, 1 (4%) case had fair and 1 (4%) had poor outcome. The aim of the treatment is to achieve functionally and cosmetically satisfactory results and to avoid complications.[13]

DISCUSSION

Closed reduction and application of cast is

still an effective method of treatment but has many drawbacks like failure of reduction,[16] re-fracture, prolonged immobilization, associated with stiffness, compartment syndrome, disusemuscle atrophy, and mal-union. In our study, in 4 cases, closed reduction failed and they were undergone intramedullary nailing. Flynn and Meyers[17] in their studies recommended intramedullary nailing in which cast failed. Primary open reduction and internal fixation with plate and screw is an alternative method of treatment. Ventral approach and dorsal approach is claimed to cause infection, scar mark[18,19] time consuming, more operative blood loss and is time consuming. The advantage claimed for the use of intramedullary nail rather than plating in pediatric fracture of the forearm include shorter operating time and cosmesis.[10] However the proponents of plating claim that anatomical bow of radius is restored for which the good rotational movement is achieved. In our study, 23 cases (92%) achieved good range of rotational movement. 96% of the patients showed good range of flexion and 76% of the patients showed good range of extension around wrist joint. 80% of the patients showed good range of flexion around elbow joint. Vender Reis et al. compared plate and screw fixation with intramedullary nailing. Myers et al. reviewed a series of 55 cases with elastic stable intramedullary nailing of Radius or ulna or both. They recommended percutaneously internally fixing the bone that had the most initial displacement then checking the stability clinically by pronation and supination, if both were stable, cast was applied, if not other bone was fixed with elastic nailing. VAS pain score was assessed by comparing pain on 3rd postoperative day with preoperative pain and there was significant improvement in 64% cases.

The average radiological union time in our study was 6-8 weeks. Time taken for open fractures to unite was slightly more compared to closed fractures. In the study done by Houshain S, Bajaj SK, in single bone fixation of both bone forearm, the radiological union was observed at a median of 6-7 weeks.[11] Kapoor V, Theruvil B, Edwards SE, Taylor GR, achieved bony union of all fractures by an average 7 weeks.

In present study in 72% cases were given 2.5mm diameter elastic nail. In most of the earlier studies 1.5-2.5mm diameter nails were used. Metaizeau et al. described the elastic stable intramedullary nailing of paediatric forearm fractures with small diameter of nails 1.5-2.5 mm.[22]

In our study, 18 cases had closed injury and 8 were compound injuries, out of 18 cases CRIF was possible in 14 cases & ORIF in rest 4 cases. ORIF was required in closed fractures mainly due to overriding, soft tissue impingement & comminution. All fracture reduction were done with the help of C-ARM. The cases that were operated earlier had a easier closed reduction than the cases that were operated late due to soft tissue contracture. Kirkos J M, Beslikas T, Kapars E A, Papavasiliou V A did a retrospective study on 50 children with unstable diaphyseal both bone forearm fractures where closed reduction was a failure, and opened reduction and internal fixation to a single bone was done. Results proved to be excellent after follow up including good alignment of ulna.

Complication- In present study, 2 (8%) cases developed Neuropraxia due to superficial radial nerve injuries, in 1 (4%) case there was a traumatic nerve injury, 1 (4%) cases had partial rupture of extensor pollicis brevis tendon, 1 (4%) case of complete rupture of extensor pollicis longus, and 2 cases (8%) case of nail protrusion due to infection. 4 (16%) patients had difficult pronation and supination due to rotational instability. Complications were all modest and transient. It may be avoided during surgery with gentle care in step wise fashion and with help of C-ARM. Shoemaker et al. described nine complications in eight cases including nerve palsy, infection, loss of reduction and nail protrusion. Atul Bhaskar[24] described intramedullary nailing as an excellent technique in children as it is safe, less invasive and associated with fewer complications. Garg, Ballal MS, Malek IA, Webster RA, Bruce CE has achieved good functional outcome, and complications were

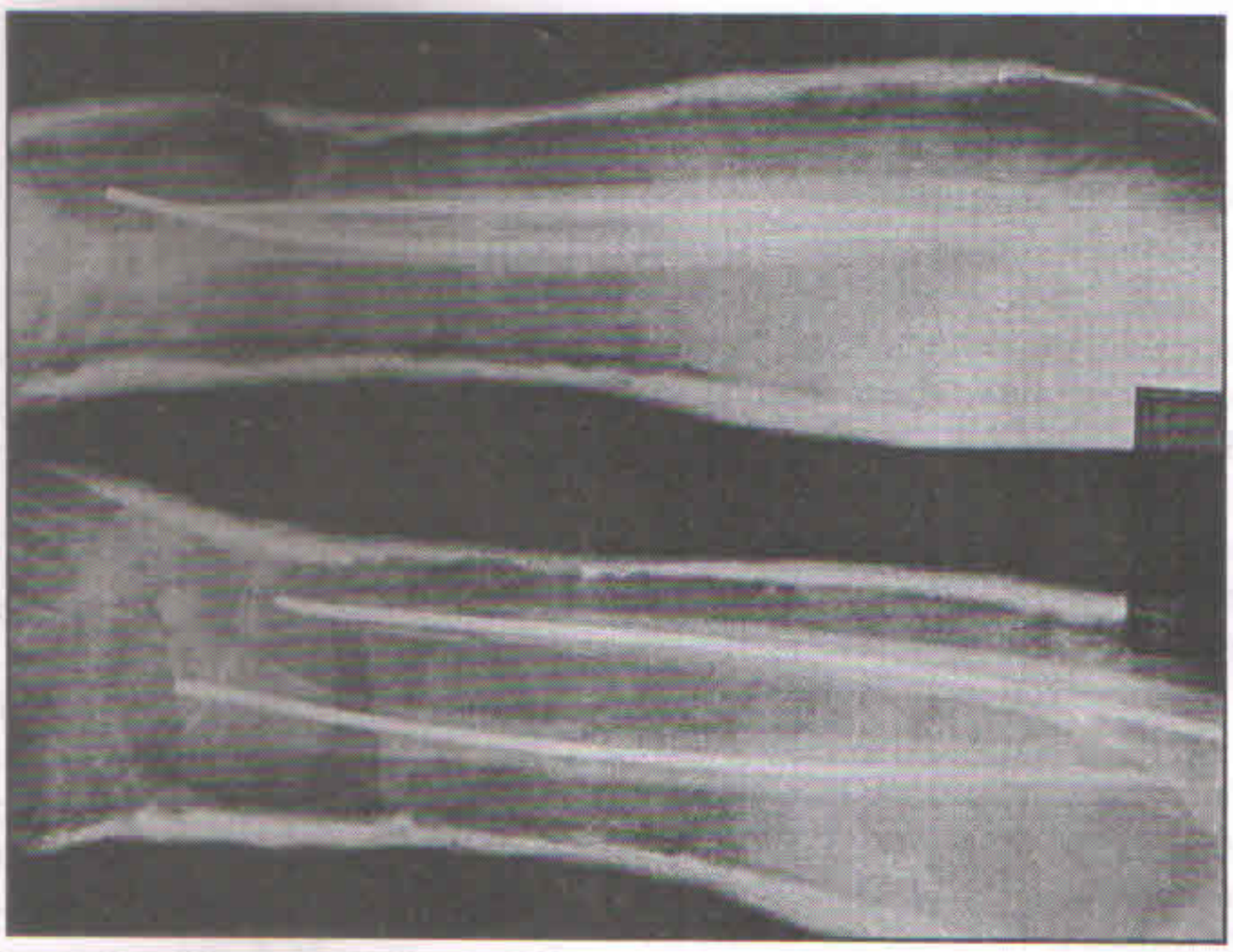

Figure 1 : Immediate postop Xray showing elastic intramedullary nails in position

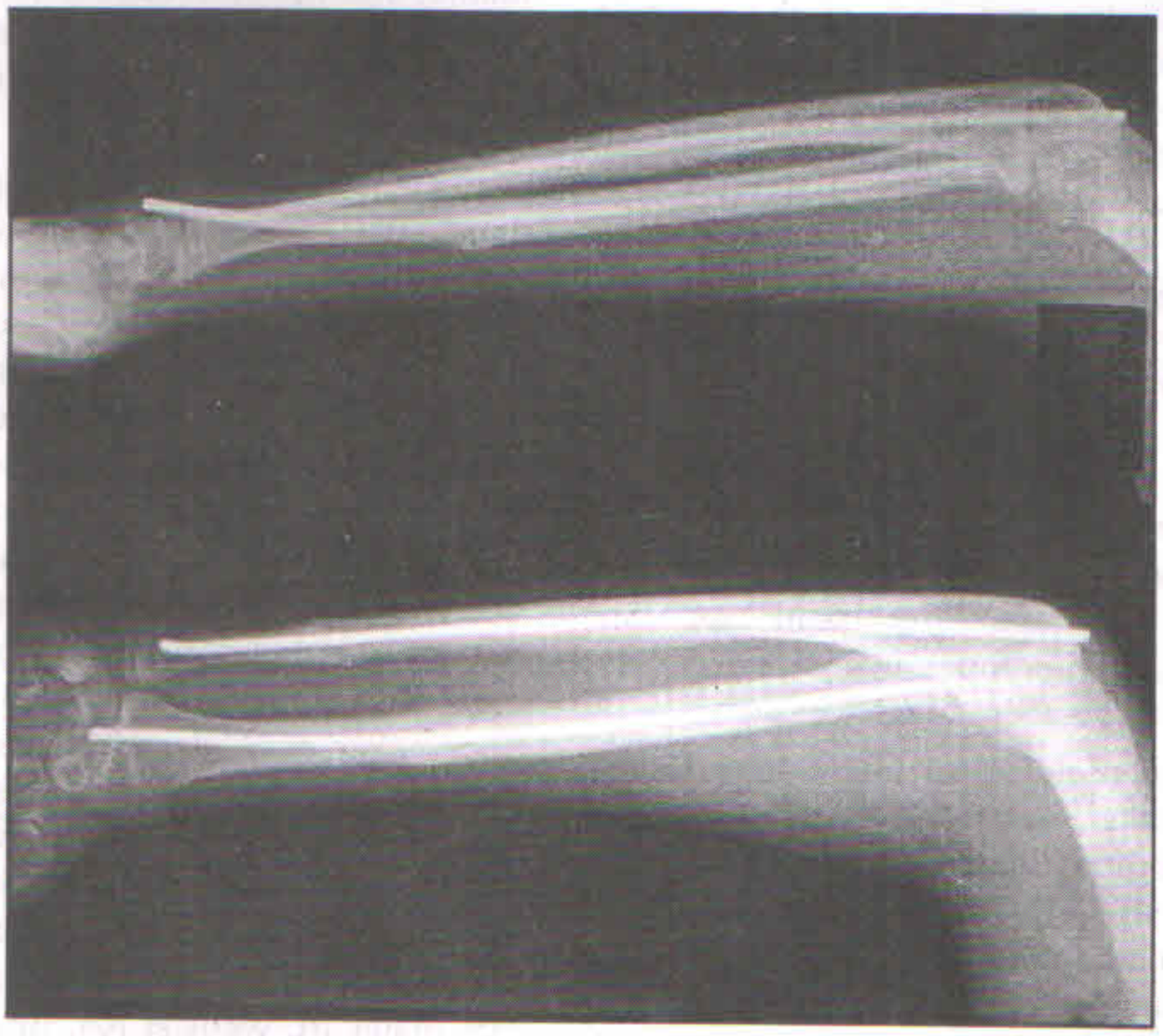

Figure 2 : Xray of no forearm following union

modest and transient. Cullen, Mark C. M. D. ; Roy, Dennis R. M. D. ; Giza, Eric B. S. ; Crawford, Alvin H. (1998), (JOT 18-22) did a retrospective review of 20 children with forearm fractures treated with intramedullary fixation; indications for surgery included fracture malreduction, open fracture,[21] polytrauma, unstable fracture pattern, and compartment syndrome. Both radius and ulna were fractured in 17 patients. Intramedullary fixationof both bones was performed in eight cases, ulna alone in nine, and isolatedradius in three. A limited open approach to one or both bones was necessaryfor insertion of the intramedullary rod in 15 of 20 cases, including the eightopen fractures. Eighteen complications occurred in 10 of 20 patients, includinghardware migration, infection, loss of reduction, reoperation, nerve injury, significant decreased range of motion, synostosis, muscle entrapment, anddelayed union. Despite the complications, 17 patients had excellent and twohad good outcomes. Although excellent clinical results can be expected with intramedullary fixation, complications related to the surgical technique can be expected.

In the present study, 20 (80%) cases had excellent, 3 (12%) cases had good, 1 (4%) case had fair and 1 (4%) case had poor due to late presentation. Eventually all cases achieved good range of movements with no functional deformity or complaints. Calder and Barry did fixation with elastic stable intramedullary nailing with excellent outcome.[9] Garg NK, Ballal MS, Malek IA, Webster RA, Bruce CE has achieved good functional outcome, and complications were modest and transient.[13] In the study done by Houshain S, Bajaj SK, in single bone fixation of both bone forearm with radiological union at a median of 6-7 weeks and at follow-up, a full range of elbow & wrist movements were found in all cases.[11] Lascombes et al. and Alam obtained excellent results and full range of motion in 92% of 85 forearm fractures treated with elastic intramedullary nail.[3]

CONCLUSION

From this study, it is concluded that closed reduction by intra medullary nailing isa good method for treatment of displaced fracture of both bone forearm in children and adolescents and can be commonly accepted as the procedure is lesstime consuming, has less complication rate and better cosmesis and with overall excellent result.

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DELAYED FIXATION OF FRACTUR NECK FEMUR IN 7 YEARS CHILD

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ABSTRACT

Neglected femoral neck fracture is commonly seen in our country. The blood supply to the femoral head is critical and can be easily disrupted by a hip fracture in children. Early reduction is desirable. There is a considerable risk of complications such as avascular necrosis (AVN) of the femoral head and neck, coxa vara, non-union, delayed union, premature physeal arrest, and infection in pediatric femur neck fractures. 7 Years old child with 2 month old neglected fracture neck of femur with deformities and pain was admitted and operated with closed reduction and two moore pin with immobilization for 4 wks, After 1 yrs of surgeries he is pain free and equal length limb with full ROM. No radiological sign of AVN, angular deformity, osteonecrosis or infection.

INTRODUCTION

Femur neck fractures constitutes less than 1% of the entire population of pediatric fractures. Neglected femoral neck fracture is commonly seen in our country.[1,2,3] The various reasons for such delay are ignorance, financial constraints, and firm belief of patients in village bone setters. The blood supply of the femoral head is different. The adult hip has intraosseous blood vessels that supply the femoral head. However, the blood vessels cannot cross the open physis and, therefore, the blood supply to the femoral head is critical and can be easily disrupted by a hip fracture in children.[4] A high incidence of complications is reported[5] http:// www. ncbi. nlm. nih. gov/pmc/articles/ PMC2762167/ - CIT11 due to kinking of vessels (rather than tear) of the proximal epiphysis; therefore, early reduction is desirable for a better outcome. Besides this, we believe that when fixation is delayed, it requires added manipulation to achieve closed reduction or more soft tissue dissection, and this results in further vascular insult, which adversely affects the outcome. Although rarely seen, there is a considerable risk of complications such as avascular necrosis (AVN) of the femoral head and neck, coxa vara, non-union, delayed union, premature physeal arrest, and infection in pediatric femur neck fractures. The most common and serious complication of pediatric femur neck fractures is known to be AVN, which can lead to a further degenerative joint disease. The most extensive microscopic necrotic changes are visible within the first year after injury and, therefore, the risk of femoral head collapse increases in this period.[6] It is classical knowledge that the treatment of AVN is unsuccessful and does not alter the natural history in pediatric femur neck fractures.[7]

CASE REPORT

A 7 yr old child came with history of fall from height (appr 15 feet) for 2 month and complains of pain in inguinal region. He had difficulty in walking/ weight bearing with short limb/ antalgic gait. On Examination. Fix flexion deformity of 30* adduction 10* apparent shortening 4cm with true shortening 2cm. On xrays It shows fracture neck femure basicervical). delbert type III) with wide

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displacement and varus position of the head in 90 deg. Head was osteoporotic and dystrophic with loss of inferior neck probably due to impaction and weight bearing. Trochanteric apophysis was up and there was no obvious sign of union. Our plan was to assess the viability of the head by MR Imaging but not feasible. After explaining all possible complications we decided to fix it with open reduction and two Knowles pins with watson Johns approach.

Post operatively he was kept non wt bearing for 6 wks followed by partial wt bearing for 4 wks. During this course physiotherapy and strengthening exercises were continued, implant was taken out at 6 mnths post op after confirming union.

After 1 Year of followup he is pain free and equal length limb with full ROM. no radiological sign of AVN, angular deformity, osteonecrosis or infection.

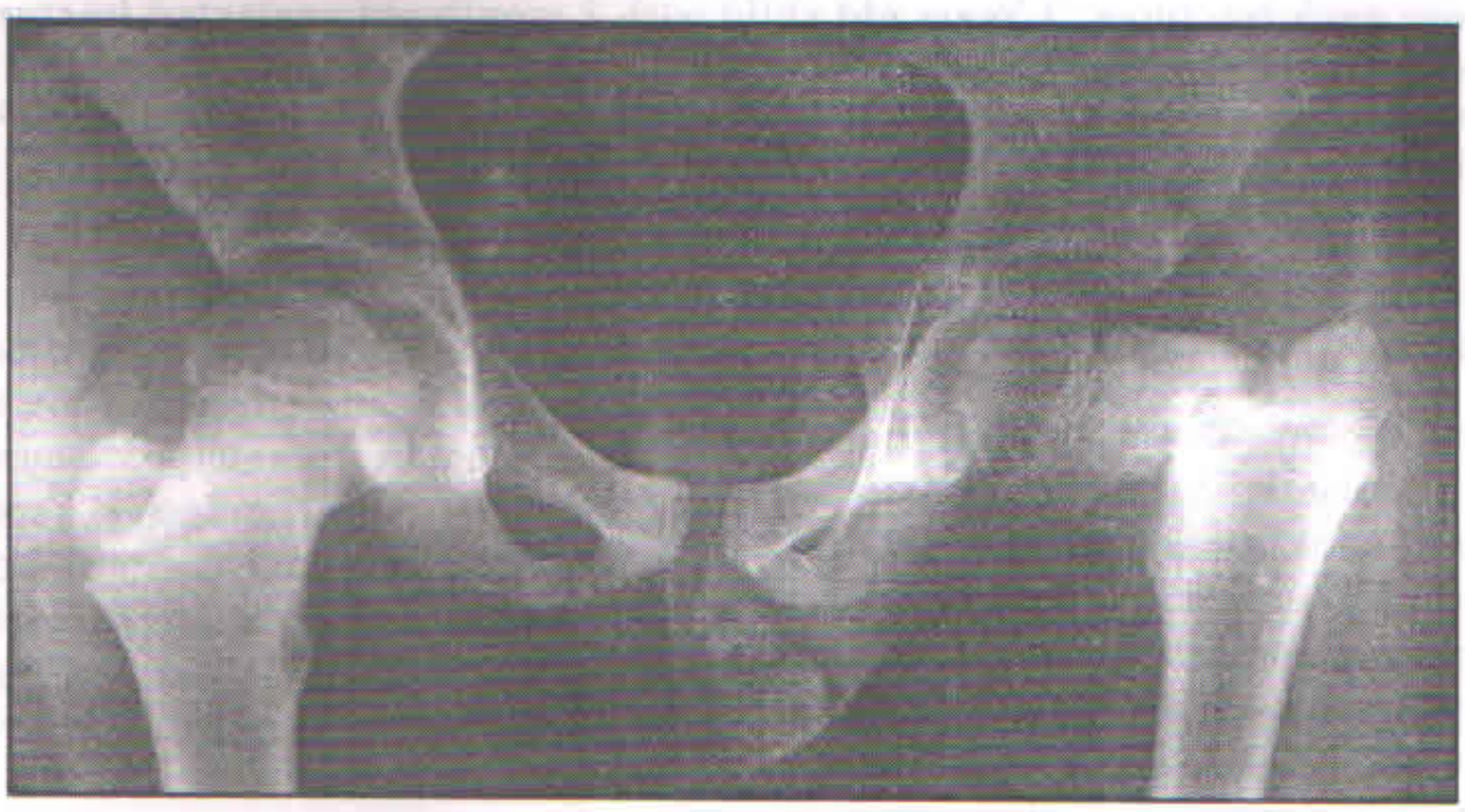

Figure 1 : Preop two months after trauma

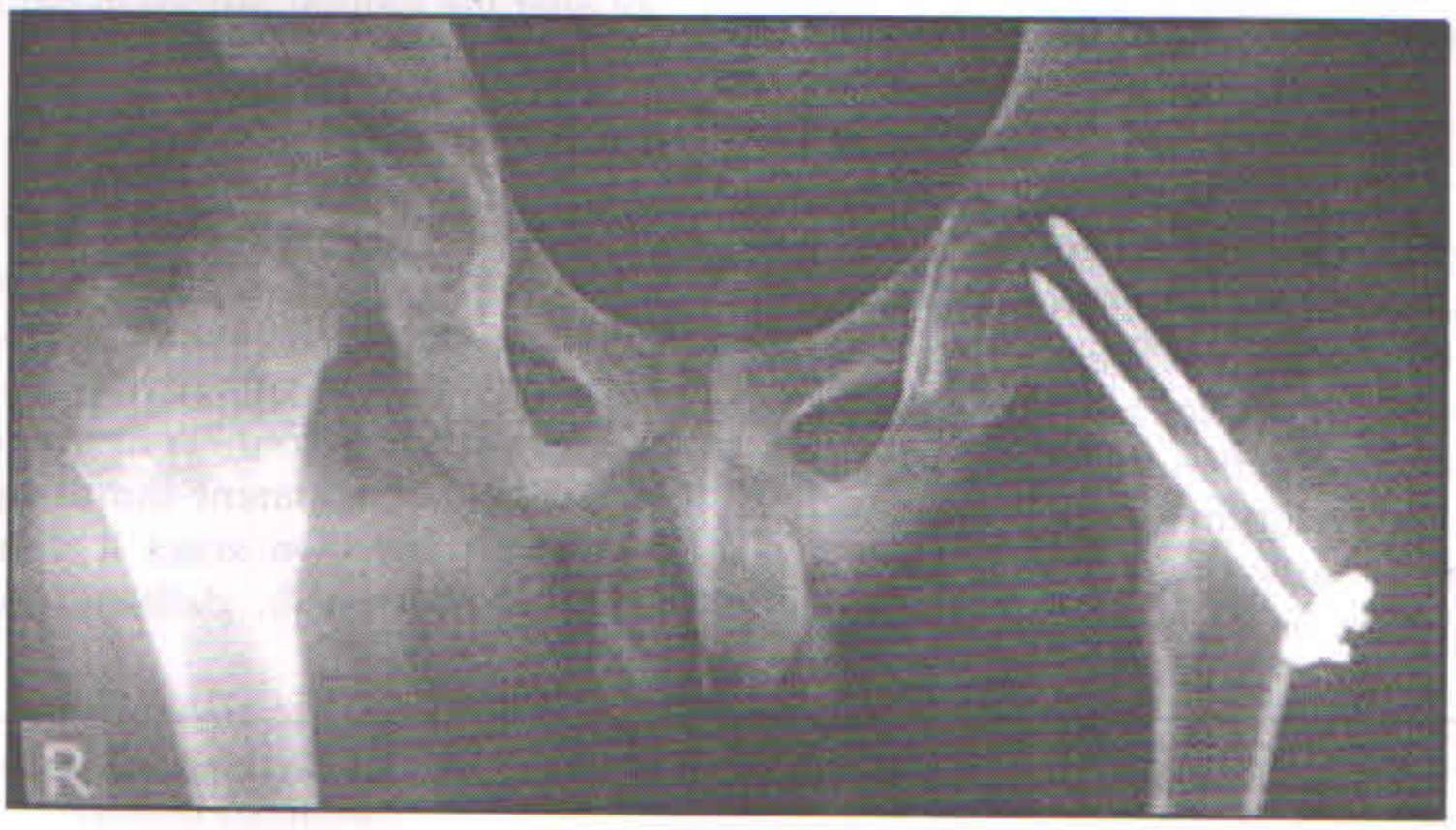

Figure 2 : Post op 6 months

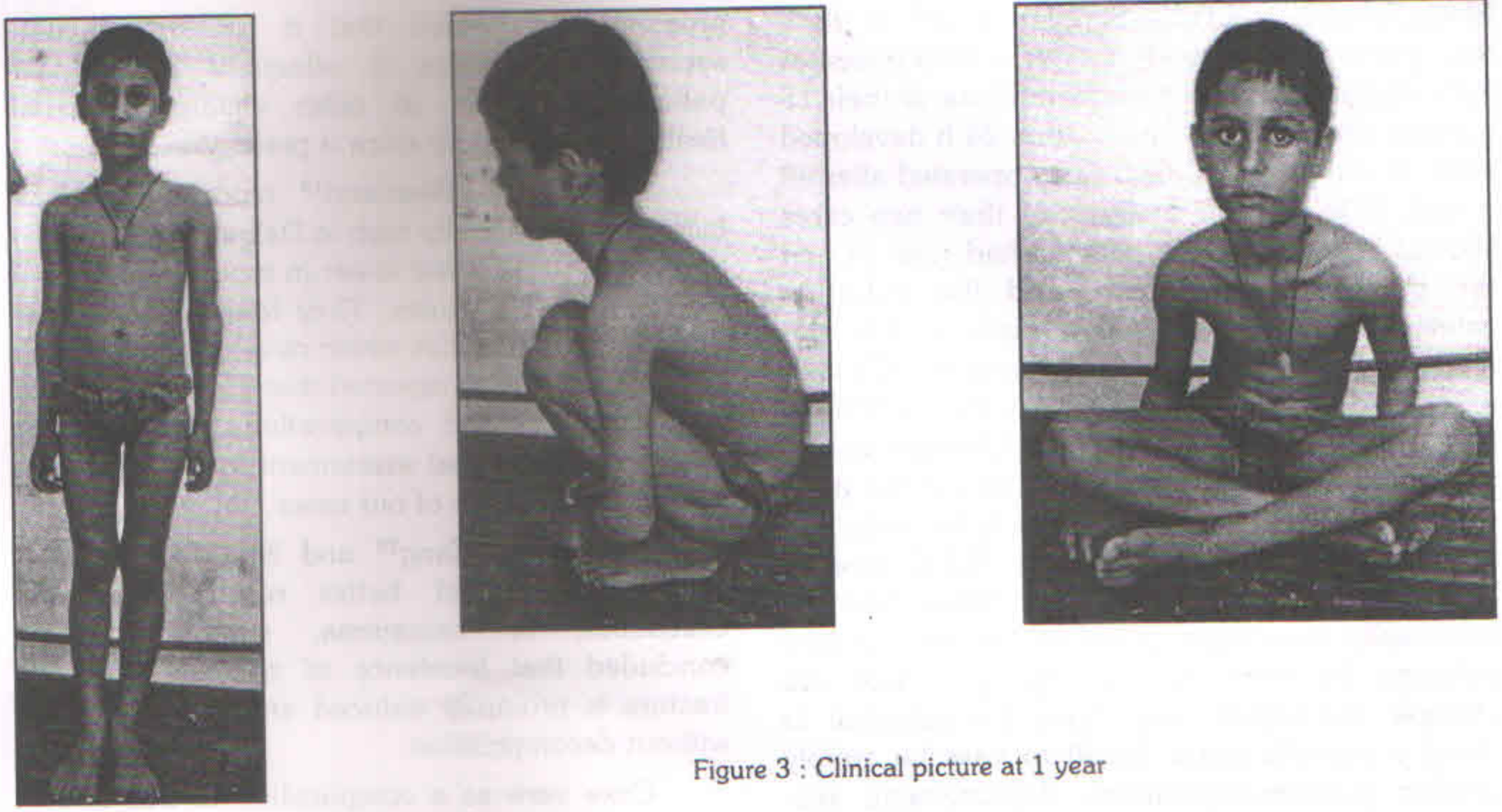

Figure 3 : Clinical picture at 1 year

Open reduction & internal fixation with moore's pin after regular followup of 6 month and implant removal done. No clinical or radiological signs of avascular necrosis were observed in the 1 year of follow-up. Remarkable decrease in the limp was noted. Patient had no hip pain or discomfort.

DISCUSSION

IJO White paper 2005 (8) recommends Following in Neglected > 3 wks Neck femur in 1-13 age group:

1. Mc Murray's osteotomy and POP one and half hip spica.
2. Abduction osteotomy and internal fixation with 135 degrees angled paediatric blade plate or paediatric DHS care is taken not to damage the epiphyseal plate as far as possible.
3. Closed or open reduction and internal fixation with a screw and free fibular graft. It is likely to disturb the growth of the upper end of the femur resulting in shortening of the limb and deformity of the head of the femur. Therefore this procedure should preferably be avoided. If it is absolutely necessary as when there is a gap of more than 1 cm between the fragments then this procedure may be carried out.

It was previously stated that a better outcome in pediatric femur neck fractures was correlated with the absence of AVN during follow-up, patient's age (<8 years), type of fracture (cervicotrochanteric, intertrochanteric fractures, and fractures without any displacement), a proper initial management procedure (early, anatomical, stable internal fixation), decompression of the intra-articular fracture hematoma, and application of postoperative immobilization. Although the time from injury to fracture reduction has been postulated to be a vital factor in determining whether a pediatric patient will develop AVN, no prospective studies are available in the English language literature, which has evaluated impact of reduction and timing on the development of AVN.[9] http://www. ncbi. nlm. nih. gov/pmc/articles/

PMC2762167/ - CIT12 Shrader et al[9] in their retrospective study found that risk of AVN increases with increased time to reduction. None of their 15 patients who were operated within 24 h developed AVN; in contrast, 2 of the 5 cases operated after 48 h had AVN. Further analysis of their two cases showed that one of the patients had type IA and the other type II fracture, and the reduction achieved in them was either poor or fair and implants used were of older generation (Canakis and Knowles pin). Delay in surgery thus cannot be totally blamed for the outcome). Dhammi et al[10] noted that average fracture union time in the open reduction group (10.2 weeks) was better than that in the closed reduction group (12.6 weeks). However, they concluded that there was no statistically significant difference in the surgical outcome between the two groups. there are multiple mechanisms that have the potential to cause a necrotic event. Insult to vascular supply (during injury/manipulation), displacement, age, and treatment method are all strong independent predicators. Moon et al11 in a structured meta-analysis of 360 cases concluded that the fracture type and age are only two statistically significant variables. It is widely recognized that percentage of good result is inversely proportional to the degree of displacement of the fracture.[12-14] However, AVN does also occur in undisplaced or even incomplete fractures. [15,16] Pforringer and Rosenmeyer[17] and Kay et al[18] observed that adolescents are at a greater risk of AVN because they still possess tenuous vascular supply without the potential ability to revascularize and remodel the femoral head. Accurate anatomical reduction and internal fixation are crucial to reduce the incidence of avascular necrosis after femoral neck fracture.

Lam's[13] http://www. ncbi. nlm. nih. gov/pmc/articles/PMC2762167/ - CIT20 series of 75 patients included 60 fresh cases (who arrived hospital within 5 days) and 15 late (reached between 7 days and 8 months). AVN recorded by him was 18% in type II and 22% in type III fractures. He concluded that displaced trans-cervical and cervico-trochanteric fractures remain an unsolved problem. He opined that if closed reduction succeeds, hip spica is adequate in younger patients. However, in older children, internal fixation reinforced by spica is preferable.

Canale and Bourland[19] reported that the incidence is especially high in Delbet type I (100%) and type II (50%) and lower in type III (27%) and type IV (14%) fractures. They found that 96% of fractures in their series which developed AVN were displaced. Ratliff19 reported that 71% of displaced fractures developed complication. Using Ratliff's criteria for functional assessment, good result was obtained in 63.63% of our cases.

Cheng and Tang[20] and Swiontkowski and Winquist[5] achieved better result with early evacuation of hematoma, whereas Flynn[21] concluded that incidence of necrosis is low if fracture is promptly reduced and stabilized even without decompression.

Coxa vara as a complication to fractures of the neck of femur in children is reported to be between 14 and 32%, [12,13,19] and that of nonunion as 6.5%,[19] 27%[13] 33%[12] and premature closure between 20%[12,13] and 62%.[19] Various authors are unanimous in concluding that the incidence of these complications increases if treated conservatively. With the increase in the trend of internal fixation in pediatric femoral neck fractures using second-generation implants, rates of these complications are significantly reduced. Flynn[21] had coxa vara in none of his patients whereas nonunion in one (6%).

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A COMPARATIVE STUDY OF UNREAMED SOLID AND CANNULATED INTERLOCK NAILING IN COMPOUND FRACTURES OF TIBIAL DIAPHYSIS

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ABSTRACT

Background : Tibia is the most commonly fractured long bone. Compound fractures of tibia are frequently complicated by delayed union, nonunion and infection owing to poor blood supply and poor soft tissue coverage. Controversy exists over optimal management of open fractures of tibia.

Material and Method : Prospective study done at our centre from September 2012 to September 2014 wherein 48 cases of compound fractures of tibia were managed by unreamed interlocking nailing with either solid or cannulated nail. Only skeletally mature patients with compound diaphyseal fractures of tibia Gustilo grade I-IIIA presenting within 24 hrs of injury were included in study.

Result : 48 patients were followed for a mean period of 10 months (6-18 months) and evaluated for functional outcome and post op complications with regard to infection and union. Functional outcome done on the basis of modified Ketenjian's criteria. 22 patients were treated using solid nail of whom 17 (77.27%) had good to excellent outcome, 2 (9.09%) had fair outcome, 3 (13.6%) had poor outcome. Cannulated nail was used in 26 cases, 19 (73.07%) had good to excellent outcome, 1 (3.8%) fair and 6 (23. 07%) poor outcome. Average time to union was similar in both the groups.

Conclusion : Primary unreamed intramedullary nailing with solid nail had better outcomes than cannulated nail with regard to functional outcome, occurence of infection and union.

Key Words : Open fractures, tibia, unreamed, intramedullary nailing.

INTRODUCTION

The open fractures of tibiaare more common than in any other long bone. Due to poor blood supply and poor soft tissue coverage these fractures are frequently complicated by delayed union, malunion and infection.[1,2] External fixation devices have been quite popular in the management of these fractures. But recently unreamed intramedullary nailing, as initial definitive management of these fractures, has been gaining acceptance. The purpose of the present study was to compare the results ofunreamed solid and cannulated intramedullary nail fixation in open fractures of the tibial diaphysis, especially in the Indian scenario. A prospective randomized comparative study was conducted to evaluate technique, outcome and time to clinical and radiological union following unreamed solid and cannulated interlock nailing. Advantages, disadvantages, follow up and complications if any and overall functional outcome were evaluated.

MATERIAL AND METHODS

Forty-eight patients with compound tibial diaphyseal fractures of Gustilo grade I-IIIA

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presenting within 24 hrs of injury were treated at M. Y. Hospital from September 2012 to September 2014. Patients presenting late, Gustilo grade IIIB and IIIC, older patients with poor bone stock, patients with Diabetes Mellitus, skeletally immature patients, pathological fractures, polytrauma patients, immunocompromised patients and patients with compartment syndrome were excluded from the study.

The patients wereapproached by the Advanced Trauma Life Support (ATLS) guidelines. After patient assessment and hemodynamic stabilization, the vascular and neurological status of the limb was assessed. The wound was carefully inspected and a photograph of the wound taken. AP and lateral X-rays of the entire tibia and fibula as well as the knee and ankle joint were taken. Fractures were classified according to the method of Gustilo and Anderson.[3] The wound was thoroughly washed with normal saline, covered with sterile dressing and the limb was primarily splinted with an above knee pop slab after performing a preliminary fracture reduction. This was followed by adequate analgesia, tetanus prophylaxis. A combination of i. v. antibiotics ceftriaxone-sulbactum, amikacin, metronidazole was given immediately and continued for minimum of 5 days. Management protocol included adequate wound debridement, stabilization with primary unreamed intramedullary locked nailing.

All patients were subjected to operative treatment within 24 hrs of presentation with unreamed solid or cannulated interlocking nail on alternating basis for randomization. Physiotherapy was started on post operative day one with static quadriceps and ankle movement. Knee bending started from post operative day two followed by gradual non-weight bearing mobilization with walker support. It was progressively increased to full weight bearing on evidence of fracture union on antero-posterior and lateral view X-rays. Union was defined as the presence of bridging callus at 3 cortices on two orthogonal radiographic views and the ability of the patient to bear full weight on the injured limb. Dynamization was done at 7-8 weeks in the absence of callus formation.

Follow up was done at suture removal, 6 weeks, 3 months and 6 months and till fracture union. All patients were assessed as per the preset protocol. Functional evaluation of patients done by modified Ketenjian's criteria ranging from excellent to poor.

Ketenjian's Criteria

Excellent	:	No notable abnormality
Good	:	Occasional pain with prolonged use
		Joint motion 75% of normal
		Trivial Swelling
		Normal Gait
Fair	:	Pain with ordinary activity
		Joint motion 50% of normal
		Small amount of swelling
		Slight limp
Poor	:	Constant pain
		Joint motion 50% of normal
		Any visible deformity
		Limp, gait on cane or crutches

RESULTS

The study consists of 48 cases of compound fractures of tibial diaphysis of which 22 were managed by solid interlock nailing and 26 by cannulated interlock nailing and followed for mean period of 10 months (range 6-18 months).

There were 46 male and 2 female study participants with an average age of 31.5 years (range 18-63y). High velocity motor traffic accidents were the most common cause of injury. The average operating time for solid nail group was 77 minutes and the average operating time for cannulated nail group was 67 minutes. Ten patients had transverse fractures, 10 had oblique fractures and the remaining 28 had comminuted fractures. Thirty one patients had Gustilo grade I compounding, 14 had grade II and remaining 3 had grade IIIA. Most of the wounds were allowed to heal by secondary intention (58. 33%),

debridement and primary closure was done in 15 (31.25%) cases and delayed primary closure was done in 5 (10.41%). There were no significant differences in patient age, gender, mode of injury, grade of compounding or overall distribution of fracture types between the solid and cannulated groups.

Union was seen in 20 (90.9%) patients in solid nail group and in 20 (76.9%) patients in cannulated nail group. 3 (9.09%) patients in solid nail group and 6 (23.07%) patients in cannulated nail group progressed to infected non union. In fractures that united average time to union was 21.2 weeks in cannulated nail group, whereas in solid nail group it was 22.8 weeks.

Dynamization was required in 6 (27.2%) cases of solid nail and in 9 (34.61%) cases of cannulated nail group. Implant failure was not seen in any of the cases in the study over an average 10 month follow up.

Functional outcome as per Ketenjian's Criteria

	Solid Nail	Cannulated Nail
Excellent	4 (18.18%)	5 (19.2%)
Good	13 (59%)	14 (53.8%)
Fair	2 (9.09%)	1 (3.8%)
Poor	3 (13.6%)	6 (23.07%)

DISCUSSION

Tibia fractures are one of the commonest fractures encountered in high velocity trauma. Open fractures of tibia are predominantly a result of road traffic accidents. Most of the fractures are comminuted and at middle 1/3 level as dictated by the velocity of injury and site of impact and bone characteristics.

Throughout 1980's external fixators had been the treatment of choice in open fractures as they provided stabilization with adequate wound management and soft tissue care. But they had been associated with complications of pin tract infection, pin loosening, malunion, delayed union, and non-union.[4,5] Plating is associated with increased risk of infection and skin necrosis.[6] Intramedullary fixation of tibial shaft fractures has gained popularity in recent years with the development of interlocking nails. However, differing surgeons advocate two different methods of nail insertion, i. e., with and without reaming of the medullary canal. Reaming can cause devascularisation of the cortex and thermal necrosis of the inner 50-70% of the cortex.[7,8] In unreamed nailing, there is less risk of fat embolism and several studies suggest better preservation and more-rapid recovery of the intraosseous blood supply after insertion of a small-diameter nail without reaming.[9-14] Also reaming leads to internal spread of infection from wound site. Henley et alin a study to compare results of manage-ment of open fracture of tibia with external fixator and unreamed intramedullary nailing found that malunion was higher in cases treated with external fixator.[15] Bhandari and associates in a metaanalysis of studies found that unreamed nail in comparison to external fixator led to fewer reoperations, less incidence of superficial infection and malunion.[16]

Sanders et alreported unacceptably high infection rate in patients treated with reamed nailing leading to belief that reaming is not advisable in open fractures.[17] Whittle et al on trial of unreamed intramedullary nailing of open fracture of tibia reported a infection rate of only 5% in grade III, 25% in grade IIIb with 96% union rate and no malunion.[18] This led to development of unreamed intramedullary nailing as alternative in open fracture of tibia.

Greitbauer et al used Solid Tibial Nail in 70 cases of acute tibial diaphyseal fractures including Grade I-IIIB open fractures and reported a union rate of 95% at 6 months postoperative. No nail failures were observed.[19] An adequate soft tissue management is mandatory in treatment of these fractures. Horn et al concluded in an experimental in-vivo study that solid nail had a greater than twofold higher resistance to infection compared to that of the cannulated nail which was statistically significant.[20] Melcher et al inoculated the

intramedullary cavities of rabbit tibiae with various concentrations of a human pathogen, of Staphylococcus aureus strain, and then inserted either a solid or a hollow slotted stainless- steel nail. They found a significantly higher rate of infection after use of the slotted nail (59%) than after the solid nail (27%) ($p < 0.05$).[21]

One patient with a segmental fracture with proximal fracture in upper third region had a gross malalignment after inserting a solid nail and couldn't be fixed in proper alignment resulting in poor result. In another patient with segmental fracture use of solid nail had to be abandoned as reduction couldn't be achieved easily and therefore a guidewire was inserted under IITV guidance and a cannulated nail was passed. In another patient planned for solid interlock nailing, the procedure had to be changed to cannulated interlock nailing because of a temporary non functioning of IITV machine. In a solid interlock nail distal locking cannot be done blindly by Solapur technique as guidewire cannot be inserted to check the screw position.

There was a significant difference with regard to infection in both the groups. Chronic osteomyelitis was seen in 23.07% of patients in cannulated group only in 9.09% patients in solid nailing group.

CONCLUSION

A higher incidence of chronic osteomyelitis and poor functional outome with cannulated interlock nailing, makes it an inferior choice for these fractures. This study highlights the fact that solid nail having a lower surface area and dead space is better at preventing infection and henceforth is superior to cannulated interlocking nail in the management of compound fractures of tibia.

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PRIMARY TOTAL HIP ARTHROPLASTY VERSUS HEMIARTHROPLASTY FOR DISPLACED NECK FEMUR FRACTURES IN OLDER PATIENTS

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ABSTRACT

Objective: This study was conducted to make a comparative analysis and evaluate the outcomes of fracture neck femur in old age managed with hemiarthroplasty versus total hip arthroplasty.

Methods: In this prospective as well as retrospective study, 33 patients were treated with total hip replacement and 36 patients with hemiarthroplasty. Pain, range of motion, hip function, and complications were assessed clinically while hip stability, femoral anteversion, acetabular cup inclination and acetabular erosion were assessed radio graphically.

Results: 69 cases were operated with a follow period of 6 months to 2.1 years and average of 1.2 years. In this study, according to Harris hip score, group A (hemiarthroplasty group) showed 58.33% excellent to good result whereas 33.34% had fair to poor result. In group B (total hip replacement group) 90.91% had excellent to good result and 9.08% had fair to poor result. The overall Harris hip score was 76.33 with SD±19.091 in hemiarthroplasty group and 86.45 with SD±6.363 in Total hip replacement group with p-value 0.0224 (<0.05) which is statistically significant.

Conclusion: Primary total hip replacement has better functional outcomes in comparison to hemiarthroplasty in fracture neck of femur in elderly patients.

INTRODUCTION

Hip fractures in older patients are associated with impaired mobility, excess morbidity and mortality, and loss of independence. With the reversing ageing pyramid and the high prevalence of osteoporosis, hip fractures remain a public health concern. Incidence estimates vary considerably among industrial conutries.[1-3] Models aimed at projecting the contribution of hip fractures to the future global of disease produced inconclusive result[4] and depended on assumptions about the effectiveness of multifaceted interventions for preventing falls and managing osteoporosis.[5-8]

The optimal surgical management of displaced femoral neck fractures in the elderly is the subject of an ongoing scientific and clinical debate. Hemiarthroplasty and total hip arthroplasty remain as widely accepted methods of hip replacement after fracture. In the long run, some patients treated with Hemiarthroplasty require conversion to total hip arthroplasty because of activity limiting thigh pain due to acetabulum wear. Reported advantages of Hemiarthroplasty compared with Total Hip Arthroplasty are reduced dislocation rates, less complex surgery, shorter operation times, less blood loss, and lower initial costs. Therefore, a number of authors prefer it for displaced femoral neck fractures. In contrast, evidence is accumulating which support better function and superior patient satisfaction for

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patients treated with total hip arthroplasty. Consequently, after weighing the pros and cons some authors have advocated total hip arthroplasty as preferable treatment. The objective of the study is to make a comparative analysis and evaluate the outcomes of fracture neck femur in old age managed with hemiarthroplasty versus total hip replacement.

MATERIAL AND METHOD

The study was conducted at SRN Hospital,Allahabad from 2010 to July 2012. In this study, 69 arthroplasty cases of the hip were performed. Out of these 69, 36 cases (24 female and 12 male) underwent hemiarthroplasty and 33 cases (21 female and 12 male) underwent total hip replacement.

All the patients of more than 60 years age presenting with displaced fracture neck of femur were evaluated according to, age, sex, type date of injury, mode of injury, time interval between injury and hospital presentation, details of primary treatment received, details of present illness, details of any comorbid illness significant past history, significant personal history and family history. Preoperative patients bone status was assessed by Singh's index[9] and C-C ratio.[10] Patients were divided randomly into two groups. Those treated by Total Hip Arthroplasty (Group A) and those treated by Hemiarthroplasty (Group B). Patients of both groups were followed up at third, sixth and twelfth month.

Functional outcomes of both the groups were assessed according to Harris hip score.[11,12] Pain & functional capacity were the two basic considerations. They were given 44 and 47 points for each respectively. Other two were the range of motion (5 points) and deformity (4 points). Then the data was analysed with the appropriate statistical methods. The statistical test used was Chi Square test. P values less than 0.05 were considered statistically significant.

All the surgeries were done under epidural or spinal anaesthesia and Posterior (Moore's) approach was used in all the cases.

RESULTS

The Mean age in total hip replacement group was 71 years (range 60 to 85 years) as compared to 72 years (range 64 to 82 years) in hemiarthroplasty group. In total hip replacement group, 63.63% were females and 36.37% were males while in hemiarthroplasty group 66.37% were females and 33.33% were males. In hemiarthroplasty group, three cases (8.33%) were Garden type II, 21 cases (58.33%) type III and 12 cases (33.33%) of type (45.46%) of type IV.63 cases (91.3 %) out of 69 had anemia followed by lung congestion and hypertension 12 cases (17.39%) each. These preoperative problems were equally distributed in both the groups.

With preoperative radiography, bone quality was assessed by Singh's index and grouped into normal, borderline and osteoporosis. About 54.54% were normal to borderline and 45.46% were mild to moderate osteoporosis in total hip replacement group. In hemiarthroplasty group, 58.33% were normal to and 41.67% were mild to moderate osteoporosis. Both groups were comparable regarding their age, gender, type of fracture and associated medical illness. Thus there was no confounding factor as far as demographic characteristics are concerned.

In the study, group A (Hemiarthroplasty group) showed mean Harris pain score is 36.75 with SD±9.899 whereas mean Harris pain score for group B(total hip replacement) was 41.27 with SD±2.828 and the t-score was -2.0641 with the p-value is 0.0449 (<0.005). This shows that total hip replacement is less painful than hemiarthroplasty group. All the components - pain, function, deformity and range of motion aggregate and form Harris hip score with maximum of 100 points. In our study group A (hemiarthroplasty group) 58.33% patients showed excellent to good results whereas 33.34% had fair to poor result. In group B (total hip replacement group), 90.91% patients showed excellent to good result. In this study, the overall Harris hip score was 76.33 with SD±19.091 in hemiarthroplasty group and 86.45 with SD±6.363 in Total hip replacement group (p-value=0.0224).

Table 1
Baseline characteristics

Characteristics	Hemiarthroplasty	Total Hip Replacement
No. cases	36	33
Mean age (in years)	71	72
Sex		
Males	33.33%	36.37%
Females	36.67%	63.63%
Side		
Right	51.33%	54.54%
Left	48.67%	45.46%
Type of fracture		
Garden II	8.33%	-
Garden III	58.33%	54.54%
Garden IV	33.33%	45.46%
Mode of injury		
Slipping on ground	51.33%	54.54%
Road traffic accident	48.67%	45.46%
Bone quality (Singh's index)		
Normal (grade 5&6)	33.33%	36.36%
Borderline (grade4)	25.00%	18.18%
Mild (grade3)	37.50%	31.82%
Moderate (grade2)	4.17%	13.64%

Table 2
Comparative evaluation of the results by Harris hip score at the end of one year

No.	Grading	Hemiarthroplasty	Total hip replacement	Total	%age
1.	Excellent (90-100)	5 (13.89%)	14 (42.42%)	19	27.54
2.	Good (80-89)	16 (44.44%)	16 (48.48%)	32	46.38
3.	Fair (70-79)	6 (16.67%)	2 (6.06%)	7	11.60
4.	Poor (60-69)	6 (16.67%)	1 (3.03%)	7	10.14
5.	Failure (<60)	3 (8.33%)		3	4.35

T-score (-2.3669), p value 0.0224

Superficial infection occurred in four patients of hemiarthroplasty group and in two patients of total hip replacement group. No sciatic nerve palsy and no dislocation occurred in any group.

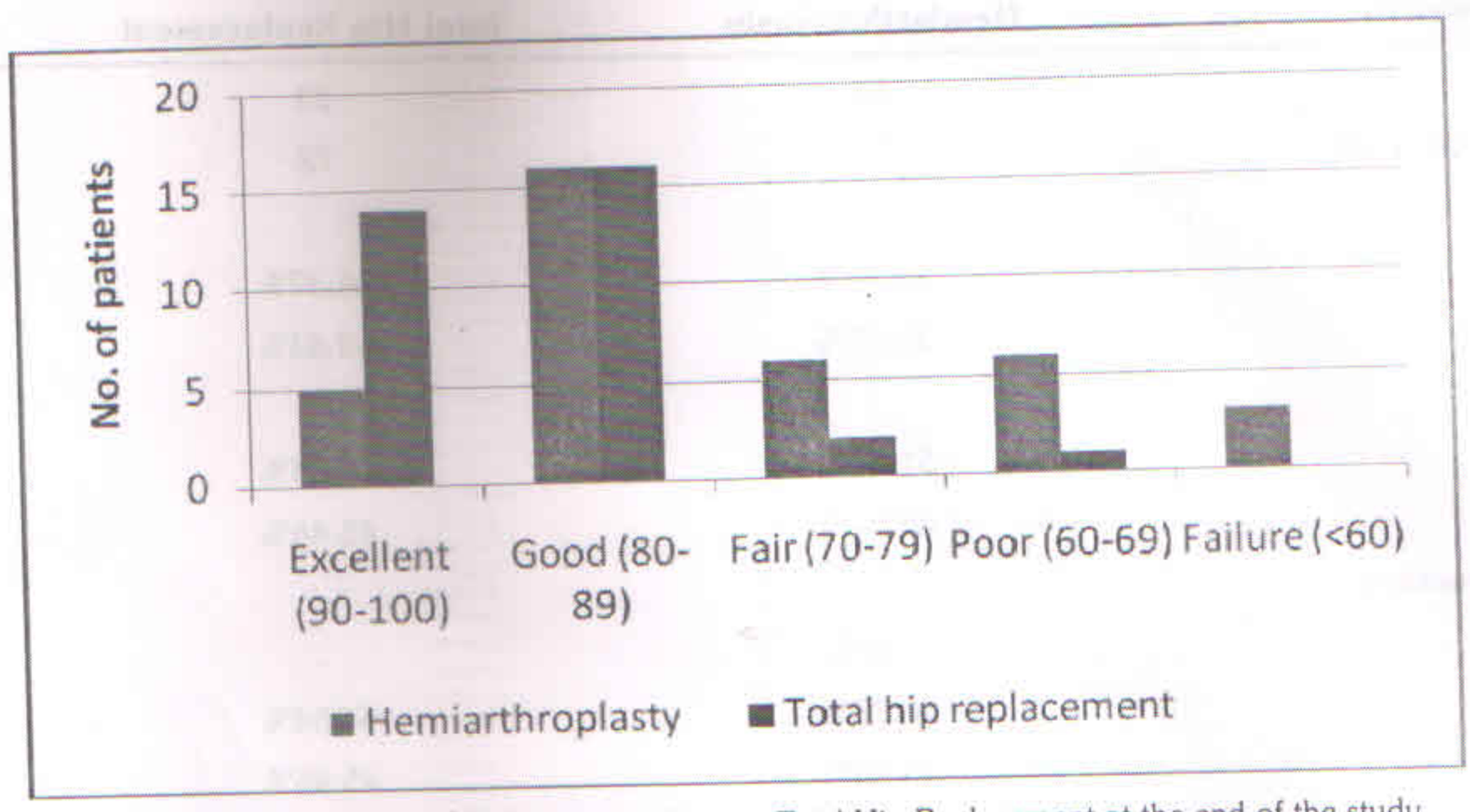
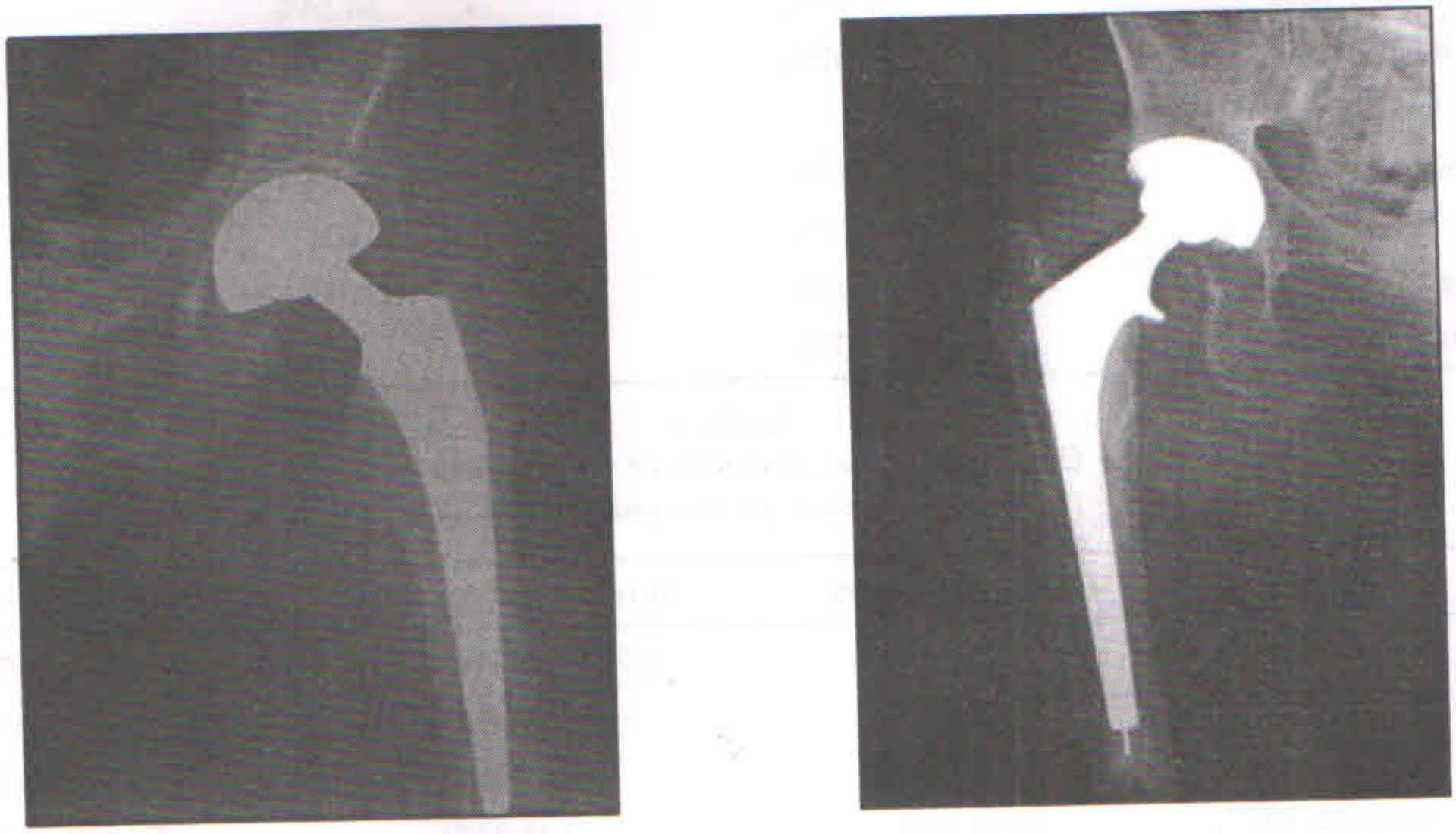


Figure 1 : Showing results of Hemiarthroplasty vs Total Hip Replacement at the end of the study



(a) (b)

Figure 2 : Showing Hemiarthroplasty (a) and Total Hip Arthroplasty for fracture neck femur in elderly

DISCUSSION

Because of elderly age and post-menopausal hormonal changes, females are more prone for osteoporosis than males and so the fracture incidence was also high in female in this series of study. Surgery should be done as soon as feasible. Immobility due to the fracture if prolonged will have its own complications like bed sore, lung infection, decreased vitality etc, which may further delay the surgery and thus may go into the vicious cycle.

Numerous studies[13-15] have addressed comparative evaluation of total hip replacement group to hemiarthroplasty group in fracture neck of femur in older age group. In this study, the mean Harris hip score was 76.33 with SD±19.091 in hemiarthroplasty group and 86.45 with SD±6.363 in Total hip replacement group with p-value 0.0224 (<0.05) and compared well with most other studies.[16-20] Skinner p et al[16] performed a prospective trial of 278 patients aged over 65 years, for the treatment of displaced sub capital fractures and found that Total hip replacement resulted in the least pain and most mobility at 1 year, while hemiarthroplasty was worst in these respects. Macaulay W et al,[17] performed a study over 41 patients and found that Total hip arthroplasty is less painful at 12 months compared with hemiarthroplasty in treatment of displaced femoral neck fracture. Blomfeldt R et al,[18] performed a four-year follow-up of a randomized controlled trial involving 120 elderly patients with an acute displaced femoral neck fracture and confirmed the better results in terms of hip function and quality of life after total hip arthroplasty as compared with hemiarthroplasty. Other studies like Cho M-R et al[19] found similar results. In our study, we evaluated that the patients with associated medical illness had poor results and had more complications, similar result was found by Nera agabeti et al,[21] but in this study as for the rate of complications was concerned there was no significant difference found between these two groups. As there were no cases of sciatic nerve palsy and all cases were done with same posterior approach, exact comparison with other studies could not be done. As in the present series there is no dislocation or subluxation postoperatively in either group, we could not correlate the degree of restoration of femoral and acetabular angles and complication in terms of dislocation.

The result of the study should be interpreted in view of the following limitations. Due to the constraints of a time bound study and because of the stringent selection criteria, the sample size was small and hence the result are subjected to Type II error and they cannot be generalized.

CONCLUSION

It is concluded that in 2.1 years of study, total hip replacement had better functional outcome in fracture neck of femur in elderly when compared with hemiarthroplasty. The postoperative pain index shows much better outcome with total hip replacement than hemiarthroplasty. The complications are correlated with time duration since surgery which shows proportional increases in complication with time.

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CONGENITAL BLOCK VERTEBRAE IN LUMBAR SPINE : A CASE REPORT

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INTRODUCTION

Fusion of vertebrae may occur due to acquired or congenital causes. The acquired causes of block vertebrae are diseases like tuberculosis, Juvenile Rheumatoid Arthritis or trauma.[1] Vertebrae column constituted by vertebrae and intervertebral discs is a manifestation of the embryological process of body segmentation or metamerism.[2] Due to a defect in this process, the vertebral bodies thus formed may be fused partially or completely. Such fusion of vertebral bodies is known as vertebral synostosis or Block Vertebrae. The vertebral bodies may also be fused surgically as a part of anterior spinal fusion. Congenital block vertebrae are seen in all the regions of spine, the order of frequency being cervical, lumbar and dorsal. The presence of lumbar block vertebrae is not very common[3] but if present, the altered biomechanics lead to premature degenerative changes[4] which may present as lumbosacral radiculopathy. Thus early diagnosis of these anomalies and thorough workup will be helpful in establishing primary diagnosis and documenting long-term changes owing to these conditions.

CASE REPORT

A 36 year housewife presented to our OPD with the complaints of chronic low back ache accompanied by radiation to left lower limb for the past 2 years. Her history was uneventful except for off and on intake of painkillers for the past 2 years. There was no history of neurological claudication. There was no history suggestive of tuberculosis. Straight leg raising test was positive at 30°. Partial sensory loss was seen in S1 dermatome on the left lower limb. Power was decreased in Extensor halluces longus (L4, 5myotome). Rest of the dermatomes and myotomes of left lower limb were normal. Sensory and motor examination of right lower limb was normal. There was no tenderness, abnormal curvature, tuft of hair, swelling orkyphus in the spine.

General blood picture was normal. Rheumatoid factor and Anti CCP were negative. Xrayof the lumbosacral spine showed fusion of L3-L4-L5 vertebrae. MRI of the lumbosacral spine showed L3-L4-L5 block vertebra, significant degenerative changes at L5/S1 disc, disc desiccation, and bilateral facet arthrosis at L5/S1 causing thecal compression, significant effacement of bilateral lateral recess and severe narrowing of bilateral L5/S1 neural foramina. Lamina, pedicle, transverse process and spinous process of the lumbosacral spine were normal. Figures 1 and 2 Screening of rest of the spine revealed no abnormality.

MRI images ruled out other common causes of lumbosacral radiculopathy like compression of nerve root by the herniated disc, an osteophyte due to degenerative osteoarthritis of spine or tumours of spine. Lack of early morning stiffness, concomitant small joint involvement and negative rheumatoid factor and anti CCP tests ruled out foraminal stenosis due to Rheumatoid Arthritis. Normal General Blood Picture ruled out spinal tuberculosis.

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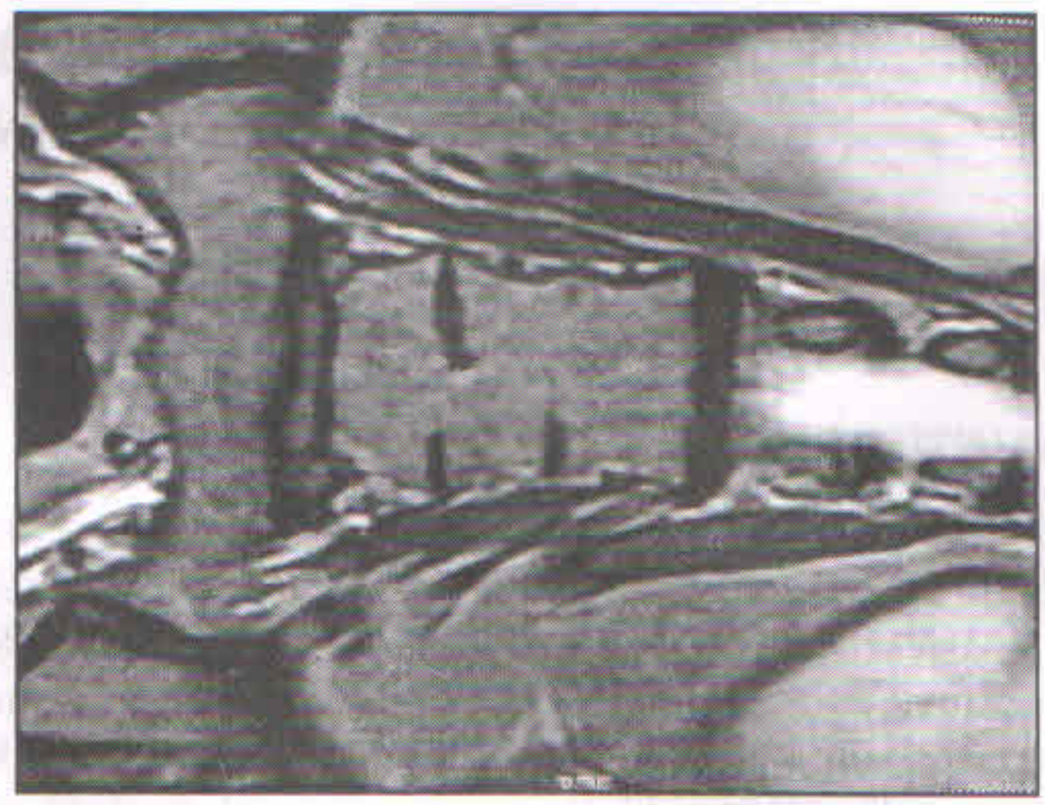

Figure 1, 2 : Sagittal and coronal MRI images of the lumbosacral spine showing L3-L4-L5 block vertebra, significant degenerative changes at L5/S1 disc and disc desiccation.

Patient was educated about her problem and various pain relieving positions. She was advised about proper posture maintenance and body mechanics with regular spinal strengthening exercises. Modalities like moist heat and cryotherapy were recommended to relax muscles and reduce pain. Standard wide Laminectomy (removal of spinous process, laminae, ligamentumflavum, medial part of facet joint and facet capsule of L4 and L5 vertebrae) and foraminotomy of bilateral L5/S1 foramina was performed. Since only partial facet joints were removed fusion was not done. Patient was relieved of her radicular pain.

At 4 weeks after operationshe continued to be painless but had sensory loss over the lateral border of foot and weakness in EHL. At 6 months follow up the patient continued to be painless but had sensory loss over lateral border of foot and weakness in EHL.

DISCUSSION

Improper segmentation of the somites during the period of differentiation of embryo leads to fusion of parts of or entire vertebrae. An example of a normally occurring block vertebra in the human body is sacrum.[5] Congenital block vertebrae are seen in all the regions of spine, the order of frequency being cervical, lumbar and dorsal (anatomy). Because there is little or no motion in the affected area, the free articulations above and below the segment are usually strained resulting in premature degenerative changes. Individuals with block vertebrae, when viewed through MRI, typically show calcified disk space, fusion of apophyseal joints, and malformation or fusion of the spinous processes (http://embryo.asu.edu/pages/congenital-vertebral-defects). Resulting spinal canal stenosis may lead to thecal sac compression leading to muscle weakness and/or atrophy, and neurological sensory loss. Block vertebra results from embryological failure of normal spinal segmentation due to decrease in local blood supply during the third to eighth week of fetal development.[4] This defect occurs during somitogenesis around the third week after fertilization.[6] The commonly encountered site is C2-C3 with an incidence of 0.4% to 0.7% with no sex predilection.[7] Although it may be encountered in any region of the spine, the location of block vertebra in order of frequency is cervical spine (C2-3, C5-6), lumbar spine (L4-5) and thoracic spine (any section).[4]

Since fusion of lumbar vertebrae may occur due to a host of other reasons like Tuberculosis, infections and trauma, it is important to rule out these possibilities when approaching a case of block lumbar vertebra. A meticulous history and general blood picture are enough to rule out these conditions.

Lumbar block vertebra is known to result in radicular pain and scoliosis.[8] However in contrast to the case reported our case did not have any spinal deformity. The presence of block vertebra results in a greater biomechanical stress in the adjoining segments leading to premature degenerative changes at adjoining motion segments. In our case these lead to disc desiccation and facet joint arthropathy with attendant thecal sac compression and lateral recess stenosis. This resulted in sensory loss and motor weakness. Since the case had presented late, operative decompression did not lead to recovery of sensory loss and motor power. However the patient was relieved of radicular pain.

It is important to recognise block lumbar vertebra as a rare cause of chronic low back ache and lumbosacral radiculopathy.Altered biomechanics due to lack of motion in the fused segments lead to premature degenerative changes in the segments below and above the block vertebra.

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THE RESULTS OF VERTEBROPLASTY IN OSTEOPOROTIC COMPRESSION FRACTURE (A MODIFIED TECHNIQUE)

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ABSTRACT

Objective: To evaluate the results and functional outcomees of vertebroplasty in osteoprotic vertebral fractures

Methods: 72 patients with osteoporotic compression fracture and spinal deformity with chronic invalidating pain treated by Percutaneous Vertebroplasty were followed for a maximum period of 2.8 years with an average of 1.3 years. The results were assessed by deformity correction, pain improvement and correction of stature.

Results: The mean pre-procedure VAS score was 8.9±1.1 which decreased significantly (P<0.001) to 4.7±2.4 within 1 month of Percutaneous Vertebroplasty and to 2.3±1.3 after 6 months (P<0.001) which is highly significant. The mean increase in anterior vertebral height after Percutaneous Vertebroplasty was 2.8 mm (range 1 to 11mm) after the procedure (P<0.001) which was statistically significant.

Conclusion: Vertebroplasty is extremely useful procedure in the management of complication of vertebral compression fracture including severe pain and vertebral deformity.

INTRODUCTION

Most of the Osteoporotic Vertebral Compression Fractures take place either spontaneously or after minor trauma, present commonly in elderly patients primarily in female as a wedged biconcave fracture.

Back pain in Osteoporotic Vertebral Compression Fracture may present as acute and excruciating or chronic and persistent pain.[1,2] One-third to three-fourths[3] of such patients may develop chronic invalidating pain. The cause may be attributed to pseudoarthrosis or osteoporotic spinal deformity. Traditional conservative methods of treating osteoporotic vertebral compression fracture include bed rest, oral and parenteral analgesic, muscle relaxant, external bracing and physiotherapy.[4] Calcitonin may have variable analgesic effect in osteoporotic vertebral compression fracture.[5] Majority of these patients respond favourably to traditional treatment, but this therapy can not address deformity. Because of elderly age of patients, concomitant disorders and fragile state of osteoporotic bone an open surgical stabilization is often not possible.

Percutaneous Vertebroplasty literally means augmentation of vertebral body through skin which was introduced and designed for management of osteolytic tumors[6-9] (firstly used in heamangiomas C2 vertebra) and later was successfully applied for osteoporotic is to reduce pain caused by vertebral compression fracture.[10-12] Primary mechanism of compression fracture consists of numerous micro fractures that stimulate nerves of periosteum during vertebral body movements (pseudoarthrosis).

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The mechanism of pain relief in Percutaneous Vertebroplasty is not clear and there are probably three possible mechanisms: 1. Mechanical stabilizing effect of injected bone cement. 2. Thermal destruction of nerve ending due to high temperature reached during polymerization of injected cement and 3. Chemical destruction of nerve endings due to composition of cement. It has been shown in previous studies that Percutaneous Vertebroplasty is more efficacious in mobile vertebral fractures as compared to fixed vertebral fractures.

PMMA has been shown to restore strength and stiffness in vertebral bodies in post-mortem studies with proven safety records since 1960.[13]

MATERIALS AND METHODS

Patients were selected with following criteria:

1. Osteoporotic vertebral compression fracture not responding to conservative therapy for more than six weeks
2. Vertebral compression fracture with at least 15% anterior height loss
3. Presence of bone marrow edema in collapsed vertebral body on MRI
4. Avascular necrosis of vertebral body (cleft phenomenon)
5. Progressively increasing pain, disability and radiological worsening documented on follow up

All these patients were assessed clinically by localizing tenderness over affected vertebra. Clinical examination was done by keeping following things in back mind:

1. Pain attributed to the fractured vertebrae level. Local bony tenderness over spine was observed.
2. Detailed neurological examination; sensory and motor changes, radiculopathies.
3. Laboratory tests: Blood investigations for complete blood cell counts, diabetes control, coagulation indices. Appropriate additional tests were done for primary disease, if any, causing the vertebral compression fracture.

The following investigations were done to evaluate the physical status of patient and the pre and postoperative results. The results were assessed both by clinical evaluation and radio logically.

1. **X-rays:** X-ray of the spine in AP and lateral views. Preferably standing lateral view in flexion and extension (flexion and extension were done by active movement with utmost care) were taken.
2. **CT scan:** CT scanning with 3D, saggital and reconstructions are helpful in assessing the complex vertebral fractures; they were done in selected cases. Thin reconstructed section showed the fracture and the integrity of the posterior vertebral wall.
3. **MRI:** This is one of the best investigations in the evolution of the vertebral compression fracture. It has shown to be useful showing bone marrow oedema or endplate oedema. This is helpful to assess all the involved fracture level, define the intervertebral clefts, and aid in giving information about pathological fracture. High density signals of T_2 weighted or short-tau Inversion Recovery (STIR) sequence signify intra-osseous oedema. Involvement of the pedicle or soft tissue or in epidural space may indicate positive outcome with Vertebroplasty. STIR: sequence is most sensitive in identifying acute fracture. Imaging modality of choice is MRI of spine as it is:
   1. Highly sensitive
   2. Increased signals in T_2 sequence show acute fracture = oedema = increased signal T_1 STIR T_2.[14-15] High intensity signal on STIR MRI have shown 100% association with osteoporotic vertebral compression fracture correction predictor for the vertebral body correction.[16]

PROCEDURE

Percutaneous Vertebroplasty is performed under local anesthesia, sometimes with sedation. Patients are positioned prone with bolster under

sides, the chest and pelvis in order to increase anterior winding of vertebral. Then with full antiseptic precautions and under fluoroscopic guidance, the affected vertebra is marked and through a small incision a 11 or 13 Gauge Vertebroplasty needle with trocar and cannula (or leur lock bone biopsy needle) was inserted through pedicle.

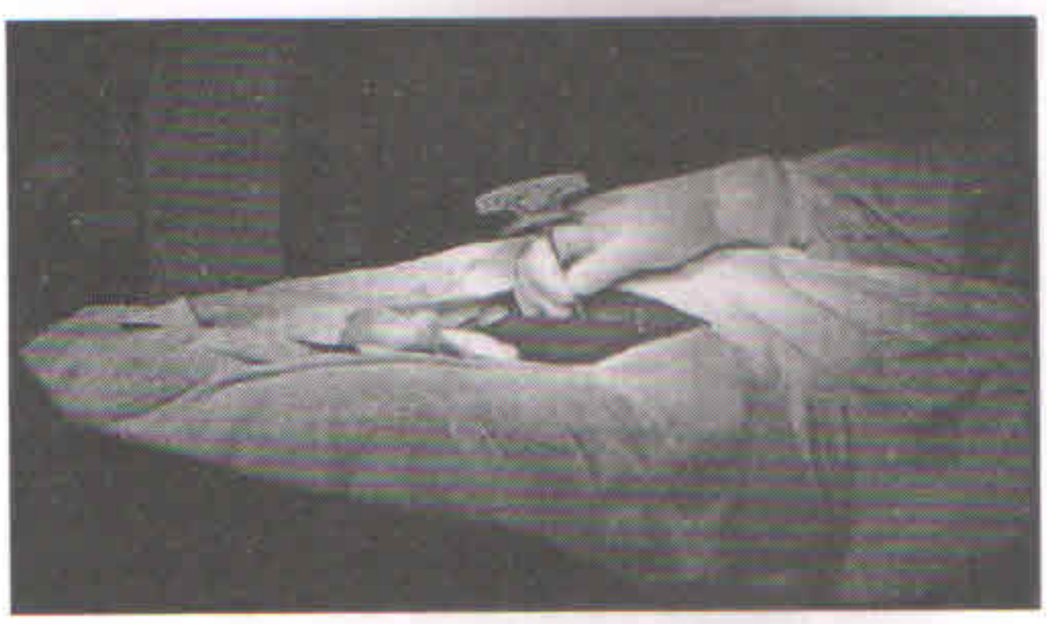

Figure 1 : Percutaneous Vertebroplasty being done under fluoroscopy

The tip of the cannula must be in center to a point approximately 1 cm posterior to the anterior vertebral body assessed laterally. Because the vertebral body is not rectangular but rather curved, leaving a safe gap between these two points is needed to ensure the anterior cortex is not breached. The contra lateral pedicle is cannulated in a similar fashion. Bilateral cannulation is favoured due to increased chance of adequate and safe cement injection. Then the normal saline is pushed through cannula until resistance in vacuum area is felt, this signifies that there is no leakage in vertebra. And by measuring volume of saline, we get an estimation of the amount of cement to be used.

Subsequently, using a fine cannula all the saline is sucked out and bone cement is pushed slowly. After injecting the cement, expansion of vertebrae is seen under C-arm X ray. Vertebroplasty cannula is rotated at same place until cement is settled down and then cannula is

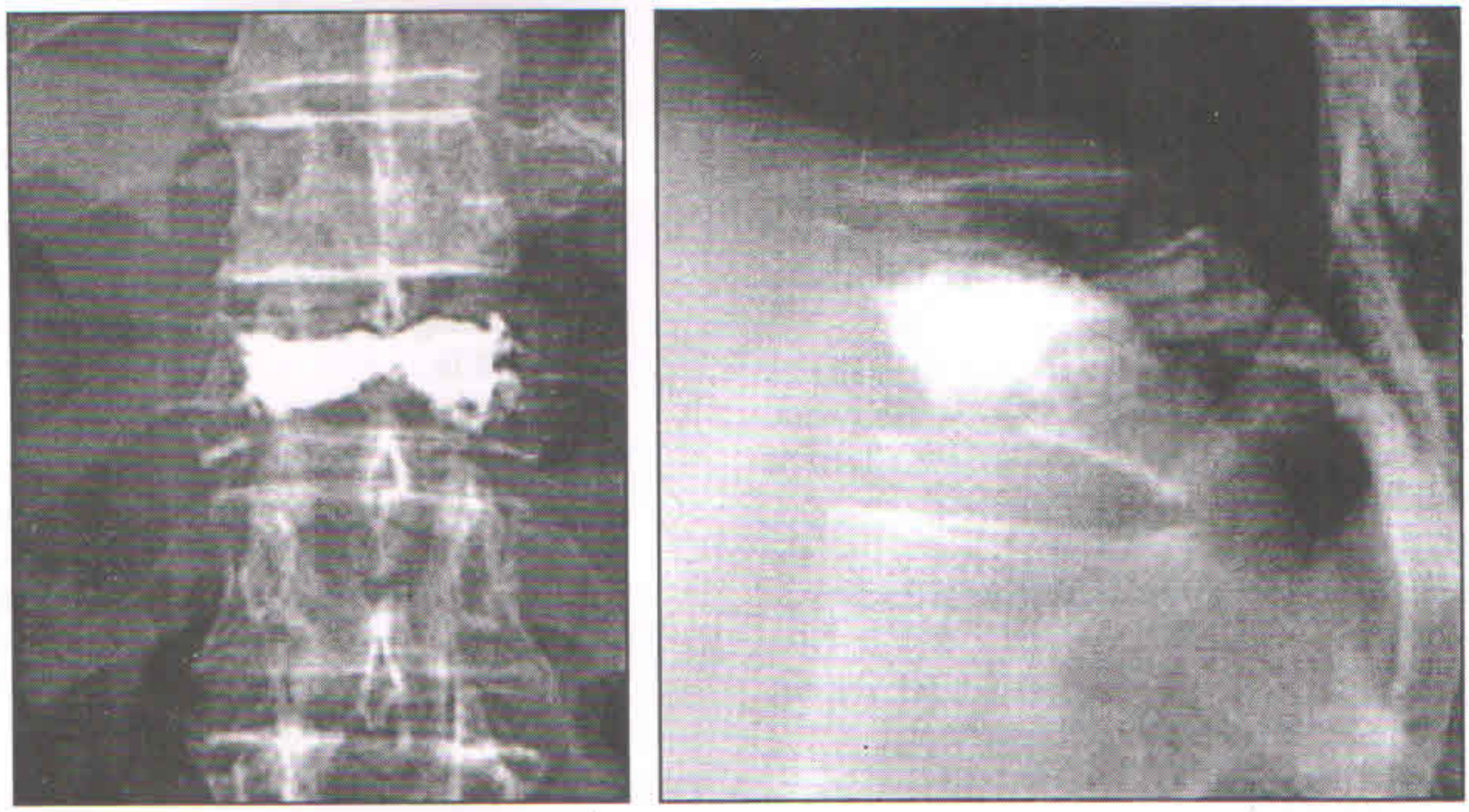

Figure 2 : AP (a) and lateral (b) X ray images following T11 Percutaneous Vertebroplasty in a 62-year-old man with an osteoporotic vertebral compression fracture. A bipedicular approach was used. There is satisfactory filling of the vertebral body in the lateral and AP projections without evident leak.
The patient's symptoms had resolved on awakening from the procedure

removed. This avoids the leakage of cement through the performed pedicle if it happened while removing the cannula. Regardless of exact measurements, visual filling of the body on the AP projection from the inner margins of the endplates along the lateral 1/3 on each side is ideal, though this is not always technically feasible

POST OPERATIVE EVALUATUON

- After completion of procedure patients were instructed to lie flat in supine position for an hour. Throughout the procedure and after that, constant watch was kept on neurological status.
- After 6 hrs of procedure, patients were allowed to stand and walk
- Before discharging patients were assessed for improvement in pain immediately after the procedure and 24 hrs then patients were observed for the presence of any neurological deficit and any other complication.
- Radiological assessments were done by X-ray on same day, at one, three, six, twelve month after the procedure.
- MRI scan was done after three months whenever feasible.
- Aggressive treatment for osteoporosis was given after the procedure.

RESULT

A total of 72 patients were treated with Vertebroplasty in the last 2.8 years with the average follow up of 1.3 years. All patients were evaluated as per the fixed protocol of our centre and the procedure was conducted under local anaesthesia, only sometimes with mild sedation so that the patient could respond to the verbal commands while the procedure was being done.

The results were assessed by deformity correction, pain improvement and correction of stature. The mean pre-procedure VAS score was 8.9±1.1 which decreased significantly ($P<0.001$) to 4.7±2.4 within 1 month of Percutaneous Vertebroplasty and to 2.3±1.3 after 6 months ($P<0.001$) which is highly significant. The mean increase in anterior vertebral height after Percutaneous Vertebroplasty was 2.8 mm (range 1 to 11mm) after the procedure ($P<0.001$) which is very statistically significant.

DISCUSSION

Most of the patients of osteoporotic vertebral compression fracture managed conservatively with bed rest analgesic, muscle relaxant, bracing, calcium. Elderly patients with medical problem have difficulties with bed rest they can develop complication like DVT, embolic phenomenon, UTI and even bed sores.

- In literature, significant pain reduction was achieved in 70% to 95% of patients with in 24 hrs.[11,19,20]
- In our study, because of modification in procedure, we found that pain relief or reduction after Percutaneous Vertebroplasty was achieved in 73.3% patients after 24 hrs while these same patients suffered on an average 8 weeks of pain before Vertebroplasty. These results are comparable to the literature. After 6 months, 93.3% of patients got relief which is comparable to the result of Liliang (2005).[20]
- Because of modification of procedure in injecting cement, no case was reported with cement leakage as compared to 16.7% in literature due to rent in vertebrae.
- In this series of study, the mean pre-procedure VAS score was 8.9±1.1 which decreased significantly ($P<0.001$) to 4.7±2.4 within 1 month of Percutaneous Vertebroplasty and to 2.3±1.3 after 6 months ($P<0.001$) which is highly significant. These results are comparable to the results of Perez-Higureras et al. (2002)[21] and Yeom et al.[22]
- The age of fracture with degree of osteoporosis is the main determinant of achieving satisfactory pain reduction.[23] The mean increase in anterior vertebral height was 2.8 mm (range 1 to 11mm) after the

procedure (P<0.001) which is very statistically significant This was comparable with result of Hiwatashi et al. (2003)[24] and Jang et al. (2003).[23]

- Even with a long follow-up period, we did not observe any radiological changes in the vertebral bodies that had been treated. Therefore, we suggest that Percutaneous Vertebroplasty can prevent the progression of vertebral collapse at the level of the treated vertebra. The Percutaneous Vertebroplasty with PMMA might increase the risk of fracture of adjacent vertebrae by shifting the normal load transmission through the spine. This risk should be weighed against the benefit of Percutaneous Vertebroplasty in preventing further collapse at the level of the treated vertebra.

CONCLUSION

- Percutaneous Vertebroplasty is a technically feasible treatment in patients with osteoporotic vertebral compression fractures which does not respond to the best possible conservative treatment.
- Percutaneous Vertebroplasty works as internal splint for the micro fractures of vertebral body by methyl methylmethacrylate cement which helps to relief severe pain.
- The pain relief and improvement of deformity, mobility, function and stature after Percutaneous Vertebroplasty is immediate.
- Successful treatment depends largely on appropriate patient selection, preoperative assessment, proper planning and meticulously performed procedure.
- In our opinion, Percutaneous Vertebroplasty is extremely useful procedure in the management of complication of vertebral compression fracture including severe pain and vertebral deformity. Improvement in the vertebral deformity in turn corrects the stature of the patient. Percutaneous Vertebroplasty helps in overall improvement of morbidity.
- Modification in conventional technique of Vertebroplasty significantly decreases the incidence of cement leakage during procedure.

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CHARACTERISTICS OF TRAUMA VICTIMS ADMITTED TO THE TRAUMA CENTRE OF KGMU

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INTRODUCTION

Research in trauma requires surveillance; creation of trauma registries and a dedicated pool of professionals trained to collect analyze and report data.[1] National Crime Records bureau is the principal nodal agency under the ministry of home affairs, Government of India, responsible for collection, compilation, analysis and dissemination of injury related information. It uses police records as its source of data. A large percentage of injuries go unreported due to lack of a systematic injury information system. Good quality information on mortality and morbidity, road design, and enforcement practices is essential for addressing the problem and for effective intervention strategies. Information on each of these is available in fragments from multiple agencies that deal with them.[2] Another problem with police records is that it is collected by individuals not trained to collect trauma related data. KGMU trauma centre is the only trauma centre of Uttar Pradesh, the most populous state of India. Many patients are referred from other tertiary care cenrtre, primary and secondary care centres of Uttar Pradesh. The objective of this study was to describe the charecteristics of trauma victims admitted to the trauma centre and thereby create baseline data for future use.

METHODS

This prospective observational study was conducted at the KGMU trauma centre. Permission for the study was granted by Institutional ethics board of KGMU. Since there is a possibility of patients admitted on different days of the week being different, all patients admitted on one randomly selected day of the week were enrolled in the study. To account for seasonal variation it was decided to collect data for 1 year. Data was collected on a questionnaire for which item analysis for inter and intra observer error had been done.

Characteristics recorded were age, sex, preexisting chronic conditions (ischemic heart disease, hypertension, diabetes mellitus, liver disease, malignancy, renal disease), systolic BP at admission, respiratory rate at admission, GCS score at the time of admission, coagulopathy at admission, time since injury to admission, referral from other centre, specific injury (Abbreviated injury scale), injury severity (Injury Severity Score), district of injury, socioeconomic status of the patient (BPL card) and mechanism of injury. Region involved was also recorded. Since many patients suffered from more than injury, regions involved were recorded as head injury associated with other injuries (Neuro-poly) and orthopaedic injuries with other injuries (ortho-poly). All other multiple injury patients not fitting in Neuro-poly and Ortho-poly were grouped togetheras polytrauma.

Patient outcome at the end of hospital stay

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was also recorded as discharged, expired, left against medical advice, and absonded. Since a number of patients leave hospital against medical advice (LAMA) or abscond, it was decided to follow them up for a period of one year to report the outcome.

STATISTICAL ANALYSIS

Data was collected using Microsoft XL. Analysis was done using stata.

RESULTS

Number of patients included was 572. Of the 572 patients, 327 were referred and 245 were direct admission.GCS Score could not be recorded in 35 patients due to presence of paralysis, quadriplegia (26 patients) or injury to maxillofacial region (9 patients) while data on ISS could not be recorded in 2 patients. Mean age 40.81±16.3 years (median 38), predominantly male (83.57%), mean ISS 12.56±7.3 (median 9), mean GCS 12.20±4.1 (median 15). Mean time to admission was 54.22±185.2 hours. One hundred forty three patients died (24.96%; 3 due to unrelated causes) during one year follow up. Out of total 572 patients, 327 (57%) patients were referred patients and 245 (43%) were directly admitted patients. (Table 1)

Table 1
Patients' characteristics at the time of recruitment (N=572, unless stated)

Quantitative variable	Mean±SD	Median
Age	40.81±16.3	38
Admission gap in hours	54.22±185.2	9.17
Respiratory rate at admission	21.75±5.8	20
Injury severity score (N=570)	12.56±7.3	9
Glasgow coma scale (N=537)	12.20±4.1	15
RTS (N=537)	7.07±1.2	7.84
TRISS (N=536)	6.44±12.7	1.2
Time to first blood transfusion in hours (N=147). *425 patients did not require blood transfusion.*	52.50±66.5	24
Number of blood unit transfused (N=147) *425 patients did not require blood transfusion.*	2.34±1.6	2
Qualitative variable	**N**	**%**
Site of accident was poorly lit/ dark	209	36.54
Female sex	94	16.43
Previous associated morbidities		
Coronary artery disease	17	2.97
Chronic obstructive pulmonary disease	27	4.72
Hypertension	26	4.55
Renal disease	4	0.70
Diabetes mellitus	15	2.62
Respiratory rate		
≤10	8	1.40
11-26	469	81.99
>26	95	16.61

Blood Pressure		
Systolic BP≤100/90	83/33	14.51
Diastolic BP≤60	66	11.54
Below Poverty Line (BPL) patients	109	19.06
Admission in Trauma Ventilatory Unit (TVU)	27	4.72
Trauma pattern		
Head injury	183	31.99
Head injury combined with any other injury	62	10.84
Single segment of an extremity (Ortho)	176	30.77
>1 segment of an extremity or >1 extremity (Ortho)	43	7.52
Other poly trauma	40	6.99
Cervical spine	27	4.72
Thoracic Spine	8	1.40
Lumbar spine	6	1.05
Chest	16	2.80
Abdominal trauma	9	1.57
Face	2	0.35

Orthopaedic and neurological injuries constituted a vast majority of eight hundred and five injuries recorded in 572 patients Table 2. Lower extremity injuries were most frequent (n=248/805 i.e. 29.00%). Head was the 2nd most commonly involved region (246/805 i.e. 28.77%). Upper extremity injuries (n=95) constituted 11.11% of all injuries. Spinal injures were 6.1% (n=53), chest injuries were 3.09% (n=26) and abdominal injuries were 1.6% (n=14). Commonest injury reported was contusion of brain. Common fractures of lower extremity were both bone leg, fracture shaft of femur, intertrochantric fracture and fracture neck of femur. Common dislocations of lower extremity were central fracture dislocation of hip, and posterior dislocation of hip. Of the 211 fractures in lower extremity, sixty two were compound fractures (62/211 i.e. 29.38%). Of the twenty four pelvic injuries, 19 were stable and 5 unstable. Common injuries to head region included cerebral contusions, intracranialhaematomavault fractures, and cerebral edema. There were 15 facial fractures. Common fractures of the lower extremity were fracture of the distal radius, fracture both bone forearm and fracture shaft humerus. Cervical spine was the most commonly involved region of the spine.

Patients referred from peripheral hospitals hadsignificantly lower GCS (Mean 11.87±4.2 Vs 12.66±3.9; p value 0.0296), higher time to admission to trauma centre (Mean 78.02±235.0 hrsVs22.44±68.8/5hrs; pvalue < 0.0001) and longer duration of hospital stay (Mean 10.89±12.3 9.25±13.3/6; pvalue 0.013). Mean time to admission to referral centre after sustaining injury was 12.65±36.5. ISS was not significantly different in thetwo groups (Mean 13.08±7.411.87±7.2;p value 0.06). Patientsreferred from peripheral hospitals had a higher proportion of hypotensive (systolic BP <100 mm Hg) patients (16.82% in referred group and 11.43% in directly admitted group) at admission, a greater proportion of head injuries (45.26% in referred group and 39.60% in directly admitted group) and higherproportion of female patients (18.96% in the referred group and 13.6% in the directly admitted group) but the differences were notstatistically significant. One year mortality since the time ofinjury was 27% in the referred group and 22% in thedirectly admitted group, the difference being statistically insignificant.

Table 2
Injuries (N=805) recorded in 572 patients

Region	Type of Injury		N	%	Comment
Head injury (n=246)	Contusion		112	13.91	93 were single and 19 multiple
	Vault fractures		48	5.96	26 were simple and 22 compound
	Cerebral edema		37	4.60	
	Extradural haemorrhage		31	3.85	30 were single and 1 multiple
	Subdural Haemorrhage		19	2.36	
	Subarachnoid haemorrhage		8	0.99	
	Intraventricuular bleed		4	0.50	
	Diffuse Axonal injury		3	0.37	
	Intracerebral/ Intracerebellar bleed		3	0.37	2 were intracerebral and 1 intra cerebellar
	Fractures of the base of the skull		1	0.12	
Lower extremity injuries (n=248) (29%)	Fractures of lower extremity (n=211) (85.08%)	Fracture both bone leg	68	8.45	34 were simple and 34 compound
		Fracture shaft of femur	30	3.73	24 were simple and 6 compound
		Intertrochantric fracture femur	24	2.98	
		Fracture neck of femur	14	1.74	
		Fracture supracondylar femur	13	1.61	8 were simple and 5 compound
		Fracture shaft tibia	13	1.61	9 were simple and 4 compound
		Fracture Upper end tibia	11	1.37	10 intercondylar and 1 lateral condyle, 6 were simple and 5 compound
		Fracture patella	10	1.24	8 were simple and 2 compound
		Pott's fracture	9	1.12	7 were simple and 2 compound
		Metatarsal fracture	7	0.87	6 were simple and 1 compound
		Subtrochantric fracture femur	4	0.50	
		Fracture shaft/head fibula	4	0.50	Shaft (3), Head (1)
		Fracture greater trochanter	2	0.25	
		Fracture lower end tibia	1	0.12	
		Fracture calcaneum	1	0.12	
	Dislocations (n = 11; 4.4%)		11	1.37	Hip (4), CFD (5), Knee (1), Interphallangeal (1)
	Crush injury (n = 11; 4.4%)		11	1.37	Leg (4), Foot (5), Knee (1), Ankle (1)
	Amputations (n = 7;2.84%)		7	0.87	Below knee (5), Above knee (1), Midtarsal (1)
	De- gloving injuries (n=2; 0.8%)		2	0.25	Thigh (1), Leg (1)
	Nerve injury (n=1; 0.40%)		1	0.12	Common Peroneal Nerve (1)
Upper extremity injures (n=95) 11.11%	Fractures of upper extremity (n=82)	Fracture scapula	6	0.75	Neck (3), Body (3)
		Fracture lower end radius	20	2.48	19 were simple and 1 compound
		Fracture both bone forearm	16	1.99	12 were simple and 4 compound
		Fracture shaft humerus	16	1.99	13 were simple and 3 compound
		Fracture clavicle	11	1.37	
		Fracture neck of humerus	3	0.37	

	Fracture radial head or neck/capitullum	3	0.37	Radial head(1), Radial Neck (1), Capitullum (1)
	Montaggia fracture disocation	3	0.37	2 were simple and 1 compound
	Fracture styloid process Radius/ ulna	2	0.25	Radius (1), Ulna (1)
	# medial condyle humerus	1	0.12	
	# intercondylarhumerus	1	0.12	
Neuro-vascualar involvement		6	0.75	Brachial plexus (4), PIN (1), Radial a. (1)
Crush injuries		5	0.62	Hand (3), Wrist (1), Forearm (1)
Amputations		2	0.25	Below elbow (1), Metacarpophallangeal dislocation (1)
Pelvic Injuries (n=24; 2.98%)		24	2.98	19 were stable and 5 unstable
Facial fractures (n=15; 1.86%)		15	1.86	Maxillary (7), Zygoma (4), Mandible (3), Nasal (1)
Chest Injuries (n=26) 3.09%	Haemothorax with fracture of ribs	9	1.12	
	Multiple rib fractures	7	0.87	
	Haemopneumothorax	4	0.50	
	Lung contusion	2	0.25	
	Flail chest	3	0.37	
	Pneumothorax	1	0.12	
Spinal Injuries (n=53) 6.1%	Cervical spine	32	3.98	26 were with neurological deficit and 6 without
	Dorsal spine	10	1.24	9 were with neurological deficit and 1 without
	Lumbar spine	11	1.37	9 were with neurological deficit and 2 without
Abdominal injuries (n=14) 1.8%	Perforation	9	1.12	Stomach (2), Jejunum (5), Urinary bladder (1), Rectal (1)
	Visceral lacerations	3	0.37	Liver (1), Spleen (1), Kidney (1)
	Mesentric tear	1	0.12	
	Urethral injury	1	0.12	
	External injuries	84	10.43	10.43

Three hundred Three hundred seventy eight (66.43%) sustained injuries due to an RTA. One twenty seven (22.32 %) patients sustained injury dueto a fall, off which 69 (54.33%) werefalls from lessthan body height, 52 were falls from more than body height (40.94%) and 6 (4.72%) were falls from a moving train. One hundred sixteen injured (20.39%) sustained an injury on being hit by a speeding vehicle of which seventy seven (66.38) were pedestrians and thirty nine were cyclists (33.72%). Sixty six injured (11.60%) sustained an injury due to skid of the two wheeler of which 58 (87.87%) were due to a motorcycle skid and 8 (12.13%) due to a bicycle skid. Ninteen were injured when they slipped from the motorcycle while sitting with legs on same side. One hundred sixty two (28.47%) injured sustained injury due to a collision of which 126 (77.78%) were due to motorcycle colliding with some other vehicle.

Table 3
Showing the mechanism of injury

Mechanism of Injury		Total N	Total %	Expiry N	Expiry %
Hit by a speeding vehicle/animal (N 116) 20.39%	Pedestrian hit by a speeding motor cycle	40	7.03	9	22.50
	Pedestrian hit by some other vehicle	37	6.50	19	51.35
	Cycle hit by a speeding motor cycle	21	3.69	5	23.81
	Cycle hit by some other speeding vehicle	18	3.16	11	61.11
Two vehicle skid N=66 11.60%	Bicycle skid	8	1.41	1	12.50
	Motorcycle skid	58	10.19	10	17.24
Pillion slipped from a moving motorcycle		19	3.34	9	37.47
Collision (N 162) 28.47%	Motorcycle involved in collision with a moving vehicle	126	22.14	27	21.43
	LMV -HMV	14	2.46	1	7.14
	LMV - LMV	12	2.11	0	0.00
	HMV-HMV	10	1.76	0	0.00
LMV overturned		15	2.64	4	26.67
Falls (N 127) 22.32%	Fall < body height	69	12.13	6	8.70
	Fall > body height (N 52)	52	9.14	23	44.23
	Fall from train	6	1.05	1	16.67
Assault		23	4.04	4	17.39
Gunshot		14	2.46	5	35.71
Stuck by falling object		14	2.46	3	21.43
Machine injuries		13	2.28	2	15.38

Red colour in the background indicates involvement of motorcycle

Table 4 summarizes the commonest causes for resulting trauma pattern. The common causes of head injury in decreasing order of frequency were motorcycle collision, pedestrian hit, motorcycle skid, pillion slipping from the motorcycle and assault. The common causes of orthpaedic injury in decreasing order of frequency were fall less than body height, motorcycle collision, motorcycle skid, pedestrian hits and fall more than body height. The commonest cause of spine injuries was fall from more than body height. Common causes of orthopoly in decreasing order of frequency were motorcycle collision, pedestrian hits, mobike skid, fall more than body height and HMV-HMV collision. (Table 4)

Table 4
Showing mechanism of injury for common trauma patterns

Region	Top 5 mechanism of injury				
Spine	Fall more than body height N 23 (40.35%)	Pedestrian hit by speeding vehicle/animal N 10 (17.54%)	Fall less than body height N 6 (10.53%)	Stuck by falling object N 5 (8.77%)	Motorcycle skid N 3 (5.3%)
Neuropoly	Motorcycle collision with some other vehicle (40.32%)	Pedestrian hit by speeding vehicle/animal (16.13%)	Cycle hit by speeding vehicle or motorcycle (11.29%)	LMV-HMV collision (4.84%)	LMV-LMV collision (3.23%)
Neuro	Motorcycle collision with some other vehicle (25.27%)	Pedestrian hit by speeding vehicle/animal (14.29%)	Mobike skid (12.09%)	Pillion slipped from moving motorcycle (9.34%)	Assault (7.14%)
Ortho	Fall less than body height (26.09%)	Motorcycle collision with some other vehicle (13.71%)	Mobike skid (12.57%)	Pedestrian hit by speeding vehicle/ animal (12.57%)	Fall more than body height (4%)
Orthopoly	Motorcycle collision with some other vehicle (27.91%)	Pedestrian hit by speeding vehicle/ animal (20.93%)	Mobike skid (13.14%)	Fall more than body height (11.63%)	HMV-HMV Collision (6.98%)
Other polytrauma	Motorcycle collision with some other vehicle (25.64%)	LMV-HMV Collision (15.38%)	Mobike skid (10.26%)	Cycle hit by speeding vehicle (7.69%)	Fall more than body height (5.13%)

Three hundred ninety (68.59%) patients were discharged, sixty seven (11.69%) left the hospital against medical advice, 8 absonded from the trauma centre and 104 expired with in the hospital. Table 5 Ten patients died after being discharged from the hospital, twenty four of the 67 LAMA patients also expired and 2 of the absconded patients died later.

Table 5
Showing status of the patients at the end of hospital stay and mortality after leaving the hospital

Status at the end of hospital stay	N	%	Expired after leaving hospital
Discharged	390	68.59%	10
Left against medical advice	67	11.69	24
Absconded	8	1.40%	2
Expired	104	68.59	

Mortality showed 2 distinct phases; one before 6 days and another after 6th day. (Figure 1)

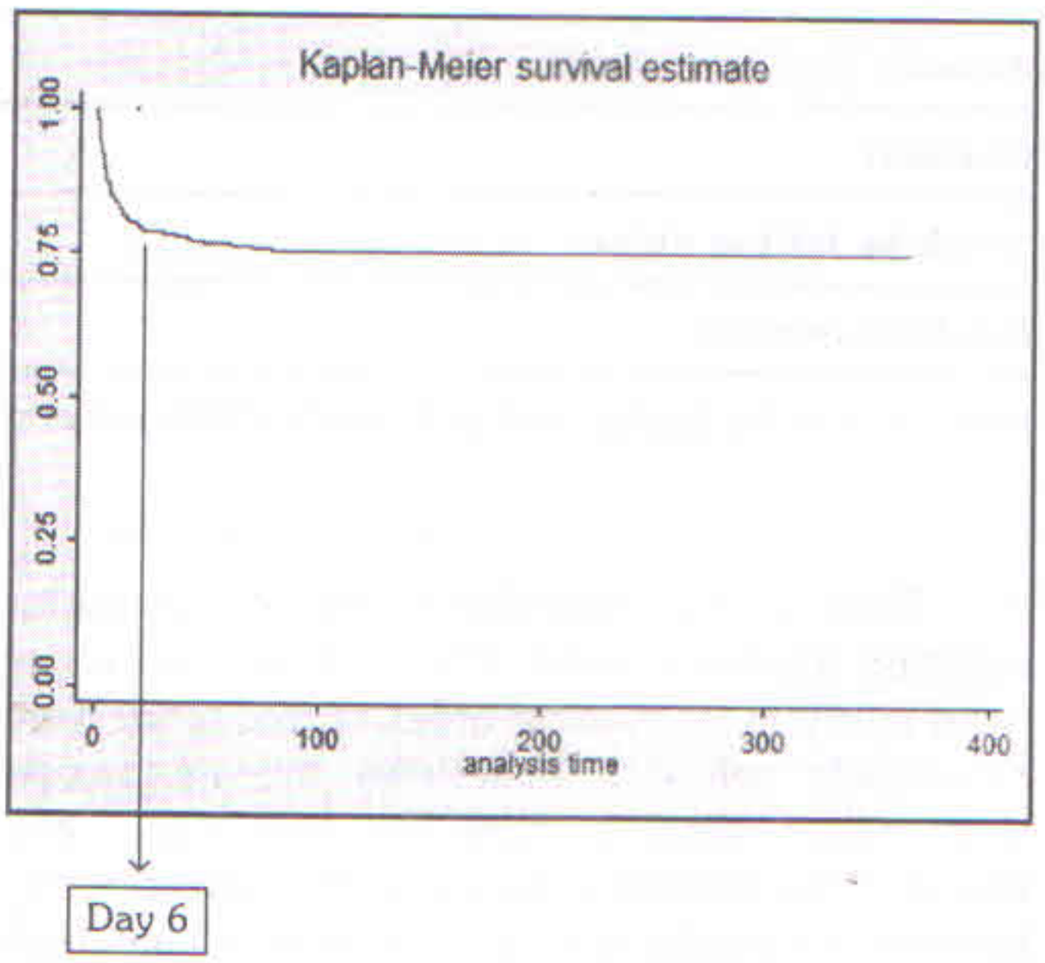

Figure 1 : Showing 2 distinct phases of mortality

DISCUSSION

Our study confirms the finding of other studies that traumatic brain injuries and orthopaedicinjuries constitute a majority of injured admitted to trauma centres.[3,4] Traumatic brain injury is known to have poor long term outcome in terms of mortality as well as morbidity.[5] A majority of patients that died after leaving the hospital in our study were traumatic brain injury patients and this could be because of the long term effects of traumatic brain injury. However we are unable to confirm this on the basis of the results of our study. Another study that investigates this long term mortality after patients leave the hospital will be able to throw better light on the causes and methods to prevent this long term mortality.

We confirm the findings of other studies that motorcycle collision with other vehicles and pedestrian hits by other vehicles are the commonest causes of traumatic brain injuries.[6] An interesting mechanism of injury for traumatic brain reported by us is pillion slipping from the motorcycle. All of these were women. In India, women pillion riders on motorcycles sit with both the legs on the same side. This habit combined with bad roads explains the mechanism of injury as well as predilection of women for this particular mechanism of injury.

In our study, the most common cause of spinal cord injury was falls, while RTA involving pedestrians being hit by speeding vehicles was the second most common cause of spinal injury. This is in contrast to results reported in studies from developed countries where RTA has been incriminated as the most common cause of spinal cord injury.[7] Different behavior patterns in different populations can affect the spinal cord injury etiology.[8] In India, lack of parapet on roofs combined with darkness due to lack of electricity supply in many rural areas makes people sleeping on roof liable to falls during night. Improvement in designs of houses making parapets compulsory can prevent falls.

An alarming finding in ours study is a very long time to admission to trauma centre or the referral hospital. Mortality in trauma patients is known to follow a trimodal distribution with the first week with in seconds to minutes, second phase within hours and the third phase within days to months.[9] Mortality during different phases of mortality is known to be decreased by phase specific interventions. For first phase the interventions are primary prevention; during 2nd include better transport facilities and care during transport; during 3rd phase the interventions include better care in the hospital.[9] Long time to admission to trauma centre as well as referral centres raises the possibility that our existing emergency medical response system is not responding to the second phase of mortality. Only 49 patients were brought to the trauma centre using ambulances and therefore the reason for this delay could be unavailability of ambulances. However we are unable to comment on factors that determined his choice of vehicle for transport as many other factors may be responsible for the choice other than availability.

A vast majority of road users in India are pedestrians, bicyclists, and motorcyclists. Unlike users of light motor vehicles and heavy motor vehicles, these are exposed to traffic environment and are thus unprotected in the event of a crash. In the event of a crash they come in direct contact with the impacting vehicle and the energy transfer is high resulting in serious injuries and death.[10] Results of our study confirm the findings of other studies that have reported a high proportion of deaths in these groups of injured. These groups contributed a majority among those admitted to the trauma centre of KGMU. Thus measures taken to protect these groups will result in decreasing the number of admissions and consequent mortality due to trauma.

Our results are in contrast to other studies that have reported significantly higher mortality in the event of referral from a peripheral hospital compared to those directly admitted. This can be explained on the basis of low number of time critical injuries like intracranial haematoma in our

study, a finding which has been reported in previous studies as well.

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