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Explain clearly yet concisely your clinical, technical or experimental procedures. Previously published methods should be cited only in appropriate references.

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Describe your findings without comment. Include a concise textual description of the data presented in Tables, Charts and Figures.

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Tables should be self-explanatory and should supplement, nor duplicate the text. Type each table on a separate sheet with double space. Number tables consecutively with a brief title for each. Give each column a short abbreviated heading. Place explanatory matter in foot-note. If you use data from another published or unpublished source, obtain permission and acknowledge fully.

**Illustrations**

Use only those distinct illustrations that clarify and increase the understanding of the text. All illustrations must be numbered and cited in the text. If possible send black and white glossy print photographs the colour photos taken may be sent to my e-mail address with permission to make black and white prints from it.

**Legends for Illustrations**

Type legends for each illustration.

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The text should include only those references that are important and have been studied in full by the authors. All references will be checked by the editorial board and we shall request photocopies of the articles if we are unable to verify. References should be represented in the text by Arabic numbers in the manuscript in the order of their appearance. The list of references at the end of the text should be in this numerical order with details as follows:

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An Experimental Study to Assess the Efficacy of Computer Assisted Pedicle Screw Fixation in Upper Thoracic Spine

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Dr P S John
Professor and HOD, Dept of Orthopedics, Medical College, Kottayam

ABSTRACT
A study was conducted using newly developed software to determine the accuracy of computer assisted pedicle screw fixation in upper thoracic spine in comparison with fluoroscopic technique. 40-pedicle screw fixations were done in articulated bone specimens (20 computer assisted /20 conventional). Fixations were done in thoracic spine (T1 - T6). Optimal screw trajectories are drawn in the pre-op thin slice CT, taking specific bony prominences as reference points. This virtual image is matched digitally with the actual image obtained via a web camera during surgery and the pedicle screws are placed in the direction of the optimal screw trajectory. Post op evaluation is using thin slice CT images. Pedicle screw placements were much more accurate with computer assistance. Grade1 (Amiot grading) pedicle screw placements were 90% with computer assisted technique as against 60% with conventional methods.

INTRODUCTION
Pedicle screw fixation especially in the thoracic spine has always been a challenge to the orthopaedic surgeon. Small pedicle size and variations in morphology in upper thoracic spine creates a lot of problems in the accurate placement of pedicle screws. Thoracic pedicles are smaller and medial penetration could damage the spinal cord and inferior penetration the roots. Various methods are used for the localization of pedicle. The methods used include the Intersection technique, Pars interarticularis technique, Mammillary process technique, Funnel shaped pedicle approach zone, Roy Camille point, Weinstein point etc. Techniques of insertion of pedicle screw include Blind technique, Fluoroscopic technique, Stereo tactic navigation which can be Image guided or Computer assisted ,Endoscopic technique, Open Lamina Technique, Ultrasound Guided technique etc..

Pedicle perforation using conventional techniques is in the range of 15 – 50% as per various studies. Unrecognised screw misplacement and permanent root damage have been documented Various studies have been conducted by Amiot et al, Lane et al, Youkilis et al, Schlenza et al etc. The preliminary reports with computer assisted navigation are showing a high degree of accuracy. We in our institution have developed a novel technique for the insertion of pedicle screws with computer assisted navigation. A study was conducted using the newly developed software for computer assisted pedicle screw placement

AIM
To compare the rate of pedicle wall perforation by screw placement using computer assisted navigation with the custom developed software and conventional fluoroscopic- technique.
MATERIALS AND METHODS

40-pedicle screw fixations were done in articulated human bone specimens. Group 1 included cases done with computer assisted technique (developed in our institution) (n = 20) and Group 2 included cases done using fluoroscopic technique (n = 20). Pedicle screw fixations were done only in thoracic spine i.e. T1 – T6. Pre-op planning and post op evaluation were done with thin slice CT images.

PROCEDURE

Pre-insertion Planning

Thin slice CT images are taken and these images are transferred to the computer without losing the accuracy dimensions of the dicom images obtained. In the planning module of the computer bony reference points are marked i.e. the transverse processes and the spinous processes. Vertical lines are drawn from these reference points. Optimal screw trajectories are drawn in the images. Screw depths are accurately measured from the CT images.

Screw insertion

The bony points are identified and markers are placed on the spinous process and on the two points equidistant from the transverse processes after making actual measurements. The markers are placed exactly vertical. These three markers are caught on the web camera and the pre planned image is superimposed on the actual image. Paired point matching is done. Further matching is done digitally. When these points are matched guide wire is placed in the direction of the optimal screw trajectory and is matched digitally with the pre planned image. Pedicle screws are placed in the direction of the optimal screw trajectory. 20 cases were done using the fluoroscopic technique.

<table>
<thead>
<tr>
<th>Vertebral level</th>
<th>Group 1 (total – 20)</th>
<th>Group 2 (total-20)</th>
</tr>
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<tr>
<td>T 1</td>
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<td>T 3</td>
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<td>T 5</td>
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<td>4</td>
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<td>T 6</td>
<td>4</td>
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</table>

Pedicle screw perforation was evaluated using thin slice CT images and in consultation with
radiologist (single blinding)

**OBSERVATION**

Pedicle screw perforations were graded according to the classification by Amiot

<table>
<thead>
<tr>
<th>Classification</th>
<th>(Louis Philippe Amiot)</th>
</tr>
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<tbody>
<tr>
<td>Grade 1</td>
<td>Ideal</td>
</tr>
<tr>
<td>Grade 2</td>
<td>0.1 – 2 mm</td>
</tr>
<tr>
<td>Grade 3</td>
<td>2.1 – 4 mm</td>
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<tr>
<td>Grade 4</td>
<td>4.1 – 6 mm</td>
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<tr>
<td>Grade 5</td>
<td>&gt; 6 mm</td>
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</tbody>
</table>

**RESULTS**

<table>
<thead>
<tr>
<th></th>
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<th>Group 2</th>
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<tbody>
<tr>
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<td>12</td>
</tr>
<tr>
<td>Grade 2</td>
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<td>Grade 4</td>
<td></td>
<td>2</td>
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<tr>
<td>Grade 5</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>20</td>
<td>20</td>
</tr>
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</table>

**STATISTICAL ANALYSIS**

On referring to Pearson Chi-square test (association between categorical data) with 1 degree of freedom the value of chi-square under probability 0.05 is 3.841 and the calculated value in our study is 4.8 which is higher than 3.841. The difference in accuracy is therefore statistically significant at 5% level.

Pedicle screw placements were much more accurate with computer assistance. Grade 1 (Amiot grading) pedicle screw placements were 90% with computer assisted technique as against 60% with conventional methods.

**CONCLUSION**

Computer assisted pedicle screw fixation using the newly developed software is superior to conventional methods especially with regards to thoracic spine were higher degrees of accuracy is needed.
REVIEW OF LITERATURE

INTRODUCTION

Though Orthopaedics has developed by leaps and bounds no consensus has been reached regarding the ideal management of fracture neck of femur. Conservative management has no role in the treatment of fracture neck of femur. Though various methods of osteosynthesis are available, the choice of treatment of fracture neck of femur in 50 – 70 years age group still remains controversial. The conventional methods of fixation which are in vogue now are associated with complications of non-union, implant failure and delayed weight bearing of the patients.

Cortical bone like fibula has been commonly used in augmenting screw fixation of fracture neck of femur.

There is only one review in literature (Robert Samuelson et al 1989) regarding the use of cancellous bone graft in the treatment of fracture neck of femur. In this study we analyse the advantages of using cancellous bone grafts in the treatment of fracture neck of femur by doing an animal experimental study.

AIMS & OBJECTIVES

1. To find out the effectiveness of using cancellous bone graft in the treatment of fracture neck of femur.

2. To find out the ideal screw hole size for Bone Impregnated Hip Screw.

3. To find out the ideal screw hole placement in Bone Impregnated Hip Screw.

MATERIALS & METHODS

This animal experimental study was conducted at the Government Veterinary Hospital, Trivandrum. Clearance for the animal experiment study was obtained from the Ethical Committee of Medical
College, Trivandrum and the Ethical Committee of the Department of Animal Husbandry, Government of Kerala.

The animal selected was goat due to the similarity of goat hip joint to human hip joint. Study was conducted on 5 young goats about 2 years of age. 3 goats had the experimental Bone Impregnated Hip Screw with different screw hole sizes and pattern of screw hole arrangement. Two goats had conventional 6.5mm cancellous screw fixation.

The Bone Impregnated Hip Screw was made of biocompatible 316 stainless steel [Fig. 1].

Intravenous anaesthetic agents were used. Hip exposed by veterinary surgeon and the Sciatic nerve was isolated. Fracture neck of femur was produced surgically and later these fractures were fixed with various screws as mentioned earlier [Fig. 2]. Protective spica was given for 3 weeks [Fig. 3]. Full range of ambulation was allowed after this period. Histopathological evaluation was done at end of 3 months.

Figure 1
Intravenous anaesthetic agents were used. Hip exposed by veterinary surgeon and the Sciatic nerve was isolated. Fracture neck of femur was produced surgically and later these fractures were fixed with various screws as mentioned earlier [Fig. 2]. Protective spica was given for 3 weeks [Fig. 3]. Full range of ambulation was allowed after this period. Histopathological evaluation was done at end of 3 months.

Figure 2
Mechanical part of study was to determine the ideal screw hole size and screw hole placement for Bone Impregnated Hip Screw. The ideal screw hole size is that which does not impair the yield strength of Bone Impregnated Hip Screw but also allows bone ingrowth through the screw holes. Bone Impregnated Hip Screws with 2 mm and 3 mm diameter screw holes were manufactured and their yield strengths were tested.
MATERIALS & METHODS

This animal experimental study was conducted at the Government Veterinary Hospital, Trivandrum. Clearance for the animal experiment study was obtained from the Ethical Committee of Medical College, Trivandrum and the Ethical Committee of the Department of Animal Husbandry, Government of Kerala.

The animal selected was goat due to the similarity of goat hip joint to human hip joint. Study was conducted on 5 young goats about 2 years of age. 3 goats had the experimental Bone Impregnated Hip Screw with different screw hole sizes and pattern of screw hole arrangement. Two goats had conventional 6.5mm cancellous screw fixation.

The Bone Impregnated Hip Screw was made of biocompatible 316 stainless steel [Fig. 1].

Another part of the mechanical part of the study was to determine the ideal screw hole pattern. Yield strength of the Bone Impregnated Hip Screw with uniform and staggered screw hole placement was tested [Fig. 4].

Yield strength of the various screws were tested using the AMSLER universal testing machine at the Department of Civil Engineering, Government College of Engineering, Trivandrum. The yield strength of the various screws was calculated using the formula

\[ \text{Yield strength} = \frac{\text{total load bearing capacity}}{\text{area}} \, \text{N/mm}^2 \]
The area of the screw was calculated by using the formula $\frac{3.14}{4} (D^2 - d^2) - 3bt$, where $D$ is the outer diameter of the screw, $d$ the inner diameter of the screw, $b$ the screw hole size and $t$ the thickness of the screw.

**OBSERVATIONS & RESULTS**

The radiological examination of the goats revealed abundant callus and good fracture union in the Bone Impregnated Hip Screw group [Fig. 5]. 6.5mm cancellous group showed lesser callus.

Gross pathology revealed union of the fracture site with abundant callus formation [Fig. 6].

Histopathology revealed that the bone present inside the screw hole was of normal architecture with near normal osteoid. Capillaries and vascular channels were seen to have grown from the bone of neck of femur to the bone inside the screw [Fig. 7]. Increased osteoid and bone formation and early union was seen in the BIHS group.
Results show that BIHS with 2mm diameter holes has yield strength more than that of 6.5mm cancellous group but less than that of Richards Dynamic Hip Screw.

The placement of screw holes also affected yield strength. More yield strength was seen when screws were placed in a staggered arrangement than in straight line.

The yield strength of the Bone Impregnated Hip Screw and other conventional screw are given in detail in Table I.
CONCLUSION

The BIHS group showed more osteiod formation and better fracture union than the 6.5mm cancellous group.

The yield strength of the BIHS was more than the 6.5 mm cancellous screw but less than Richards Dynamic Hip Screw. Staggered placement of the holes increases the yield strength of the screw. The yield strength of the screw is inversely proportional to the square of the diameter of the screw hole.

Further studies must be directed for the development of BIHS made of MRI friendly metal or ceramic as used in Cage spinal instrumentation or made of biodegradable materials, so that screw removal can be avoided.

REFERENCE

Phase I - Clinical Trial of Bone Impregnated Hip Screw (BIHS) for the Treatment of Fracture Neck of Femur

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INTRODUCTION

Though Orthopaedics has developed by leaps and bounds no consensus has been reached regarding the ideal management of fracture neck of femur. Conservative management has no role in the treatment of fracture neck of femur. Even though various methods of osteosynthesis are available. The choice of treatment of fracture neck of femur in 50 – 70 years age group still remains controversial. The conventional methods of fixation which are in vogue now are associated with complications of non union, implant failure and delayed weight bearing of the patients.

Cortical bone like fibula has been commonly used in augmenting screw fixation of fracture neck of femur. There is only one review in literature (Robert Samuelson et al 1989) regarding the use of cancellous bone graft in the treatment of fracture neck of femur. In this study we analyse the advantages of using cancellous bone grafts in the treatment of fracture neck of femur.

AIMS & OBJECTIVES

To find out the effectiveness of Bone Impregnated Hip Screw in the treatment of fracture neck of femur.

To find out the ideal screw hole size and screw hole pattern in Bone Impregnated Hip Screw.

Measuring the yield strength and comparing them with the yield strength of currently available methods of fixation forms the mechanical part of the study

MATERIALS & METHODS

This study was conducted between September 1999 and December 2002 in the Department of Orthopaedics, Medical College, Thiruvananthapuram. Clearance was obtained from the Trivandrum Medical College Human Ethical Committee. 15 patients were treated with Bone Impregnated Hip Screw and all the 15 patients volunteered for treatment by
Bone Impregnated Hip Screw after the procedure and complications were explained in detail to them.

Garden Type I, II & III fractures were included in the study. All cases were done under spinal anaesthesia. The age of patients varied between 35 and 55 years. Most common mechanism of injury was fall. The details of the type of fracture, age wise distribution and mechanism of injury is given in Table I.

<table>
<thead>
<tr>
<th>Type of fracture</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Garden type I</td>
<td>5</td>
</tr>
<tr>
<td>Garden type II</td>
<td>8</td>
</tr>
<tr>
<td>Garden type III</td>
<td>2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-35</td>
<td>2</td>
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<tr>
<td>35-40</td>
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<td>40-45</td>
<td>2</td>
</tr>
<tr>
<td>45-50</td>
<td>3</td>
</tr>
<tr>
<td>50-55</td>
<td>5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanism of Injury</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>10</td>
</tr>
<tr>
<td>RTA</td>
<td>4</td>
</tr>
<tr>
<td>Assault</td>
<td>1</td>
</tr>
</tbody>
</table>

Patients positioned in fracture table and lateral surgical approach was used. Cancellous bone graft was taken from the iliac crest. The Bone Impregnated Hip Screw is filled with bone graft taken from iliac crest (Fig I). Fracture is fixed first with 6.5 mm cannulated cancellous screw. Position confirmed using C Arm. This screw is removed and Bone Impregnated Hip Screw is introduced into the track created by 6.5 mm cancellous screw using the Bone Impregnated Hip Screw spanner. Lock nut applied using 4.5 mm screw driver.

**Fig. I**

Patient is allowed non weight bearing crutch walking from the seventh day and range of motion exercises are started from the third post operative day. X-ray is taken at end of 6 weeks to assess progress of union. Weight bearing is started at end of 12 weeks after confirming union clinically and radiologically.

Mechanical part of the study was to calculate the yield strength of Bone Impregnated Hip Screws with various screw hole sizes and screw hole pattern. This was measured using the Amsler universal testing machine.

\[
\text{Yield strength} = \frac{\text{total load bearing capacity}}{\text{area}} \text{ N/mm}^2
\]

The yield strength of Bone Impregnated Hip Screw was compared with that of conventional screws.

**OBSERVATIONS & RESULT**

Majority of fractures united within 16 weeks (Fig II) and the details of union rate are given in Table II. Non union was seen in 2 cases treated by Bone Impregnated Hip Screw. Superficial infection was present in one case and was treated by appropriate antibiotic cover.

<table>
<thead>
<tr>
<th>Time (weeks)</th>
<th>BIHS group</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 – 10</td>
<td>0</td>
</tr>
<tr>
<td>10 - 12</td>
<td>2</td>
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<tr>
<td>12 - 16</td>
<td>7</td>
</tr>
<tr>
<td>&gt;16</td>
<td>3</td>
</tr>
</tbody>
</table>
The yield strength of Bone Impregnated Hip Screw was found to be more when screw holes were put in a staggered pattern rather than uniform pattern (Fig III). The diameter of the holes also had an impact on the yield strength. Bone Impregnated Hip Screws with 2 mm holes had more yield strength than those with 3 mm holes. The yield strength of Bone Impregnated Hip Screw with 2 mm holes was found to be more than the conventional 6.5 mm cancellous screw but less that Richard Dynamic Hip Screw. The detailed analysis of the yield strength is given in Table III.

**DISCUSSION**
Fracture neck of femur around 50 year group is still an unresolved problem. Studies show a failure rate as high as 30% to 50% in surgical fixation of fracture neck of femur. The rate of union attained by BIHS was comparable to any other standard method of fixation.
The non union rate in the BIHS group (20%) was less than that of the cancellous group (26.7%). All non unions occurred in Garden Type III fractures which could point to the fact that the amount of initial trauma was a determining factor in the development of non union in fracture neck of femur.

The yield strength of Bone Impregnated Hip Screw was more than 6.5 mm cancellous screw. The placement of screw holes also affected yield strength. More yield strength was seen when holes were placed in a staggered arrangement than in a straight line.

**CONCLUSION**

Bone Impregnated Hip Screw produced early and better bone healing and less chance of non union. The non union rate was less than cancellous screw group. Morbidity in Bone Impregnated Hip Screw group was less when compared to cancellous screw group.

Staggered placement of screw holes increased the yield strength of screw. The yield strength of the screw is inversely proportional to the square of the diameter of the screw hole. The effectiveness of BIHS is well established and Phase II clinical trial is underway.

Further studies must be directed for the development of BIHS made of MRI friendly metal or ceramic as used in Cage spinal instrumentation or made of biodegradable materials so that screw removal is avoided.

**REFERENCE**


Multiple joint dislocations is a rare problem. Often the diagnosis is difficult and treatment which may have to customized on an individual basis. It is more difficult when there are multiple conditions presenting with more or less same clinical features.

Case Report

8 days old neonate presented with deformities in both upper and lower limbs and facial abnormalities. There were no significant antenatal problems. She was born by LSCS and was breach presentation. There was no history of consanguineous marriage. There was no history of congenital anomalies in the family.

Examination of the face showed prominent forehead, widened eyes and depressed nasal bridge. [Fig 1]. Upper limbs showed clinically normal shoulder and hands but elbows showed flexion deformity, abnormal mobility of the elbows. X-rays of the elbows showed bilateral deficient lower end of humeri. [Fig 2].

In the lower limbs examination showed bilateral dislocated hips, bilateral dislocated knees with hyperextension and equino valgus deformity of both ankles [Fig3]. The neck was short and there was no spinal anomalies. The chest wall showed Harrison’s sulcus and an elastic appearing
thoracic cage.

Fig. 2
Blood investigations were within normal limits. Radiological investigations showed bilateral elbow dislocations, bilateral hip and knee dislocations and valgus at subtalar joints (Fig. 3). Lateral x-ray of ankle joint showed accessory calcaneal ossicle which is considered pathognomonic of Larsen’s syndrome [Fig 4]. MRI scan of the cervical spine which was found to be normal.

In view of the above clinical and radiological features a diagnosis of Larsen’s Syndrome was made. After evaluation of the spine especially the cervical spine, at the age of 6 months, the dislocations of the knees were treated by open reduction and quadriceps-plasty. The reduced knee joints were stabilized with K wires [Fig 5] and knee immobilized in flexion for six weeks and K wires removed at six weeks.
Pt was followed up regularly. At three years of age she walks with support, stands on her own. The hips which were bilaterally dislocated were left alone. She has a 0-90 degree motion of the knee with active extension. She has severe plano-valgus deformity and is using an alkathine AFO.

**DISCUSSION**

Larsen’s syndrome is a rare autosomal dominant disorder. It is characterized by generalized ligamentous laxity, hypotonia, dysmorphic facial features, multiple dislocated joints. It affects the axial, appendicular and face. In the face prominent forehead, widened eyes [hypertelorism], and depressed nasal bridge are common features. In the axial skeleton it affects the cervical spine with cervical kyphosis and cervical spinal cord compression and also cervical spondylolisthesis at C6-C7 or C7-T1 and hyperlordosis. Evaluation of cervical spine must be done before any surgical procedure is attempted, as during anesthesia fatal cord compression can occur. The cervical kyphosis may not need immediate fusion but care must be taken during intubation. The other anesthetic problems that can occur are due to tracheo- laryngomalcia. Lesions of mitral valve and aorta have been reported. The thoracic cage can be plastic and costochondral joints can be lax and bracing for scoliosis should be done with caution as this can cause deformation of the chest wall due to scoliosis pads. Scoliosis and spondylolisthesis can occur but need fusion only if progressive.
In the hands spatulate thumb, long cylindrical fingers and dislocated metacarpo-phalangeal thumb are common features. In the elbow humero radial and humero ulnar dislocations can occur. No active surgical interventions are usually required as the function is reasonably good. If needed radial head excision can be performed at maturity. Sometimes webbing and severe flexion contracture can occur. Rarely proximal radio-ulnar synostosis can occur.

The lower limbs are involved and present with a spectrum of findings. The hips are unilaterally or bilaterally dislocated. If bilateral they can be left alone. Larsen himself advocated leaving the bilateral dislocations alone. Unilateral dislocations must be reduced by closed or open reduction. The interesting thing about dislocations of the hip in this condition is absence of hyperlordosis. The knees are usually hyper extended or dislocated anteriorly and need to be treated by serial casting, open reduction and quadriceps plasty or femoral shortening to achieve flexion.

The feet shows equino valgus or varus deformity but it is advisable to wait till child is full weight bearing. They are usually asymptomatic and usually controlled well with orthosis. Lateral radiograph of the ankle shows accessory calcaneal ossicle which is pathognomonic of Larsen’s syndrome [Fig 6].
Fig. 6

The differential diagnosis of Larsen’s syndrome is classified based on two phenomena—
1. Due to ligamentous laxity
2. Due to contractures and deformities.

The differential diagnosis of ligamentous laxity include Marfans and Ehler Danlos syndrome. Ehler Danlos syndrome and Marfan’s syndrome do not show multiple joint dislocations like Larsen’s syndrome. Also Marfan’s syndrome in addition to distinct clinical features has definite diagnostic criteria. Differential diagnosis of joint contractures and deformities include Arthrogryphosis and Beal’s syndrome. Patients with Arthrogryphosis and Beal’s syndrome have rigid joints while in Larsen’s are relatively mobile joints. Also Beal’s syndrome patients have crumbed pinna which is characteristic. The typical clinical features of facial deformities and multiple dislocated joints and the pathognomonic accessory calcaneal ossicle on x-rays points to the diagnosis.

REFERENCES

Primary Fibromyxosarcoma of Bone
A Case Report

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ABSTRACT

We describe a case of Primary Fibromyxosarcoma of the bone, which to our knowledge is the first ever case that is being reported. In September 2003, an 80-year old man presented with a swelling over the lateral end of left clavicle of 2 months duration, which was gradually increasing in size. The swelling was tender on palpation and had variable consistency. X-ray showed total destruction of lateral end of clavicle and the CT Scan was suggestive of a lytic expansile lesion. The lesion was excised with the lateral end of clavicle. Histopathological examination was in favor of fibromyxosarcoma. Three months later, the patient developed a recurrence at the same site. Now the swelling is about 15 x 8cms in size. Anterior Axillary nodes were palpable. Radiograph revealed complete destruction of the neck of scapula. There was no evidence of any distant metastases.

INTRODUCTION

Fibrosarcoma of bone is a well-recognized and accepted clinicopathologic entity. A primary fibrosarcoma of bone is a pure, fibroblastic malignancy, i.e., no tumor osteoid or cartilage production is recognizable. Fibrosarcoma occurs in individuals of all ages. But it has a tendency to occur in adult and older people. Fibrosarcoma usually affects metaphyseal area of the long bones. Approximately 50% of these occur in the distal segment of the femur or proximal portion, from where they destroy the cortex and often extend into the soft tissues. The radiologic pattern of fibrosarcoma is non-specific. The principal feature is osteolysis with other characteristics varying with grade of malignancy. A “soap – bubbly” appearance is reported in about 25% of cases. High grade tumors usually break through the cortex and invade the surrounding soft tissues.

The important histological features include malignant, collagen-producing spindle cells, “Herring bone” pattern of arrangement of spindle cells, varying degrees of anaplastic, malignant giant cells, and “storiform” pattern. Very rarely fibrosarcomas may show myxoid stoma and they have been termed as myxofibrosarcoma. The treatment mainly consists of wide or radical excision and chemotherapy.

Fibrosarcomas form only about 3 to 5% of all biopsy-analysed bone tumors and it usually affects long bones around knee. Myxofibrosarcomas are very rare and those affecting the bone are not yet reported.
Case Report

In September 2003, an 80 year old man presented with a swelling over the lateral end of (Lt) clavicle, since 2 months. He had been noticing a moderate increase in size of the swelling, which was around 12 x 8 cm at the time of presentation. He did not have any other symptoms. On palpation, swelling was moderately tender and had firm consistency with irregular cystic areas.

X-ray revealed near total destruction of lateral end of clavicle.

CT-Scan was suggestive of a lytic expansile lesion arising from the lateral end of clavicle.
The lesion was excised with the lateral end of clavicle.

The per operative finding was that of a purely bony lesion, well-encapsulated, with no evidence of any soft tissue infiltration. Histopathology report came as a neoplasm composed of cells arranged in loose sheets and herring bone pattern in a myxoid stroma. Cells have moderate amount of pale eosinophilic cytoplasm and vesicular nuclei with mild pleomorphism. Scattered multinucleated giant cells were also seen. Small foci of necrosis were present. Mitotic figures 3-4/10 HPF. Arborising and curvilinear vascular channels were seen in the stroma, which is a pathognomonic feature of myxofibrosarcoma. He was treated by Department of Oncology.

Three months later, the patient started noticing a recurrence of swelling at the same site. 11 months later the growth was 15 x 8 cm in size. On palpation, it was moderately tender and there was severe limitation of shoulder joint movements. Anterior axillary nodes were palpable. Radiograph revealed complete destruction of the neck of scapula and the superior half of the head of scapula. There was no evidence of any distant metastases 11 months after excision.

**DISCUSSION**

Myxofibrosarcoma is extremely rare and its exact incidence is not given in literature. When this elderly man presented to us with a rapidly growing swelling of the lateral end of clavicle, we considered the possibility of a metastatic lesion. But inspite of extensive investigation in search of a primary, we could not find one. So we decided to excise the lesion with the lateral end of the clavicle.

The panel of pathologists reported the case as myxofibrosarcoma. It had all the characteristic histological features. Since the tumour was primarily confined to the bone we considered the diagnosis of a primary myxofibrosarcoma arising from the lateral end of clavicle. This rare tumor has never been reported to arise primarily from the bone.

**CONCLUSION**

Fibrosarcoma is a rare tumor of the bone and its myxoid variant is even more rare. Early diagnosis is important as wide excision and chemotherapy can improve survival rate. To the best of our knowledge this is the first case of primary myxofibrosarcoma reported in literature.

**ACKNOWLEDGEMENT**

We acknowledge the professional help and guidance of Prof. Vijayalakshmi MD (Pathology), Rtd. Professor of Pathology, Medical College, Kottayam in the diagnosis of this rare entity.

**REFERENCE**

2. Ackerman, Surgical Pathology, Pg : 1969
Corticotomy and Distraction for Avascular Necrosis Head of Femur

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Postgraduate Trainee, Department of Orthopaedics, Medical College, Kottayam

Prof. Dr. P.S. John
Professor & HOD, Dept. of orthopaedics, Medical college Kottayam

ABSTRACT

Corticotomy and distraction is aimed at increasing the vascularity of femoral head (distraction angiogenesis) in avascular necrosis of femoral head in young adults. The increase in vascularity in this study is demonstrated by pre and post operative radio nuclide angiogram. The increase in vascularity can accelerate the repairing process and hence reduce the chance of collapse and deformation of femoral head, and thereby prevent early degenerative arthritis.

We have studied ten patients with avascular necrosis of femoral head. All our patients were males and their age group varied from 21 to 46 years. The minimum follow-up is three years.

Only patients in Ficat group 3 and 4 were included in the study.

Under anaesthesia, through a lateral approach a unicortical rectangular piece of bone with the attachment of gluteus medius is taken from the base of greater trochanter (modified corticotomy) and the fragment is gradually distracted (controlled fractional distraction) using special device (four specially designed pins and an Ilizarov side plate and nuts). Periodic assessment by X-ray, clinical assessment and post distraction angiogram done to confirm increase in vascularity.

Corticotomy and distraction is a simple surgical procedure, and is cost-effective less costly, and all our patients tolerated surgery well. All of our patients showed significant improvement in clinical, radiological and radio nuclide angiogram studies.

Corticotomy and distraction treatment is a good surgical option for avascular necrosis of head of femur. The importance of this treatment lies in the fact that total hip replacement in young patients, especially in avascular necrosis is known to cause early failures.

BACKGROUND

Avascular necrosis of head of femur is a crippling condition mostly affecting young people. Even though there are many forms of treatment, none is found to arrest the progress of the disease or to reverse the pathological process occurred on the femoral head. It is found that the only effective treatment for late stages of avascular necrosis is total hip replacement. If this surgery is done in young people, life of the implant is less because of high level of activity of young people so they have to undergo revision.

Considering the numerous complications of total hip replacement, the high cost of
surgery and the need for frequent revision it is not ideal for the Indian patient. As a definitive procedure in early stages of avascular necrosis it is an effective method which can postpone total hip replacement. It is based on ilizarov -technique of neo angiogenesis in peripheral vascular disease.

**AIM OF STUDY**

The corticotomy and distraction treatment is aimed at increasing the vascularity of femoral head (distraction angiogenesis) in avascular necrosis of femoral head. The increase in vascularity in this study is demonstrated by comparing pre and post operative radio nuclide angiogram. The increase in vascularity can accelerate the repairing process and hence reduce the chance of collapse and deformation of femoral head, and the subsequent early degenerative arthritis.

**MATERIALS AND METHODS**

We have done this study in ten patients with avascular necrosis of femoral head over a period of 4 years from June 2000 to June 2004 and the average follow up is 3 years. All of our patients were males, and their age group varied from 21 to 46 years. Right hip was involved in 3 patients and left hip in 5 patients. Two patients presented with bilateral involvement. We had done the study after getting clearance from the ethical committee.

**Inclusion criteria:** Patients were selected on the basis of X-ray and clinical findings. Patients in Ficat group III & IV were included in the study. For this group of patients there is no other treatment option except total joint replacement.

**Pre operative assessment:**

<table>
<thead>
<tr>
<th>Clinical</th>
<th>Objective</th>
<th>Radiological</th>
<th>Radionuclide angiogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>– subjective(pain)</td>
<td>– range of movement</td>
<td>– extent and density of the avascular segment</td>
<td>– to quantitate the blood flow in the femoral head</td>
</tr>
</tbody>
</table>

**Implants:**
Consists of five specially designed pins and an Ilizarov side plate and nuts for bridging type (across the hip) and four specially designed pins and an Ilizarov side plate and nuts for the non bridging type (on the proximal femur alone)

**Anaesthesia:** Spinal Anaesthesia or General Anaesthesia.

**Procedure:**
After anaesthesia, patient is placed on a fracture table. Traction is applied. Four pins are applied under image control, two on the ilium, just above the acetabulum and the other two in the shaft of femur (for bridging type) corresponding to the length of side plate used. Then through a lateral approach greater trochanter is exposed and a unicortical rectangular piece of bone 4x3 cm size is cut from the cortico cancellous area (modified corticotomy) on the lateral aspect of greater trochanter.
with intact periosteal attachment and intact gluteus medius attachment. Fifth pin is drilled through the rectangular piece of bone. Then the whole assembly is stabilized by fixing the side plate using nuts.

In non bridging type, the difference is that only three pins are applied on the proximal femur distal to the modified corticotomy site corresponding to the length of the side plate used. Then modified corticotomy is performed as in bridging type and fourth pin is drilled through the rectangular piece of bone. Then the whole assembly is stabilized using side plate and nuts as in previous method.

Distraction is initiated on the tenth day at the rate of 0.5 mm/day (controlled fractional distraction) for twenty days. Rate of distraction confirmed on day eight, day twelve and at day twenty.

Implants removed after twenty days and radio nuclide angiogram done on next day to assess increase in vascularity. Skin traction is continued and range of motion exercises started. Thereafter periodic assessment is done once in a month by clinical and radiological methods. Partial weight bearing allowed after four months. Full weight bearing allowed from the next month onwards.

**Radionuclide angiogram (First pass study):** This is an ideal method which can be used to compare or quantitative vascular status of localized areas of our body. This vascular status assessment of femoral head pre and post operatively was conducted with the help of Department of Nuclear Medicine, Amrita Institute of Medical Sciences, Cochin.

**Technique:** Sterile saline based 99m Tc (15 mci, TcO4-) is given as rapid intravenous injection. Vascular dynamic images are formed at the rate of 2 seconds per frame for 1 minute. The images are picked up using a dual headed gamma camera. For quantisation the images are summed up (summed up images). Time Activity Curve is a method used in this procedure to compare the vascular status of different areas of body or of the same area at different periods. This is obtained by plotting a curve with time in milliseconds on X axis and radio activity detected on Y axis.

**Radiological assessment:** The size and radio density of the avascular area observed and compared with previous film at each visit.

**OBSERVATIONS**

We have selected ten patients with advanced avascular necrosis head of femur in stage III & IV of Ficat and Arlet classification for our study. All of
them had radiological evidence of avascular necrosis with collapse and early degeneration at the time of presentation. Clinically all of them had gross restriction of range of movement and crippling joint pain. Average age of selected group is 30 years. For this group of patients only treatment option is total joint replacement, which is very costly and not ideal in the young group.

<table>
<thead>
<tr>
<th>Name</th>
<th>Aetiology</th>
<th>Ficat stage</th>
<th>Pain relief Radiologic-al evidence of revascularisation</th>
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<td>Thajumon22</td>
<td>Fracture neck of femur</td>
<td>Stage III</td>
<td>++</td>
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<td>Stage</td>
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<tr>
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<td>III+</td>
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<tr>
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<tr>
<td>Biju 28</td>
<td>Idiopathic</td>
<td>III+</td>
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</table>

First pass study – increase in vascularity
- 2.5 times
- 2 times
- 2.1 times
- 1.8 times
- 2 times
- 2.3 times
- 2.5 times
- 2.2 times
- 2.4 times

Post operatively all the patients showed good improvement in clinical, radiological and radio nuclide angiogram studies.

<table>
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<th>Pre op</th>
<th>flex Pre op</th>
<th>Ext. Pre op</th>
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Ext

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Pre and Post operative range of flexion in our patients

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<th>Adduct Post op</th>
<th>Abd Postop Add</th>
<th>Pre Op</th>
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</tbody>
</table>

Ext. Rtn

30

Pre and Post operative abduction in our study
Testing the significance of the results
Test of significance applied to ROM (Flexion)
Pre op mean
Pre op standard deviation
Post op mean
Post op standard deviation
Difference between 2 means
SE (d) between two means

The post operative radionuclide angiogram done after treatment, clearly demonstrate marked increase in vascularity of the femoral head.

**RADIOLOGICAL ASSESSMENT**

![Pre-op x-ray](image)
Post op x-ray
X – showing Marked reduction in size and density of sclerotic segment after corticotomy and distraction treatment.

TIME ACTIVITY CURVE OF RADIO NUCLIDE ANGIOGRAM
DISCUSSION
This new technique is based on sound biological and biomechanical principles.

Rationale of Corticotomy and Distraction Treatment

Gradual distraction of corticotomy site stimulate neo osteogenesis and local inflammation, which increases regional vascularity and promote regeneration of vessels. This is a technique already described by Ilizarov in the treatment of thrombo-angitis obliterans.

The frame when fixed across a joint act as a joint distraction device and hence reduce pain. It also reduces even minimal subluxation of hip. Joint distraction minimises the chance of collapse of the avascular segment. This technique was already described by Dror Paley for Perthes’ disease and avascular necrosis. By making a corticotomy, we are decompressing the high pressure bone compartment. Therefore it also functions something like a core decompression. By distraction of the fragment (with insertion of gluteus medius muscle), the lever arm increases hence it increases the effectiveness of the gluteus medius action and reduces abnormal gait. At the same time it reduces the force acting across the joint and thus reduces the chance of collapse.

Biomechanics and advantage of corticotomy and distraction

When the patient stands on both lower limbs, the weight of the body act equally on both normal hip joints. When one limb is lifted the weight of the limb also added to the body weight so that the centre of gravity shift to the same side. The abductors of static hip must act with enough strength to maintain the equilibrium. The amount of downward pull of abductors and the force of centre of gravity are directly related to the distance of these points from the centre of the hip.
In our surgical procedure, distraction of corticotomy fragment produces lateralisation of the insertion of gluteus medius by at least 1cm. hence effectiveness of muscle pull is increased.

Corticotomy and distraction treatment is a simple surgical procedure, and it is not at all costly and all our patients tolerated surgery well. All the patients had significant improvement in clinical symptoms and range of movements as well as significant improvement in radiological and radio nuclide angiogram. The initial results of this study showed that corticotomy and distraction treatment is an excellent treatment option even in advanced avascular necrosis. The results will be better if the procedure of corticotomy and distraction is done in the earlier stages of evolution of avascular necrosis.

The importance of this study lies in the fact that total hip replacement in young patients, especially in avascular necrosis is known to cause early failures.

**ACKNOWLEDGEMENT**
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[17] Steinberg Me, Brighton CT, Cores A et al Osteonecrosis of femoral head. Stulberg BN, Baner TN, Belhobek GH. Making core decompression work Clin
Early Patellar Tendon Bearing Cast for Tibial Shaft Fractures
The Trivandrum Medical College Experience

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Dr. K.K Chandra Babu
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INTRODUCTION
Chief goals of treatment of fracture tibia are
union in good position
early ambulation
Many types of treatment available to achieve this
i. plaster cast immobilisation
   ii. osteosynthesis
   1. closed IM nailing
   2. open IM nailing
   3. DCP

In this study we assess the various advantages and shortcomings of using early PTB for treating diaphyseal fractures of tibia.

AIMS OF STUDY
1. Assess the rate of union
2. Resultant shortening & angulation
3. Relationship between initial shortening & final shortening
4. Knee stiffness
5. Economic aspect

MATERIALS & METHODS
This study was undertaken at Medical College, Thiruvananthapuram, from March 2000 to April 2002. 64 patients were included in the study. The male female ratio, age wise distribution, type of fracture and mechanism of injury are given in Table I.
<table>
<thead>
<tr>
<th>Table I</th>
<th>Male</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>&lt; 20 years</td>
<td>43</td>
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</tr>
<tr>
<td>20 – 40 years</td>
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<td>40 – 60 years</td>
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<th>Type of Fracture</th>
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<td>28</td>
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<tr>
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<th>Type of Fracture</th>
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<tr>
<td>Closed</td>
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<tr>
<td>Type I compound</td>
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<td>Type II compound</td>
</tr>
<tr>
<td>RTA</td>
</tr>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>Assault</td>
</tr>
</tbody>
</table>
Degree of compounding

42
17
5

Mechanism of injury

42
17
5

Protocol for Management

All fractures were initially assessed. The following fractures were excluded:

a. fracture of upper 1/3rd of tibia
b. supramalleolar fracture
c. Type III compound fracture

After initial stabilisation of the patient, X rays of the affected leg and that of the normal leg were taken. This was done to measure the initial shortening. Another method for assessing initial shortening was looking for fibular overlap in an associated non comminuted fracture of fibula. Type I and Type II compound fractures were adequately debrided. Appropriate antibiotic cover was given. All patients were treated by closed reduction and above knee posterior plaster slab under iv sedation on the day of admission. Cast was completed at the end of first week if position was good and the slab was not loose. Else fresh long leg cast was applied. Patient was asked to review after 2 weeks. Patellar tendon bearing functional below knee plaster cast was applied. X ray was taken to confirm the fracture alignment. Angulation if any was corrected by wedge correction and cast reinforced. Ambulation was started from 3rd day onwards using walker/stick. Patient was asked to bear as much weight as pain allowed and were asked to review at the end of 4 weeks. Radiological examination was done to detect any angulation or rotational deformity. If there was no deformity and no loosening of the cast, patient was asked to review when the plaster was damaged or became loose. Majority of patients required two PTB casts. If there was any deformity, correction was attempted. All Patients were followed up for 3 months after clinical union. The time the patient was able to bear full weight, was taken as clinical union.

OBSERVATIONS & RESULTS

Rate of union was assessed in detail. Union took place in 10 - 24 weeks time. Average union time was 10 weeks [Fig. 1]. There was one case of non union. The rate of union, shortening, angulation and range of movement of the knee were assessed and details are given in Table II. It was found that majority of the patients had no shortening or angulation and had reasonable good range of movements. The one case of non union belonged to the Type II compound fracture group.
The shortening present at the time of initial application of posterior long leg slab remained as such at the end of union of fracture.

**Economic Aspect**
Each patient required plaster of paris for long leg slab, cast completion and on an average 2 PTB casts. About 25 rolls of POP were required. Maximum expenditure worked out to Rs. 2500/- (25 × Rs. 100). 3 patients developed plaster sore which healed by itself.
DISCUSSION

Tibial shaft fracture is one of the commonest fractures seen in our casualty department. Though various methods of osteosynthesis are available, they are well out of reach of the majority of patients arriving at the hospital.

Advantages

Advantages of Early PTB Cast include

- Rate of union comparable to any other mode of treatment.
- The resultant angular deformity within acceptable limits.
- Practically no limitation of knee movements and no muscle wasting [Fig. 2].
- No complications of anaesthesia and surgery.
Incidence of infection following operative treatment varies from 1.6% to 3.2% for closed IM interlocking nailing (Alho et al. 1990).

AO Plating infection rate average 4% (Baten et al. 1978).

Disadvantages

Although the shortening present initially did not increase at the end of treatment, about 30% of patients had about 1cm shortening. This did not produce any cosmetic or functional limitation to the patient.

On an average, patient was able to weight bear only on the 29th day. Other modalities of treatment may facilitate early weight bearing, but when we consider the overall picture the advantages of PTB surely outweighs this minor glitch.

CONCLUSION

Early functional cast bracing using PTB cast is an attractive and relevant method of treatment for diaphyseal fractures of Tibia in a government hospital setup, catering mainly to the middle and lower socioeconomic group and with limited theatre and surgical facilities.

REFERENCE


Therapeutic Ultrasound in Fracture Healing
A Clinical and Experimental Approach

Prof P S John
Professor and HOD, Department of Orthopedics, Medical College, Kottayam

Dr Benjamin George
PG trainee in Orthopedics, Medical College, Kottayam

INTRODUCTION

Ultrasound has been used therapeutically for accelerating fracture healing for many years. Ever since it’s clinical use there was growing interest in this modality of osteoinduction. But the controversy on the exact mechanism of osteoinduction still continues. The US FDA has approved the use of ultrasound in fresh fractures from 1994 and for established non-unions from 2000. The role of chemical messengers like neurotransmitters in osteoinduction has evoked new interest in research in this field.

AIM OF THE STUDY

In our study we try to bring out the exact biomolecular mechanism by which ultrasound induces fracture healing. If we could elucidate the exact mechanism of osteoinduction at the cellular or molecular level we may be able to modify fracture healing as such.

MATERIAL AND METHODS

The study was conducted in two phases. In the first phase we induced fractures of the left tibia of Wistar strains of rats under ether anaesthesia. They were divided into two groups. The first group was given low intensity pulsed ultrasound (30mW/ cm²) 20 minutes a day for ten days. Tissue samples and serial X-rays were taken weekly for three weeks from both groups.

Cells were taken in the Phosphate buffer solution (PBS) and the viability tested with Trifan blue stain. Then the cells were cultured in RPMI medium (Rosewaal Pasteur Memorial Institute medium) for 24 hours. Radioactive thymidine incorporation test was done on these cells. The results of the uptake study two case and control groups were compared statistically. Cells were again cultured with various neurotransmitter combinations and radioactive thymidine incorporation test done and the results compared in both groups.

In the second phase of the study, seven patients with fracture distal end of radius were taken three of which had a bilateral
fractures. 5 of these fractures were kept as controls. The cases were subjected to low intensity pulsed ultrasound for 20 minutes for 2 weeks. The patients were assessed radiologically, sonologically and through cell studies before and after ultrasound therapy exactly as in the first phase.

RESULTS

First phase: There was increased callus formation in the ultrasound group when assessed radiologically. At the cellular level, there was increased thymidine incorporation in the ultrasound group.

Table 1: Radioactive thymidine incorporation test expressed in scintillation counts

<table>
<thead>
<tr>
<th>Case</th>
<th>Control</th>
<th>Case</th>
<th>Control</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>7190</td>
<td>6583</td>
<td>7814</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Radioactive thymidine incorporation test with neurotransmitters

<table>
<thead>
<tr>
<th>Neurotransmitters</th>
<th>1 week</th>
<th>2 week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serumon</td>
<td>9499</td>
<td>119</td>
</tr>
<tr>
<td>Butaclomol +</td>
<td>9510</td>
<td>8622</td>
</tr>
<tr>
<td>GABA +</td>
<td>10403</td>
<td>2451</td>
</tr>
</tbody>
</table>

Second Phase: There was increased callus formation when assessed sonologically in the ultrasound group. And at the cellular level there was increased thymidine incorporation in the case group. The increased activity was obtained also with neurotransmitter administration.

Table 3: Radioactive thymidine incorporation in subjects

<table>
<thead>
<tr>
<th>3 week</th>
</tr>
</thead>
<tbody>
<tr>
<td>7752</td>
</tr>
<tr>
<td>6161</td>
</tr>
<tr>
<td>6228</td>
</tr>
</tbody>
</table>

Table 4: RTI in cells after 5HT administration

| Case | 1
|------|---
| Patient 1 | 11006
| Patient 2 | 79970
| Patient 3 | 32533
| Patient 4 | 43453
| Patient 5 | 39763

Control
7486
6052
6573
5489
6913

Table 5: RTI in cells after D + BU administration

| Case | 1
|------|---
| Patient 1 | 11608

Control
7184
7200
6943
5467
4774

Table 6: RTI in cells after GABA + BI administration

| Case | 1
|------|---
| Patient 1 | 56605
| Patient 2 | 33832
| Patient 3 | 41326
| Patient 4 | 39552
| Patient 5 | 39552
<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th></th>
<th>3</th>
<th>Patient 33062</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Patient 45632</td>
<td></td>
<td>5</td>
<td>Patient 37194</td>
<td></td>
</tr>
</tbody>
</table>

|     | Control 5936 |   | 5285 |   | 5487 |   | 4378 |   | 5279 |   |

Control

**Radioactive study after neurotransmitter admin - composite comparison**

GABA + BI 5HT D + BU
So, the radioactive thymidine incorporation was significantly higher in the cases after ultrasound administration and after neurotransmitter treatment.

**DISCUSSION**

Low intensity pulsed ultrasound has been proved in previous studies in literature to significantly enhance fracture healing. In our study, the level of radioactivity was an index of osteoblast activity at the fracture site. In all the 5 cases in our study the radioactive thymidine incorporation was significantly higher when compared to the control group. This is prima facie evidence to the fact that ultrasound increases cell replication.

We tried to elucidate the mechanism by which ultrasound enhances healing by experimentally adding neurotransmitters at the fracture site in both cases and controls. The radioactive thymidine incorporation was markedly increased in all the five cases with all the three different sets of neurotransmitters added. Since the neurotransmitters act through their respective receptors this indicates that the receptor levels of these neurotransmitters were significantly increased at the fracture site by ultrasound administration.

Thus we postulate that ultrasound enhances fracture healing by increasing the receptor activity of neurotransmitters and hence neurotransmitter activity at the fracture site. This also indicates that neurotransmitters play a role in inducing fracture healing. How neurotransmitters act at the molecular or subcellular level in effecting the healing process remains to be studied in detail. Also the present study has to be supplemented by further studies in larger populations to authenticate the proposed mechanism by which ultrasound induces fracture healing. In the light of the concrete base thus achieved this could pave the way for an entirely new frontier in fracture management and impetus for further research.

**CONCLUSION**

We conclude that an important mechanism by which low intensity pulsed ultrasound acts is by up regulating the receptor activity of neurotransmitters at the fracture site which probably enhances fracture healing.

**REFERENCES**


Review Article

Computer Assisted Orthopaedic Surgery Growing In Asia

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In recent times an increasing number of Orthopaedic Surgeons worldwide are using Computer Assisted Orthopaedic Surgery (CAOS) tools in navigation and performing everything from joint replacement to Spine and Trauma surgery. Computer Assisted Orthopaedic Surgery technologies represent an array of instruments, including intra-operative fluoroscopic navigation, 3D image-guided and non-image based navigation systems, Robotics and new intra-operative visualization tools. Still, orthopaedic surgeons today are restricted in their ability to couple pre-operative planning with surgical implementation or to integrate medical imaging directly into the operating room. However, progress is being made in these areas at tremendous pace. Computer Assisted Orthopaedic Surgery-based technologies are the surgical toolbox of the future, which can couple simulations with real time evaluations of surgical performance.

Instrument developers and industrialists are still striving to introduce devices that offer timely and accurate intra-operative data like the position of bone, tool and cutting guide orientation, or the
location of implants. Eventhough a large number of orthopaedic surgeons throughout the world are gaining hands-on experience with computer assisted orthopaedic surgery tools, the cost of these equipments are still some what prohibitive. The field of computer assisted orthopaedic surgery tools and technologies are relatively young. According to Rolf K. Miehkle, MD, Ph.D, treasurer and immediate past president of CAOS International, CAOS is undergoing changes very rapidly.

Navigation in Orthopaedic Surgery

Some of the most recent developments in navigation include the possibility to not only navigate cup orientation in the Hip, but also to combine that with stem navigation. More orthopaedic surgeons are presenting details of their experience using CAOS tools in Knee Arthroplasty to perform proper ligament or soft tissue balancing. This is in fact a major step forward because before this, we only navigated the resection planes on the distal femur and the tibial head. Another development in CAOS is high tibial osteotomy. The results of doing high tibial osteotomy today are more reliable using navigation tools. This is an area where CAOS instruments are really making a difference. Results of navigated reconstruction of the anterior cruciate ligament have also become promising. CAOS tools allow us to perform some pelvic trauma procedures with decreased invasiveness and more routine procedures such as intra-medullary nailing with decreased radiation exposure. It has been shown that operating time can be saved during ilio-sacral screw placement using computer assistance. (David M. Kahler, MD, President CAOS International).

Robotics in orthopaedic surgery

Just a few years ago, many orthopaedic surgeons and product developers were excited about the prospect of using robotic tools to perform joint implants and some trauma and spine surgeries. Some cardiologists use robots to perform heart surgeries. The use of robots has been well documented at several orthopaedic centers throughout the world. William L. Bargar MD of, Sacramento, U.S.A. was the first to use robotics in Hip replacement surgeries. Dr. Andre Bauer MD, Marbella, Spain has been using Robodoc system for the last ten years in Europe. Col. B K Singh, Delhi, India has performed 9 total Hip replacements using robotic system. There are a number of shortcomings with this technology at present. The greatest disadvantage is the bulkiness of the instruments. Another disadvantage is the danger of impairing the soft tissues around the trochanteric region.

Asia & Pacific Rim

Despite these challenges many orthopaedic surgeons in Asia and Pacific Rim are interested in exploring the potential of robotics and other CAOS tools. The cost of the system, the increased preparation and operating time, the added costs for imaging, accuracy and validation, and surgeons’ acceptance of robots and their high costs are the main obstacles in Asia according to most of the system manufacturers. The growing interest in robot-assisted arthroplasty and navigation systems are because of their accuracy and precision. The use of CAOS tools in Asia, especially robotics is concentrated in just a few regions at present. Robots have been installed in only three of 47 Asian countries; Japan, Korea and India. According to Sungman Rowe MD, Ph.D, President of the Korean Orthopaedic Association, fewer than 15 orthopaedic surgeons in Asia use robotics on a routine basis while approximately 50 Asian orthopaedic surgeons use navigation routinely in their practice.
Future of CAOS in Asia

It is widely accepted in Asian countries that computer and robot assisted surgery is one of the current hot topics in orthopaedic surgery. Hence it is necessary to teach the residents and medical students how to use computers and robots for orthopaedic surgery. Therefore all the National Orthopaedic Associations should support the use of CAOS tools, although the systems are not perfect and satisfactory yet. According Rowe the use of CAOS in Asia will rapidly increase in the next 5 to 10 years. There remains a wide spread perception that CAOS system are complicated and costly, and that they add little value to the practice of a capable surgeon. The advantages of this technology in terms of improved accuracy and decreased intra-operative radiation exposure are simply too great to ignore. The implant industry which is very competitive will definitely drive these systems to become less costly and easier to use in near future. Looking at the tremendous pace in the progress of this technology, we are forced to believe that CAOS tools and techniques will soon be embraced by our traditionally techno-friendly specialty.

REFERENCES


Navigating the Future – Surgery Using Computer

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Computer Assisted Orthopaedic Surgery (CAOS) is getting popular and accepted in the various parts of the world. There have been many initiatives that have know brought these technologies from the research room all the way to clinical use and commercial developments. In some parts of Central Europe, Computer Assisted Surgery tools are being used on a routine basis, but there are continuing challenges in the clinical adoption and routine use of these surgical tools. Computer Assisted Orthopaedic Surgery – based technologies are the surgical toolbox of the future and represent a spectrum of devices, including 3 dimensional image guided and non-image based navigation systems, intra operative fluoroscopic navigation, Robotic assistive tools, and new intra operative visualization devices. CAOS tools couple simulations with real time evaluations of surgical performance.

Currently we have a limited ability to couple pre-operative planning with surgical implementation or to integrate medical imaging directly into the operating room. We lack tools, sensors or measurement devices that provide timely and accurate intra operative data like the position of bone, tool and cutting guide orientation or location of implants. The new generation of CAOS tools will couple and tightly integrate planning and imaging with the surgical intervention, and permit simulation and optimization of a patient-specific pre operative plan and integration of medical images directly into the operating room. They will also provide measurement devices and sensors providing intra operative information to surgeons, as well as become a great educational and training tool.

Possibilities and Limitations

CAOS tools and technologies can assist and compliment, they do not replace surgeons. With computer assisted devices and tools, surgeons can accomplish surgical tasks neither could do alone. With a recent interest less invasive and minimally invasive joint replacement and the re-discovery of partial joint re-surfacing, CAOS based tools have the potential to impact daily clinical practice the same way that fiber optic technology has revolutionized many orthopaedic subspecialties.

Balancing these new capabilities are the potential negative aspect of introducing new technologies into clinical practice; the real costs and time expenses for pre-operative or intra operative imaging that may not normally be used in routine practice, costs of the systems themselves, and increased operating time, accuracy and validation and surgeons acceptance.

CAOS technologies have the potential to be used in different capacities; research tools, training tools, in routine clinical practice, as commercial proposition, and as an enabler for less and minimally invasive surgical techniques. However, the most powerful argument for their use may be that they enabled surgeons to develop techniques that are more accurate, less and minimally
invasive.

Classifications

CAOS tools range from an active robotic system capable of performing surgery autonomously to passive or navigation systems that provide additional information during a procedure, but do not perform the surgical action. The surgeon controls the intervention but acts on information.

Navigation is analogous to a surgical information system. The spectrum of tools represents the classification system based on control and safety. This is in contrast to the active or robotic system, that works under their own software and hardware control for at least a portion of the procedure. Over the last several years a spectrum of surgical navigation systems have become available. These range from systems that use pre operative images such as CT Scan, to those that use intra operative imaging with fluoroscopy. There are also systems that do not require any images pre operatively or intra operatively; these “image free” navigation systems use information that is collected during surgery, such as centers of rotation of the hip, knee, ankle, and visual information like anatomical landmarks.

Each of these approaches has certain limitations and benefits. Clinical functionality is most important. For instance, CT based systems provide complete and full functionality. Fluoroscopic navigation systems are amenable to any application that already uses fluoroscopic to reduce the radiation exposure time. However navigation functions on the image that is obtained rather than on the patient’s true anatomy. Any limitations in the fluoroscopic images would also carry over into the navigation system. Although image less navigation systems provide the opportunity to do away with any images, the information collected will determine the functionality in the system and may not have the complete the functionality of a CT or image based system.

Steps to Navigation

There are 3 steps to navigate. The phase is data acquisition pre operatively or during surgery, including pre operative images, fluoroscopic images or kinematic information, such as the determination of center of rotation or anatomic landmarks during surgery.

The next two steps – tracking and registration – are necessary to take that information and use it during surgery. Registration may be a foreign term to some surgeons, but we routinely do this process with any of our surgical interventions. Registration is the ability to relate images such as x-rays, CTs, or MRIs and a patient’s 3 dimensional anatomy to the anatomical position on the surgical field. Registration is the way to teach the navigation systems the same process.

Several techniques have been developed for this registration process. The early techniques required the use of pins or fiducials for robotic type devices. However these pins were placed in a second surgical procedure that needed to be done prior to the scanning and were applied in places that were not in the primary surgical field. Due to these drawbacks, developers introduced pin-less type registration in which the unique shape of the bone was used to achieve the same goal and did not require pins or separate incisions or procedures. This surface based registration has become the gold standard for CT based navigation because of its high level of accuracy and reliability. Using this technique for registration, a surgeon can collect a cloud of surface points on the bone using a tracked probe. The unique shape of the bone is then used to match the pre operative plan with the position of the patient in the operating room.

In the fluoroscopic navigation, the registration process is, in essence, automatic and is performed
online as long as the bone and fluoroscope are tracked when the images are obtained. Registration using imageless system is a matter of identifying the joints’ centers of rotation through kinematic testing or by having the surgeon visually collect important land mark points. Tracking becomes important because we need sensors and measurement devices that can provide feedback during surgery on the orientation and relative position of the tools to bony anatomy. So that we can act on that information in timely manner. By attaching optical or electro magnetic trackers to regular surgical tools, we convert our current tools to smart tools in which we can know the position and orientation of the tools’ alignment with respect to the bony anatomy of interest, all in real time.

Intra operative measurement tool

Once you achieved tracking with registration during surgery, you have a real time intra operative measurement tool that can provide timely information to surgeons on the relative position of the tools to the bony anatomy. As a secondary benefit you have the power of the imaging modality online during the surgery and can access those images during the actual procedure. One way to become comfortable with using a navigation system clinically is to first use the system as an intra operative measurement tool. In other words, the system can be used by surgeon just to measure what you currently do. Measure the accepted technique or guides that you currently do and use the navigation system to document your current techniques. After you obtain confidence in the use of this system and the information that it provides, you then can use the system to actually navigate parts of your procedure. It is always important to validate the CAOS technique both intra operatively and clinically, remembering that the most important factors are improving patient outcome.

There is a spectrum of navigation technologies. The clinical functionality you want out of a system determines what type of CAOS system should be just applied. We have all learned in the past that one tool cannot solve all our clinical problems. Probably the CAOS platform of the future will include a spectrum of these tools all in one plat form. What is necessary? Only the surgeon knows for sure. So that what are the costs? Costs include surgeon time both before and during the actual procedure, additional operating room time, additional technician time, and the actual cost of the hardware and the software for the navigation system itself. In the end, however, the most important factors in the adoption of the CAOS technologies will be ease of use for surgeons and operating room staff, and documented improved patient outcomes by obtaining more accurate and reliable alignment and less invasive techniques.

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