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LUPIN PHARMA

LUPIN

For The Management of Osteoporosis

For The Management of Osteoporosis

℞ CORCIUM Fit

Coral calcium, Vitamin D3, Zinc gluconate, Pine bark extract

℞ CORCIUM PLUS

Coral calcium, Folic Acid, Vitamin B6, Vitamin B12 (as Cyanocobalamin) (Cap)

℞ CORCIUM K2

Coral calcium, Calcitriol, Vitamin K2 (Tab)

For the maintenance of joint health

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℞ MOVNWALK

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What Lies In Future Orthopaedics

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Predictions are difficult about future, but change is inevitable. Orthopaedics is also constantly changing and touching new horizons every day. Existing techniques are being systematically upgraded and new techniques are constantly being integrated into existing systems. Although, it cannot be predicted too much, about how orthopaedics will look tomorrow, but there are a few key trends that are becoming apparent. Hence we orthopaedians have to rise up to face the challenge and to keep up the pace.

Today, like other surgical fields, orthopaedics is also on minimal invasive path with precision, favouring day care and overnight procedures. Minimal invasive procedures have been already established in joint surgeries of knee and shoulder. But now arthroscopies of small joints like ankle, wrist, elbow etc are also regularly performed. Scopies are recently performed even for various tendinopathies and also for nerve decompression. Minimal invasive and endoscopic spinal procedures are increasingly done and the spectrum of diseases which can be treated endoscopically is day by day increasing, broadening their scope. Even various training programs and fellowships are being structured and dedicated to these minimal invasive surgeries. Knee replacements are also being performed as day care procedures with the help of micro-plasty and improved instrumentation. Thus minimal invasive surgery is the future prospective of orthopaedic surgery and the trend towards outpatient and minimal invasive procedures in diagnostic studies and imaging, hospital-based treatment and rehab programs will also continue as technologies advance.

Newer advances are made in the field of implant and metallurgy as well. Femoral neck plate system, PFNA-2, Fence plate, variable angle plates, patellar plates, locked nails for rami are some of the examples of newly available implants. But are these implants really useful and beneficial for our patients or it is just an industrial and market driven hype to use them, will be tested over time. Proximal femur plate, short PFN, surface hip replacement and metal on metal arthroplasty are some of the examples which failed as quickly as they arrived. Hence we as surgeons should be vigilant, aware and judicious, in use of these implant weighing all pro and cons and use the implant what suits our patients the best.

The weak link in implant surgery is the metal with which they are made. There has been continuous research for search of an ideal metal to be used in orthopaedics. Today, other than stainless steel implants, implants made of titanium, and other alloys are available. Recently developed biodegradable implants and carbon implants are particularly useful for intra-articular fractures, which avoids need for second surgery for removal and are also radio transparent. Prosthesis made of zirconium, oxinium or newer alloys like TiNbN or NiCo are advantageous as they are inert, better survival-ship, less corrosive and less wear. Smart implants of further generations will be self-protective by automatically responding to changes in the local environment.

Orthobiologics including stem cell therapies and platelet-rich plasma have revolutionized some the orthopaedics treatment protocols by enhancing regeneration and repair. They are of tremendous use in sports injury, tendinopathy, arthropathies and wound healing. They act by increasing the growth factors at the pathology site and thus delay in aging procedure. They are increasingly used for joint preservation. Other treatments like including recombinant growth factors, cell transplants, gene therapies, stem cell therapy, tissue-engineered products are the new evolving biologics markets.

Introduced about two decades ago, computer-assisted orthopaedic surgery (CAOS) has emerged as a new and independent area in orthopaedics and traumatology. With the advances in technologies and imaging

modalities, surgeries are increasingly performed with computer navigation, computer assisted, patient specific instruments and by robotics. Computer assisted surgery in arthroplasy, scoliosis, pedicle insertion etc have increased accuracy. Further uses of robotics to perform these surgeries have added a new dimension to orthopaedic surgery. The spectrum is increasing day by day. These are more precise, accurate, user friendly, lesser risk, economical and with fewer complication, especially for complex joints, deformed bones and complicated cases. Use of hexapods with computer software's has given precision and flexibility for rapid corrections of deformity with simultaneous correction in all the planes. Use of robotics and computer software based hexapods is being explored and expanding for traumatological applications as well. Artificial intelligence in orthopaedics is in its infancy, yet its use has been helpful. But robotic surgery and artificial intelligence with its transformative potential will revolutionise orthopaedics and become increasingly common and it will assist and enhance decision-making intra-operatively, as well as in the planning and recovery stages too.

Many recent advances have occurred not only inside the operating theatre, but also outside the hospital and clinic room, both before and after surgery,as well. Improved imaging and printing have helped surgeons to better delineate three dimensionally, to assess the pathology early and definitely, thus help in better treatment at early stage. Fluoroscopy-based navigation, intra-operative 3-D fluoroscopy, O-arm, 2-D or 3-D multiple Image Stitching, Image Fusion or Statistical Shape Modelling are some of the recent modalities which can overcome the common problems of viewing of small portion of the target structure in a single C-arm image due to the limited field of view as these newer modalities image the entire structure by creating a panoramic view and also allow for visualization of critical structures such as nerve roots or vascular structures during surgical navigation. These improved diagnostic capabilities with the recent advancement like low-dose X-ray imaging, cartilage imaging, diffusion tensor imaging, MR arthrography, and high-resolution ultrasound and enabling image-guided interventions with real-time MRI or CT fluoroscopy, molecular imaging with PET/CT, and optical imaging have added a new dimension to orthopaedic practice. It is expected that with the advent of the flat panel technology, the use of fluoro-CT as a virtual object generator will significantly grow.

Smart phones and computers have added a new tool as an armamentarium for both the surgeons as well patient. They are helpful in many ways and can help in literature review, knowledge updates, search on a certain topic, diagnosing, pre-operative planning of patients, deformity assessment, measurement and calculations, treatment progress and to evaluate the outcome. They can also help to communicate, collect data digitally, remote monitoring, peer or expert advice for getting a second opinion. Hence it is very much necessary for a surgeon to learn and operate on these smart phones smartly because new generations of mobile imaging systems, will soon be available.

Issues related to training, technical difficulty, and learning curve are commonly presumed to be major problems to the acceptance of new technology, but these are not supposed to be the barriers for surgeons. The barriers to adoption are more intrinsic to the technology itself, including intra-operative glitches, unreliable accuracy, frustration with intra-operative registration, and line-of-sight issues. Despite these possible challenges, the future for the orthopaedic field looks bright as it evolves.

Large numbers of newer modules covering a wide range of traumatological and orthopedic applications have been developed, validated in the laboratory and in clinical trials. Some of them are abandoned, because the anticipated benefit failed to be achieved or the technology proved to be unreliable or too complex to be used intra-operatively. Hence all these new techniques, procedures, technologies and devices need to be carefully evaluated first in the laboratory setting and then clinically and must be proved better in both short and long-term outcomes for our patients rather than just a market driven gimmick.

A planned multidisciplinary approach holds the key for future treatment amalgating together other disciplines as well. Despite the advantages of newer technologies, to the patient and the surgical team and increased accuracy, technology is yet to gain general acceptance among orthopaedic surgeons of all age.

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Micro-Endoscopic Tubular Minimal Invasive Spine Surgery - Overview

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Abstract

Damage to paraspinal muscles as by caused by conventional open posterior lumbar spinal surgery can lead to inferior clinical and functional results. Minimally invasive approach to lumbar spine by microscopic, endoscopic or micro-endoscopic techniques using specialised instruments via neuro-vascular planes using muscle splitting approach to accesses the pathological site can reduce or minimise these complications. MIS techniques have demonstrated less blood loss, less postoperative pain, decreased need of analgesics post operatively, faster rehabilitation, shorter hospital stays and lower infection rates as compared to open techniques. while achieving equally efficacious results.

A thorough knowledge of anatomy of posterior spinal structures and understanding of the instruments used in minimal invasive spine surgery is of paramount importance. This article focuses on the anatomy, history, basics, instrumentation and indications used in minimally invasive lumbar spine surgeries.

Keywords: Spine, Micro-Endoscopic, Minimal Invasive

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Introduction

Posterior lumbar spinal surgery, is among the most commonly performed spinal surgery. It inherently causes damage to surrounding posterior paraspinal muscles. This morbidity due to posterior lumbar spinal surgery, is mostly attributed to damage of paraspinal muscles, excision or injury of midline posterior interspinous and supraspinous ligaments or due to associated blood loss during surgery. Among the different surgical approaches to the spine, it appears that injury to the muscles and ligaments is greatest when using conventional posterior midline approach. Injury to paraspinal muscles can be caused by direct injury caused by dissection, thermal injury as by electrocautery, compression injury as by forceful retractors of by denervation. It can lead to atrophy of muscles with subsequent loss of function, thus giving rise to inferior clinical and functional results [1]. These can be reduced or minimised by minimally invasive approaches to lumbar spine by microscopic, endoscopic or micro-endoscopic techniques using specialised instruments.

The goal of any lumbar spine surgery is to achieve adequate decompression of spinal cord and nerve roots, attainment of fusion and maintenance / restoration of sagittal alignment. Minimally invasive spine (MIS) surgery also aims towards attainment of these goals, but via minimal invasive approach by minimal incision and soft tissue damage. A thorough knowledge of anatomy of posterior spinal structures and understanding of the instruments used in minimal invasive spine surgery is of paramount importance and shall benefit to optimise the learning curve of MIS. This article focuses on the anatomy, history, basics, instrumentation and indications used in minimally invasive lumbar spine surgeries.

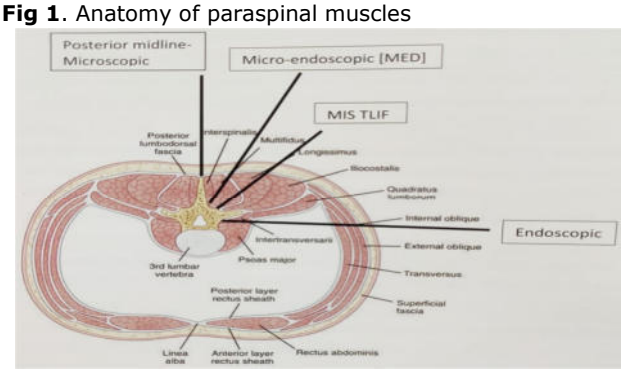
Anatomy of posterior paraspinal muscles

The posterior paraspinal muscles are responsible for controlled movements of lumbar spine while maintaining its stability. These are composed of two muscle groups (fig1):

a. The deep paramedian transverse spinalis group which includes the multifidus, interspinalis and intertransversarii.
b. The superficial and lateral erector spinae muscles which include the longissimus and iliocostalis.

All receive their innervation from the dorsal rami (table 1) [2].

Fig 1. Anatomy of paraspinal muscles



Principles of MISS surgery:

To preserve the spinal anatomy as much as possible while addressing the pathology optimally to reduce morbidity and achieve targeted goal of surgery.

Rationale of using MISS technique:

Minimal invasive spinal surgery uses muscle splitting approach and accesses the pathological site through known neuro-vascular planes. Surgeon can move from one compartment to other, only after incising the fascia over the other compartment so as to prevent disruption of the neurovascular supply of muscles.

The safe surgical corridor for MIS-TLIF is the neurovascular plane between the multifidus and longissimus muscle. When approaching the spinal canal, laminae or facet joint, as in micro-endoscopic decompression and discectomies, a trans-multifidus compartment approach is used. When placing percutaneous pedicle screws or posterolateral onlay fusion, a transerector spinae approach is used (fig 1).

Thus minimal invasive spinal surgery strives to minimize muscle injury and preserve bone ligament complex, providing early recovery. Kim et al compared trunk muscle strength between patients treated with open posterior instrumentation and percutaneous instrumentation and found that, latter group displayed 50% improvement in extension strength [3]. Lee et al studied markers of skeletal injury and found that markers return to baseline in 3 days in MIS group whereas open group required 7 days [4]. Similarly, Stevens et al assessed post-surgical [6 months] MRI sequences of patients undergoing open and MIS TLIF and found marked intermuscular and intramuscular oedema in the open group as compared to normal appearance of multifidus in MIS group [5].

Table 1 - Showing origin, insertion, nerve supply & action of posterior paraspinal muscles

Muscle	Origin	Insertion	Nerve supply	Prime action
Multifidus	Spinous process and lateral surface of lamina	Mammillary processes of caudal vertebra two to five levels below	Medial branch of dorsal rami	Prime stabilizer of spinal column
Erector spinae	Longissimus Transverse process Iliocostalis Tips of transverse process & adjacent fascia	Longissimus Posterior superior iliac spine Iliocostalis Ventral edge of iliac crest	Longissimus Intermediate branch dorsal rami Iliocostalis Lateral branch of dorsal rami	Move the trunk to Extension, lateral bending and rotation
Interpsinalis, Intertransversarii and short rotators	Intertransverse and interspinous ligaments	Intertransverse and interspinous ligament	Dorsal rami	Proprioceptive sensors

History

Spine surgeons around the world are in a constant attempt to achieve optimum surgical results with minimum collateral damage and to overcome drawbacks of traditional conventional surgeries. This is how Minimally Invasive Spine Surgery (MISS) came into use. MISS is the most advanced and least invasive form of spine surgery as it reduces the morbidity of a conventional technique and achieves the surgical goals. Reports of MISS procedures date back to the early 20th century [6]. The development of microscopic, fluoroscopic and endoscopic systems came into existence only in 1990s and from then MISS gained momentum. Tubular access to the lumbar disc was first reported by Faubert and Caspart in 1991. Tubular access minimised muscle damages and decreased blood loss considerably. Tubes became popular due to the easy access to contralateral side. Problems like degenerative disc, lumbar canal stenosis, listhesis etc can be dealt with the tubular technique. Micro-endoscopic discectomy was then described by Foley and Smith in 1997 [7]. The evolution of endoscopes was very well accepted by orthopaedic surgeons. Later microscope was introduced and added in this tubular technique by around 2003. Microscope gave better magnification and illumination giving better surgical outcomes. Fusion for treating instability patterns was also possible with minimal invasive spinal surgery, as the percutaneous pedicle screws came into existence.

Instruments for MISS

Instruments for standard microscopic, micro-endoscopic and endoscopic surgery may vary depending on the type of surgery to access the bony spine. Standard microlumbar decompression requires unilateral approach to access bony spine for decompression. Instruments required for MIS are as follows (fig 2).

Fig 2. Instruments used for MIS (a) Mc Cullohs Retractors (b)MIS instruments (c) Serial dilators (d) tubular retractors) (e) Percutaneous pedicle screw instrumentation (f) cannulated pedicles screw

a. C-arm and Microscope: A good quality C-arm and microscope are essential for successful MIS surgery. Surgery should not be contemplated unless anatomical landmarks are clearly seen through the C-arm. Microscope with assistant eye piece as well, with good focussing depth and light adjustment provides adequate magnification and illumination for decompression through narrow working channels.
b. Mc Cullohs Retractors: in which one blade fits into interspinous process and the wide blade sits on paraspinal muscles over the corresponding facet joint, allowing for unilateral exposure are used. Varying sizes and depth blades are available, corresponding to the depth of exposure required.
c. Serial dilators: These are concentric tubes used sequentially for serial dilation decreasing the need for muscle stripping during the exposure.
d. Tubular retractors: These cylindrical retractors allow the surgical corridor to be opened after serial dilation. Tubular retractors are preferred to blades as these are thin walled (0.9mm). The retractor allows for appropriately sized working channel ranging from 14mm to 25mm choosing appropriate depth size is important as it prevents the muscle from intruding into the field of view. The retractors can be fixed or expandable. Expandable retractors provide a larger working channel after docking.
e. Table mounted retractor holder: In MIS, retractor holder, which is table mounted is used to hold the tubular retractor in place than self-retaining. In self-retaining mechanism, constant pressure is exerted on tissues thus causing damage, whereas the pressure exerted by MIS table mounted retractors is undetectable.

f. MIS instruments: The MIS instruments for spinal decompression and fusion procedures are same as that of open techniques except that these are long and bayonetted which helps the surgeon to work through narrow working channel and under the microscope.
g. Burr: A high speed burr with long and thin shaft is usually required for decorticating and thinning bony elements
h. Percutaneous pedicle screw instrumentation: Instruments and pedicle screws required for percutaneous techniques are different. A Jamshedi type needle [Cook's needle] with trocar and cannula, which are gently tapped with mallet to reach isthmus of pedicle is required for pedicle marking. After trocar removal, cannulated tap over a K-wire is inserted through the cannula. Once tapping is done, cannulated pedicle screws are inserted over the guide wires inserted previously. These are connected with a sleeve during insertion which later help in passage of rods.
i. Percutaneous Rods: These rods have a bullet tip which ensure easy percutaneous passage. They are usually pre bent to accommodate for lumbar lordosis. Also they have an attachment for secure connection to rod insertor.
j. Rod insertion systems. There are two types of rod insertor systems. First, when the rod is inserted through screw heads and other is Pivot mechanism when rod is inserted after creation of passage above and across screw heads. Inner screws inserted help in gradual approximation of the rod to the screw heads through the sleeves.

Indications: The indications of minimally invasive spine surgery are similar to open traditional surgical indications. MIS is equally efficacious with Micro-endoscopic discectomies and decompressions. Similarly, it is effectively used in cases where instrumentation and fusion is required like spondylolisthesis, degenerative scoliosis and trauma. MIS is advantageous in revision spine surgeries as it provides a native surgical approach free of scar tissue. MISS now is widely used for dealing lumbar disc herniations, lumbar canal stenosis, cervical disc herniations, lumbar spondylolisthesis, spine infections, tumours, spinal deformities and spinal trauma and the spectrum is increasing day by day (Table 2).

Table 2 – Indications for MIS

Spinal Degenerative Conditions	Micro-endoscopic discectomy Micro-endoscopic decompression Degenerative instability Cervical Lamino-foraminotmy MISS C1-2 Trans-articular Screw Fixation
Spinal Infections	Transpedicular biopsy Endoscopic decompression and debridement Endoscopic drainage of epidural abscess Anterior/Transforaminal debridement and reconstruction
Spinal Trauma	Percutaneous Vertebroplasty/ Kyphoplasty Percutaneous pedicle screw fixations Anterior minimal access decompression and stabilization supplement with percutaneous screws
Spinal deformities	Adult deformities- Anterior/ Lateral minimal access- XLIF/ALIF/OLIF with percutaneous screws Congenital and Adolescent deformities
Spinal Tumors	Intra and extra medullary tumors

Contraindications: Obesity [BMI> 40), advanced spondylolisthesis (Grade 3 or 4) and previous instrumentation that requires open approach for extension or removal are all relative contraindications. In these patients, MIS is technically demanding and has high rate of complications as the working length through the tube increases [8].

Advantages: MIS techniques are advantageous in [9-12] as it:

a. Minimizes muscular trauma & denervation.

b. No trauma to paravertebral muscles on contralateral side.
c. Bilateral decompression can be done through unilateral approach.
d. Preservation of posterior ligamentous tension band.
e. Significant reduction of risk associated with dead space after conventional laminectomies.
f. Decrease chances of infection.
g. Small incision, better cosmesis.
h. Early mobilization, negligible postoperative wound pain, decreased need of analgesics post-operatively and an early start to rehabilitation.
i. Minimal blood loss
j. Shorter hospitalization
k. Early mobilization ensures decreased postoperative complications such as DVT, UTI, or pneumonia.
l. Very less chances of increasing instabilities even in grade I spondylolisthesis.
m. Lesser chances of wrong level surgeries.

Drawbacks: The MIS is has following drawbacks, which can be overcome by experience -

1. Radiation exposure: Fluoroscopically guided pedicle screw placement exposes surgeon to increases dose of radiation. Although, with gain in experience and advent of navigation exposure to radiation is markedly decreased [13].

2. Operative time: Studies have shown that the operative time for screw insertion is longer than conventional method, but this time reduced as surgeon gains experience.

3. Learning Curve: MIS has a steep learning curve. Technical difficulty of the process and lack of training opportunities adds to this drawback.

Future Trends:

MED is gaining popularity because of its advantage over conventional methods as it increases precision and accuracy of the surgeon thus making the job a lot easier and will not be surprising with each passing day to see MED soon being accepted as a gold standard technique worldwide. Widespread applications to tackle numerous spinal pathologies with safety and achieving excellent clinical and functional outcomes have prompted most surgeons to want to perform MIS procedures.

Author's viewpoint: The author feels that the first surgery to venture with minimally invasive surgery would be micro endoscopic decompression (MED). After successfully operating around 5-6 cases one can plan for micro endoscopic discectomy and then gradually MIS TLIF, each after 5-6 cases. One must not feel shy to convert an MIS surgery into an open procedure if at any point the goals of surgery are compromised. One must adequately counsel the patient pre operatively for such a consequence.

Conclusion: MIS surgery aims to achieve better clinical and functional results through minimal soft tissue injury and bone resection while attaining the goals of spinal decompression and fusion. The instruments required for MIS technique are different and one must have a thorough knowledge of these before contemplating minimally invasive surgery. This technique has a steep learning curve and has its own contra-indications and limitations. It is an important tool in the armamentarium of a spine surgeon and should consider this technique taking into account its advantages and clinical results.

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Outcome of Modified Wiltse Paramedian Approach For Fusion of Single Level Lower Lumbar Spinal Instability

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Study performed at Netaji Subash Chandra Bose Medical College, Jabalpur (M.P.)

Abstract

Background: Conventional midline dorsal approach to spine leads to excessive muscle retraction and hence muscular injury, denervation, atrophy or ischemic necrosis. Wiltse paraspinal sacrospinalis-splitting approach prevents these complications. We retrospectively evaluated the outcome of this modified Wiltse approach done for fixation of single level lower lumbar spinal instability.

Material & Methods: 12 patients of single level lumbar spinal instability in vertebral burst fracture or in spondylolisthesis at L4-L5 or L5-S1 level operated via modified Wiltse approach with minimum of one year follow up, were evaluated for pain by VAS score, neurology, blood loss, duration of surgery and hospital stay and radiologically for assessment of pedicle screw fixation.

Results: The mean age in the group was 34.6 years (range 16 to 45 years). 4 patients were male and 8 were female. Mean blood loss for the surgery was 150 ml (range 134 to 170 ml). The average C arm exposure was 12.5 (range 8 to 21). The average length of hospital stay was 3.5 days. None of the patients had any postoperative neurological complications or deterioration. The mean VAS score improved from 8.3 pre-operatively to 3.3 at third postoperative day and finally to 1.2 at one year follow-up.

Conclusion: Wilste Paraspinal approach, being a muscle sparing approach, provides excellent exposure to transverse process, minimal intraoperative bleeding, low infection rate, low postoperative morbidity and improved outcomes.

Keywords: Wiltse approach, Paraspinal approach, Spondylolisthesis, Trans-sacrospinalis approach

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Introduction

Conventional open posterior midline approach is the most common approach used for pedicle screws fixation for lower lumbar pathology. This approach requires excessive retraction of the bulky lower lumbar muscles, which results in paraspinal muscle damage and denervation, which may lead to postoperative flat back deformity and chronic back pain [1]. In order to prevent these complications, Wiltse in 1968, developed the paramedian approach, also known as posterolateral or paraspinal muscle sparing approach. It is based on lateral dissection between the muscles, two finger breadths away from the midline spinous process rather than midline approach elevating the muscles from spinous process, specifically used for the far lateral discectomy. This approach had advantages of minimal muscle injury, lesser intra-operative bleeding and a shorter hospital stay [2]. Later on, he modified his approach to the sacro-spinalis splitting approach to have clear cleavage between multifidus and longissimus paraspinal

muscle [3]. In the process of further refinement, he extended the indications for the approach from lateral discectomy to other uses like insertion of pedicle screws and decompression of the opposite side from inside the vertebral canal [4]. We retrospectively evaluated the results of this modified Wiltse approach done for fixation of single level lumbar spinal instability as an alternative to conventional open posterior approach to avoid muscle damage and reduce radiation exposure.

Material and Methods

This retrospective study was conducted at our tertiary level institute from January 2017 to December 2019 in patients operated for single level lumbar spinal instability at L4-L5 or at L5-S1, via modified Wiltse approach.

Institutional ethical clearance and written informed consent from all the patients was obtained. All patients with lumbar spine instability at L4-5 or L5-S1 operated via modified Wiltse approach with minimum one year follow up were included in the study. Lumbar spine instability was evaluated on dynamic X-ray's and Magnetic resonance imaging. Burst fractures and spondylolisthesis either grade 1 or 2 at single level were included in the study. Patients operated for more than grade 2 listhesis, for more than one level involvement of lower lumbar instability or for lumbar canal stenosis were excluded from study.

All the patients were operated under general anesthesia in prone position over longitudinal bolster under image intensifier. All patients were operated via modified Wiltse approach, via single midline skin incision. After midline skin incision and subcuticular dissection in midline, lumbosacral fascia was identified. Two paraspinal vertical incisions were made through the fascia approximately 3-4 cm lateral to the spinous process at the marked level on both the side. Superficial and deep fascia was split longitudinally along with blunt splitting of sacrospinalis, identifying the clear cleavage plane between the natural gap of multifidus medially and longissimus laterally (fig1). Small amount of fat helped to delineate this plane. The muscles were then meticulously teased apart in avascular plane till the transverse process. Following this the transverse process and facet joints were palpated and after retraction with Meyerding's retractors, the entry point for the pedicle screws was identified at mamillary process. Slightly nibbling the base of superior articular facets, the desired size pedicle screws were inserted into the appropriate vertebra after, inspecting the walls of the channel with a ball-tipped probe. The direction and position of pedicle screw placement was confirmed with fluoroscopy. For applying another pedicle screw, the retractor was moved up or down, maintaining it between the inter-muscular planes. The required numbers of pedicle screws were inserted and then assembly was completed by placing connecting rods. In case, of spinal trauma only pedicles screws were inserted whereas in cases of spondylolisthesis, the facet joint was removed and bone filled inter body cage, was additionally inserted after discectomy and preparation of vertebral body endplates by high speed burr. Local bone grafts were harvested from posterior iliac crest with same incision in case of L5 vertebral burst fracture for posterolateral fusion whereas in cases of listhesis bone graft removed during decompression and facet removed was used for inter body fusion. After checking decompression, fixation and reduction under image intensifier the closure was done with both sides of fascia with running suture without any drain.

Postoperatively, patients were mobilized with help of lumbar corset from second postoperative day and discharged after three to five days. Suture removal was done at two weeks. Patients were followed monthly for three months and then three monthly up to one year. All patients were assessed for pain by VAS score, neurology, blood loss, duration of surgery and hospital stay. Fixation of the pedicle screws was assessed radiologically.

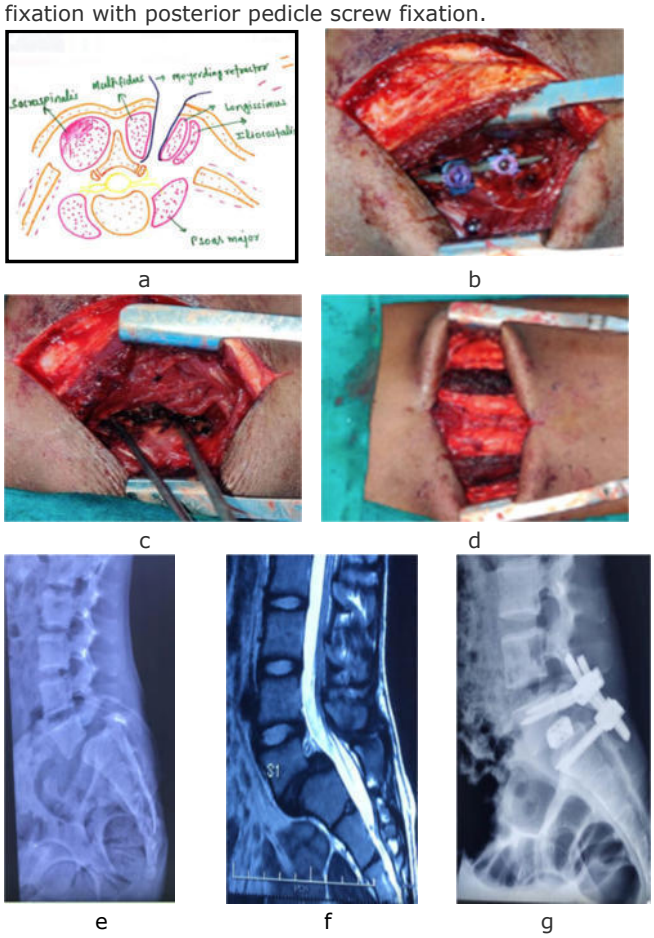
Results

12 patients of single level lumbar spine instability at L4-L5 or L5-S1 were included in the study. The mean age in the group was 34.6 years (range 16 to 45 years). 4 patients

were male and 8 were female. Out of 12 patients, 2 patients were with L5 vertebral body burst fracture, 6 patients had L4-5 and 4 patients had L5-S1 isthmic spondylolisthesis.

Mean blood loss for the surgery was 150 ml (range 134 to 170 ml). The average C arm exposure was 12.5 (range 8 to 21). The average length of hospital stay was 3.5 days. None of the patients had any postoperative neurological complications or deterioration. The mean VAS score improved from 8.3 pre-operatively to 3.3 at 3rd post-operative day and finally to 1.2 at one-year follow-up. None of the patients needed any analgesic medications at 1-year follow-up. Follow up anteroposterior and lateral X-rays at 1-year showed stable hardware with no screw loosening, infection or any root symptoms in any case (fig 1).

Fig 1. Illustration (a) and intraoperative photographs (b to d) showing modified Wiltse approach between multifidus and longissimus with two vertical paramedian facial opening with single midline skin incision, the pedicle geometry and muscle sparing approach with pedicle screw insertion. Preoperative lateral (e) X rays and sagittal MRI scan (f) of 18 years' patient with L5-S1 spondylolisthesis. Postoperative lateral X rays (g) showing inter body fixation with posterior pedicle screw fixation.



Discussion

Conventional midline dorsal approach to spine involving erosion of paraspinal muscles from spinous process leads to excessive muscle retraction by retractors while approaching far lateral side [1]. Prolonged overstretching of the paraspinal muscle by retractors also occurs during exposure of entry points for pedicle screw fixation. This stretching can damage the posteromedial branch of the spinal nerves and descending branches of posterior lumbar artery supplying the muscle [5-7]. This can cause muscular injury, denervation, atrophy or ischemic necrosis of muscle leading to poor outcome with increased chronic pain or failed back [1]. This paraspinal muscle damage have been described by numerous authors and also confirmed by increased muscular edema and levels of inflammatory mediators in patients undergoing conventional midline muscle-stripping approach versus those undergoing surgery by minimally invasive approach [8-13].

Wiltse's, paraspinal sacrospinalis-splitting or trans-sacrospinalis approach to the lumbar spine, prevents these complications by reducing excessive retraction of paraspinal muscles because this approach involves access to the spine from lateral side through the muscular plane between multifidus and the longissimus parts of the sacrospinalis muscle [2-4]. The advantage of this approach is that it offers a more direct route to the pedicle screws entry point i.e. transverse processes and facets of the lumbar spine with almost minimal muscle stretching and less bleeding than through the midline approaches [14,15]. Olivier et al in their cadaveric study documented that two incisions 3 cm away from the midline, are in the middle of the two vascular networks which prevents the skin necrosis [16]. Further, moving the retractor between and maintaining the intermuscular planes, places minimal pressure on the muscles and that too only for very short time which avoids any undue pressure on the muscle, thereby decreasing muscle ischemia and related problem. Thus this approach maintains the integrity of the paraspinal musculature and soft tissues. Wiltse Paraspinal

approach, being a muscle sparing approach, has many advantages as compared to the traditional midline approach like excellent exposure to transverse process, minimal intraoperative bleeding, low infection rate, low postoperative morbidity and improved outcomes [17].

We retrospectively reviewed the results of this modified Wiltse's approach, used for fixation of 12 patients with mean age 36.4 years of single level lumbar instability in vertebral burst fracture or in spondylolisthesis at L4-L5 or at L5-S1 level and found the approach to be safe, minimally disruptive, less damage to the paraspinal musculature and improved outcome as seen in improved VAS score. The radiation exposure in our series was also quiet low by this approach, which is due to better direct visualization of the pedicle screw entry point which is a therapeutic benefit of this approach, in contrary to increased radiation exposure by percutaneous techniques which are associated with higher radiation exposure [18]. Recently this approach is widely used for non-fusion dynamic lumbar spine stabilization as it is quicker and safer [18,19]. The approach can be done via minimally invasive means also for easy access to extraforaminal and foramina part of disc space, which further decreases muscle damage and blood loss.

Wiltse approach is limited by lesser operating space and less obvious surrounding anatomic landmarks which can be overcome by better magnification with loop and clear intraoperative imaging. It allows for placement of screws from the facet in a more lateral to medial trajectory leading to higher chances of facet violation, and hence the surgeon must be very careful when placing screws [21].

Conclusion

Modified Wiltse approach can be used safely for fusion of single level lower lumbar spinal instability with early ambulation and minimal morbidity. Wilste Paraspinal approach, being a muscle sparing approach, provides excellent exposure to transverse process, minimal intraoperative bleeding, low infection rate, low postoperative morbidity and improved outcomes

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Efficacy of Microscopic Posterior Cervical Laminectomy for Multilevel Compressive Cervical Myelopathy: A Long Term Analysis

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Study performed at Mumbai Institute of Spine Surgery, Bombay Hospital and Medical Research Centre, Mumbai and Lilavati Hospital & Medical research Centre, Mumbai

Abstract

Background: Cervical spondylotic myelopathy and ossified posterior longitudinal ligament (OPLL) are the two most common causes of compressive multilevel cervical myelopathy. These may cause progressive neurological deterioration and require surgical treatment. There is no gold standard treatment available. Anterior surgery is associated with morbidity and complications in multilevel cases because of which posterior surgeries are preferred, which have shown good clinical outcomes. We determined the long-term efficacy of microscopic posterior cervical laminectomy for multilevel compressive cervical myelopathy.

Material & Methods: We reviewed 110 patients with multilevel compressive cervical myelopathy who underwent posterior cervical laminectomy from January 2007 to December 2014. Patients with age ≥45 years, C2-C7 cobb's angle ≥ 10º, compression at ≥3 levels and a minimum of 5 years follow-up were included in the study. Demographic data, pre and post-operative clinical parameters (visual analog scale [VAS], Nurick's grading and modified Japanese orthopaedic association [mJOA] score), radiological parameters (C2-C7 Cobb's Angle), peri-operative parameters, complications and recovery rate were evaluated.

Results: The mean age of the patients was 55.6 years (44-74) with M: F 68:42. The mean blood loss and mean operative time was 93.9 ml and 96.6 minutes. There was significant improvement ($p<0.05$) in VAS (3.7±1.5 to 1.9±0.8), Nurick's grading (3.3±0.9 to 1.8±0.6) and mJOA score (8.3±1.4 to 13.9±1.8). At final follow-up 61.8% patients' maintained cervical lordosis, 21.8% changes to a straight spine and 16.3% became kyphotic. Intraoperatively 7 patients had a dural tear. 3 patients showed neurological deterioration postoperatively and 3 had unilateral C5 palsy which improved within 6 months period. 19% had an excellent outcome, 39% had good, 33.6% had fair and 8.1% patients had a poor outcome.

Conclusion: Microscopic posterior cervical laminectomy is the gold standard surgical procedure in patients with multilevel compressive cervical myelopathy with good recovery and clinical outcomes in properly selected patients. In long term it may causes progression of kyphosis, without any significant clinical affection.

Keywords: Cervical spondylotic myelopathy, OPLL, Cervical laminectomy, CSF leak, C5 palsy, Neurological deterioration.

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Introduction

Multilevel compressive cervical myelopathy is the commonest cause of spinal cord impairment in the elderly population [1]. It comprises cervical spondylotic myelopathy (CSM), ossification of the posterior longitudinal ligament (OPLL), ossification of the ligamentum flavum (OLF), and degenerative disc disease (DDD). These structural changes, narrows the spinal canal and reduces the space available for the spinal cord, leading to neurological deficit. Surgical decompression is the gold standard procedure for preventing the progression of neurological deficits in these patients [2,3]. Good surgical results can be obtained by various surgical procedures done either anterior or posterior, such as anterior corpectomy and fusion, laminectomy alone or laminoplasty and laminectomy with fusion (LF). Patients with less than 3 segments involved can be managed by anterior surgeries, whereas when the involvement is more than 3 segments, posterior surgery is the gold standard [4]. The long-term efficacy of cervical laminectomy is already described in literature in past, but long-term follow-up data in Indian subcontinent is scanty. Here we are presenting long term outcome of microscopic posterior cervical laminectomy for multilevel compressive cervical myelopathy, with respect to functional recovery, complications and radiological outcomes.

Materials and methods

After ethical committee approval, we retrospective analyzed 118 patients (8 lost to follow-up) with multilevel compressive cervical myelopathy who underwent microscopic posterior cervical laminectomy in a single hospital by a single surgeon from January 2007 to December 2014. Preoperatively all the patients had signs and symptoms of long tract involvement, such as hand clumsiness, gait disturbance, and hyperreflexia in lower limbs. Patients with age ≥45 years, compression at 3 or more levels, C2-C7 cobb's angle ≥ 10º (lordotic) and a minimum of 5 years' follow-up after microscopic posterior cervical laminectomy were included in the study. Patients with only axial neck pain without myelopathy, instability on dynamic x-ray's, fracture/infection/metabolic disorders, revision surgery or having developmentally narrow spinal canal were excluded from the study. Demographic data (age, sex, duration of illness to presentation, and co-morbidities), pre- and post-operative clinical parameters (neck pain score - visual analogue scale [VAS], Nurick's grading and modified Japanese orthopaedic association [mJOA]), radiological parameters (Sagittal cervical Cobb's Angle), perioperative parameters (operative time, blood loss, and hospital stay), postoperative complications (infection, root palsy or neurological worsening) were evaluated. The recovery rate was calculated as per hirabayashi [5], recovery rate (%) = [postoperative JOA score - preoperative JOA score]/ [18 - preoperative JOA score] * 100. A recovery rate of > 75% was considered an excellent outcome, 50%–75% as good outcome, 25%–49% as fair outcome, and < 25% was considered a poor outcome.

All patients were operated under general anaesthesia, in prone position on padded bolsters. Padding was done under all the bony prominences and ocular pressure was checked after positioning. The neck was placed in neutral or in mild flexion. The arms were strapped by the side (fig 1). After confirmation in C-Arm a standard midline posterior exposure from C3 to C6 was carried out up to the lamina-facet junction taking care to preserve the attachments to C2 and C7. The dissection was restricted just lateral to the lamina-facet junction and the soft tissues attachments over the facet joints were preserved. The furrow at the junction of the lamina and the facet joints was marked at all levels requiring laminectomy. Under microscopic guidance the gutters were created on both sides using a high-speed cutting burr (Midas burr) till the inner cortex were reached. 1-mm Kerrison rongeur was used to remove the flavum up to the lateral gutters created. The rongeur was used to complete the furrows on either side all the way up to the C2–C3 interlaminar space. The laminectomy was completed by lifting the laminae en bloc from the caudal end, and gentle dissection was performed for any adhesion between the ligamentum flavum and dura. Undercutting of

C2 and C7 laminae with C4-C5 foraminotomy was done in all the cases to provide adequate decompression.

Postoperatively patients were encouraged to sit up in bed 24 h after the surgery. Patients were mobilized out of bed on the 2nd postoperative day using a soft cervical collar which was discontinued after suture removal. Patients were sequentially followed up at 4 weeks, 3 months, 6 months, 12 months and then annually. At each follow-up clinical and radiological evaluation was done. The statistical analysis was carried out using a paired student *t*-test. Differences were considered statistically significant at $P < 0.05$. Statistical analysis was done using SPSS software 20.0 (SPSS Inc., Chicago, IL, USA).

Fig 1. Positioning of the patient in well-padded bolsters, arms by the side strapped and head secured.

Results:

118 patients fulfilled the inclusion criteria, out of whom 8 patients were lost to follow up and hence 110 patients were included in the study. Out of 110 patients 63 had degenerative cervical spondylotic myelopathy (CSM) and 47 had cervical OPLL. The mean age of the patients was 55.6 years (range 44 to 74 years) with Male to female ration of 68:42. The mean duration of presentation of illness was 3.2 months (range 1 to 8 months) and the mean duration of follow-up period was 7.6 years (range 5 to 11 years). 48 patients had ≥ 2 comorbidities, 44 had < 2 and 18 had no associated comorbidities. 21 patients were non-ambulatory at the time of presentation (table 1).

The mean blood loss was 95.9 ml (range 70 to 180 ml) and the mean operative time was 95.6 mins (range 82 to 140 min). The mean duration of hospital stay was 4.8 days (range 3 to 8 days) (table 2). VAS demonstrated significant improvement ($p<0.05$) from pre-op 3.7±1.5 to post-op 1.9±0.8. There was significant difference ($p<0.05$) in Nurick's grading preop 3.3±0.9 to post op 1.8±0.6. mJOA score improved from pre-op 8.3±1.4 to post-op 13.9±1.8 ($p<0.05$) (Table 3) the mean recovery rate at final follow-up was 57.7%. Out of 110 patients 21 (19%) had an excellent outcome, 43 (39%) had good, 37 (33.6%) had fair and 9 (8.1%) patients had a poor outcome (table 3). Out of 110, 68 (61.8%) patients maintained cervical lordosis, 24 (21.8%) changes to a straight spine and 18 (16.3%) became kyphotic (kyphosis greater than +5°, straight from -5° to +5°, lordosis less than -5°) (table 3).

Fig 2. Cervical CT scan [(1a) sagittal, (1c) Axial] showing mixed type of OPLL from C2-C6 with significant canal compression (>50%) and myelomalacia [MRI sagittal (1b), axial (1d)] changes in the spinal cord. Post-operative MRI [(1e) sagittal, (1f) axial] after multilevel laminectomy showing well decompressed canal.

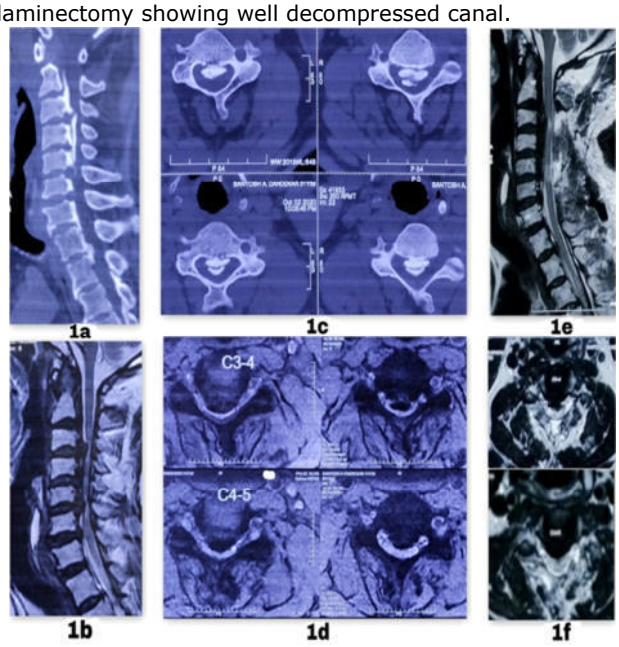
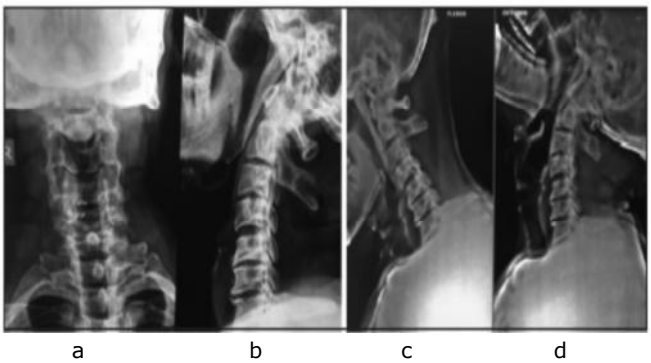


Fig 3. 53 year old male patient with multilevel cervical spondylotic myelopathy operated by microscopic posterior multilevel laminectomy. Immediate AP(a) & lateral (b) & postoperative lateral flexion (c) and extension (d) x ray images at 5 year follow-up showing maintained cervical lordosis.



Intraoperatively 7 (6.3%) patients had a dural tear, although no repair was done intraoperatively, as the tear was small. There was no case of post-operative CSF leak. Superficial infection developed in 6 (5.4%) individuals for which intravenous antibiotics were given till the healing and there was no case of deep infection or wound dehiscence. 3(3.6%) patients showed neurological deterioration just after the surgery, out of which 2 showed decrease in their mJOA score by 5 points and 1 showed decrease in mJOA by 3 points. Over the time mJOA improved to their preoperative level. All these 3 cases were patients operated for cervical OPLL. 3 (3.6%) patients had an isolated unilateral C5 palsy which was transient in nature and improved within 6 months period with regular physiotherapy (table 4).

Table 1: Demographics

Variables		**N=110**
Age		55.6 (44-74)
Gender (M: F)		68:42
BMI		31.9
Comorbidities (DM, HTN, BA, HIV)	≥2	48
	<2	44
	No comorbidity	18
Surgical indication	CSM	63
	Cervical OPLL	47
Duration symptoms (months)		3.2
Duration of follow-up (years)		7.6 (5-11)

Table 2: Perioperative parameters

Parameters	**Mean**
Operative time (minutes)	95.6 (82-140)
Blood loss (ml)	95.9 (70-180)
Hospital stay (days)	4.8 (3-8)

Table 3: Clinical and radiological outcomes:

Parameters		**Pre-op**	**Post-op**	**p-value**
VAS		3.7±1.5	1.9±0.8	<0.05
Nurick's score		3.3±0.9	1.8±0.6	<0.05
mJOA score		8.3±1.4	13.9±1.8	<0.05
mJOA Recovery rate (%)	Excellent (>75%)	21 (19%)		
	Good (50%-75%)	43 (39%)		
	Fair (25%-49%)	37 (33.6%)		
	Poor (<25%)	9 (8.1%)		

Table 4: Complications:

Complications		**N (%)**
Intraoperative	Dural tear	7 (6.3%)
Early post-operative	Superficial infection	6 (5.4%)
	Deep infection	0
	CSF leak	0
	C5 palsy	3 (3.6%)
	Neurological deterioration	3 (3.6%)
Late post-operative	Axial neck pain	24 (21.8%)
	Progressive kyphosis	18 (16.3%)
	Delayed Neurological deterioration	0
	Reoperation	0

Discussion

Surgical decompression is the gold standard treatment for multilevel cervical compressive myelopathy. Various techniques include anterior, posterior or combined approach [6]. The disadvantages associated with anterior approach are increased blood loss and surgical time, post-operative dysphagia, hematoma formation and fusion-related complications [4,7-9]. Studies have shown that in general elderly patients have higher mortality, postoperative complications, and bony nonunion rates than younger patients [7,8]. Puvanesarajah et al demonstrated significantly increased rates of surgical complications and mortality after anterior cervical fusion [9]. Posterior decompression (laminectomy) with or without fusion are reliable and effective in treating multilevel cases [10].

The incidence of kyphotic change after multi-level laminectomy is approximately 20% [11]. The different causes include young age, preoperative kyphosis, and aggressiveness of posterior soft tissue resection, extent of facetectomy or capsule resection and multiplicity of laminectomy level. Facet injury is the most significant cause of postoperative kyphosis [12]. To overcome the disadvantages associated with laminectomy procedure laminoplasty came into light which preserves the posterior elements that protect the spinal cord against external forces and might decrease the incidence of neurological deterioration caused by falls by providing spinal stability [5,13,14]. Despite a variety of laminoplasty techniques, its advantages over laminectomy remains unclear. A review of literature revealed that the general result in

the long-term follow-up of laminoplasty patients is similar to that in laminectomy patients [14]. Lee et al in his study suggested that there was no significant difference between cervical lordosis overtime in patients operated by laminectomy alone, laminoplasty and laminectomy with fusion [6]. Kaptain et al reported on 46 patients undergoing laminectomy and concluded that the development of a postoperative deformity (kyphosis) was more than twice as likely in patients with a "straight" preoperative spine (loss of lordosis) than in those with a normal lordosis [10].

In our study in 21.8% curvature changed to a straight spine and 16.3% became kyphotic. This change in the cervical alignment had no significant effect on the clinical outcomes of the patients and none of our patient required surgical intervention for that. In a study by Lee et al, 70.6% maintained their original curvature or improved from straight spine to lordosis [14]. The reasons for the maintenance of cervical lordosis in our study can be because of meticulous dissection and preservation of facet capsule during laminectomy under microscopic guidance and the selection of only those patients who has a C2-C7 cobbs ≥ 10º. The mean recovery rate in present study at final follow-up was 57.7% which is more than the study done Kato et al [12] where at last evaluation it was 32.8% and comparable to Lee et al [14] study with a recovery rate of 56.3%. We observed that history of trauma, high BMI, a low preoperative mJOA score and late presentation were associated with a delayed recovery while higher preoperative JOA score and younger age at surgery were associated with early recovery.

Progression of OPLL was seen in 65.4% of the cases without any delayed neurological deficit, which is lesser than suggested by Hori et al [15] (in 71% at 10 years) and more than suggested by Chiba et al [16] where it was 56.5% of patients after 2 years.

The risk of durotomy during laminectomy is 0.3%–13% and can be up to 18% with revision surgery [17]. Singhatanadgige et al found the incidence of C5 palsy was higher 9.6%–25% following laminoplasty with fusion compared to 0%–8% in laminoplasty group [18]. Lee et al observed 5.9% C5 palsy in his study [14]. In our study the incidence of C5 palsy was 3.6% which recovered spontaneously within 6 months' period. Axial neck pain may be the most frequently reported complication of laminectomy, with reports of its incidence ranging anywhere from 16%–48%. We observed 21.9% incidence of axial neck pain which was manageable with medications. Bartels et al in his clinical randomized trial did not find a difference in the neurologic outcome or quality of life between laminectomy alone and laminectomy fusion groups at an average follow-up of 18.3 months which suggest that laminectomy alone may be safe and effective in patients with preserved cervical lordosis and a stable cervical spine, without preoperative spinal instability [19].

As per our results and understanding we suggest microscopic posterior cervical laminectomy for patients with compressive cervical myelopathy ≥3 levels, without instability and C2-C7 cobb's angle >10°. Complications associated with fixation like higher incidences of C5 palsy, pseudoarthrosis, more surgical time in old and debilitated patients can be avoided. There are chances of post-laminectomy kyphosis which can be prevented by proper patient selection and OPLL progression which we think is only radiological without any clinical effect. This is a single surgeon, single hospital study and is the only study done on this pathology in Indian subcontinent with a long-term follow-up.

There are several limitations in this study. first, the study is retrospective and represents the experience of a single surgeon in a single institute. Though it is retrospective in nature all the data was collected prospectively. Second, our inclusion criteria were narrow because of which it cannot we used in large number of patients. Third, there is no comparative group in our study. To determine the actual efficacy multicentric comparative studies are needed.

Conclusion:

Microscopic posterior cervical laminectomy is the gold standard surgical procedure in patients with multilevel compressive cervical myelopathy with good recovery and clinical outcomes in properly selected patients. In long term it may causes progression of kyphosis, without any significant clinical affection.

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Analysis of Potential Bone Donors and Deferral Rates for Bone Bank in a Tertiary Care Hospital

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Abstract

Background: Bone grafts are widely used in various orthopaedic procedures. Problems of limited availability of autograft and donor site complications can be overcome by use of allograft procured from the bone bank. The banks are underutilized due to high donor deferral rate. Hence this study is done to analyse the donor profile and donor deferral rate of our bone bank.

Material & Methods: Donor deferral rate in pre-harvesting phase, intraoperative phase and post harvesting phase in 67 patients of fracture neck of femur undergoing hemi-replacement / total hip replacement (THR), osteoarthritis hip undergoing THR and osteoarthritis knee undergoing total knee replacement, who donated the bone was analysed.

Results: Overall donor deferral rate was 69% as 46 donors out of the total 67 were rejected and only 21 (31%) donors were eligible for use. 24 (35%) donors were rejected during the pre-harvesting stage; 1 (1.4%) donor was rejected intraoperatively, whereas 21 (31 %) donors were rejected during the post harvesting period.

Conclusion: High rate of donor deferral rate has led to donation losses and burden on limited resources. Awareness, effective trained staff, proper counselling and consent, improved serological testing and equipped bone banks can reduce donor rejection and meet the increasing demand for bone grafts.

Keywords: Bone bank, Allograft, Donor selection.

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Introduction

Bone grafts, bone substitutes and bioactive factors are now commonly used in various orthopaedic surgical procedures. Bone grafts augment natural healing via osteoinductive, osteoconductive and/or osteogenic mechanisms [1]. Use of bone substitutes as alternative for bone grafts is limited because of its limited role in osteosynthesis, its cost and availability [2-3]. Bioactive factors, although have better osteogenetic potential, but they lack in providing structural support and are costly and not readily available. Hence bone graft still remains the gold standard especially autologous bone graft.

Allograft although can be used as a strut, a buttress, to fill up cavities or as an augmentation in combination with autografts but its osteoconduction and osteoinduction properties are limited in comparison to autografts [4]. Further, autografts are advantageous in terms of immunology, storage, transmission of infectious diseases and vitality, which are of concern with allograft use [5]. Autologous bone grafts can be procured from iliac crest, fibula, tibia, rib etc. But the use of autologous bone grafts is limited due to the fact that only small amount can be harvested as its availability is limited and it can lead to donor`s surgical site complications such as hematoma, increased

surgical time, peritoneal perforation and herniation of the contents, sacroiliac joint instability, dysesthesia, fatigue fractures, growth impairment, growth disturbances and osteomyelitis [3].

These problems of limited availability of autograft and donor site complications can be overcome by use of allograft stored from the bone bank. The head of femur of patients undergoing hemi-arthroplasty or total hip replacement, femoral and tibial condyles of patients undergoing total knee replacements and bones from traumatic amputation of limb are generally discarded. These bones if processed and stored properly can provide a steady supply of allogenic bone graft which can meet the increased demand of bone grafts. Various methods can be adopted in bone bank to increase the osteoconduction and osteoinduction of bone grafts and reduce their immunogenicity like freezing, chemosterilisation, demineralization, lyophilisation and antigen extracted autodigested allograft [1,2].

Thus bone banks which are centers for acquiring, characterizing, and storing bones or bone tissue for future use, can ensure availability of bone in large quantities of different size and shape and decreases donor site morbidity. Thus availability of a hospital based bone bank, can broaden the spectrum of operations that can be performed [6,7].

But performance of bone bank depends on strict control at all the stages [6,7]. The majority of bone bank adheres to the guidelines formulated by American Association of Tissue Banks and also endorsed by the European Association of Tissue Banks. It consists of five components- organization of well-trained harvesting team, donor selection, documentation, storage, processing and testing of tissues obtained and implementation [8]. Combination of these factors enables a greater scope of use and number of recipient's patients, reducing the incidence of tissue contamination.

Donor screening or selection is an important step in the maintenance of bone banks as it aids in selecting the donor and reduces the risk of disease transmission, thus improving results of allografting [9]. Donors can be deferred in any phase from pre-operative phase, intraoperative phase to post-operative phase. This present study is done to analyze the donor profile for a bone bank and the donor deferral rate of a bone bank in a tertiary care hospital at different levels.

Material and Method

This observational study was conducted in Department of Orthopaedics and Microbiology at tertiary care center, Delhi from October 2017 to September 2018. Patients of fracture neck of femur undergoing hemi-replacement / total hip replacement (THR), osteoarthritis hip undergoing THR and osteoarthritis knee undergoing total knee replacement were included in the study. Patients with history of malignancy, history/clinically active infection, history of autoimmune disorder, vaccination (live vaccine within four weeks), serology positive for HIV, HBV or HCV, history of diabetes mellitus or any hormonal imbalance or narcotics use were excluded from the study. In addition to surgical consent the donors were also consented for both donation of bone for harvesting and to be a part of the study. Patients who denied consent for donation of harvested bone or to be part of study were also excluded from the study.

A head to toe clinical examination was carried out of all the patients to rule out any active infection. Surgical site examination was performed. All eligible donors were listed and were given a unique identification number and a database was maintained. The patients who had consented to be a part of the study were asked to fill a pre designed questionnaire. This step led to the deferral or acceptance of the donor in the pre-operative stage itself. The selected donor's blood samples were sent for blood grouping and cross matching, erythrocyte sedimentation rate, total leukocyte count and serology for viruses - HIV, Hepatitis C and Hepatitis B.

The number of donors excluded after this step and the reason for exclusion was recorded. During harvesting the bone specimens were sent for aerobic culture, anaerobic culture and fungal culture to the department of microbiology. Bone was processed and

preserved in the bone bank as per the standard protocol. Repeat serology of patients (HIV, HBV, HCV) and culture sensitivity was sent again after 6 months. The grafts of donors whose repeat serology could not be taken as they were lost to follow up were also coined deferred. A complete record of all the donors and the reason for their exclusion was recorded. The donor data was analyzed using excel work sheets and the percentage of donors/grafts accepted or deferred due to various reasons out of the total donors was calculated.

Results

A total of 67 patients were included in the study for the purpose of donor analysis and bone harvesting. 35 were male patients and 32 were female patients. The average age of the patients was 62 years.

46 (68%) patients underwent hemi-arthroplasty for fracture neck of femur and 14 (20%) patients underwent THR. Out of 14 THRs, 8 patients were cases of secondary osteoarthritis of hip, 2 patients were case of ankylosing spondylosis and 4 patients were cases of avascular necrosis of femoral head. 6 (12%) patients underwent total knee replacement for osteoarthritis knee of which one patient underwent bilateral total knee replacement.

The donor deferral rate was 69% as 46 donors out of the total 67 were rejected and only 21 (31%) donors were eligible for use. 24 (35%) donors were rejected during the pre-harvesting stage; 1 (1.4%) donor was rejected intraoperatively as bone was used as autograft, whereas 21 (31 %) donors were rejected during the post harvesting period.

The causes of donor rejection during pre-harvesting period were no consent for bone donation (2 donor), history of tuberculosis (7 donor), avascular necrosis of femur head (5 donors), osteoarthritis of the knee (2 donors), ankylosing spondylosis (2 donors), secondary osteoarthritis of hip (1 donor) with previous surgical intervention, positive serology testing for viral markers 5 donors (3 for Hepatitis B and 2 for Hepatitis C). Only one donor was rejected during intra-operative period as the bone harvested was used as autograft.

A total of 21 (31%) donors were rejected during the post-operative period. 16 donors were rejected as their bone cultures came out to be positive. Yeast was in culture of 6 patients, Staphylococcus epidermidis in 5 donors, Pseudomonas species in 2 donors, Streptococcus species in 1 donor and Micrococcus species in 2 donors. 5 donors were rejected as they were lost to follow up. 2 donors died during the post harvesting period and 3 donors despite repeated attempts could not be contacted. No donor was rejected after follow up serology done 6 months post harvesting.

Discussion

There is an unmet need for bone grafts in the field of orthopaedics. Bone grafts are widely used in various orthopaedic procedures for reconstruction of bone skeletal defects, non-union, arthroplasty, revision arthroplasty, malignant bone tumor resection, and spinal surgery for segmental fusion or deformity correction [1,2].

Autogenous bone grafts are the gold standard, as they provide all necessary factors to promote bone repair, osteoconductive collagenous scaffold matrix, osteoinductive growth factors, and osteogenic stem cells and does not carry the risk of disease transmission or immunogenicity [10,11]. Graft can be obtained from iliac crest, fibula, tibia, ribs etc. But autograft harvesting increases the surgical time and is associated with complications related to donor site morbidity in up to 25% of patients including pain, hematoma, herniation of soft tissue, perforation, infection, nerve or arterial injury and cosmetic defects [12]. Further the amount of autograft which can be harvested is also limited.

Donor site morbidity and limited availability of autograft can be prevented by use of allograft obtained from cadaveric donors or discarded bones during surgery as in hemi-arthroplasy, THR or TKR etc. In the bone bank, before these bones are ready to be used are required to be prepared, processed and stored properly so that they can retain their properties. Allografts are prepared as fresh, fresh frozen, freeze dried, decalcified or lyophilized bone. Allografts are processed by freezing,

chemosterilisation, demineralisation, lyophilisation, antigen extracted autodigested allografts to reduce the immunogenecity and risk of disease transmission [13].

Donor selection is of paramount importance in the bone banking to reduce disease transmission, in addition to other steps like organization of trained harvesting team, documentation, storage, processing and testing of tissues obtained and implementation. Pre-operatively this includes an informed consent to be taken both verbally and orally along with thorough history, clinical examination and investigation to determine the serological status for HIV, HBV and HCV of the patient. Intra-operative selection requires bone specimen to be sent during surgery for aerobic, anaerobic and fungal culture. Following which the harvested bone is processed and preserved in the bone bank. A repeat serology for HIV, HBV and HCV is sent after six months, after which bone is ready for clinical use.

This study was performed to analyze the donor profile of 67 bone donors from our bone bank and to record the deferral rate as per the stage of rejection as pre-harvesting rejection, intraoperative rejection and post-operative rejection. In our series, 24 (35%) donors were rejected during the pre-harvesting stage, 1 (1.4%) in intra-operative stage as procured allograft was consumed as autograft in the same patient and 21 (31 %) donors in post harvesting period.

2(3%) donors were rejected as they didn't give consent for bone donation, this can be due to the fact there is still lack of awareness and religious obligations which prevents people from bone donation. There is a need to create awareness about the importance of bone donation from both, living as well as cadavers and about the fact that bone harvested from living donors does not cause any harm to the donor.

A positive history of tuberculosis, despite having taken complete treatment led to the rejection of 7(10%) donors in the pre harvesting stage itself, to prevent the risk of disease transmission and there are case reports to support this [14, 15]. Donors suffering from ankylosing spondylosis (2 cases), avascular necrosis of femoral head (5 cases) and secondary osteoarthritis (3 cases) were rejected because bones from such donors cannot be used as grafts due to the ongoing disease activity and poor bone quality which is not suitable for grafting and may lead to increased chances of graft failure and graft rejection [16].

The risk of HIV transmission has been estimated to be around one in 1.6 million, in properly screened and processed allografts and two cases of HIV transmission as a result of musculoskeletal allografting have been reported [17, 18]. Hepatitis B and C transmission occurs in less than 1% of solid organ recipients and is believed to be at a lower rate for tissue and cell recipient [19]. We rejected 5 donors who tested serology positive preoperatively for HBV (3 cases) and HCV (2 cases) to prevent viral disease transmission. The risk of disease transmission can be eliminated by-correct allograft processing, removal of blood, blood products and soft tissues and by gamma radiation [20].

16 (23%) donors were rejected as their cultures for aerobic, anaerobic and fungal came out to be positive post-operatively. The percentage of culture positive allograft in our series is comparable with other centers [21]. Most common organisms in our series were skin contaminants Staphlycoccus epidermidis (5 cases) and Micrococcus (2 cases). Some studies used culture positive allograft also for transplantation, as authors could not link this post-operative infection to a positive bone graft culture and this has even led to discontinuation of practice of performing intraoperative allograft bone culture on a routine basis [22-24]. But in contrast to this, we rejected such culture positive allografts [22]. We suspect inadequate decontamination of the patient's skin pre-operatively, subsequent manipulation during operative procedures or resource limited setting like ours with the possibility of bio-burden exceeding the maximum acceptable limited value could also be a reason for culture positive allografts [24]. The possibility of low grade bacteraemia/ fungaemia pre-operatively leading to hematogenous spread of the microorganism to the operative site can also

be attributed to culture positive bone allografts. Donors who were lost to follow up (5 cases), died (2 cases) and who could not be contacted (3 cases) were also rejected since their post harvesting serology status could not be ascertained. This rejection can be reduced by formation of proper integrated database with all contact details, patient's complete medical and surgical history.

Overall, only 1/3 of the bone from donors was available for transplantation and the rest 2/3 was rejected, which is a huge amount of donor rejection and subsequent donation losses. Hence we need measures to reduce donor rejection and look for more sources to harvest bones in order to meet the ever increasing demand for bone grafts. Effective training of staff, proper counseling and consent of potential donors, rapid screening, and improved serological testing by nucleic acid amplification test can lower the donor deferral rate. Allograft obtained from femoral head, tibial and femoral condyles from live donors is not sufficient and bones from traumatic amputation and cadavers can contribute to a large amount of allografts. There is a need to create awareness about the need and utilities of bone donation and requirement to set up bone banks where bones are harvested, processed and stored for further clinical use. These bone banks should also be equipped with various tools such a gamma radiation, deep freezing, lyophilisation to reduce the immunogenicity and chances of graft failure.

Conclusion

Bone grafts are widely used in various orthopaedic procedures. Donor site morbidity and limited availability of autograft, has increased the potential for use of allograft obtained from cadaveric donors or discarded bones. In the bone bank, these allografts are prepared, processed and stored properly so that they can retain their properties. High donor deferral rate has led to donation losses and burden on limited resources. Awareness, effective trained staff, proper counseling and consent, improved serological testing and equipped bone banks can reduce donor rejection and meet the increasing demand for bone grafts.

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Surgical Management of Acromioclavicular Joint Injuries by Ligament Reconstruction Using Mersilene Tape and Ethibond

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Study performed at Department of Orthopaedics, R. D. Gardi Medical College & Associated Hospital, Ujjain (M.P.)

Abstract

Background: Acromioclavicular (AC) injuries account for 9% to 12% of all shoulder injuries. Rockwood grade IV to VI AC injuries require surgical fixation, which can be done by Mersilene tape reconstruction, K-wire transfixation, hook plates, reconstruction using autografts, or suture anchors. But no gold standard procedure has been established till date.

Material & Methods: 12 patients of AC joint disruption treated by surgical reconstruction using mersilene tape and ethibond suture were evaluated functionally using Visual analog scale (VAS) and Constant and Murley scores and radiological for re-displacement and fixation.

Results: The mean age in the group was 46.6 years (range 26 to 61), with male to female ratio of 3:1. Mean delay in surgery was 11 days (range 4 to 14 days), mean blood loss was 100 ml and mean duration of surgery was 54 min. The mean pre-operative VAS score improved from 6.41 to post-operative score of 2.68 and 1.25 at 6 and 12 months respectively. Constant Murley score improved from a mean pre-operative score of 51 to a post-operative score of 88.33 and 92.08 at 6 and 12 months respectively. At the final follow up all the patients had satisfactory results in terms of pain, cosmetic correction and movements and strength of the shoulder. The AC joint was clinically as well as radiologically stable in all the cases.

Conclusion: Anatomic reconstruction of AC joint disruption requires reconstruction of both coracoclavicular ligament as well as acromioclavicular ligament to achieve stability in both superior-inferior as well as antero-posterior plane, which can be achieved by mersilene tape fixation augmented by 5-0 ethibond suture leading to excellent results.

Keywords: Acromioclavicular injuries, Mersilene tape, Ethibond, Ligament reconstruction

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Introduction

Injuries in and around the shoulder joint, including acromioclavicular joint injuries, are common occurrence in active young adults. Acromioclavicular (AC) joint injuries account for 9% to 12% of all shoulder injuries. Sports related incidents account for 25–50% of these acromioclavicular (AC) separations [1-4]. These injuries are grouped according to the Rockwood classification system into six groups [5]. Grades I and II injuries represent strain and partial tearing of supporting ligaments and are treated conservatively with excellent results. Surgical management is typically indicated for patients with grades IV to VI AC joint injuries. For patients with grade III injuries, there is a debate regarding the optimal treatment strategy. Various operative techniques have been proposed. Current treatment focuses on anatomical reconstruction of coraco-clavicluar (CC) ligaments which show better outcome in biomechanical comparisons [3,4]. These

techniques involve reconstruction of the conoid and trapezoid ligaments through anatomically-based tunnels in the clavicle. A variety of stabilization methods have been used for the AC joint, including mersilene tape reconstruction, K-wire trans fixation, hook plates, reconstruction using autografts, and suture anchors. But no gold standard procedure has been established. We evaluated the outcomes of surgical reconstruction of AC joint disruption by mersilene tape and ethibond suture, which provides enhanced tensile strength to the fixation.

Material & Method

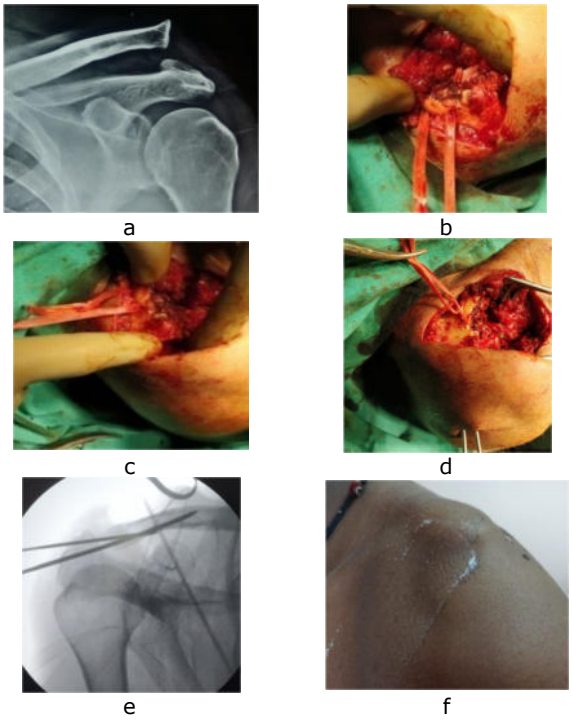
This study was conducted at our centre from March 2017 to March 2019, in patients of AC joint disruption treated by surgical reconstruction by mersilene tape and ethibond suture, after obtaining Institutional Ethical Committee clearance.

All patients of age more than 18 years, with isolated, closed, grade III or more as per Rockwood classification system of AC joint disruption, presenting within 2 weeks of injury were included in the study. Patients having associated injuries, more than two weeks old injury, chronic AC joint injury or with co morbidities were excluded from our study.

All patients were evaluated by thorough history followed by complete physical exam and range of motion estimation. AP, lateral and Zanca views of the shoulder joint were done and injury was classified as per Rockwood classification system. After stabilizing the patients haemo-dynamically, fitness for surgery was obtained and following this all the patients were treated surgically with reconstruction of coraco-clavicular ligaments using mersilene tape augmented with ethibond no 5 in general anaesthesia in supine position with a sand bag beneath the scapula of the operating side.

A 5 cm vertical incision was given 3 cm medial to the AC joint centred over the coracoid process. Blunt dissection was done to expose the clavicle, coracoid and the acromion, taking care of the haemostasis. With the help of 4.5 mm drill bit, a hole was made in the clavicle for the conoid ligament at around 3cm proximal to the acromio-clavicular joint slightly posterior to the midline of the clavicle from above downwards. Similarly, another hole was made in clavicle for the trapezoid ligament around 1.5cm proximal to the acromio-clavicular joint slightly anterior to the midline on the clavicle from above downwards to correctly reproduce the anatomic location of the respective ligaments. Mersilene tape augmented with 5-0 ethibond suture was passed under the coracoid process in a figure of eight manner and then passed through these holes and tied over clavicle to correct superior displacement and to replicate the anatomy (fig. 1). Another drill hole was then made in the acromion with the help of 4.5 mm drill bit from antero-medial to posterolateral direction for reconstruction of the acromioclavicular ligament by another Mersilene tape augmented with 5-0 ethibond suture, which was passed across joint to tie knot anteriorly to hold antero-posterior displacement. A 2mm smooth Kirschner wire was used to transfix the acromioclavicular joint temporarily, to provide additional support to the mersilene tape.

Fig 1. X ray Zanca view (a) of 50 years' male with AC joint disruption. Intraoperative photograph (b to d) and fluoroscopic view (e) showing ligament reconstruction by mersilene tape, ethibond and transfixing k wires. 4 weeks follow up clinical photograph (f) showing healed scar after k wire removal.



Post-operatively, patients were given cuff and collar pouch for 2 weeks, following which suture removal was done. The shoulder was

immobilized in a sling for 4 weeks, after which the K-wire was removed and range of motion exercises were started. Strengthening exercises were done at 3 months postoperatively. Patients were followed regularly till minimum follow up of one year. All the patients were evaluated functionally using Visual analog scale (VAS) and Constant and Murley scores and radiological for re-displacement and fixation.

Results

12 cases of Rockwood type III to V AC joint injuries with mean age of 46.6 years (range 26 to 61) were included in the study. Right shoulder was involved in 8 out of 12 cases. Males were predominantly affected with male to female ratio being 3:1. Mechanism of injury was fall in 10 cases, whereas 2 had a road traffic accident. The mean delay in surgery was 11 days (range 4 to 14 days). The mean blood loss in surgery was around 100 ml and mean duration of surgery was 54 min.

The mean pre-operative VAS score improved from 6.41 to post-operative score of 2.68 and 1.25 at 6 and 12 months respectively. Constant Murley score improved from a mean pre-operative score of 51 to a post-operative score of 88.33 and 92.08 at 6 and 12 months respectively. At the final follow up all the patients had satisfactory results in terms of pain, cosmetic correction and movements and strength of the shoulder. The AC joint was clinically as well as radiologically stable in all the cases with normal alignment and anatomical reduction of the AC joint, which was maintained even at final follow up. No case had postoperative wound complications, loss of fixation or osteolysis. None of the case required any revision surgery.

Discussion

Grades I and II injuries are treated conservatively with excellent results. Surgical treatment of the disrupted AC joint is well established in types IV, V, and VI. But the management of grade III injuries remains controversial and continues to evolve ranging from non-operative treatment to older surgical techniques. Prospective studies comparing non-operative and operative treatment of these injuries have shown similar results with no great advantage of either treatment.

Though many surgical procedures have been reported in the literature to manage these injuries, it has been difficult to achieve good long term functional outcome in AC joint disruptions. Surgical techniques used are such as excision of distal end of clavicle, K-wires or Bosworth screw fixation [6]. Cooper's first described surgical fixation of an AC dislocation in 1861 [7]. Weaver and Dunn first described the treatment of these injuries through excision of the lateral end of the clavicle and transfer of the coraco-acromial ligament to the rest of clavicle [8]. Since the transferred ligament was weaker than the native coraco-clavicular ligaments, recurrence of the dislocation was a common complication. Numerous modifications of this technique have been reported to reduce the risk of secondary dislocations with varied results like Mumford et al and Cadenat et al [9-10]. Hardware prominence and loss of fixation has been a common complication of other procedures.

We evaluated the outcomes of surgical reconstruction of AC joint disruption in 12 cases by Mersilene tape and ethibond suture and found excellent results. A similar study was done by Deshpande et al, in which they showed outcome of reconstruction of acromio-clavicular ligament and coraco-clavicular ligament using mersilene tape as to correct the antero-posterior displacements and the superior-inferior displacements respectively [11]. Mandice et al confirmed improved surgical outcomes, when Mersilene tape fixation techniques were augmented with fiber wires with restoration of shoulder joint to near normal anatomic and functional shoulder joint without donor site morbidity [12]. Hence we augmented our Mersilene tape reconstruction for both acromio-clavicular ligament and coraco-clavicular ligament, with 5-0 ethibond suture for more strength and so our results were better functionally as compared to their study in terms of function, disability, pain, and satisfaction.

Mc Connell et al in cadaveric specimens tested the stiffness of three different methods of fixation i.e. coraco-clavicular Bosworth screw (CC Screw), a coraco-clavicular sling of

Mersilene tape (CC Sling), and a Hook Plate used in acute disruption of the acromio-clavicular (AC) joint and compared it with baseline to see which fixation most closely replicate the stiffness of healthy cadaveric AC specimens (Intact). They showed that the coracoclavicular sling using mersilene tape was significantly less stiff than the intact joint or the other methods of fixation [13]. In their study, they have used only mersilene tape for fixation of coraco-clavicular sling, whereas we in our study have used mersilene tape along with ethibond to increase its mechanical and tensile strength and used them as a sling for both coraco-clavicular and acromio-clavicular fixation, so as to maintain the anatomy of the joint in both the planes.

Haung et al in a retrospective comparative analysis of single coracoclavicular suture fixation with mersilene tape versus hook plate concluded that both hook plate and mersilene tape fixations provides comparable clinical outcomes, but hook plate may need removal of implant [14], but mersilene tape did not require removal.

Studies by Fakuda et al [15], Urist et al [16] and Lee et al [17] confirmed that acromioclavicular ligaments provide support in the antero-posterior plane and coraco-clavicular ligaments provide stability in superior plane. Debski et al biomechanically confirmed that the conoid and trapezoid ligaments act separately but synergistically in restraining antero-posterior and superior loading of the AC joint [18]. Beitzel et al in their study concluded that both the CC ligaments and the AC ligaments should be repaired anatomically to control the optimal physiologic function (translation and rotation) [19]. Hence we reconstructed both the ligaments for providing both antero-posterior and superior stability at the earliest i.e. in fresh cases. Further, the importance of early fixation was stressed by study of Rolf et al who compared with the results of delayed surgical reconstruction after conservative treatment versus re-surgery after primary failure and revealed a statistically significant better outcome in the early reconstruction group, regarding the Constant score, the degree of AC joint reduction, numbers of complications and patient's satisfaction [20]. Our study is limited by lack of control, fewer numbers of patients and lesser follow-up. Further studies with larger group and longer follow-ups are suggested.

Conclusion

Anatomic reconstruction of AC joint disruption requires reconstruction of both coracoclavicular ligament as well as acromioclavicular ligament to achieve stability in both superior-inferior as well as antero-posterior plane, which can be achieved by mersilene tape fixation augmented by 5-0 ethibond suture leading to excellent results.

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Correlation of Various Anthropometric Measurements with Tibia Interlocking Nail Length Measured Intra-Operatively

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Study performed at Department of Orthopaedics, Sri Aurobindo Medical Science and Post Graduate Institute, Indore (M.P.)

Abstract

Background: A proper and accurate size of tibial nail insertion is necessary for better functional outcome and to prevent complications related to improper nail length. Various preoperative and intraoperative measures are used, with varied accuracy for nail size estimation. With aim to find out the best anthropometric measure correlating with the tibial nail length, we correlated various anthropometric measurements to actual size of tibial interlock nail used in 100 cases of tibial shaft fracture.

Material & Methods: 5 anthropometric parameters were measured i.e. (1) distance from medial knee joint line to ankle joint line (K-A) (2) distance from medial knee joint line to medial malleolus (K-MM) (3) distance from tibial tuberosity to ankle joint (TT-A) (4) distance from tibial tuberosity to medial malleolus (TT-MM) (5) distance from tip of olecranon to 5th metacarpal head (O-MH) in 100 cases of tibial shaft fractures treated with interlocking nail and were correlated with the tibial nail size used.

Results: Mean size of nail used was 33.61±1.69 mm (range 28 to 36 mm). Mean of five anthropometric parameters for K-A, K-MM, TT-A, TT-MM and O-MH, were 35.61±1.59 (range 30 to 39 mm), 37.16 +1.36 (range 32 to 41.5 mm), 33.58 ± 1.79 (range 28 to 37 mm), 34.40 ± 1.21 (range 30 to 39 mm), and 33.10 ± 1.61 (range 28 to 36 mm) respectively.

Conclusion: All anthropometric parameters i.e. TT-A, TT-MM, K-A, K-MM and O-MH can be used for nail size prediction. O-MH was nearly accurate to the nail size as compared to other methods because of interpersonal variation in palpation of tibial tuberosity.

Keywords: Tibial interlocking, tibial nail length, anthropometric measurements

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Introduction

Tibial diaphyseal fractures are among most common fractures of the long bones, about three times more common in men and typically occurs in younger adults [1,2]. Intramedullary interlocking nailing has been the gold standard in treatment of these tibial shaft fractures [3,4]. An accurate size of tibial nail and screws selection is of paramount importance, in addition to proper fracture reduction and fixation. A proper size nail avoids irritation of the soft-tissue envelope and enables easy extraction of the nail in future, if needed. This insertion of the correct-sized nail is also essential for satisfactory outcomes. A shorter nail results in mal-reduction and inadequate working length, leading to failure of the implant. A longer nail would distract the fracture site and impinge on the patellar

tendon, causing pain. Forceful insertion of a longer nail could cause the penetration of the nail into the tibiotalar joint. To avoid these complications, accurate size nail insertion is very important. Nail size estimation can be done pre-operatively or intra-operatively. Accurate preoperative nail estimation can reduce intra-operative errors, operative time and radiation exposure [5-7].

Various anthropometric measurements provide an easy way to preoperatively estimate tibial nail length [8]. Existing literature provides varying and contrasting accuracies to each anthropometric parameter. Hence we measured various anthropometric measurements in 100 cases of tibial shaft fracture and compared their proximity to actual size of tibial interlock nail used, in order to check, which anthropometric measure correlates best with the tibial nail length.

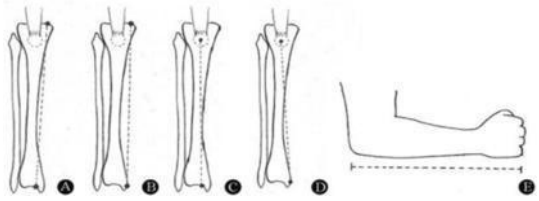
Material and Methods

This study was conducted in 100 cases of tibial shaft fractures treated with interlocking nail admitted in our institute after obtaining Institutional Ethics Committee clearance and written informed consent from all the patients. All skeletally mature patients of tibial shaft fracture, open type I or II as per Gustilo Anderson criteria, operated by closed tibial interlocking nail were included in the study. Skeletally immature patients, injury or prior abnormality to contra-lateral tibia or upper limbs were excluded from the study.

All patients were haemo-dynamically stabilized, followed by proper evaluation of the patient by detailed history and examination. Five anthropometric parameters were measured using a metallic scale on contra-lateral normal leg and ipsilateral upper limb. These were (1) distance from medial knee joint line to ankle joint line (K-A) (2) distance from medial knee joint line to medial malleolus (K-MM) (3) distance from tibial tuberosity to ankle joint (TT-A) (4) distance from tibial tuberosity to medial malleolus (TT-MM) (5) distance from tip of olecranon to 5th metacarpal head (O-MH) (fig 1).

X rays of the involved limb were taken including knee and ankle joints. Patients were investigated and fitness for anaesthesia was obtained. All the patients were treated with tibial interlocking nail in supine position under spinal anaesthesia. Intra-operative tibial nail size was assessed on the fluoroscopic image as seen on C arm and proper size nail was inserted and the size used was noted. Intraoperative nail size used was then compared with that of five anthropometric parameters measured and their correlation to nail size was assessed.

Fig 1. Illustration of anthropometric parameters measured (a) medial knee joint line to ankle joint (K-A) (b) medial knee joint line to medial malleolus (K-MM) (c) tibial tuberosity to ankle joint (TT-A) (c) tibial tuberosity to medial malleolus (TT-MM) (e) tip of olecranon to 5th metacarpal head (O-MH).



Results

100 cases of tibial shaft fractures treated with interlocking nail were included in study. The mean age was 36.4 years (range 18 to 49 years). 74 were male and 26 were females. Road traffic accident was most common mode of injury seen in 79 cases where as rest had injury due to fall.

Mean size of nail used was 33.61±1.69 mm (range 28 to 36 mm). Mean of five anthropometric parameters were 35.61±1.59 (range 30 to 39 mm), 37.16 +1.36 (range 32 to 41.5 mm), 33.58 ± 1.79 (range 28 to 37 mm), 34.40 ± 1.21 (range 30 to 39 mm), and 33.10 ± 1.61 (range 28 to 36 mm) for K-A, K-MM, TT-A, TT-MM and O-MH respectively (table 1).

Table 1. Comparison of nail size with anthropometric parameters

	Mean ± SD (range in mm)	**'t' value**	**P value**
Actual Nail size	33.61 ± 1.69 (range 28 to 36 mm)		
K-A	35.61±1.59 (range 30 to 39 mm)	8.614, df=198	0.001*
K-MM	37.16+1.36 (range 32 to 41.5 mm)	4.326 df=198	0.001*
TT-A	33.58 ± 1.79 (range 28 to 37 mm)	3.800, df=198	0.001*
TT-MM	34.40 ± 1.21 (range 30 to 39 mm)	4.169, df=198	0.001*
O-MH	33.10 ± 1.61 (range 28 to 36 mm)	2.100, df=198	0.037*

Discussion

A proper and accurate size of tibial nail insertion is equally necessary for better functional outcome, in addition to proper fracture reduction and fixation [1-4]. Improper sized nail, either shorter or larger can cause impingement, soft tissue irritation, patellar tendinitis, joint penetration, mal-reduction, delayed union, stress fractures, and difficulty in dynamization or removal [5-7].

Many methods both preoperative and intraoperative, are mentioned in literature to determine the correct nail size i.e. proper length and diameter of an intramedullary tibial nail to be used. Each method has its merits and demerits, and most are lacking in accuracy.

Intraoperative methods used are nail-against-limb technique, two guide wires technique and by using a radiographic ruler [5-7]. Intraoperative techniques, the guide wire method and use of intraoperative radiographic ruler have an excellent accuracy of 94% according to Galbraith et al [8]. But, inaccuracies may occur due to eccentric C-arm placement, with the measurement being taken from the lowest exposed part of the guide wire or by not holding the radiographic ruler close and paralleled to the tibia [8]. Further, these techniques cannot be utilized in comminuted fractures or bilateral tibial fractures as these use comparisons with the opposite normal side or restoration of normal tibial length as a guide for measurement, which is difficult in bilateral or comminuted fracture cases respectively. Further, these intraoperative techniques take valuable operating time and add radiation exposure to both the patient and the operating room personnel. Two guide wires technique cannot be used when un-reamed nails are used [8]. Intraoperative, primary insertion of inaccurate size nail may need exchange of an incorrect length nail which further increases the radiation and operating time and causes frustration for the surgeon. Hence although, intraoperative measures are considered to be the most accurate methods, they provide no scope for preoperative planning and are not recommended in isolation for estimation of tibial nail length [6,9].

So preoperative planning for tibial interlocking nail should also include estimation and determination of tibial nail length preoperatively in-order to augment the accuracy of intra-operative tibial length estimation, so that we could avoid these intra-operative problems. This also avoids wastage of inaccurate nails which are discarded during the operative procedure [8]. Accurate preoperative nail estimation also can reduce intra-operative errors, operative time and radiation exposure [5-7].

Preoperative estimation of tibial nail length can be done by radiographic assessment or by anthropometric measurements. The preoperative radiological methods described are krammer splint technique, templating, scanograms, spotograms and direct measurement from radiographs of the contralateral limb. These preoperative methods which rely on conventional radiography can cause inaccuracies due to malrotation in positioning the patient, inadequate exposure and variation and errors in magnification [7]. Krettek et al reported a magnification of 7% in standard tibial radiographs and found templates unreliable in selecting implant length, because magnification varies depending on the splint used, position of limb at time of X rays and distance of the cassette and tube [5]. The problem of magnification can be overruled by use of a radiographic ruler or marker [6]. But routinely use of such a radiographic ruler for all cases is not feasible and is difficult especially in a poly trauma patient. Further if the radiographic marker is not kept at proper level it could result in poor accuracy in determining the correct nail length [6]. Digital radiograph although helps to assess the fracture pattern better, but its modularity to change the magnification of the length of tibia to fit the size of X ray film, makes them unsuitable for estimation of tibial nail length. Digital aids and scanogram are not routinely recommended for trauma cases and availability and cost is also an issue.

Anthropometric measurements can be done quickly, easily and freely, even in uncooperative or polytrauma patients. Several anthropometric methods have been described for the preoperative estimation of tibial nail

length. Most commonly used anthropometric measurements described for the preoperative estimation of tibial nail length are knee joint line to ankle joint line (K-A), knee joint line to medial malleolus (K-MM), tibial tuberosity to ankle joint line (TT-A), tibial tuberosity to medial malleolus (TT-MM), olecranon to fifth metacarpal head (O-MH) and body height (BH) [9-12].

Existing literature provides varying and contrasting accuracies to each anthropometric parameter used. Hence, in order find out the best anthropometric measure correlating with the tibial nail length, we measured various anthropometric measurements in 100 cases of tibial shaft fracture and compared their proximity to actual size of tibial interlock nail used. We found that in our study the mean nail size was 33.61, whereas mean K-A was 35.61, mean K-MM was 37.16 +1.36, mean TT-A was 33.58, mean TT-MM was 34.40 and mean O-MM was 33.10 ± 1.61. The mean TT-A and O-MH was the closest length of actual sized tibial nail used. Among the two we found O-MH distance to be the most accurate as the tip of olecranon and metacarpal head are easy to palpate, in comparison to tibial tuberosity, which is difficult to palpate as it may not be prominent or it wide enough to take as a reference point, causing intra observer errors.

Conclusion

Accurate size tibial nail insertion is of paramount importance for satisfactory outcome. Various anthropometric measurements help to assess the tibial length size preoperatively, among which distance between the olecranon tip to 5th metacarpal head, correlates best with the ideal nail size to be used. When, one of the landmarks, for the measurement cannot be easily palpated or to increase the accuracy of nail size prediction, other anthropometric measurements can be used.

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Functional Outcome of Bilateral Total Hip Arthroplasty by Posterolateral Approach: A Prospective Study in Indian Population

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Study performed at Department of Orthopaedics, Sri Aurobindo Institute of Medical College & Post Graduate Institute, Indore (M.P.)

Abstract

Background: Total hip arthroplasty (THA) is the most widely accepted surgical procedure for the treatment of Avascular necrosis of femoral head, with favourable clinical outcomes having been reported in various studies. Most patients that undergo THA suffer from primary osteoarthritis. The posterolateral (Moore's) approach to hip permits easy access with fewer tissue dissection and blood loss while raising the risk of neural injury and postoperative dislocation of the prosthesis.

Material and Methods: This longitudinal study was conducted on 50 arthritic hips (25 patient) operated by a single surgeon with Bilateral THA via posterolateral approach (Southern Moore's approach). All patients with bilateral osteoarthritis of hip secondary to avascular necrosis of hip (grade III or IV) more than 18 years of age, patients with normal septic profile and patients who were willing to undergo total hip arthroplasty according to our protocol were included in the study. The patients were followed up at the end of 6 weeks, 3 months and six months postoperatively after bilateral THA.

Results: Among 25 patients in this study, 20 patients (80%) were males and 5 patients (20%) were females. All the patients were between 18 to 60 years of age. The most common etiology for AVN was idiopathic in 11 patients (44%) followed by Steroid abuse in 8 patients (32%).The most common complication encountered in our study was Limb length discrepancy (LLD) in 3 patients (12%) followed by Posterior Dislocation of hip in 2 patients (8%). The mean pre op HHS was 28.22 and 26.73 for right and left hip which improved significantly post operatively with HHS of 82.36 after 6 months post operatively which suggest excellent improvement in clinical outcome.

Conclusion: Uncemented bilateral THA can be used in patients with excellent to good functional outcome at midterm follow-up, high satisfaction rate and lower rate of complications. Longer follow-up and multi-centric studies with larger sample size are necessary to establish confirmatory results.

Key Words: Arthroplasty, Hip, Bilateral, Avascular necrosis

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Introduction

Total hip arthroplasty (THA) is the most widely accepted surgical management for the treatment of avascular necrosis of femoral head, with favourable clinical outcomes reported in numerous studies [1–5]. THA is also considered as most effective and definitive treatment for osteoarthritis and other hip pathologies, such as rheumatoid arthritis, ankylosing spondylitis and osteonecrosis [6,7].

Approximately 20% of all patients who underwent THA will need surgery of the contralateral hip, at some time [8]. Studies suggest that since THA is most commonly done for primary osteoarthritis, which is

usually a bilaterally involving hip pathology, and so patients, with unilateral THA could need a contralateral THA within 10 years [9,10]. Literature lacks in mid-term outcomes of bilateral THA in the Indian population.

Many surgical approaches to the hip are described, each with its distinctive advantages and disadvantages [11]. While some studies have found statistical associations between approach and outcome, most consider the individual surgeon's comfort and proficiency with an approach as most important [12]. The posterolateral (Moore's) approach which is most commonly used approach, permits quick access to hip joint with lesser tissue dissection and blood loss, but raising the risk of neurovascular injury and postoperative dislocation of the prosthesis [13-18]. In view of lack of literature on outcomes of bilateral THA, we evaluated the outcome of bilateral THA operated by posterolateral approach.

Material and Method

This longitudinal study was conducted from January 2018 to Jan 2020 in Orthopaedic department of our tertiary care centre in 25 patients with 50 arthritic hips who were operated by a single surgeon (1st Author) with bilateral THA via posterolateral approach (Southern Moore). Institutional ethical committee clearance and informed written consent was obtained before the study.

All patients of age more than 18 years with bilateral osteoarthritis or avascular necrosis of hip with grade III or IV were included in the study. Patients age less than 18 years, unilateral hip pathology, unfit for surgery or ankylosed hip were excluded from the study. In all the cases bilateral THA was performed, which was done as staged surgery and the second hip was replaced within 2 months of first THA.

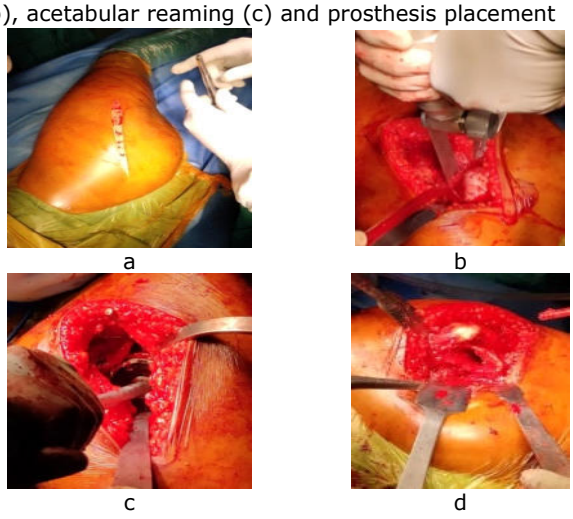
All the patients were subjected to thorough history, clinical examination and investigations which include routine pre-operative profile, ESR and CRP. Standard pelvic roentgenogram true AP view with both hips including the upper third of femur, 15 degrees of internal rotation AP view and lateral X-rays of the hip were taken to estimate the anatomic relationship of the femur and pelvis, so that accurate restoration of combined anatomy and biomechanics of hip can be achieved. Aspirin, anticoagulants and other anti-inflammatory drugs, if patient was on, were stopped 7 days before the surgery. Any occult infections like skin lesion, dental caries, and urinary tract infections were recognised and treated preoperatively.

All patients were operated in lateral position following sterile techniques under spinal anaesthesia via southern Moore's approach. A 15 cm incision centring over the greater trochanter was given, extending from the posterior border of greater trochanter curving posteriorly along the fibres of gluteus maximus, 5 cm below the posterior superior iliac spine and distally along the shaft of femur for 10 cm. The fascia over gluteus medius and maximus was incised and uncovering of vastus lateralis was performed. The gluteus maximus muscle was split along the direction of muscle fibres proximally. The sciatic nerve was identified and protected. The short external rotators were identified and cut as close to its insertion over the greater trochanter. Longitudinal or T shaped incision was made in the joint capsule and the head was posteriorly dislocated by internally rotating the femur along with some traction. Standard femoral neck osteotomy, acetabular preparation and sequential reaming followed. Sizing and trial was done before final placement of acetabular cup and polyethylene liner at 45°-50° inclination and 10^0 anteversion fixed with the appropriate size screws. After placing acetabular component, femoral canal was prepared with sequential broaching and appropriate size femoral stem was place in 10° of femoral ante-version. Trial reduction was done to estimate the proper head-neck size and after satisfaction, the final size of head place over the stem and stability of joint was checked after reduction. The wound was closed in layers over a drain (fig 1).

Postoperatively, the operated limb was kept in abduction with an abduction pillow in between the lower limbs. Drain was removed after 48 hours. Intravenous antibiotics were continued for 5 days. Static quadriceps exercises were started and patient was mobilized in bed from day one. Weight bearing and walking with support was started from 2nd day

postoperatively. Suture removal was done at 2 weeks. The contralateral hip was operated within 2 months of the primary THA. Patients were assessed functionally by Modified Harris hip scoring and radiologically by x rays for component placement and complications if any.

Fig 1. Intraoperative photograph of THA via posteo-lateral approach showing incision (a), femoral neck osteotomy (b), acetabular reaming (c) and prosthesis placement



a b c d

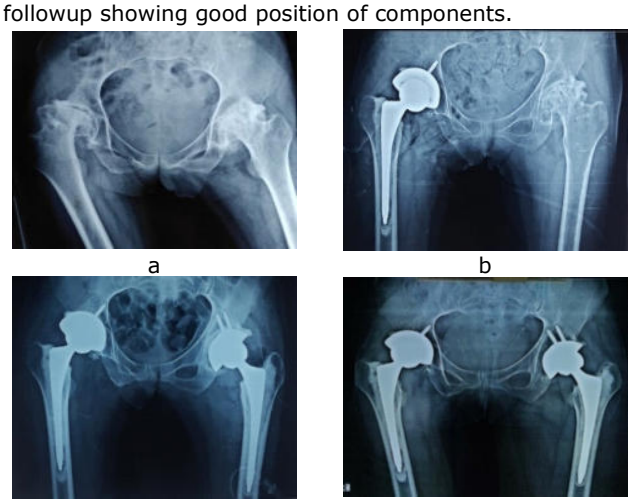
Results

25 patients (50 hips) with mean age 34.92 years (range 19 to 59 years), who underwent bilateral total hip arthroplasty were included in the study. Out of these patients 20 (80%) were male and 5 (20%) were females. Most common cause of AVN was idiopathic as seen in 13 (52.0%) patients, followed by steroid induced as seen in 6 (24.0%) patients, in 4 (16.0%) patients it was alcohol induced and one each had AVN due to post traumatic fracture neck of femur and sickle cell disease. Three patients had associated co-morbidities in form of diabetes mellitus alone in one patient, hypertension alone in one and both diabetes and hypertension in one patient. In rest of the patients no co-morbidities were present. Mean blood loss was 350 ml in surgery.

The mean pre-operative HHS was 28.28 ± 2.97 and 26.40 ± 2.31 for right and left hip which improved significantly to 89.96 ± 3.32 and 88.08 ± 12.53 respectively after 6 months of bilateral THA suggesting excellent outcome.

Peri-prosthetic fracture and radiculopathy occurred in one patient each, leg length discrepancy (LLD) was seen in 2 cases whereas in 3 cases unilateral dislocation was seen, all of which were treated accordingly. Hip dislocations were reduced on the same day under general anaesthesia. Maximum LLD was 2 cm which was treated by appropriate shoe raise. Wound Dehiscence and haematoma formation which was evident in 1 patient (4%) was treated by haematoma drainage and delayed suture removal. Peri-prosthetic fracture was found intra-operatively and thus was managed with encirclage wire and delayed weight bearing. One patient complained of anterior thigh pain which was managed conservatively and got resolved in 1 month.

Fig 2 – Antero-posterior X ray of pelvis preoperative (a), after right THA (b), after left THA (c) and 6 months followup showing good position of components.



a b c D

Discussion

Total Hip Arthroplasty (THA) has been established as a reliable surgery of choice in relieving pain and dysfunction associated with hip arthritis [19]. The primary aim of THA is to provide a painless, stable and mobile hip to the patient. Selection of patients is of paramount importance while planning for total hip arthroplasty [20,21].

Alternative treatment for THA such as hip arthrodesis and resection arthroplasty, both give pain relief, but at the cost of mobility and stability respectively and so results in restriction of activities of daily living. Patients may also limp affecting hip biomechanics to such an extent that they will have low back pain and ipsilateral knee pain in long term. Resection hip arthroplasty leads to worse Harris Hip score, low satisfaction rate and poor

functional outcome. Also, the gait provided by each of these options has very high energy consumption. But the most important part is that both these procedures cannot be performed for bilateral involvements [22]. THA remains the only choice for bilateral hip arthritis.

The outcomes of bilateral THA are less explored. Hence we reviewed outcomes of bilateral THA in 25 patients (50 hips) with mean age of 34.9 years, operated by posterolateral approach and found significant improvement in mean pre-operative HHS of 28.28 ± 2.97 and 26.40 ± 2.31 for right and left hip to 89.96 ± 3.32 and 88.08 ± 12.53 respectively after 6 months of bilateral THA suggesting excellent outcome.

Goyal et al suggested cemented implants over uncemented implants as cemented implants are cheaper and provide painless and early full weight-bearing compared to uncemented implants [23]. Mäkelä et al compared the survival of cemented and uncemented hip replacement prosthesis in patients older than 55 years and concluded that cemented implants have better survival than uncemented implants [24]. Zimmerman et al concluded no statistically significant differences in clinical or functional outcomes between cemented and uncemented prostheses till 12 months' post-surgery [25]. We used both implants, with uncemented implants in 46 hips and cemented in 4 hips. The results were statistically insignificant on comparison of both the groups.

Oscar Skoog et al on studying the relations between hip surgical approaches and risk of reoperation due to dislocation found that increased risk of dislocations is associated with using posterior Moore's approach compared with the direct lateral Harding's approach [26]. 2(8%) of our patients had posterior hip dislocations postoperatively within one month, but were managed on same day with closed reduction performed under general anaesthesia. The functional outcome didn't alter after the dislocation and was as good as other patients even at 6 months follow up. Other complications in our series were periprosthetic fracture and radiculopathy occurred in one patient each, leg length discrepancy (LLD) was seen in 2 cases, the incidence of which is acceptable and comparable to other studies.

In our study, we tried to reduce the influence of confounding variables by selecting a homogeneous and undiversified cohort of patients who received the similar type of uncemented total hip prosthesis and all were operated on by a single surgeon. The study is limited by shorter follow up and small number of patients.

Conclusion

Bilateral THA can be employed in patients with mid-term excellent to good functional outcome, high satisfaction rate and lower rate of complications. Patients returned to their work after surgery, who previously were unable to do so and started doing most of the activities of daily living without any difficulties. Longer follow-up and multicentric studies with larger sample size are necessary to establish confirmatory results.

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Evaluation of Platelet Rich Plasma Therapy in Osteoarthritis Of Knee

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Abstract

Background: Knee osteoarthritis (OA) is common entity in adults causing disability and decreased work productivity. Management of early OA is not established showing varied results of conservative and medical treatment. We evaluated the functional outcome of intra-articular injection of platelet rich plasma (PRP) for management of early stages of OA knee.

Material and Methods: 30 patients of OA knee, Kellgren type II or III, more than 40 years' age, were treated with 4 ml of intra-articular autologous PRP injection and were assessed by improvement in functional outcome as seen by WOMAC and VAS score.

Results: The mean age was 54.17 ± 8.18 years (range 44 to 78 years). 14 (46.7%) were males and 16 (53.3%) were females. 11 (36.7%) patients had KL grade 2 and 19 (63.3%) patients had KL grade 3 osteoarthritis. The mean pre-procedural WOMAC score of 47.67 ± 6.50 improved to 23.70 ± 5.88, 23.57 ± 5.12 and 25.80 ± 5.69 at one, three and six months after the PRP injection, respectively. The mean pre-procedural VAS score of 5.37 ± 0.85, improved to 1.43 ± 1.04, 1.43 ± 0.63 and 1.73 ± 0.58 at one, three and six months after the PRP injection, respectively. Pain at injection site was seen in 1 (3.3%) patient and 1 (3.3%) patient developed superficial infection.

Conclusion: PRP therapy provides pain relief and improves the functional outcome in early stages of Osteoarthritis of Knee.

Keywords: Platelet Rich Plasma, Osteoarthritis, WOMAC score

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Introduction

Osteoarthrtis of knee is found in 11% of population over the age of 60 years. It is one of the most common causes of disability in adults leading to decreased work productivity and is the cause of highest medical expenses of all arthritis conditions [1,2]. Osteoarthritis is characterized pathologically by localized loss of cartilage, remodeling of adjacent bone by formation of osteophytes and associated inflammation [3]. Treatment of severe arthritis is well established in form of joint replacement. But, satisfactory results have not been obtained with various conservative and medical modalities in early stages of OA knee [4]. Hence this study was carried out to evaluate the functional outcome of intra-articular injection of platelet rich plasma (PRP) for management of early stages of OA knee.

Materials and Method

This study was conducted on 30 arthritic knees treated with PRP therapy, presenting to Department of Orthopaedics at our institute from Sept 2018 to Sept 2020. Prior to study institutional review board approval and written well informed consent was obtained from all the patients. All patients of Kellgren (KL) type II or III osteoarthritis knee with more than 40 years' age were included in the study. Patients with less than 40 years, Kellgren type IV OA

knee, OA with significant joint deformity, inflammatory arthritis, patello-femoral arthritis or associated with systemic disorders such as rheumatoid arthritis or infection were excluded from the study.

Thorough history and comprehensive clinical examination of the patients was done and details were recorded in the customized proforma designed for the purpose of the study. Weight bearing standing AP and lateral view X-rays of the affected knee were taken. Pre-procedural WOMAC knee score and VAS score were calculated.

PRP was obtained from patients own blood by drawing 20 to 30 ml of the patient's venous blood in a ACD vacutainer and subjecting this autologous blood to centrifugation (Two spins at 2400 rpm for 10 mins and 3600 rpm for 15 mins). Following this centrifugation, the PRP was separated out as the buffy coat and then PRP was extracted and filled in a sterile syringe. With the patient placed in supine position and the affected knee in slight flexion sterile painting and draping was done. Four ml of autologous PRP of the patient was injected intra-articularly into the suprapatellar bursa of the patients knee after following strict asepsis.

Post injection, the patients were prescribed ice fomentation and paracetamol orally for 3 days. Range of motion exercise, light aerobic activities and strength training exercises were started as per the patient's tolerance. Patients were followed regularly at one, three and six months and were reassessed for functional outcome by WOMAC knee score and VAS score. Statistical analysis was performed using SPSS program for statistical analysis, version 12.0 for windows, and statistical significance was set at $p < 0.05$.

Results

30 patients of OA knee with mean age 54.17 ± 8.18 years (range 44 to 78 years) were included in the study. 14 (46.7%) were males and 16 (53.3%) were females. 13 (43.3%) patients has left side involvement and in 17 (56.7%) patients right side was affected. 11 (36.7%) patients had KL grade 2 and 19 (63.3%) patients had KL grade 3 osteoarthritis. 22 (73.3%) patients had no co morbidities. 5 (16.7%) patients had associated hypertension and 3 (10.0%) patients had diabetes mellitus.

The mean pre-procedural WOMAC score of 47.67 ± 6.50 improved to 23.70 ± 5.88, 23.57 ± 5.12 and 25.80 ± 5.69 at one, three and six months after the PRP injection, respectively (table 1). The mean pre-procedural VAS score of 5.37 ± 0.85, improved to 1.43 ± 1.04, 1.43 ± 0.63 and 1.73 ± 0.58 at one, three and six months after the PRP injection, respectively (table 1). Pain at injection site was seen in 1 (3.3%) patient and 1 (3.3%) patient developed superficial infection at the site of injection which healed with antibiotics. In 28 (93.4%) patients there were no complications.

Table 1. WOMAC and VAS score after the PRP injection

	Duration	**[Mean±SD]**	**'t' value**	**P value**
WOMAC SCORE	Preoperative	47.67 ± 6.50	15.342, df=29	0.001*
	At 1 month	23.70 ± 5.88		
	At 1 month	23.70 ± 5.88	0.357, df=29	0.724, NS
	At 3 months	23.57 ± 5.12		
	At 3 months	23.57 ± 5.12	-3.795, df=29	0.001*
	At 6 months	25.80 ± 5.69		
VAS SCORE	Preoperative	5.37 ± 0.85	16.429, df=29	0.001*
	At 1 month	1.43 ± 1.04		
	At 1 month	1.43 ± 1.04	0.000, df=29	1.000, NS
	At 3 months	1.43 ± 0.63		
	At 3 months	1.43 ± 0.63	-3.525, df=29	0.001*
	At 6 months	1.73 ± 0.58		

Discussion

Knee Osteoarthritis (OA) is one of the commonest problems in ageing adults, causing pain, disability and morbidity, which had been treated conservatively by oral chondro-protectives, intra-articular injections of steroids or visco-supplements [1,2].

Earlier OA was considered initially as a degenerative disorder and a natural occurrence of "wear-and-tear" on joints as a result of aging leading to mechanical and biological events that destabilize the normal processes of degradation and synthesis of articular cartilage chondrocytes, extracellular

matrix and subchondral bone leading to increased water content, decreased proteoglycan content and altered collagen matrix, finally causing degeneration of articular cartilage [3]. Recent research evidence is changing and it is suggested that impaired remodeling and repair of damaged tissue is the main cause and so if we could prevent this, it may be possible to arrest the progress and even reverse the changes [4].

PRP, an autologous blood product contains alpha granules and growth factors which activates the tissue healing and bone and cartilage regeneration changing the joint milieu, in addition to its role in hemostasis [5,6]. This effect of PRP to act at various levels to alter the joint homeostasis has been demonstrated by various studies. Higher amounts of collagen II, prostaglandin (PG) synthesis, increased chondrocyte proliferation, production of matrix molecules, increased hyaluronic acid secretion, lower level of apoptosis and down-modulation of joint inflammation and increased mRNA have been well documented by PRP therapy [7-14].

We evaluated the role of intra-articular injection of platelet rich plasma (PRP) for management of 30 early stages of OA knee patients in terms of improvement in functional score and found that mean WOMAC score of 47.67 ± 6.50 pre-procedural improved to 25.80 ± 5.69 and mean VAS score of 5.37 ± 0.85 pre-procedural, improved to 1.73 ± 0.58 at six months after the PRP injection, respectively.

Various studies have demonstrated the efficacy and advantageous effect of PRP in OA knee. Studies have compared the efficacy of PRP and steroid injection, saline, placebo, hyaluronic acid injections and found that PRP is superior and had sustained effect in comparison to other method of treatment [15-21]. Our results were similar to these studies although we haven't compared it with any other alternative treatment method. There is only one study which shows no superior results of PRP at one year in comparison to visco-supplementation which was done by Filardo [22].

Thus intra-articular PRP injection is safe, effective and feasible treatment option for management of early osteoarthritis knee. It is minimal invasive and without the risk of immunological reaction. It demonstrates clinical improvement in self-reported pain and functional capacity with no major side effects. In spite of these proven efficacy still there are some issue related to PRP administration which needs to be sorted out by further studies like, ideal PRP preparation, dosage, frequency and duration of PRP and the population and severity cohort in which it is beneficial.

Conclusion

Use of single PRP injection in the treatment of osteoarthritis knee has high efficacy and safety, being a simple, economical and short procedure, which requiring less surgical skill and can be done in OPD/Minor procedure without any major complications.

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Neglected Cauda Equina Syndrome Due To Prolapsed Lumbar Intervertebral Disc In An Adolescent Patient: A Case Report And Review Of Literature

Gawande J, Verma PK, Mishra S, Lakhtakia PK

Study performed at Department of Orthopaedics, Shyam Shah Medical College, Rewa (M.P.)

Abstract

Case report: Lumbar disc herniation is very rare in children and adolescent age group. We report a rare case of two months old neglected case of post traumatic L4-L5 disc herniation causing cauda equina syndrome and bilateral foot drop in a 13-year-old patient. He was treated successfully with emergency L4 laminectomy and L4-L5 discectomy, and he recovered fully without any restricted activity. Cauda equina is a surgical emergency, which should be diagnosed and operated as early as possible for good results, even if the patient presents late.

Keywords: Cauda equine syndrome, Lumbar disc herniation, Laminectomy

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Introduction

Back problems, as such are rare problems in pediatric and adolescent age group except for congenital deformities and infections [1-2]. These problems can have variable clinical presentation from local or radicular pain, different motor or sensory deficit, with or without involvement of bladder and bowel, depending on the pathology, size, location and relationship of the lesion with the nerve root. Radicular symptoms from caudal nerve root compression may vary from sciatica, sacral or buttock pain, vaginal or penile paraesthesia or sensory changes over the buttocks, perineal area and lower extremity or cauda equina syndrome. When these clinical features are present or are symptomatic, they need detailed evaluation and investigations, including thorough history, proper clinical and neurological examination and radiographic and MRI scans of the affected area. They may require surgical treatment, if they are symptomatic or leading to neurological deficit [3-5].

Delayed presentation of such debilitating neurological deficit problems is further rare, as these hamper the daily activities of the person grossly. We report such a rare case of neglected cauda equina syndrome in an adolescent which was successfully treated by laminectomy. We reported this rare case to create awareness among the surgeons regarding occurrence of cauda equina syndrome even in adolescents and to have high clinical suspicion for such cases and include it in differential diagnosis of back pain even in adolescents and considering them for early MRI scans.

Case Report

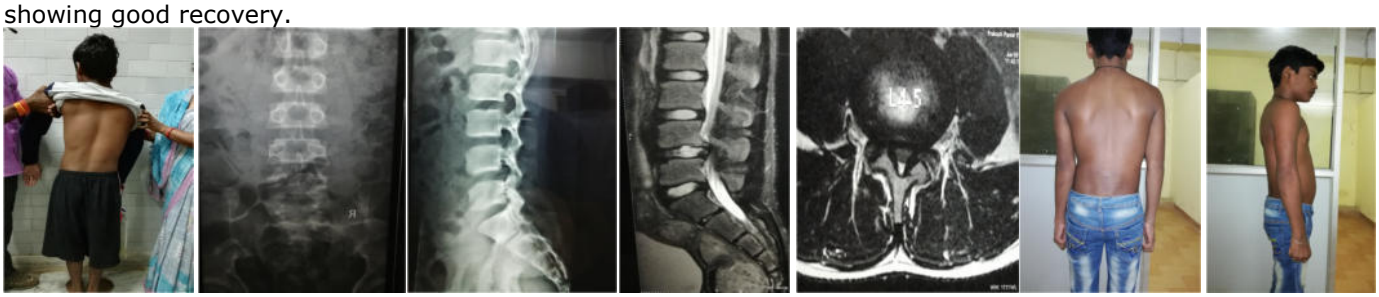
A 13 years old male, presented to our OPD with complains of back pain since 2 months. He had a history of lifting a heavy object about 2 months ago after which the pain started, for which he was only prescribed some analgesics by the local practitioner, after

investigated to normal, on X-rays and blood investigations.

No further treatment or any consultation was taken by the patient for next 2 months and even the complaints did not improve either. Hence patient reported to our tertiary center OPD. He had severe back pain with severe difficulty to pass urine and stools since last 15 days and was unable to pass urine since last two days. He was having severe back ache, radiating down to both legs, inability to stand without support, peri-anal numbness and bilateral foot drop. On examination he was not able to stand erect and was taking support to stand. He preferred to lie down with his knees and hips flexed. Straight leg raise test was painful at 30^0 on both side, power was 3/5 in ankle dorsi-flexors, 1/5 in extensor hallucis longus and 2/5 in planter flexors on both side. Ankle reflex was absent, planter reflex was mute, peri-anal sensations were absent and anal reflex was absent.

An immediate MRI of lumbar spine with whole spine screening was ordered. MR showed us a big central disc prolapse of L4-L5 disc compressing the dural sac and the transversing nerve roots causing both central canal and lateral recess stenosis with complete cut off sign of CSF. Pre-operative investigations were done and after fitness for surgery patient was planned for surgery on emergency list. Under general anesthesia in prone position, open L4 laminectomy with L4-L5 discectomy was done through posterior approach. The surgery was completed uneventfully. He was given a lumbar corset for 2 months and physiotherapy and mobilization was slowly started as he regained power. Postoperatively, patient reported improvement in radicular pain immediately and was able to walk without support on 5th post-operative day. He was able to pass urine and stools on his own on 7th postoperative day. After a period 2 months of restricted activity, he started going to school. At 6 month follow up his only complaint was mild numbness on dorsal aspect of both feet with full recovery of power in both limbs and bladder and bowel control.

Fig 1. Preoperative clinical photograph (a), anteroposterior (b) and lateral (c) x rays of lumbar spine and sagittal (d) and transverse section of MRI at L4-5 level of the patient showing L4-5 disc herniation with severe nerve compression. Postoperative clinical photograph (f & g) after laminectomy and discectomy at L4-5 showing good recovery.



a b c d e f g

Discussion

Disc degeneration and it's prolapse generally starts around 30 years of age and lumbar disc prolapse causing neurological deficit is very rare in children. Wahren first reported a lumbar disc herniation in a 12-year-old child in 1945 [1]. Report published by Mayo clinics in 1982, on 9991 discectomies showed only 0.5 % were children of the age 16 years and younger [2].

Trauma in the form of sports or lifting any heavy object is the most common cause being reported to precede symptoms of disc prolapsed in children, whereas in adult population disc degeneration leads to disc prolapse [3-5]. Few studies have demonstrated epiphyseal ring separation in lumbar disc prolapse in children [6-8]. High body mass index and genetic predilection have also been associated with increase incidences of lumbar disc herniation in adolescent patients [9].

Most of the patients with disc herniation present with acute onset low back pain radiating down to one or both legs. On

examination, there is loss of lumbar lordosis and may be sciatic listing on either side. Child may prefer to lie down on the sides with hip and knee flexed. There can be gross restriction of movement in spine and as such the whole body. Straight leg raise is painful in these patients. It is important to rule out other more common diagnosis like infection, fracture, muscle strain, ligament strain, osteoid osteoma and lytic spondylolysis. Plain radiographs and MRI are the most important investigations to be done. Apophyseal separation should be looked for and reported carefully [9,10].

After confirming the diagnosis, treatment is aimed to relieve the symptoms, neurological improvement and early return to routine life. Conservative treatment is recommended and found to be effective by Zamani et al [9]. While most of other studies suggest excellent results after surgical decompression [2,3,6,11-15]. Kurihara and Kataoka reported only 40% patients responding to conservative treatment and recurrence was common after starting routine activities [3]. The main cause of failure of conservative treatment in adolescent is the well hydrated disc. It does not resorb like the degenerated dehydrated adult disc. Other cause can be the less compliance of children to activity restriction as compared to adults. Symptoms due to separated epiphyseal cartilage seen in few patients are also very difficult to manage conservatively [16].

Cauda equina syndrome, progressive neurological deficit and disabling pain not responding to conservative treatment need surgical treatment [16]. Cauda equina syndrome is a very rare presentation in adolescents but should be diagnosed promptly and should be decompressed on emergency basis. Early surgical intervention promises the best chance for neurological recovery. Percutaneous endoscopic discectomy, micro-discectomy and open discectomy are the techniques which are generally used. Open discectomy with partial or complete laminectomy is the procedure most often performed. Posterolateral disc can be excised with laminotomy and flavotomy. With the central disc bulge and stenotic canal we need to remove the complete lamina to adequately decompress the cauda equine nerve roots. The protruded annulus and disc should be removed and nucleus should be adequately decompressed. All loose disc fragments should be removed. Complete or overzealous discectomy should be avoided as it does not serve any good in neurological improvement and it may speed up the degeneration of the disc and facet joints. This leads to stenotic changes at that level [17]. For children and adolescents, it is very important to maintain the integrity of the inner part of the annulus where the proteoglycan synthesis is the most active [18]. Ishihara's et al showed that leaving the inner annulus intact could lead to partial regeneration of the intervertebral disc [14]. Though our case presented very late with typical features of cauda equina syndrome but responded well to the decompression, as prompt surgery was done. This better outcome might be due to his young age. Early post-operative complications found in adolescent patient could be wound hematoma (1-4%) and delayed wound healing (3%), none of which were seen in our case. Post-operative surgical site infection or discitis is rare in children and adolescent patients [16]. Late complications reported are the disc space narrowing, foraminal stenosis and adjacent level disc degeneration [17]. There are chances of recurrent disc herniation (5-10%) which may need revision standard discectomy [10].

Conclusion

Prolapsed intervertebral disc causing symptoms though very rare but should be considered in adolescent patients with significant history of trauma. Cauda equina is a surgical emergency and should be diagnosed and operated as early as possible for good results. Even if the patient presents late, like ours decompression should be offered to the neural tissue whenever possible, especially in young age patients.

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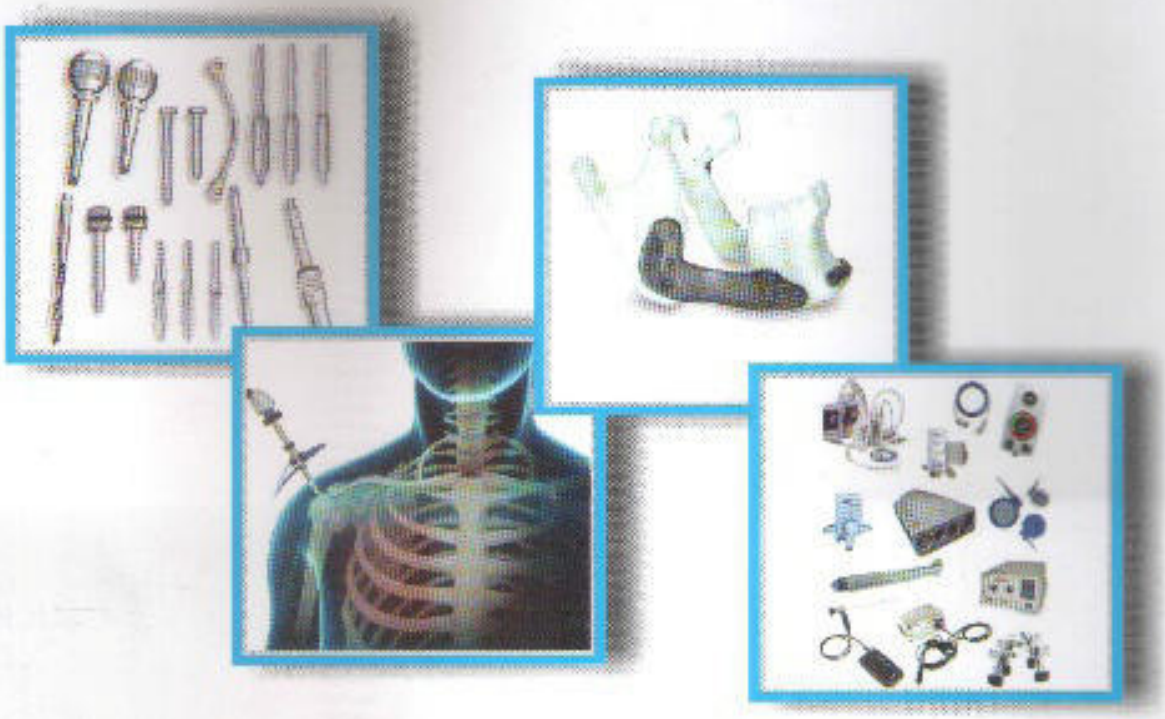

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