“EVALUATION OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HUMERAL SHAFT FRACTURE TREATED WITH LOCKING COMPRESSION PLATE”

BY

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DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

In partial fulfilment of the requirements for the degree of

MASTER OF SURGERY

IN

ORTHOPAEDICS

Under the Guidance of

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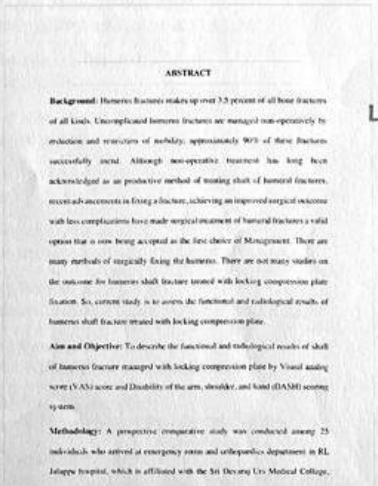

ABSTRACT

Background: Humerus fractures makes up over 3.5 percent of all bone fractures of all kinds. Uncomplicated humerus fractures are managed non-operatively by reduction and restriction of mobility; approximately 90% of these fractures successfully mend. Although non-operative treatment has long been acknowledged as an productive method of treating shaft of humeral fractures, recent advancements in fixing a fracture, achieving an improved surgical outcome with less complications have made surgical treatment of humeral fractures a valid option that is now being accepted as the first choice of Management. There are many methods of surgically fixing the humerus. There are not many studies on the outcome for humerus shaft fracture treated with locking compression plate fixation. So, current study is to assess the functional and radiological results of humerus shaft fracture treated with locking compression plate.

Aim and Objective: To describe the functional and radiological results of shaft of humerus fracture managed with locking compression plate by Visual analog score (VAS) score and Disability of the arm, shoulder, and hand (DASH) scoring system.

Methodology: A prospective comparative study was conducted among 25 individuals who arrived at emergency room and orthopaedics department in RL Jalappa hospital, which is affiliated with the Sri Devaraj Urs Medical College,

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The Institutional Ethics Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has examined and unanimously approved the synopsis entitled **"Evaluation of functional and Raiological outcome of humeral shaft fracture treated with locking compression plate"** being investigated by **DR. BANDARU VENKATA HRUSHIKESH**, Dr. Arun H S in the Department of Orthopedics at Sri Devaraj Urs Medical College, Tamaka, Kolar. **Permission is granted by the Ethics Committee to start the study.**

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EVALUATION OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HUMERAL SHAFT FRACTURE TREATED WITH LOCKING COMPRESSION PLATE

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ABBREVIATIONS

GLOSSARY	ABBREVIATIONS
LCP	Locking compression plate
DCP	Dynamic compression plate
IMIL	Intramedullary interlocking
IM	Intramedullary
VAS	Visual analog score
DASH	Disability of the arm, shoulder, and hand score
ORIF	Open reduction and internal fixation
CRIF	Closed reduction and internal fixation
MIPO	Minimally Invasive Plate Osteosynthesis
RR	Relative Risk
CI	Confidence Interval
AO	Arbeitsgemeinschafy fur osteosynthesefragen
IEC	Institutional Ethics Committee
SD	Standard Deviation
RTA	Road Traffic Accident
L	Lower
M	Middle
U	Upper

ABSTRACT

Background:

Humerus fractures makes up over 3.5 percent of all bone fractures of all kinds. Uncomplicated humerus fractures are managed non-operatively by reduction and restriction of mobility; approximately 90% of these fractures successfully mend. Although non-operative treatment has long been acknowledged as a productive method of treating shaft of humeral fractures, recent advancements in fixing a fracture, achieving an improved surgical outcome with less complications have made surgical treatment of humeral fractures a valid option that is now being accepted as the first choice of management. There are many methods of surgical fixation of humerus. There are not many studies on the outcome for humerus shaft fracture treated with locking compression plate fixation. So, current study is to assess the functional and radiological results of humerus shaft fracture treated with locking compression plate.

Aim and Objective:

To describe the functional and radiological results of shaft of humerus fracture managed with locking compression plate by Visual Analog Score (VAS) and Disability of the Arm, Shoulder, and Hand (DASH) scoring system.

Methodology:

A prospective comparative study was conducted among 25 individuals who arrived at emergency room and orthopaedics department in R.L Jalappa hospital, which is affiliated with the Sri Devaraj Urs Academy of Higher Education and Research Tamaka, Kolar, with a fractured humerus shaft meeting the inclusion and exclusion criteria during the period between December 2020 and July 2022.

Results:

Mean VAS score at 6 month follow up was 2.52 with 0.963 SD which is excellent and Mean DASH score at 6 month follow up was 11.88 with 4.781 SD which is very good functional outcome. The mean VAS score, at 6 weeks follow up was 7.08 which was reduced to 2.52 at 6 months follow up. According to mean DASH score, at 6 weeks follow up was 55.24 which was reduced to 11.88 at 6 months follow up. The fracture consolidation at 6 months follow up was found to be excellent. There were no post-operative complications noted in this study.

Conclusion:

Based on the data, it is concluded that locking compression plate is safe and dependable in attaining union in patients of any age group and activity level since it can be applied at all levels of the humeral shaft and can result in 100% union when used with the correct principles and excellent osteogenic stimulus. An understanding of anatomy, surgical indications, procedures, and implants, as well as patient expectations and functions, is necessary for successful management of shaft of humerus fracture.

Keywords: Locking compression plate, Shaft of humerus fracture, Functional outcome, Radiological outcome

INTRODUCTION

INTRODUCTION

Humeral shaft fractures contributes about 3% of all long bones fractures.[1] A simple fracture pattern made up 63% of injuries, while 5% of them were linked with open wounds. In up to 18% of closed injuries, there is a considerable risk of neurological damage in conjunction to humeral shaft fracture.[2] They almost typically occur after a strong trauma in young people or a minimal trauma in older persons. If the fracture line is situated between the brachialis muscle's distal and proximal insertions, the injury is known as a humeral shaft fracture. According to the AO, a long bone diaphyseal fracture is one that occurs between the two epiphyseal squares.[3]

The oldest accounts of this injury date to ancient Egypt circa 1600 BC, while Greek and Roman sources like Corpus Hippocratic make mention of it.[4] More recent literature from the 20th century shows that this was a challenging fracture to treat. Campbell noted in 1924 that fractures of the humerus' shaft experienced delayed & non-union more frequently than those of any more long bones, a finding that was subsequently confirmed in 1935 by Ghormley and Mroz, who uncovered a non-union rate of 65%. According to Caldwell's 1933 recommendation, the hanging cast should

be used as equipment for ambulation since the limb's weight distal from the fracture will operate as tractional force to realign the fracture.[5]

Although shoulder injury patterns differ depending on the sport and position, overhead activities like baseball, swimming, tennis, and volleyball all depend on the kinetic chain's integrity. The most crucial biomechanical principle needed to assess and treat issues with the athlete's shoulder, warrants attention since disruption of this vital process predisposes to injury.[6]

Bimodal damage distribution exists in age, peaking in the 3rd and 7th decades, with younger people experiencing extremely powerful mechanisms and older populations experiencing low energy falls.[7–9] Incidence for each age group was between 13.4 and 14.5 for 100,000 per year, rapidly rising to around 90 per 100,000 by the 9th decade.[10] Shaft injuries make up 13% of humerus fractures, with proximal humerus injuries accounting for 79 percent of all cases.[11] Since then, the care of these fractures has greatly changed, valuing both non-surgical and surgical approaches. Numerous non-surgical treatments were used in the years after Campbell.[3,12,13]

For specific circumstances, such as patients with multiple injuries, compound fractures, comminuted fractures, fragility fractures, long spiral fractures, patients with neurovascular injury and fractures in obese

patients, surgical management of humeral shaft fractures is taken into consideration.[8,14]

Since then, surgical fixation techniques have attained popularity because they promote early joint mobilisation and fracture healing.[3] The best surgical procedure is still plate and screw fixation.[15] The typical internal fixation with a plate and screw has a more chances of failure and complication risk, nevertheless.[16]

The techniques of nailing and plate fixation are both being applied. It has been demonstrated that plate fixing lowers the frequencies of malunion and also non-union.[17] Open reduction with internal fixation is often used to treat diaphyseal humerus fractures in adults because it helps in prevention of neurovascular damage by direct vision and also spares elbow and shoulder injury. Compression-based fixation methods are proven to have a lower non-union rate, expedite recovery, and cause less joint stiffness.[18] The main disadvantage of plate fixation is soft tissue rupture, which raises the possibility of infection and also nerve damage. The use of plating in conjunction with autologous non-vascularized fibular graft (ANVFG) has occasionally occurred. This design gives increased biology for gap and atrophic non-unions in long bones while also enhancing biomechanical strength.[19]

The preservation of fracture biology, a potential accelerated time to union, a reduction in blood loss, and a briefer surgical period are all benefits of nailing. However, this method has been linked to secondary procedures at a greater rate, rotator cuff injuries, and chronic shoulder pain and impingement.[17,20] Both procedures are evolving quickly, with the introduction of minimally invasive plating methods that reduce soft tissue stripping and the creation of straight nails that may alleviate shoulder issues associated with older generations of nails.

Despite the fact that numerous meta-analyses have been conducted and neither treatment modality has been clearly shown to be superior, plate fixation is becoming more popular.[21] It seems crucial to reassess the outcomes of this procedure given the growing use of plating.

AIMS & OBJECTIVES

AIM AND OBJECTIVES

AIM

To describe the functional and radiological outcome of humerus shaft fracture treated with locking compression plate by Visual Analog Score (VAS) and Disability of the Arm, Shoulder and Hand (DASH) scoring system.

OBJECTIVES

1. To describe the functional outcome of shaft of humerus fracture managed with locking compression plate by VAS score and DASH scoring system.

2. To describe the radiological outcome of shaft of humerus fracture treated by locking compression plate.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Humerus shaft fractures encompass a set of fractures where the main fracture is between supracondylar ridge distally and surgical neck proximally. It makes up over 3.5 percent of all bone fractures of all kinds. Open wounds were present in 5% of injuries, while simple fracture patterns made up 63%.[22]

Reduction followed by restriction of movement are conservative approaches for uncomplicated humerus fractures; approximately 90% of these fractures successfully mend.[22] The numerous options for conservative treatment include hanging casts, functional braces, velpeau dressing, and shoulder spica. 'Charnley' the first orthopaedic surgeon favours a conservative approach. Although non-operative treatment has long been acknowledged as a successful approach of treating shaft fractures, Surgical management of humeral fractures is currently recognised as the first choice of management due to recent improvements in fracture fixating techniques, success of enhanced surgical treatment, less complications, and higher efficacy of controlling complications.

Recent times have seen an increase in the need for surgical intervention due to polytrauma from auto accidents, very obese individuals, and older people with osteoporosis, segmental fractures, and fractures with more than 50% comminution. Lastly operative internal fixations have been

required because of the failure of conservative treatment, the patient's refusal to wear a bulky U cast, the likelihood of shoulder and elbow limitation, and other factors.

Relevant Anatomy

The region between epicondyles and the surgical neck is frequently referred to as the humeral shaft.[1] It is essential to understand the intricate neurovascular architecture of the limb in order to perform a safe procedure. The brachial artery, axillary, median, ulnar & radial nerves are surgical landmarks that should be observed while exposing of the shaft.[23] Blood supply to most of the shaft comes from a nutritive artery that travels along the antero-medial border between the brachialis muscle origin and coracobrachialis insertion. This location is only distal to the bone's midway.[24]

The humerus shaft in the proximal half is nearly cylindrical before flattening out and becoming triangular shape distally. Anterolateral, anteromedial, and posterior are its three main surfaces.[23] The radial groove and tuberosity of deltoid are the main surgically significant regions. The deltoid muscle attaches onto the tuberosity of deltoid, which is an elevated portion in the centre of the anterolateral surface. The triceps lateral head attachment on is where radial groove or musculo-spiral groove begins. It continues distally and laterally directing towards

anterolaterally. The profunda artery and radial nerve both run via this groove.

The primary radial nerve damage rate in the literature is upto 22% from 4%, and iatrogenic injury is about to be 3%, so the radial nerve warrants specific consideration.[25–27] It originates from the brachial plexus's posterior chord and before entering the triangular space it travels anteriorly to the subscapularis muscle alongside the deep brachial artery. Between 9.7 and 14.2 cm distal to acromion, travels down the radial sulcus, between lateral & medial triceps heads. About 6.5cm next to back of the humerus radial nerve then runs.[28] Typically, it comes out of the spiral groove 12.6cm from the lateral and about 19cm from to the medial epicondyle.[23,27,29]

The distal articular surface is typically 10 cm away from the radial nerve as it departs from spiral groove. After that, the radial nerve reaches anterior compartment via lateral intermuscular septum.[23,27] Here is where the nerve could get hurt if there is a Holstein-Lewis fracture.[1,30] The lateral intermuscular septum is where radial nerve gives posterior antebrachial cutaneous nerve which travels down the back of the septum to the forearm. Through the brachialis & brachioradialis muscles, radial nerve runs distally in the arm.[23]

Axillary nerve emerges from brachial plexus's posterior cord. In front of the subscapularis muscle it enters the quadrangular area and winds round the surgical neck in order to innervate teres minor and deltoid muscles. The axillary nerve loops around the surgical neck and is found at about 4.3 to 7.4cm to the acromion.[23]

Along shaft of humerus, brachial artery & median nerve follows common path. Both occur seldom while exposing the shaft. Medial and lateral cords of the brachial plexus forms the median nerve, which travels through intermuscular septum directly medial to brachial artery. Both components move distally in space intermediate to the biceps and pronator teres.[23]

Medial cord's ulnar nerve runs anterior to medial intermuscular septum as well. Then, 8 cm in front of medial epicondyle, cut across posteriorly at Struthers' arcade. The ulnar nerve continues behind medial epicondyle, the intermuscular septum & into the cubital tunnel.[23]

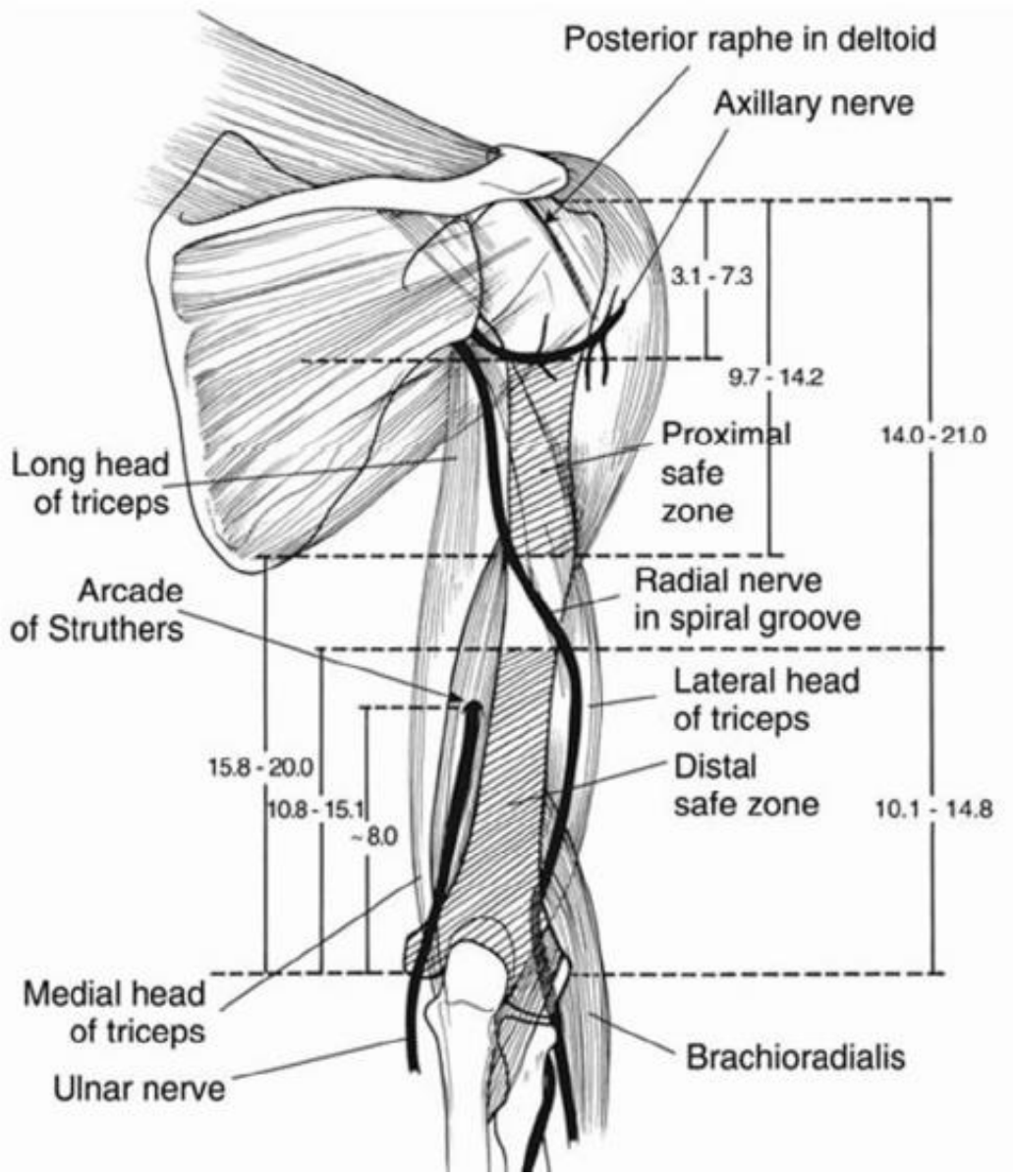


Figure 1: Anatomy of Humerus - Posterior view[23]

Depicting the brachium's neurological structure from back, with respect to important anatomical landmarks. The area of the posterior humerus in between axillary nerve and the spiral groove is known as the safe zone. The spiral groove is away from the distal safe zone.[23]

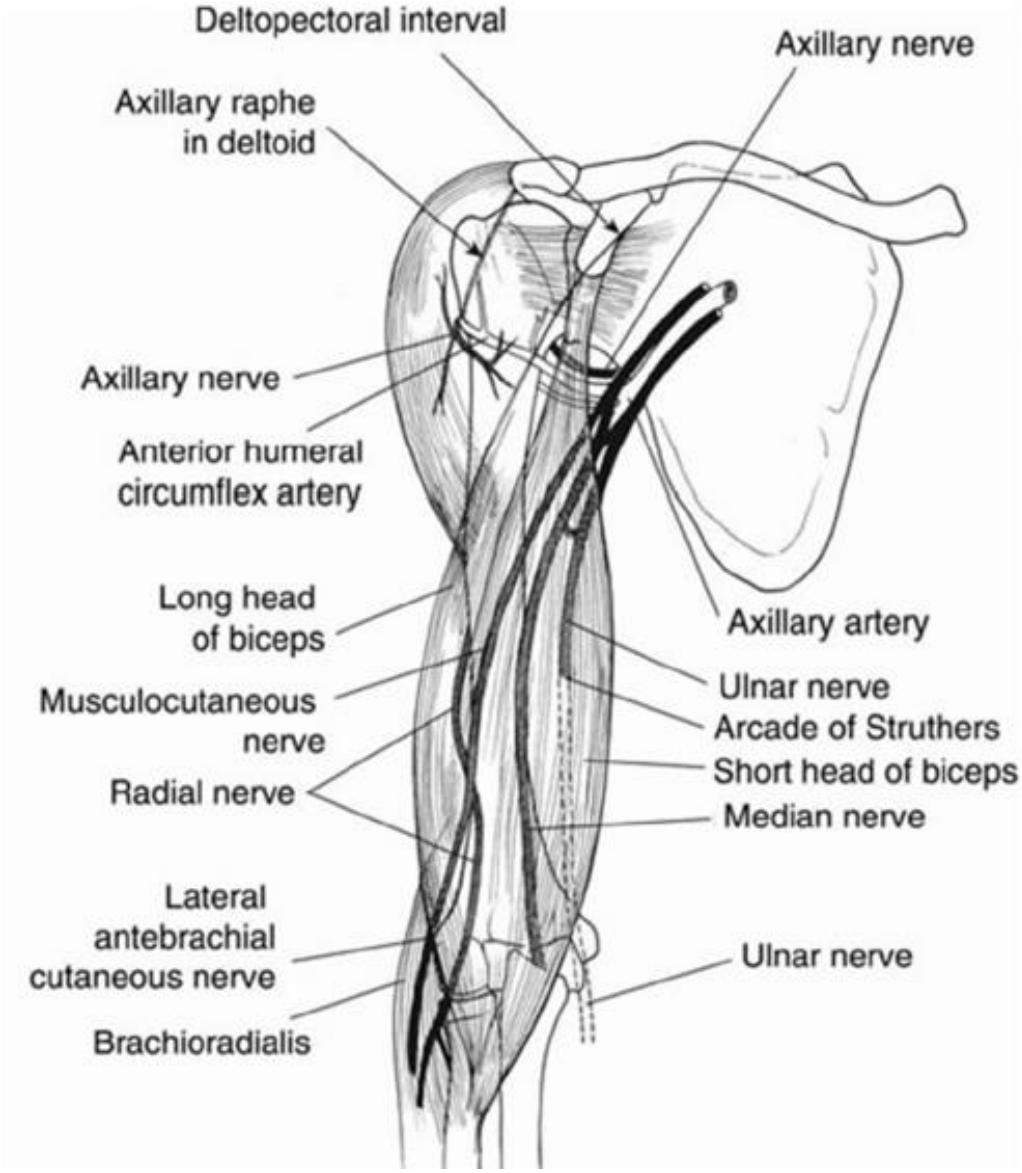


Figure 2: Anatomy of Humerus – Anterior view[23]

Keep in mind how the subscapularis muscle's inferior edge is connected to axillary nerve and the anterior circumflex humeral artery. When performing a deltopectoral approach, the "three sisters"—the anterior humeral circumflex artery and its 2 venous comitantes—are frequently ligated separately to prevent excessive blood loss and assure optimal exposure of the humeral metaphysis.[23]

Fracture shaft of humerus

One of the fractures that orthopaedic surgeons around the world see the most frequently is a humeral shaft fracture.[31] Approximately 5 to 8 percent of all fractures of the extremities are humeral fractures, and 3 percent of all long-bone fractures are shaft fractures.[10,32] There are roughly 13 humeral shaft fractures per 1 lakh people for year.[33]

Classification of humerus shaft fractures

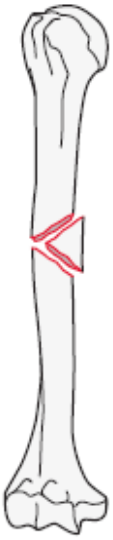
The combined classification of the Orthopaedic Trauma Association (OTA) and Arbeitsgemeinschaft für Osteosynthesefragen (AO), which was derived from the Müller AO long-bone fractures classification, is the most commonly used classification for humeral shaft fractures.[34]

Simple, wedge and complex fractures are three primary types, which are still categorised by pattern. When humeral shaft fractures are classified, there is a significant intra-observer agreement and a modest interobserver agreement among various orthopaedic surgeons.[35]

Types:

Humerus, diaphyseal segment,
simple fracture
12A

Humerus, diaphyseal segment,
wedge fracture
12B



Humerus, diaphyseal segment,
multifragmentary fracture
12C

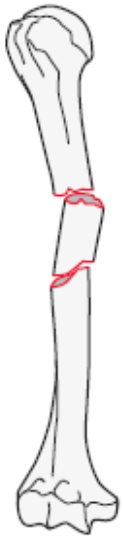
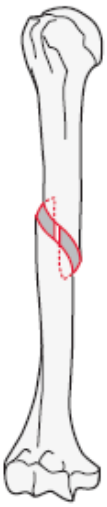


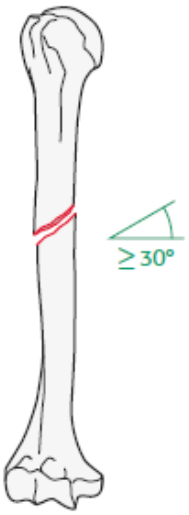
Figure 3: Types of fracture of Humerus at diaphyseal segment[36]

Groups:

Humerus, diaphyseal segment, simple,
spiral fracture
12A1*



Humerus, diaphyseal segment, simple,
oblique fracture (≥30°)
12A2*



Humerus, diaphyseal segment, simple,
transverse fracture (<30°)
12A3*

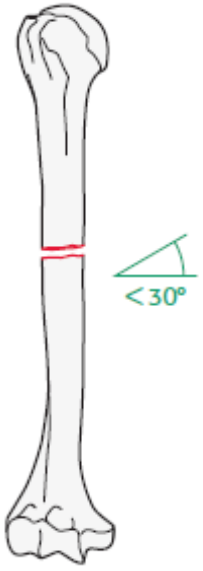


Figure 4: Humerus, diaphyseal segment, simple fracture types 12A[36]

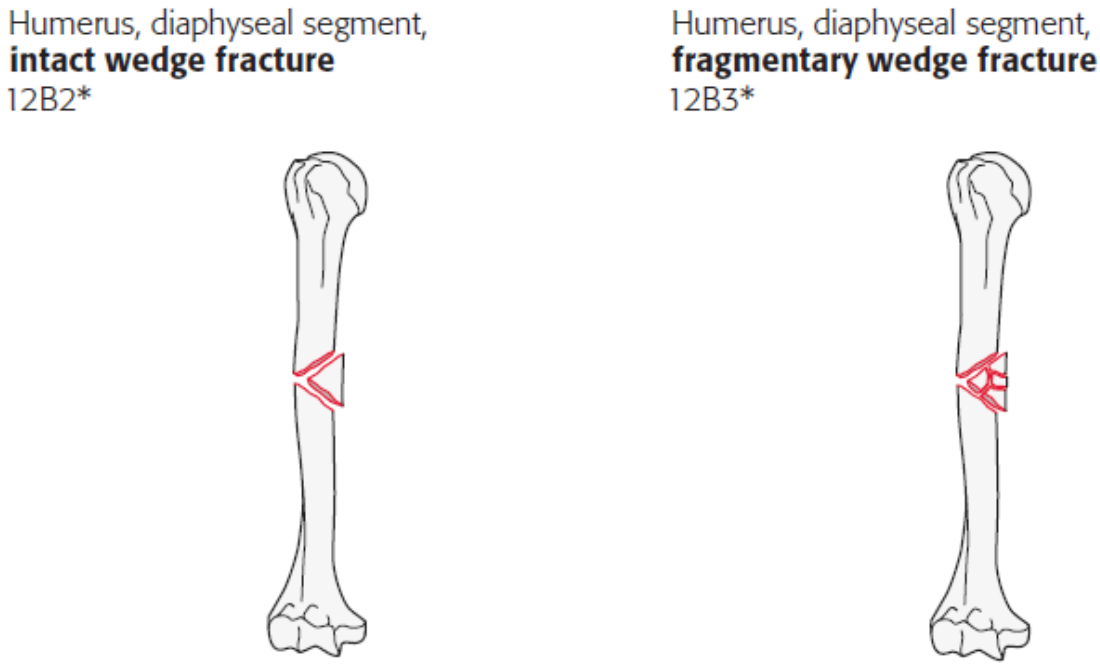


Figure 5: Humerus, diaphyseal segment, wedge fracture types[36]

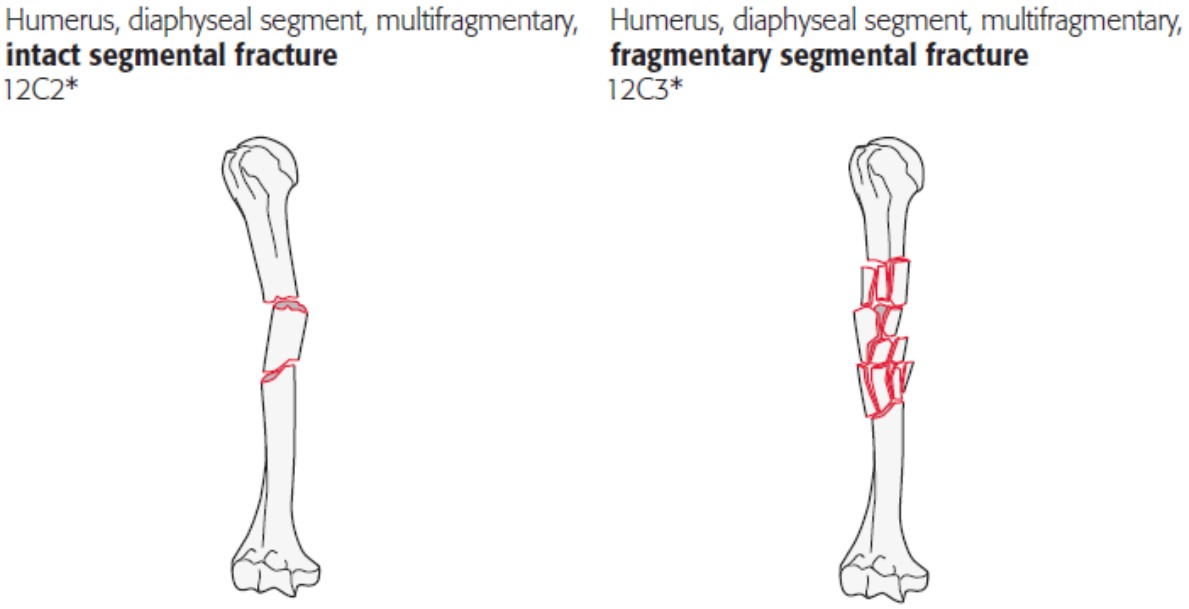


Figure 6: Humerus, diaphyseal segment, multifragmentary fracture types[36]

Following shoulder arthroplasty, periprosthetic diaphyseal type of humerus fractures are commonly categorised using one of two methods. 1) Wright and Cofield classification scheme, depends on the position of fracture with respect to the humeral stem's tip.[37]

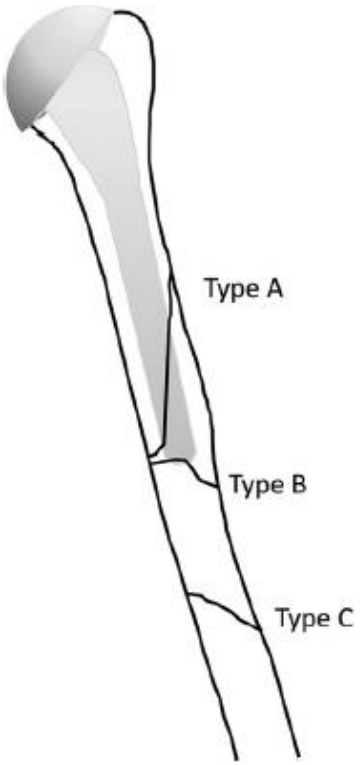


Figure 7: The Wright and Cofield classification of periprosthetic fracture of the humerus[37]

Type-A start from stem's tip with proximal extension, Type-B starts from tip of the stem with distal extension, and type-C involves entirely far from the stem's tip.[37]

According to Campbell et al., the alternate categorization is centered on the location of the fracture.[38,39] The tuberosity is the first region, followed by the metaphyseal, proximal, middle, and distal humeral diaphysis in that order. These categorization methods are constrained by their low interobserver reliability and inability to provide decision-making guidance.[40]

Non-surgical Management

Most surgeons continue to concur that nonsurgical treatment of humeral diaphyseal fractures is ideal. In 1966 assessment of 32 people who had humerus shaft fractures, klenerman found that 20° angulation anteriorly or 30° of varus were the upper borders at which the abnormalities may become evident clinically without function compromise.[13] As long as these values are used, bracing radiography parameters will be considered satisfactory.

The majority of research to date have not discovered any conclusive links among the severity of angular malformation and function results. Shields et al. discovered no relationship among the self-reported functional outcomes ratings and residual deformities in the sagittal or coronal planes between 0° and 18° or 2° and 27°, respectively.[41]

Hanging arm cast

According to the DeMourgues and Babin articles, this is a classic - treatment strategy, but a 2003 french multi-center study found that it was still utilised in 50% of patients who were conservatively treated.[3]

The traction caused by the long-arm cast's (1–1.5 kg) weight reduces the fracture. Patients must be physically fit and knowledgeable to hang the cast-covered arm, move the shoulder in a pendulum motion, and allow the arm to keep at chest level while sleeping. At least six weeks are spent wearing the cast. It takes an average of 52 days to reach union. Occurrence of non-union ranges from two to five percent. Due to the weight of the cast, there is a chance that neck pain, shoulder and elbow stiffness, and elbow stiffness in particular, will develop.[3]

Bracing protocol

Immobilization was carried out using shoulder spica casts, hanging arm casts, thomas arm splints, modified velpeau dressings, and coaptation splints prior to 1977, when sarmiento et al. first described the functional brace for humeral shaft fractures.[42] Although they involved the shoulder, elbow, or both joints, these techniques were comparatively effective in keeping the bony alignment necessary for union to happen. In the end, treatment caused proximal or distal stiffness, or both, as well as challenges carrying out daily activities.[1]

Most of the times, diaphyseal fractures of the humeral shaft are still best treated without surgery. However, when treated with functional bracing, fractures that involve the mid- or proximal-third of the diaphysis are more prone to non-union, and surgery should be taken into account.[43]

Figure 8: An over-the-shoulder brace for a humeral fracture[1]

Even while non-surgical treatment for humeral shaft fractures produces satisfactory results, there are numerous concomitant morbidities, such as non-union and shoulder and elbow stiffness brought on by prolonged immobility.[31]

SURGICAL MANAGEMENT

External fixation or open reduction with internal fixation, minimally invasive percutaneous osteosynthesis, and intramedullary nailing are some of the surgical treatment options that are available.[31] High grade open fractures (Gustilo types-II and III), ipsilateral forearm fractures (floating elbow), nerve and significant vascular injuries, pathological fractures, and delayed or non-unions are all good candidates for surgical treatment. Bilateral injuries, segmental fractures, fractures with axial distraction, and multiple trauma are examples of relative indications.[43]

According to a study by Harkin et al., the rate of non-union for surgical treatment of humeral shaft fractures was 4 percent compared to 33 percent for conservative treatment in 30 out of 126 cases. Patients having a strong history of psychiatric disorders were also advised to have an operational intervention.[44] In their study, Westrick et al. also shown that the non-union rate in the operative group was much lower than the non-union rate in the conservative group, with a rate of 10.2 percent as opposed to 23.2 percent.[8]

Open Reduction and Internal Fixation (ORIF)

The gold standard for the treatment of diaphyseal humerus fractures is plate fixation following ORIF.[17] Different methods can be utilised to visualise the fracture, and a plate with screws is employed. These locking compression plates compress the fracture site similarly to dynamic compression plates since they are thick, somewhat narrow (4.5 mm), employ 3.5 mm screws, and are 4.5 mm wide. Six to eight cortices on either side of the fracture must be included in the build.[3]

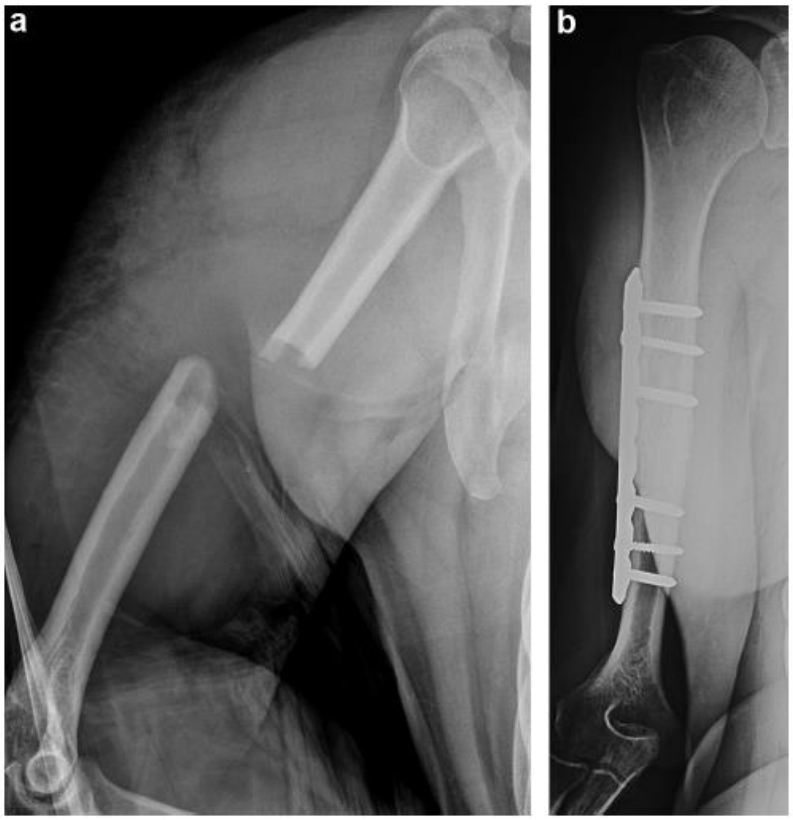


Figure 9: Treatment with locking compression plate of a highly displaced fracture of the middle third of the humeral shaft. (a) At admission. (b) At union.

Benefits include directly inspection of the injured area, a better chances of reducing the fracture morphologically, complete rigidity & quick tissue regeneration. Van de Wall et al. discovered a minimal risk of complications in a trial involving 102 individuals getting plate fixation.[17]

The surgeon's preference, the patient's circumstances, neurological, and the integrity of the vasculature all play a role in the decision of the surgical technique.[3,45] Anterolateral approaches are frequently used, particularly for more proximal fractures. Through the entirety of the incision, the radial nerve is noted and guarded. When there are concomitant vascular injuries, it may be preferable to avoid the nerve and locate the brachial artery via the medial approach.[3]

Finally, there are variants in the posterior approach regarding the splitting or sparing of the triceps. Since the radial nerve will be nearby, meticulous dissection is necessary.[3,46] Preventable radial nerve paralysis happens at comparable rates regardless of the approach.[45] In a case series of 66 patients with a single surgeon, the triceps-sparing technique shown highest rate of union and a reduced prevalence of wrist drop (3 %).[46]

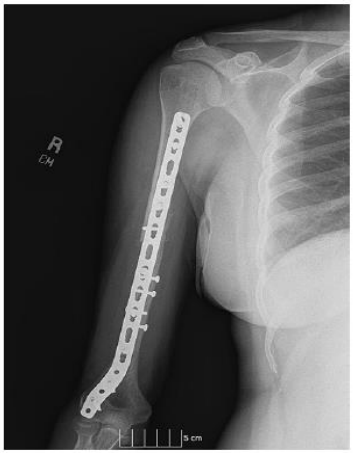


Figure 10: The posterior approach can be extended proximally and distally for long plate application[47]

The mechanical characteristics of anteromedial, anterolateral, and posterior fixations were investigated in a biomechanical study comparing ten-hole locking compression plates in sawbones. In every mechanical test, except for four-point bending, the anteromedial plating outperformed the others. Despite the fact that this study supports anteromedial fixation, an anteromedial technique is not advised for patients who also have radial nerve palsy.[48]

Figure 11: Lag screws and compression plating of comminuted humeral shaft fracture.[47]

Intramedullary Nailing (IMN)

The use of intramedullary nailing for diaphyseal humeral fractures has grown in popularity because to the minimal dissection needed, conservation of the fracture haematoma, of the use of stability and secondary healing. The disadvantages of IM nails include an increased likelihood of rotational malignment, shoulder discomfort, and re-operation.[8]

Figure 12: Intramedullary nail[47]

Medial side of the larger tuberosity serves as the beginning point for antegrade IMNs.[47]

While retrograde IM nails enters by posterior triceps splitting region, anterograde IM nails enter at larger tuberosity or apex of the humeral

head. Since, special danger of humerus fracture at distal third while inserting or removal of this kind of nail, the retrograde method is less common.[3]

Iatrogenic rotator cuff injury caused by IM nailing has been linked to pain at shoulder joint and stiff shoulder. The complaints have diminished in severity as IM nail design and technique progress. Particularly advised is an entry site that is a little to the side of the humeral shaft axis.[49]

In an analysis where comparison was done between ORIF and IM nailing in sixty patients, Fan et al. found that IM nailing had equally united and functionally good as plating, also IM nailing was having reduced intraoperative blood loss, shorter operating times, shorter hospital stays, and less significant sequelae.[50]

Minimally Invasive Plate Osteosynthesis (MIPO)

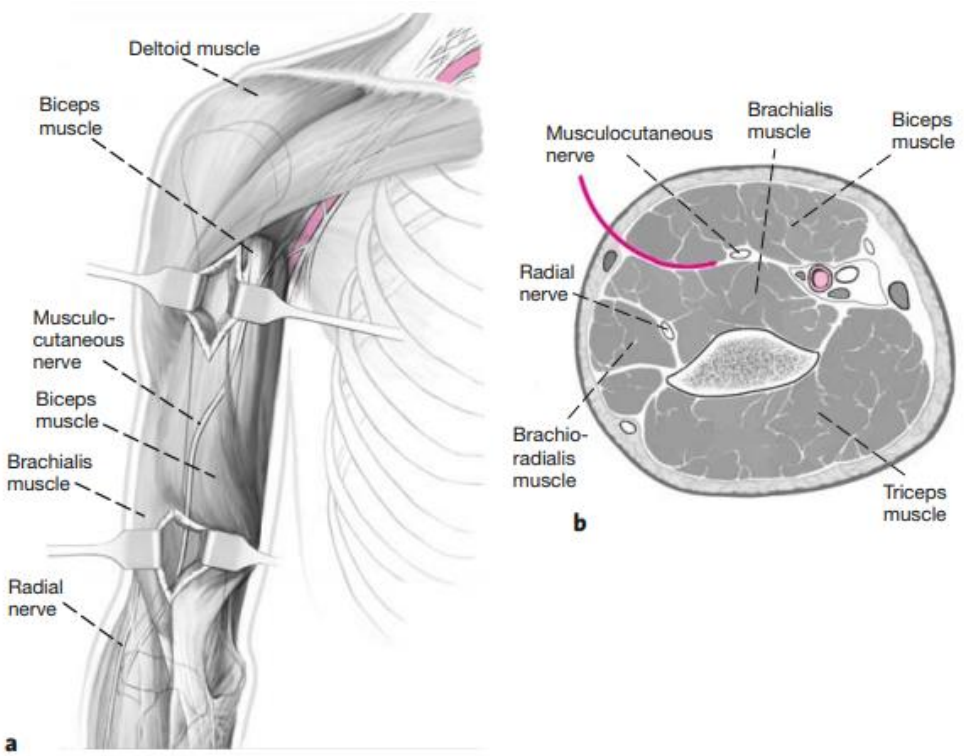


Figure 13: Two incision in Minimally Invasive Plate Osteosynthesis[51]

Approximately 6 cm distal to the front portion of the acromion process, a 3-cm proximal incision is made, and the dissection is then continued down to the humerus. About 5 cm from the elbow's flexion crease, a 3-cm distal incision is made along the lateral border of the biceps. The distance between the brachialis and the biceps brachii is noted.[51]

The MIPO technique is an innovative idea with the goal of achieving indirect bone regeneration and relative stability. By adopting a minimally invasive surgical technique, the plate is positioned anteriorly to lower the risk of iatrogenic radial nerve injury in bridging fashion. Benefits include

minimising shoulder issues that can occur when an intramedullary nail is utilised, reducing traditional plating complications, and minimising dissection.[52]

The MIPO approach is quite promising, however because the fracture cannot be directly reduced, there may be a rotational disparity between the two sides. This was demonstrated in a small research to be of minimal clinical consequence because patients had good or exceptional functional outcomes.[53]

External Fixation (Ex-Fix)

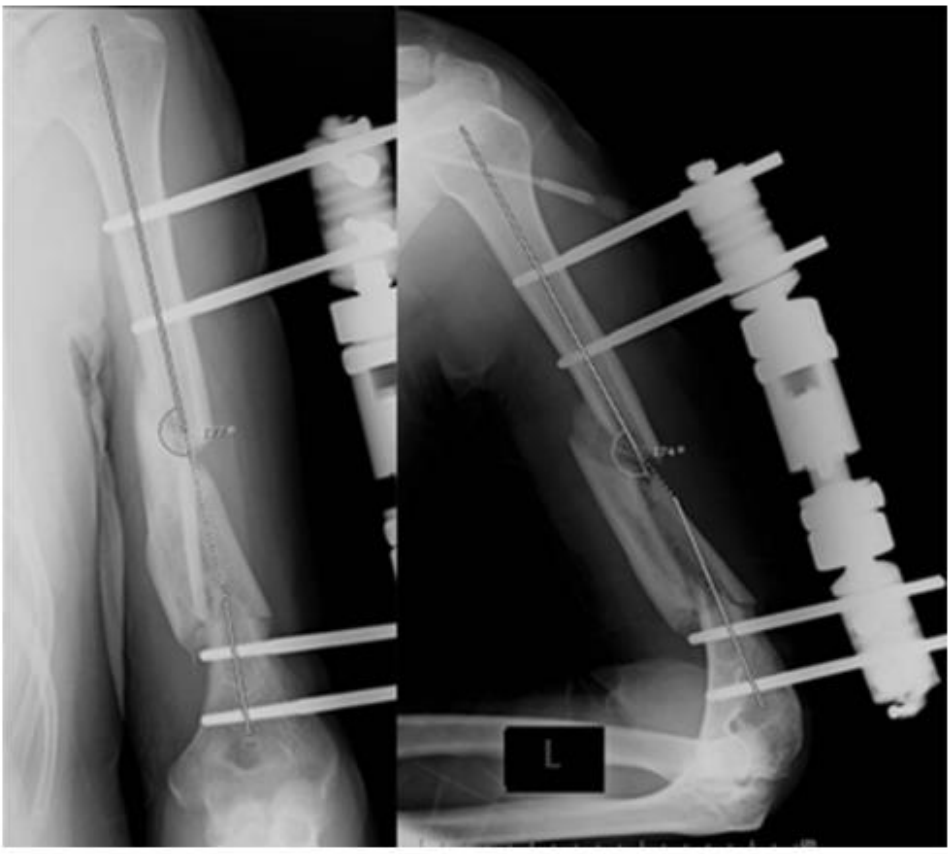


Figure 14: A complex fracture between the middle and distal third of the right humeral shaft.[54]

Four months after the event, the fracture had radiographically healed and had adequate alignment in the coronal (varus 3 degrees) and sagittal planes.

The exterior fixation (Ex-Fix) technique is only occasionally used. When soft tissues prevent internal fixation or polytraumatized patients need stability with minimum systemic insult, it is typically a temporary solution; nevertheless, it can also employed in cases of severe comminution in fractures, open fractures, or infective conditions. Bi-

cortical pins are placed with caution on the humerus along lateral aspect so as not to cause a neurovascular injury. The pins are connected to one another by rods. It is important to take extra precautions to obtain length and prevent improper rotation. It takes fourteen weeks to achieve bony union with an external-fixator.[3,8]

COMPLICATIONS OF SURGICAL MANAGEMENT

Nerve Palsy

Radial nerve palsy is the most frequent complication of humeral shaft fractures.[55] A primary palsy is brought on by the initial injury, whereas a secondary palsy might result from scar tissue or a fracture callus affecting the nerve while receiving conservative care. In cases of iatrogenic injury, closed care with or without fracture manipulation or surgical intervention may result in iatrogenic secondary palsies.[56]

The symptoms include paraesthesia of the hand's dorsum, weakness in the thumb abduction, finger and thumb extension at the metacarpophalyngeal joints and wrist dorsiflexion.[3] A more proximal lesion may be indicated by the lack of the brachioradialis or extensor carpi radialis longus muscles. According to reports, between 50 and 68 percent manifest as total palsies.[57–59] According to Chang and Ilyas, there are four different types of radial nerve palsies associated with humerus fractures: type 1

neuropraxia, type 2 imprisoned, type 3 partial transection, and type 4 complete transaction.[60]

Ulnar and median nerves can also be damaged, though rarely. These frequently happen in open fractures with severe soft tissue damage. In a case of closed humeral shaft fracture treated with intramedullary nailing, the ulnar nerve was discovered to be transected upon further inspection, according to Stahl et al. since there was no evidence of a neurological deficiency prior to surgery, it is unknown if this was a primary or subsequent damage.[61]

Injuries to the brachial plexus, whether partial or complete, can occur in 1.6-3% of cases. Therefore, a complete neurology examination is essential. A combined axillary and radial nerve palsy would indicate that the posterior fascicle of the brachial plexus has been injured.[3]

Delayed/Non-Union

It has always been thought that closed humeral fractures have a high rate of union. More than 90% of non-operative union rates have been recorded in various studies.[26,55,62–65] However, more recent studies indicate greater non-union rates of 13–23%,[8,66–68] and in 2020, a sizable multicentre study revealed that hospitals in north america had a rate of 29 percent.[69]

Long oblique and spiral fracture patterns, as well as proximal-third fractures and distal-third fractures, as well as advanced age, smoking,

alcoholism, and non steroidal anti-inflammatories, are all associated with non-union when treated conservatively. Psychiatric pathology (psychotic/bipolar disorder, dementia, or multiple involuntary psychiatric admissions) is also linked to non-union.[5]

Mal-Union

When it comes to abnormalities, the humerus is quite tolerant; anterior angulation of up to 20° or varus angulation of about 30° are typically acceptable. A study on rotation found that functional ratings for an average variation of 6° inward rotation and 9° outward rotation did not differ significantly from one another..[53]

Infection

It is assumed for all surgical procedures, but notably for fixing a plate. 2-4 percent of people are infected.[70,71] These were broken down by fixing techniques and Pidhorz et al. stated an estimate of 4% for plate fixation, 1.6 % for IM nail fixation, and 4% for ex-fix application.[3] On the other hand, with non-operative management, infection is rarely a concern(0%).[8]

Vascular Injury

Brachial artery rupture is the most common cause of the uncommon (0.5–3 percent) vascular injuries. These require immediate assistance by a vascular surgeon because temporary repair may be necessary to stabilise the broken fragment prior to repair of blood vessels.[3]

Shoulder Difficulties

Shoulder discomfort and a reduced range of motion are linked to anterior nailing.[72] 41 percent had limited shoulder function, and 56 percent reported pain at the fracture or shoulder location.[73] Injury to the rotator cuff, tendon damage, impingement (17%), and adhesive capsulitis can all compromise shoulder function.[50,72,74] Schwarz et al. discovered that 17.5 percent of cadaveric studies had an incidence of iatrogenic infraspinatus tendon injury.[49]

In their analysis of 40 antegrade humeral nails, Muccioli et al. discovered a 12.5% incidence of supraspinatus tendon lesions, of which 2 were ascribed to the high nail location.[5] But they were all asymptomatic. Given that the frequency in symptom less healthy adults was 16% in ultrasonography studies, supraspinatus tendon lesions are probably of minimal consequence. However, the long head of the biceps tendinopathy was symptomatic, and half of those symptoms were a result of a mistake in the positioning of the locking screws. [49]

Articles describing the role of locking compression plate in fracture shaft of humerus

1. The observational study carried out in Pondicherry, India, by Boben et al. after a sufficient preoperative examination, 30 patients with fractured humeral shafts who reported to the emergency room were treated with ORIF using LCP. At 3 and 6 months, patients underwent functional assessment using the ASES grading system, and at 6 weeks, 3 months, and 6 months, radiological union was evaluated. After surgery, there was a 96.7 percent union rate, according to the assessment of the results. Most of the patients who underwent ASES scoring reported having an outstanding outcome, with a mean score of 94.5 (out of a possible 100). They came to the conclusion saying locking compression plate as fantastic surgical substitute for treating people with humerus shaft fractures.[31]

2. Thirty patients with fracture shaft of humerus has been taken in the prospective analysis by Patel et al. in Gujarat, India, and were given plate osteosynthesis treatment (15 patients-LCP & 15 patients-LCDCP). At 6 weeks, 3 months and 6 months analysed clinically and radiologically. The shoulder and elbow functions were evaluated using UCLA grading method and MEPI system, respectively. There was no significant difference in mean UCLA score and mean MEPI sore among 2 groups (p

= 0.186 and 0.204, respectively). In terms of superficial infection, deep infection, radial nerve palsy, mean blood loss, and mean operation length, there was no discernible difference between the two groups ($p > 0.05$). In the LCP group, there were two cases of delayed union (>20 wks) and one case in the LCDCP group. They concluded that while LCP is more expensive than LCDCP, it provides more secure strut and angle stable fixation, making it more beneficial for osteoporotic bones. Overall performance in both groups is nearly equal. In terms of union, mobilisation, hospital stay, blood loss, and complications, there is no discernible difference between the two groups.[75]

3. The possibility of a single centre between October 2014 and January 2017, 63 patients with displaced humeral shaft fractures were enrolled in a random trial in Turkey by Akalin et al. To compare the radiological and clinical results of interlocking nail (ILN) and locking compression plate fixation (LCP) for humeral shaft fractures, they were divided randomly into two groups as LCP fixation (group 1) and interlocking nail (ILN) (group 2). DASH, ASES, and UCLA scores as well as SF-36 questionnaires and VAS findings were discovered to have no significant difference between the two groups after fracture callus was radiologically identified. The UCLA score was considerably higher in group-1 at the most recent follow-up. They came to the conclusion that whereas the ILN

group had much less pain and identical complication rates, the LCP group had significantly greater shoulder function than the ILN group. Both techniques are thus advantageous surgical choices for people who have humeral shaft fractures.[76]

4. In their retrospective analysis, Singh et al. in Uttar Pradesh, India, included 212 patients who underwent plate osteosynthesis treatment for displaced humeral shaft fractures between January 2005 and December 2009. 110 patients in group B had LCP osteosynthesis treatment, while 102 patients in group-A received LCDCP osteosynthesis. For the first six months, clinical and radiological evaluations were performed monthly, and for the following six months, they were performed every two months. The shoulder and elbow functions were evaluated using UCLA grading and MEPI grading, respectively. To evaluate the functional effects of the fracture fixation, Rodriguez- Merchan criteria were applied. When comparing the functional outcomes of the 2 classes, Rodriguez-Merchan criteria revealed no significant altration ($p = 0.48$). There was no significant difference in mean UCLA score and mean MEPI sore among 2 groups ($p = 0.34$ and 0.54, respectively). This study came to the conclusion that in fractures of the humeral shaft, the principle of fracture fixation was more significant than plate selection.[18]

5. 44 patients with fractures of the humeral shaft underwent open reduction and internal fixation with either an intramedullary nail (IMN) or plating in the prospective randomized trial McCormack et al. conducted in Canada. Patients were monitored for at least six months. According to the American Shoulder and Elbow Surgeons' score, the visual analogue pain score, range of motion, and the time needed to return to normal activities, there were no appreciable variations in the function of the shoulder and elbow. Compared to 13, just three participants in the IMN group experienced problems in the plating group. They recommended that the optimal course of treatment for unstable fractures of the humeral shaft still be open reduction and internal fixation with a plate. Fixation by IMN may be recommended in certain circumstances, although it is more technically difficult and subject to greater difficulties.[77]

6. 24 patients with non-union of humeral shaft fractures after unsuccessful internal fixation were included in the prospective study carried out by Kumar et al. in Bangalore, India. The lowest follow-up period was 2 years, and the mean follow-up period was 3.4 years (range: 2.4 to 5.7 years). The patients' average age was 41.04 years (range: 24 to 57 years). Using LCP and autologous bone grafting, osteosynthesis was performed on all 24 patients. The radiographic evaluation of fracture union and pre- and postoperative functional assessment using the modified Constant and

Murley score system were the main outcome assessments. 16 weeks on average were needed to unionise (range: 10 to 28 weeks). Delay in union (n = 2), temporary radial nerve palsy (n = 2), and chronic non-union (n = 1) were complications. Constant and Murley's functional evaluation score revealed outstanding outcomes in 11, good outcomes in 10, fair outcomes in 2, and poor outcomes in 1 patient. They came to the conclusion that locking compression plating and cancellous bone grafting are a reliable option for achieving union in humeral diaphyseal non-union with failed prior internal fixation. Patients who have higher physiological demands also benefit from this treatment because it produces a good functional outcome.[78]

7. In a side-by-side comparison research, 60 patients with fractured humeral shafts who had surgery were examined for their functional and radiological outcomes as well as any complications. The study was done in India by Angad Jolly et al. For 30 of these patients, ORIF with Locking Compression Plates was used, and for the remaining 30 patients, CRIF with IMIL nails was used. When the demographic traits of the two groups were examined at baseline, they were comparable. The operative time, operative loss of blood, and stay in the hospital following surgery all were significantly different in favour of the IMIL nail group, according to follow-up results. Except for a statistically significant increase in the

incidence of shoulder-related problems and an increased likelihood of implant failure in the IMIL nail group, the functional outcome in both groups was comparable. The radiological results did not significantly differ across the groups. Despite a higher volume of intra-operative blood loss and longer surgery time, we came to the conclusion that ORIF with locking compression plates is a better surgical option for treating humerus shaft fractures than CRIF with IMIL nails due to a better functional outcome and lower risk of implant failure.[79]

8. 21 patients with 21 acute complex humeral shaft fractures (AO type C) were included in the observational study by Jiang et al. in Shanghai, China. All were minimally invasively treated with locking compression plates. The Constant and HSS scoring systems were used to evaluate how well the shoulder joint was functioning again. A median of 28.7 months (with a range of 19–37) were spent monitoring the patients. Nineteen fractures (90.4%) were successfully treated with one operation and healed solidly in 14.3 weeks on average. At the last check-up, 20 patients (95.2 percent) had appropriate alignment, and the mean HSS score for all patients was 91.7 points. All patients also had good to exceptional elbow function. With a mean constant score of 83.1 points, 18 patients (85.7%) had good shoulder function. The use of a locking compression plate and minimally invasive plate osteosynthesis, which had a high rate of union

and lower risk of complications, was found to be a safe alternative to traditional surgical procedures in the treatment of complex humeral shaft fractures.[80]

9. In the current analysis, 60 consecutive patients from a comparative study by Prakash Pal et al. in Uttar Pradesh, India, who underwent surgery for acute shaft humerus fractures between 2009 and 2011 using either locking compression plating or stack nailing, and who had a less duration of following period of 12months, were included. Of the sixty patients, five had non-union (1 in plating and 4 in stack nailing). The study's findings led researchers to the conclusion that locking compression plating is the choose treatment for most humerus fractures because it better preserves joint function, reduces the need for secondary bone grafting for union, and does so with less adverse effects on the patient.[81]

10. 30 patients with humeral shaft fractures were investigated for the prospective study by Rupesh Kumar et al. in Nainital, India. The subjects were treated with internal fixation with antegrade interlocking nail fixation and plating. Results were assessed using the accepted technique and subjects were followed up for about of 16 to 19 months. They looked at internal fixation, nailing, and plating as options. All fractures healed without incident and with the typical complications. However, they require two nailing reoperations and one bone graft plating case. They

concluded that internal fixation plays a significant role in producing superior outcomes, such as reduced deformity, early mobilisation, and strong union. Nailing was a good alternative to plating because it was less invasive, caused less infection and nerve damage, and reduced the likelihood of implant failure. However, plating was superior choice for fixation in terms of shorter coalition times, greater joint mobility and fewer reoperations.[22]

11. Radhakrishna et al carried out the prospective study for functional outcomes of Locking Compression Plate for surgical management of shaft of humerus fractures, which involved thirty patients in Bangalore, found that the moderate time until fracture consolidation was 19w (range: 18-24w). Delay in union and temporary radial nerve palsy were complications. At last checkout, every patient had a Constant and Murley Score between 71 and 85, suggesting a successful outcome. In the study, mild pain affected 83.33 percent of cases (n=25), whereas moderate pain affected 16.66 percent of cases (n=5) at the follow-up.[82]

MATERIAL & METHODS

MATERIALS AND METHODS

STUDY DESIGN:

Patients with humerus shaft fractures participated in the prospective observational study.

STUDY AREA:

Patients who diagnosed with a fractured humerus shaft by orthopaedics department of the R.L Jalappa hospital, which is affiliated with the Sri Devaraj Urs Academy of Higher Education and Research Tamaka, Kolar, the subjects of the study.

STUDY PERIOD AND DURATION:

Period between December 2020 and July 2022 (1 year 8 months)

STUDY POPULATION:

All patients who were admitted to the R.L Jalappa hospital between December 2020 and July 2022 and who were given the diagnosis of humerus shaft fracture in the emergency room and orthopaedics department.

SAMPLE SIZE CALCULATION

Following treatment for humeral diaphyseal fractures, Patel M et al revealed that 93.3 percent of the participants who had Locking compression plate had excellent or good marks on the functional assessment.[83]

Assuming alpha error of 5% (95% confidence limit) and an absolute precision (d) of 10%,

The minimum required sample size was estimated to be 20.

The sample size was derived from the following formula:

Sample size (n) = $(\boldsymbol{P}*\boldsymbol{Q})/\boldsymbol{d}^{2}$ where

Z is the critical value for 95% Confidence Interval

D is the absolute precision

P is the expected proportion and q=1-p

The sample size was calculated using OpenEpi software version 3.01 (Open-Source Epidemiologic Statistics for Public Health).

The final sample size was enlarged to include 25 patients who fulfil the inclusion and exclusion criteria and who receive locking compression plate for the management of diaphyseal humerus fractures after it was discovered that lost-to-follow up in our context was 20%.

INCLUSION CRITERIA:

- Patients more than 18 years of age
- Closed humerus shaft fractures
- Open type-1 humerus shaft fractures (Gustilo-Anderson classification)

EXCLUSION CRITERIA:

- Humerus shaft fractures associated with neurovascular injury
- Pathological fractures
- Associated ipsilateral upper limb long bone(radius/ulna) fractures

SAMPLING METHOD:

All patients who were diagnosed with a fractured humerus shaft between December 2020 and July 2022 and were admitted to the emergency room and the orthopaedics department of the R.L Jalappa hospital, which is affiliated with the Sri Devaraj Urs Academy of Higher Education and Research Tamaka, Kolar (universal sampling).

INTERVENTION

Once the patient's overall state was stable, the surgery was carried out. Place the patient in a lateral decubitus position. An incision from the tourniquet to the tip of the olecranon in line with the humerus will be given. Dissection will be carried down to the triceps fascia, incise the fascia, and carry the dissection laterally to the intermuscular septum. Identify the lower lateral brachial cutaneous nerve and follow it proximally where it meets the radial nerve as it pierces the septum. This usually is at the level of the tourniquet. Release the tourniquet and identify the radial nerve. Dissect the triceps muscle proximally off the intermuscular septum and free the radial nerve proximally, distally, anteriorly, and posteriorly, including incision of the lateral intermuscular septum for 3 cm to allow mobilization of the nerve. Incise the triceps off the periosteum to expose the humerus; Place a single bone clamp in the proximal and distal fragments, far away from the fracture, to control the fragments and reflect the triceps. After debridement of the fracture site, insert a lag screw for provisional fixation. Perform large-fragment plating in neutralization, compression, or bridge-plating mode. Confirm alignment of the humerus and reduction of the fragments with fluoroscopy. Perform routine skin closure.

DATA COLLECTION PROCEDURE

According to AO classification, the fracture was categorised. Until the moment of surgery, a "U"-shaped coaptation splint kept the injured limb immobile. Patients who met the criteria for surgical fitness and had test results that were within the normal range under an appropriate anaesthetic had ORIF+ LCP for humerus shaft fracture. For 4-6 hours following surgery, the patient was kept off food and liquids. After 3 days of continuing intravenous antibiotic administration, antibiotics were given orally for 5 days following. Pain medications were administered based on the subject's needs. An arm sling or sling and swathe is used to support the arm. Active finger flexion and extension were encouraged keeping the limb elevated. The limb's neurovascular condition, discomfort, and degree of edema were monitored. An after-surgery radiograph was taken. The first dressing change was made 48 hours after the operation. Suture removal was performed on 14^{th} day following surgery under stringent asepsis if the suture line was uncontaminated. Whenever the patient feels comfortable enough, gentle hand and elbow motions can typically be started. Arm should not be used forcefully, though shoulder and elbow ranges of motion should be gently helped from an early age. Bearing weight and strenuous using could be gradually started once the callus is noticeable. Patients underwent routine reviews every 6 weeks, 3 months

and 6 months. Each follow-up included a clinical evaluation of them. Every time a patient visited, a follow-up radiograph was done and patient was evaluated on clinical and radiological basis for fracture union, optimum function, and comorbidities. At the time of follow-up, the patient's DASH and VAS scores were evaluated.

STUDY TOOLS

1. Visual Analog Scale as mentioned in Annexure
2. DASH scoring system as mentioned in Annexure

STUDY VARIABLES

- Age
- Gender
- Place of residence
- Mode of Injury
- Mechanism of Injury
- History of injury in same arm
- Blood pressure
- Temperature
- Side of injury
- Swelling at site of injury
- Shortening of arm

- Presence of crepitus
- Neurological and vascular status
- Co-morbidities
- Complications
- VAS score at 6^{th} week, $3^{rd,}$ and 6^{th} month
- DASH score at 6^{th} week, $3^{rd,}$ and 6^{th} month

ETHICAL CONSIDERATION

The Institutional Ethics Committee granted its approval in terms of ethics. Following a thorough preoperative evaluation and only after obtaining informed, written agreement, surgery was performed. The researchers made sure that the participants' privacy and secrecy were maintained throughout the study by only using the collected data for the intended purposes of the analysis.

DATA ANALYSIS

- The gathered data were imported into Microsoft Excel and then examined by IBM. software for statistics SPSS 23.0.
- Frequency analysis and percentage analysis were employed to characterise the data using descriptive statistics for discrete variables. For continuous variables, mean, median, and standard deviation were employed.

- Discrete variables in the two groups were examined for statistically significant differences using the Chi Square test or Fisher's exact test to characterise the data in inferential statistics. Using the Independent T test, continuous variables in the two groups were examined for statistically significant difference.

    - The probability value of 0.05 was regarded as the significant level in all the statistical techniques.

RESULTS

RESULTS

Table 1: Age wise distribution (n = 25)

		Age in years
Mean		33.32
Median		38.00
Mode		38
Std. Deviation		8.934
Minimum		20
Maximum		45
Percentiles	25	24.00
	50	38.00
	75	40.50

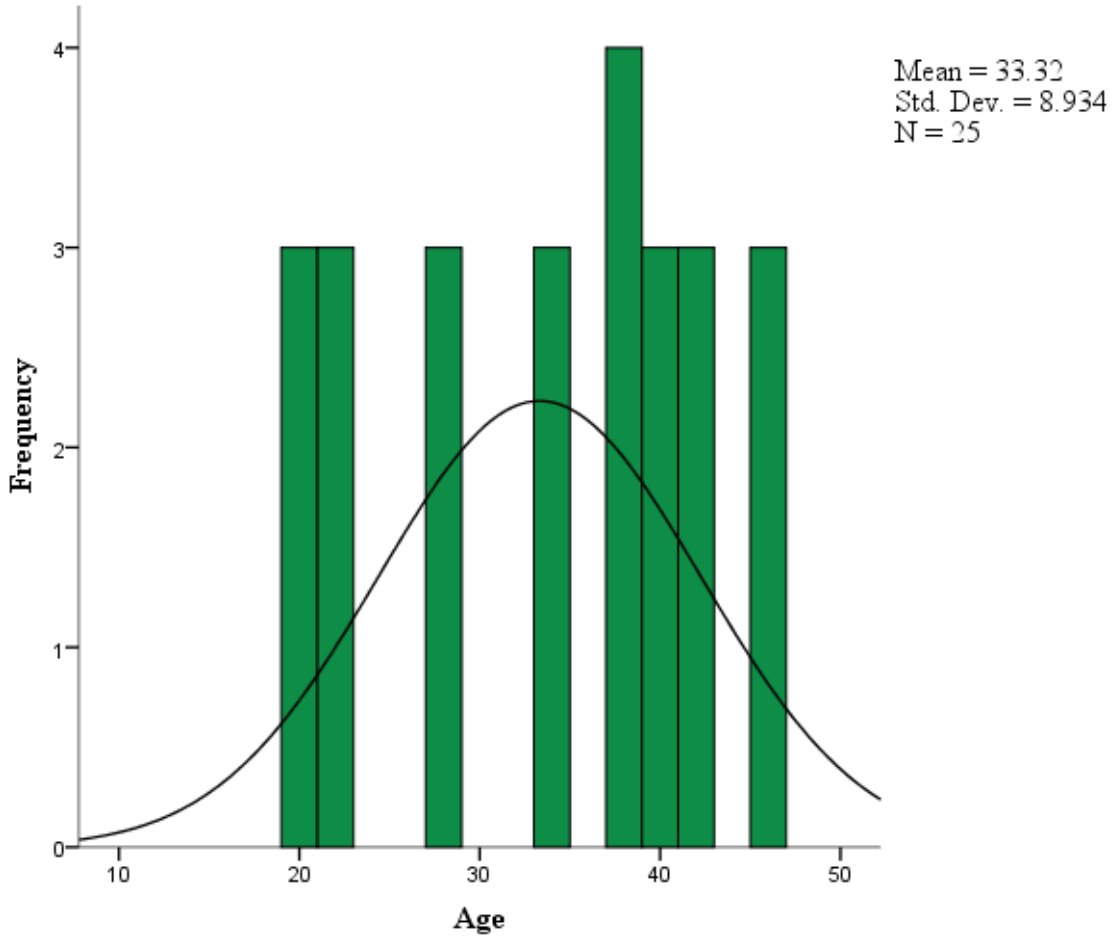


Figure: 15 Age distribution of the study participants (n = 25)

Comment: The mean age of the study participants was 33 years with the standard deviation of 9 years.

Table 2: Gender wise distribution (n = 25)

Gender	Frequency	Percent
Female	10	40.0
Male	15	60.0
Total	25	100.0

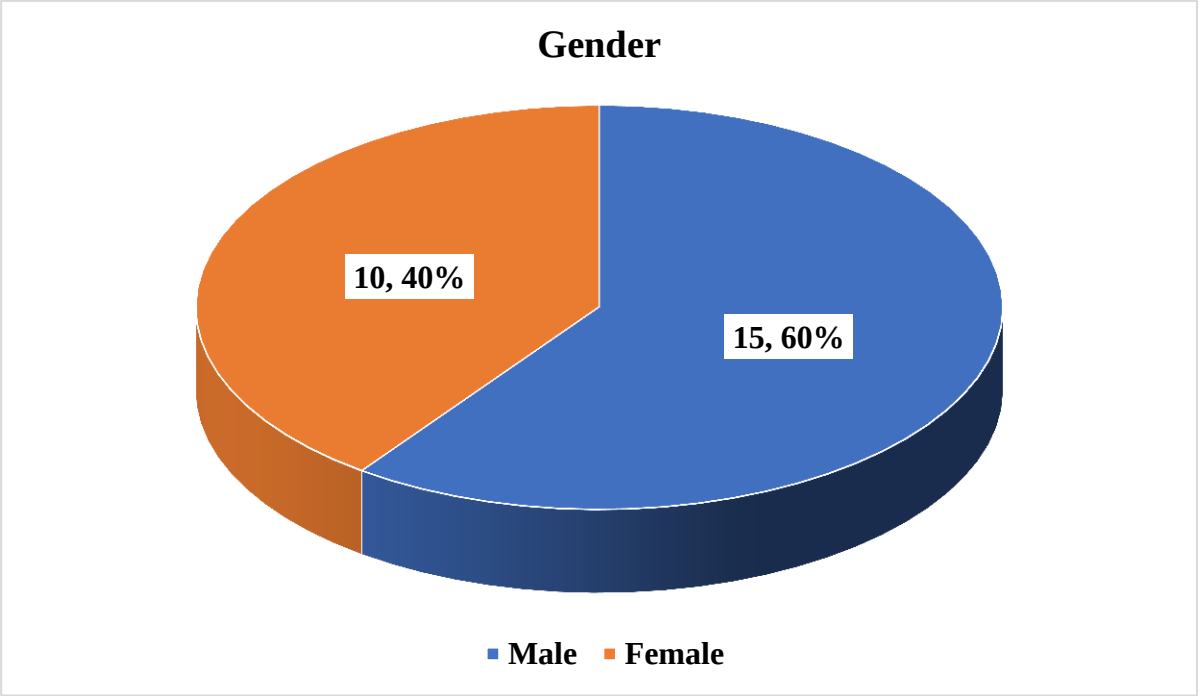


Figure 16: Gender distribution of the study participants (n = 25)

Comment: Among the study participants about 60 percent of the individuals were males.

Table 3: Place wise distribution of the study participants (n = 25)

Place	Frequency	Percent
Rural	13	52.0
Urban	12	48.0
Total	25	100.0

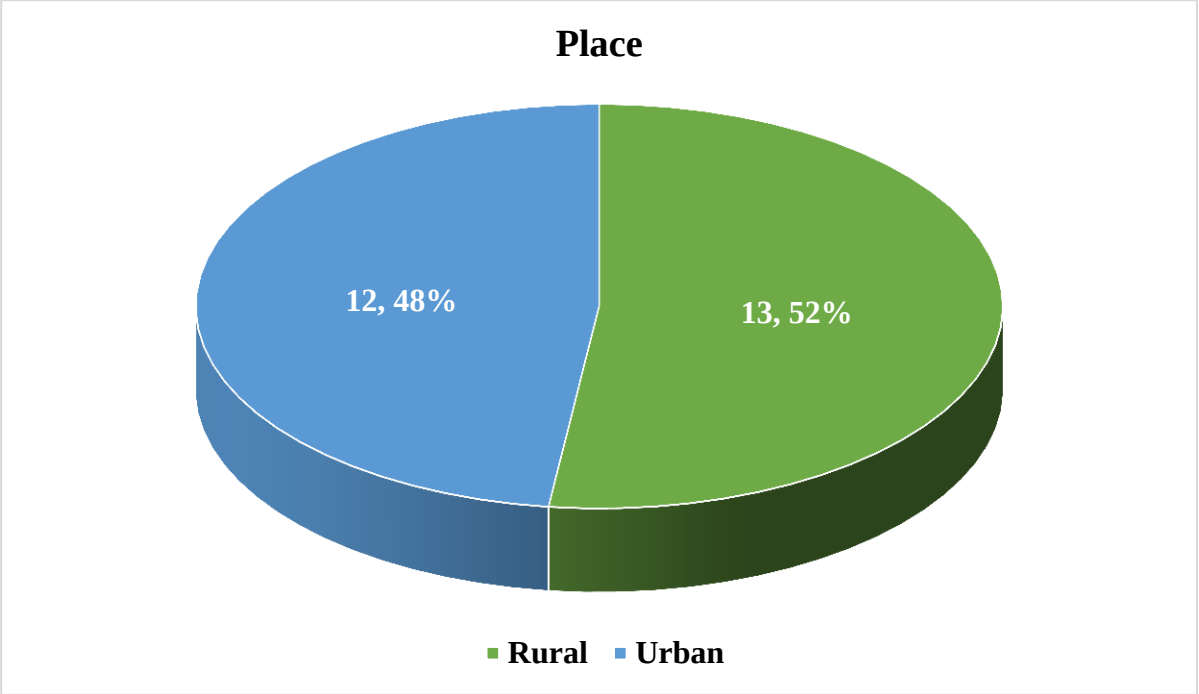


Figure 17: Place distribution of the study participants (n = 25)

Comment: Among the study participants about 52 percent of the individuals were hail from rural area.

Table 4: Distribution of the study participants according to the mode of injury

Mode of injury	Frequency	Percent
Assault	3	12.0
Fall from height	6	24.0
Motor cycle accident	10	40.0
Motor vehicle accident	6	24.0
Total	25	100.0

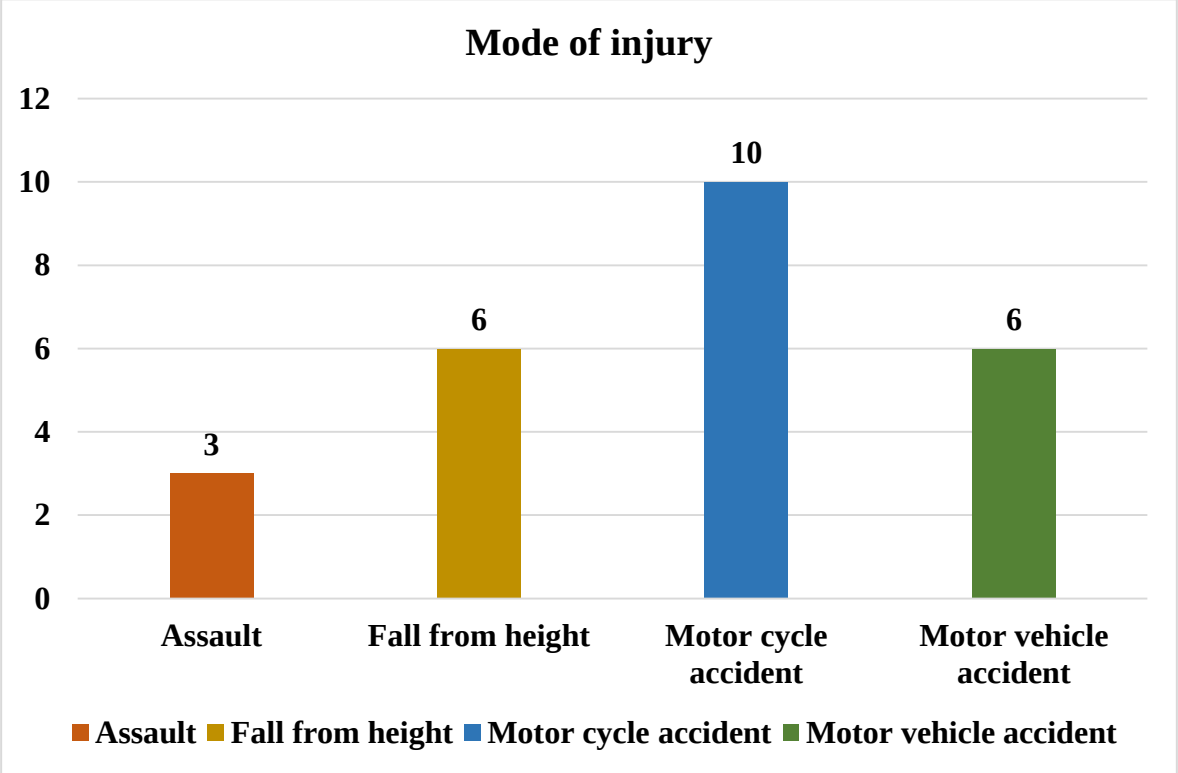


Figure 18: Distribution of the study participants according to the mode of injury

Comment: Among the study participants about 40 percent of the individuals had injury due to motor cycle accident.

Table 5: Distribution of the study participants according to the mechanism of injury (n = 25)

Mechanism of injury	Frequency	Percent
Direct	22	88.0
Indirect	3	12.0
Total	25	100.0

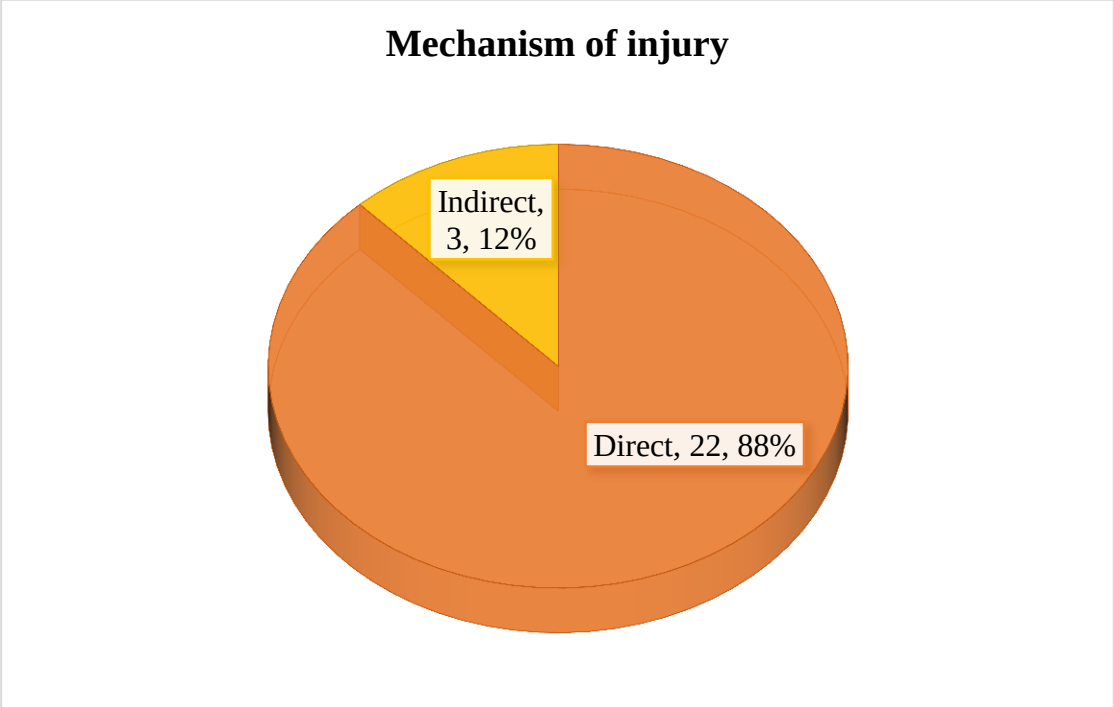


Figure 19 Distribution of the study participants according to the mechanism of injury (n = 25)

Comment: Among the study participants about 88 percent of the individuals had direct injury.

Table 6: Distribution of the study participants according to the Past history of injury in same arm (n = 25)

Past history of injury in same arm	Frequency	Percent
No	23	92.0
Yes	2	8.0
Total	25	100.0

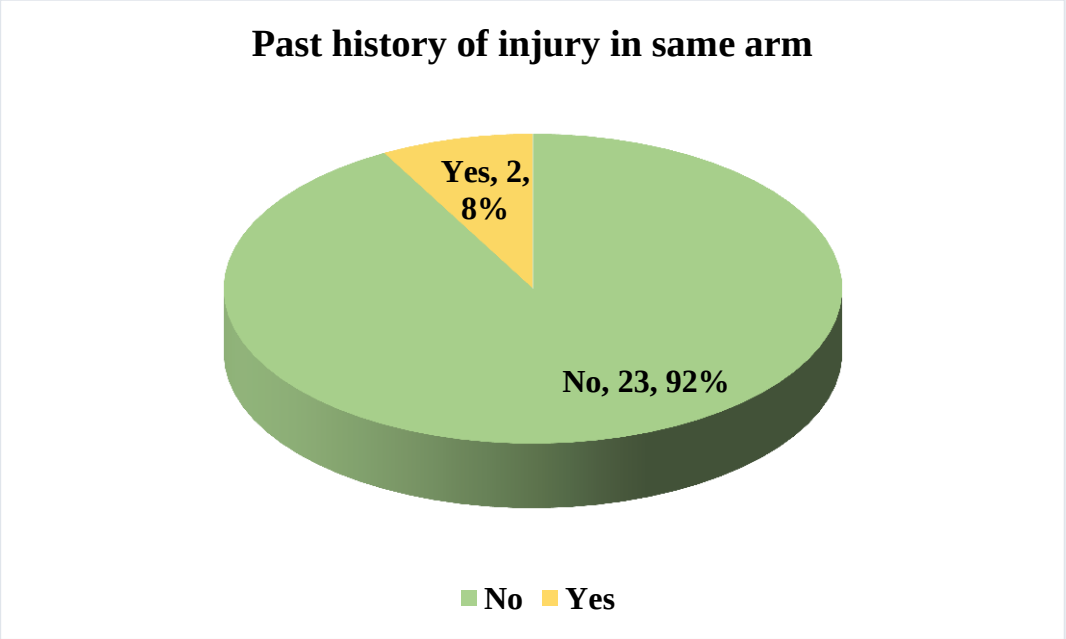


Figure 20: Distribution of the study participants according to the Past history of injury in same arm (n = 25)

Comment: Among the study participants about 8 percent of the individuals had similar past history in the same arm.

Table 7: Distribution of the study participants according to the side of involvement (n = 25)

Side of involvement	Frequency	Percent
Left	6	24.0
Right	19	76.0
Total	25	100.0

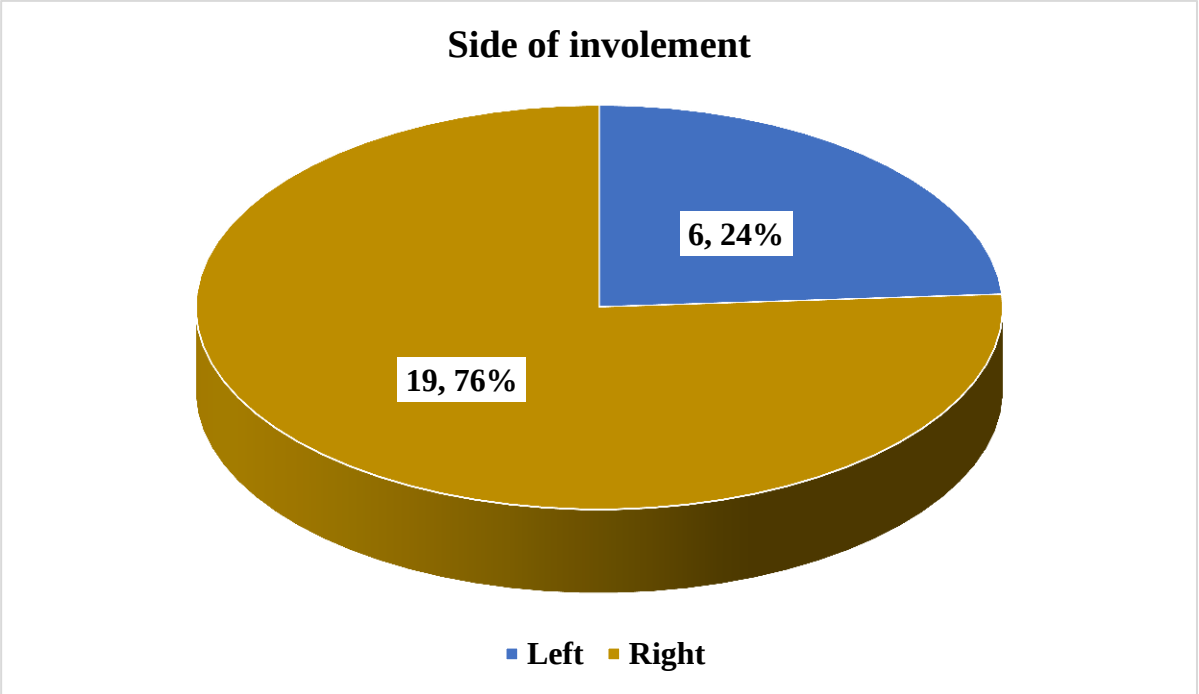


Figure 21: Distribution of the study participants according to the side of involvement (n = 25)

Comment: Among the study participants about 76 percent of the individuals had right side of the body involvement.

Table 8: Distribution of the study participants according to the presence of swelling (n = 25)

Swelling	Frequency	Percent
No	8	32.0
Yes	17	68.0
Total	25	100.0

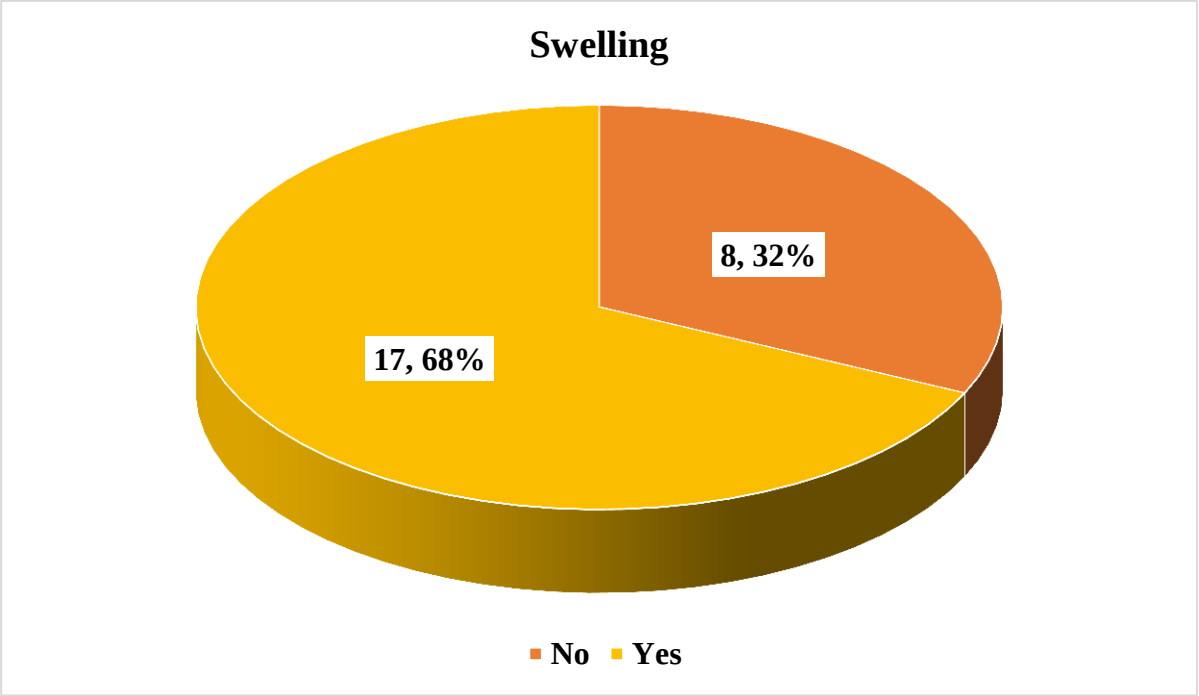


Figure 22: Distribution of the study participants according to the presence of swelling (n = 25)

Comment: Among the study participants about 68 percent of the individuals had swelling in the injury region.

Table 9: Distribution of the study participants according to the presence of shortening (n = 25)

Shortening	Frequency	Percent
No	6	24.0
Yes	19	76.0
Total	25	100.0

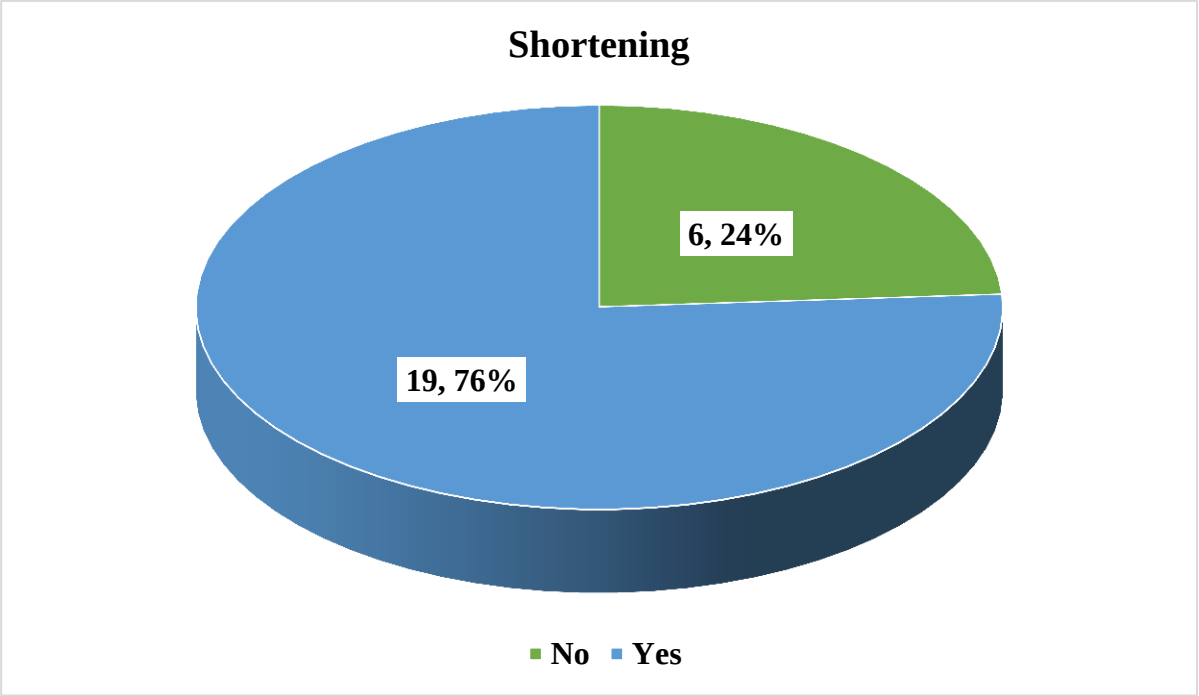


Figure 23: Distribution of the study participants according to the presence of shortening (n = 25)

Comment: Among the study participants about 76 percent of the individuals had shortening in the injury region.

Table 10: Distribution of the study participants according to the presence of crepitus (n = 25)

Crepitus	Frequency	Percent
No	6	24.0
Yes	19	76.0
Total	25	100.0

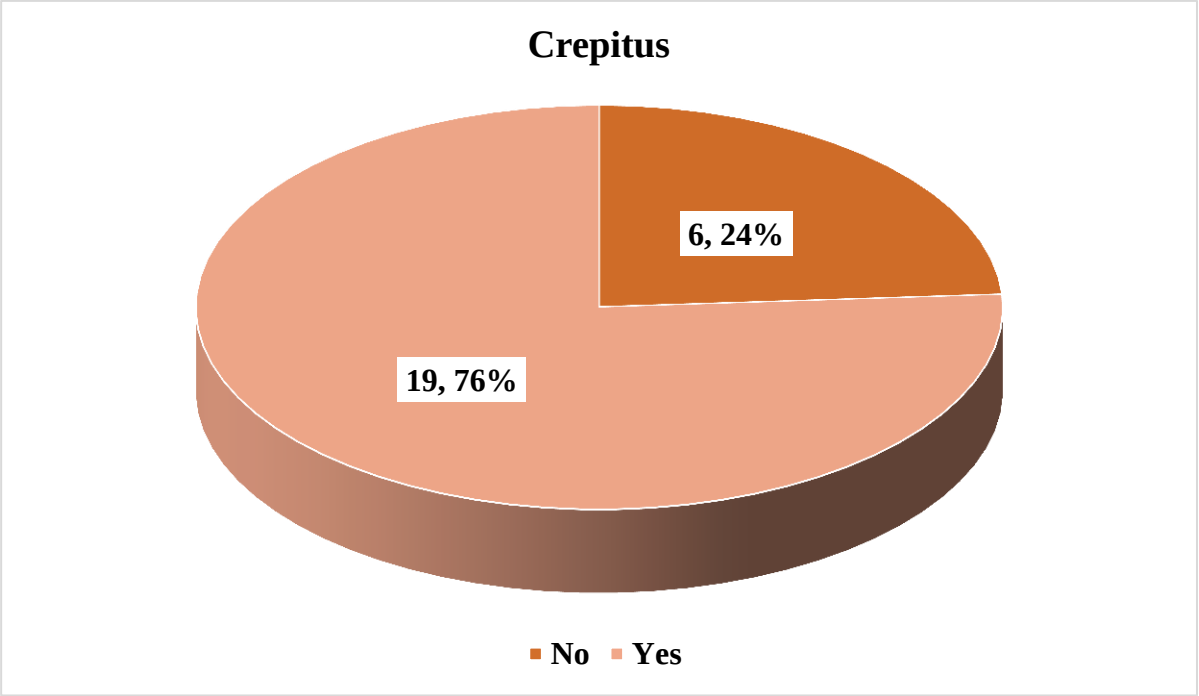


Figure 24: Distribution of the study participants according to the presence of crepitus (n = 25)

Comment: Among the study participants about 76 percent of the individuals had crepitus in the injury region.

Table 11: Distribution of the study participants according to their hypertension status (n = 25)

Hypertension	Frequency	Percent
No	17	68.0
Yes	8	32.0
Total	25	100.0

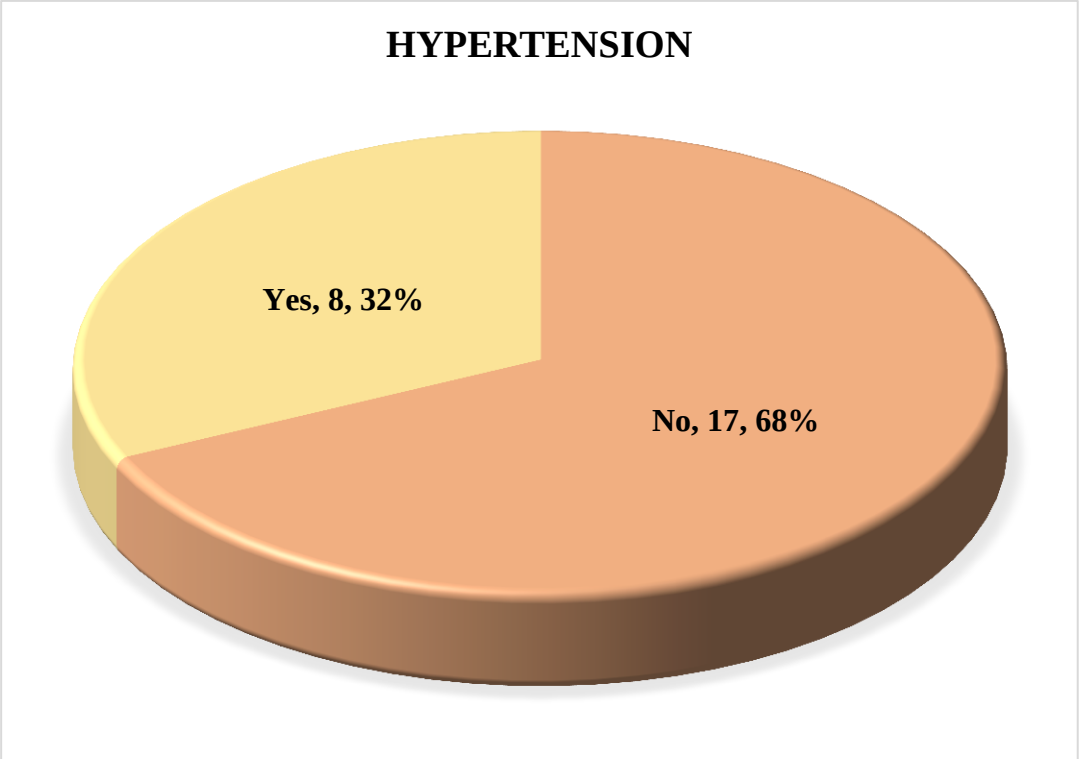


Figure 25: Distribution of the study participants according to their hypertension status (n = 25)

Comment: Among the study participants about 32 percent of the individuals had co-morbidity of hypertension.

Table 12: Distribution of the study participants according to their diabetes status (n = 25)

Diabetes	Frequency	Percent
No	18	72.0
Yes	7	28.0
Total	25	100.0

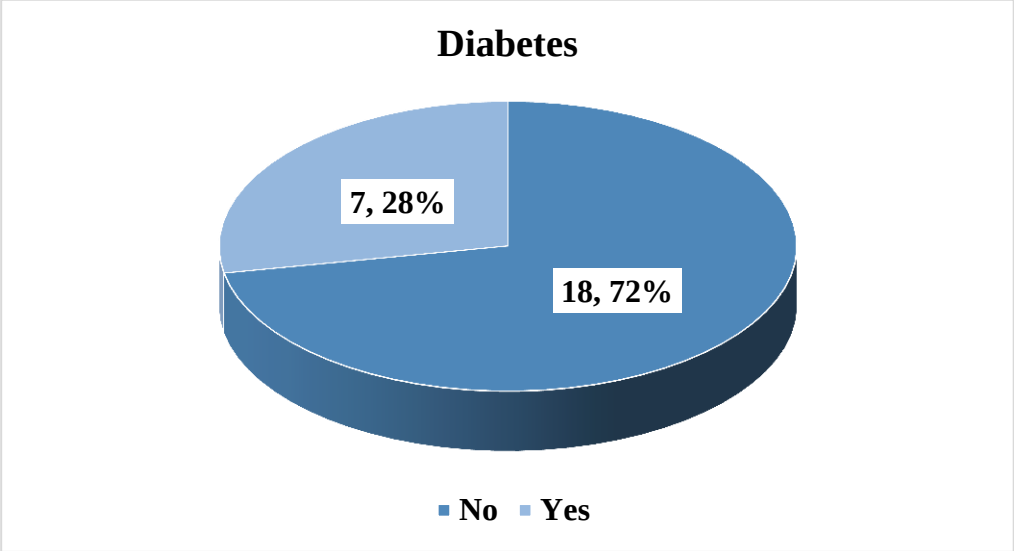


Figure 26: Distribution of the study participants according to their diabetes status (n = 25)

Comment: Among the study participants about 28 percent of the individuals had co-morbidity of diabetes.

Table 13: Distribution of the study participants according to their need for blood transfusion (n = 25)

Blood transfusion	Frequency	Percent
No	19	76.0
Yes	6	24.0
Total	25	100.0

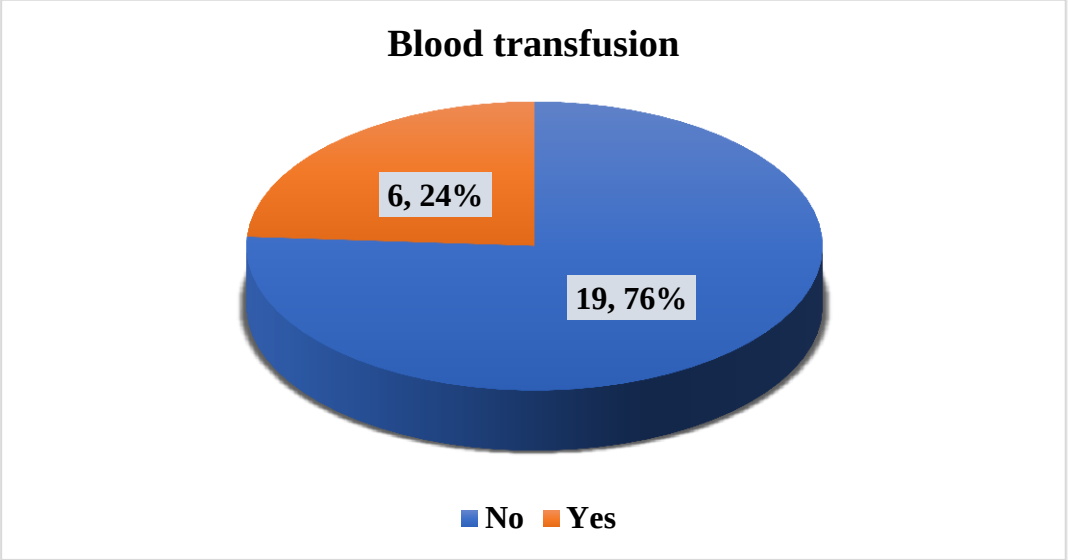


Figure 27: Distribution of the study participants according to their need for blood transfusion (n = 25)

Comment: Among the study participants about 24 percent of the individuals were administered with blood transfusion.

Table 14: Distribution of the study participants according to their blood pressure status (n = 25)

		Systolic BP	Diastolic BP
Mean		129.60	84.00
Median		130.00	80.00
Mode		120	80
Std. Deviation		11.358	5.000
Minimum		120	80
Maximum		150	90
Percentiles	25	120.00	80.00
	50	130.00	80.00
	75	140.00	90.00

Comment: the mean systolic BP and diastolic BP of the study participants was 129 mm Hg and 84 mm Hg respectively.

Table 15: Distribution of the study participants according to their diagnosis (n = 25)

Diagnosis	Frequency	Percent
Closed fracture	16	64.0
Type 1 open fracture	9	36.0
Total	25	100.0

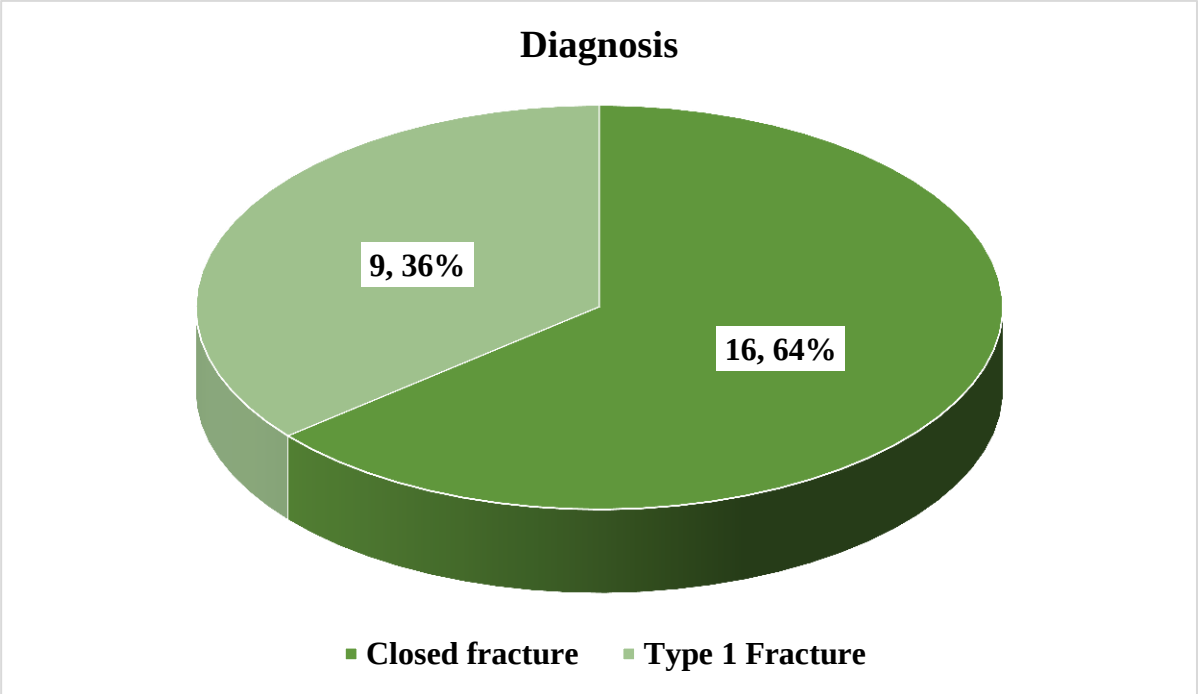


Figure 28: Distribution of the study participants according to their diagnosis (n = 25)

Comment: Among the study participants about 64 percent of the individuals were diagnosed as closed fracture and remaining were diagnosed as type 1 open fracture.

Table 16: Distribution of the study participants according to the disease complication (n = 25)

Complication	Frequency	Percent
No	22	88.0
Yes	3	12.0
Total	25	100.0

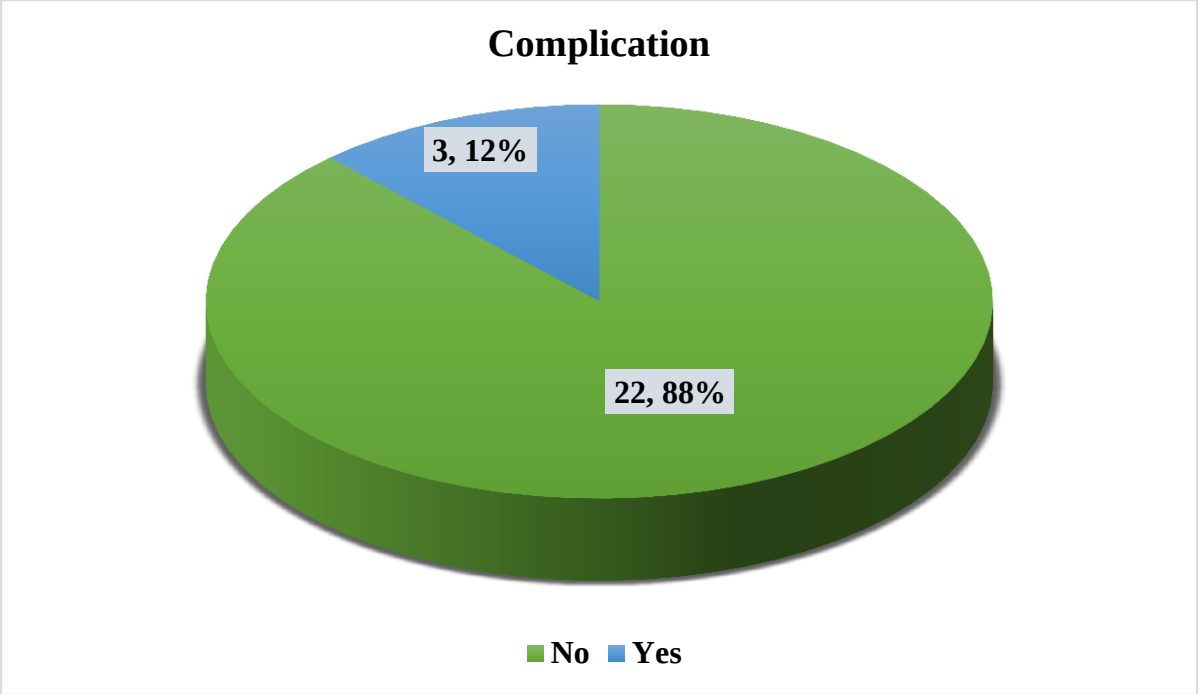


Figure 29: Distribution of the study participants according to the disease complication (n = 25)

Comment: Among the study participants about 12 percent of the individuals had disease complication.

Table 17: Distribution of study participants according to their VAS scale scores at various intervals (n = 25)

		VAS score at 6 weeks	VAS score at 3 months	VAS score at 6 months
Mean		7.08	4.16	2.52
Median		7.00	4.00	2.00
Mode		6[a]	4	2
Std. Deviation		1.288	.850	.963
Minimum		5	3	1
Maximum		9	6	4
Percentiles	25	6.00	3.50	2.00
	50	7.00	4.00	2.00
	75	8.00	5.00	3.00

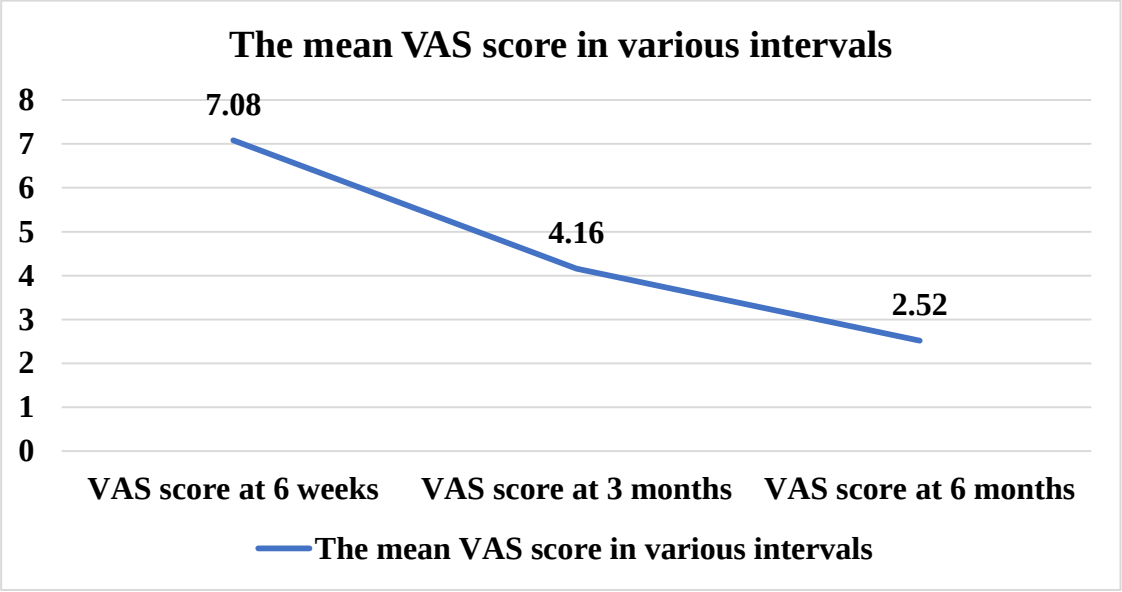


Figure 30: Line diagram showing VAS scale scores at various intervals among the study participants (n = 25)

Comment: There is a huge reduction in the felt pain among the study participants between the duration from 6 weeks to 6 months.

Table 18: Distribution of study participants according to their DASH scores at various intervals (n = 25)

		DASH score at 6 weeks	DASH score at 3 months	DASH score at 6 months
Mean		55.24	31.20	11.88
Median		58.00	33.00	9.00
Mode		58	33	9
Std. Deviation		10.721	9.097	4.781
Minimum		40	19	7
Maximum		72	44	20
Percentiles	25	45.50	22.00	8.50
	50	58.00	33.00	9.00
	75	63.50	40.00	16.50

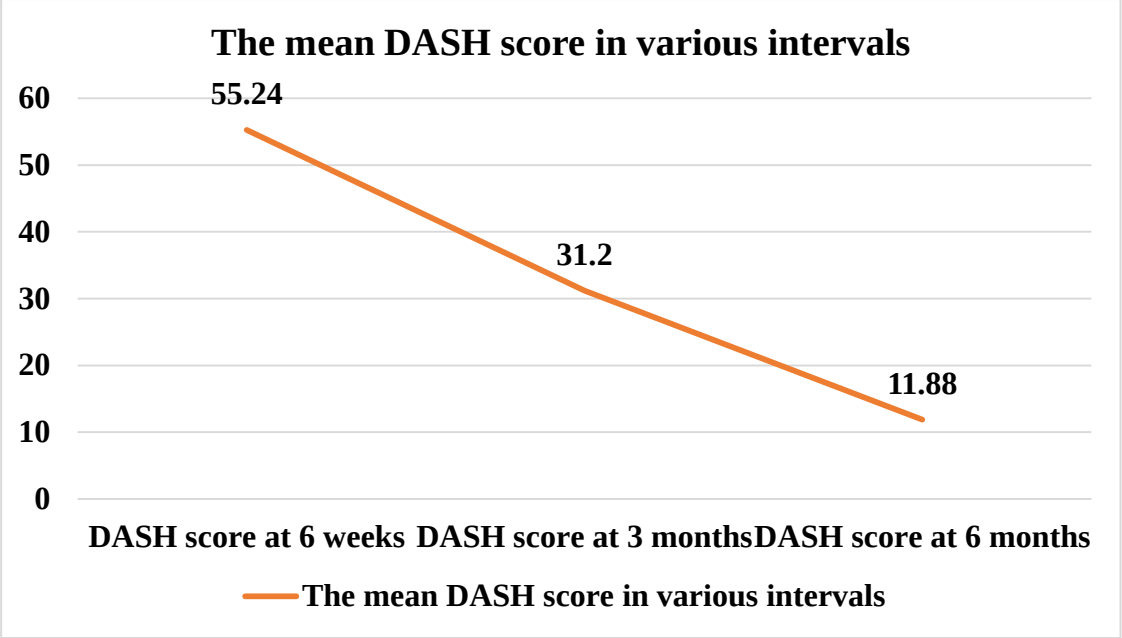


Figure 31 Line diagram showing DASH scale scores at various intervals among the study participants (n = 25)

Comment: There is a huge reduction in DASH scores among the study participants between the duration from 6 weeks to 6 months.

Table 19: Association between gender and scores of VAS scale and DASH scale (n = 25)

	Gender	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	Female	4.40	1.350	- 0.267	0.595
	Male	4.67	1.113		
DASH score difference between score at 6th week and score at 6th month	Female	40.00	5.831	- 5.600	0.042
	Male	45.60	7.039		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among male and female gender is 4.67 and 4.40 individually. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among male and female gender is 45.60 and 40.00 individually. The difference between these means is statistically significant (p = 0.042) according to independent T-test.

Inference: Among the study participants who were males, shows good improvement according to DASH score.

Table 20: Association between residing place and scores of VAS scale and DASH scale (n = 25)

	Place	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	Rural	4.38	1.387	- 0.365	0.456
	Urban	4.75	0.965		
DASH score difference between score at 6th week and score at 6th month	Rural	41.85	6.149	- 3.154	0.272
	Urban	45.00	7.816		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants hail from rural and urban is 4.38 and 4.75 respectively. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants hail from rural and urban is 41.85 and 45.00 respectively. The difference between these means is not statistically significant according to independent T-test.

Table 21: Association between mechanism of injury and scores of VAS scale and DASH scale (n = 25)

	Mechanism of injury	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	Direct	4.45	1.224	- 0.879	0.239
	Indirect	5.33	0.577		
DASH score difference between score at 6th week and score at 6th month	Direct	42.05	6.440	- 10.955	0.008
	Indirect	53.00	0.000		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to direct and indirect of mechanism of injury is 4.45 and 5.33 respectively. The difference between these means is not statistically significant according

to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to direct and indirect of mechanism of injury is 42.05 and 53 respectively. The difference between these means is statistically significant ($p = 0.008$) according to independent T-test.

Inference: Among the study participants with indirect injury shows good improvement according to DASH score.

Table 22: Association between history of similar illness and scores of VAS scale and DASH scale (n = 25)

	Past history of similar illness	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.52	1.201	- 0.478	0.597
	Yes	5.00	1.414		
DASH score difference between score at 6th week and score at 6th month	No	44.26	6.587	11.261	0.026
	Yes	33.00	.000		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of history of similar illness is 4.52 and 5.00 respectively. The difference between these means is not statistically significant

according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of past history of similar illness is 44.26 and 33.00 respectively. The difference between these means is statistically significant (p = 0.026) according to independent T-test.

Inference: Among the study participants who have no similar history has shown good improvement according to DASH score.

Table 23: Association between co-morbidity of hypertension and scores of VAS scale and DASH scale (n = 25)

	Hypertension	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.18	1.074	- 1.199	0.016
	Yes	5.38	1.061		
DASH score difference between score at 6th week and score at 6th month	No	44.24	6.987	2.735	0.376
	Yes	41.50	7.231		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of hypertension is 4.18 and 5.38 respectively. The difference between these means is statistically significant (P = 0.016) according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of hypertension is 44.24 and 41.50 respectively. The difference between these means is not statistically significant according to independent T-test.

Table 24: Association between side of involvement and scores of VAS scale and DASH scale (n = 25)

	Side involved	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	Left	3.83	1.169	- 0.956	0.087
	Right	4.79	1.134		
DASH score difference between score at 6th week and score at 6th month	Left	36.00	3.286	- 9.684	0.002
	Right	45.68	6.263		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to side of involvement, left and right, is 3.83 and 4.79 respectively. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to side of involvement, left and right, is 36 and 45.68 respectively. The difference between these means is statistically significant (P = 0.002) according to independent T-test.

Inference: The study participants who had right side of involvement showed good improvement in DASH score.

Table 25: Association between associated swelling and scores of VAS scale and DASH scale (n = 25)

	Swelling	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.63	1.061	0.096	0.856
	Yes	4.53	1.281		
DASH score difference between score at 6th week and score at 6th month	No	43.38	8.717	0.022	0.994
	Yes	43.35	6.403		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of swelling is 4.63 and 4.53 respectively. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of swelling is 43.38 and 43.35 respectively. The difference between these means is not statistically significant according to independent T-test.

Table 26: Association between associated shortening and scores of VAS scale and DASH scale (n = 25)

	Shortening	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.83	.753	0.360	0.531
	Yes	4.47	1.307		
DASH score difference between score at 6th week and score at 6th month	No	40.17	7.960	- 4.202	0.209
	Yes	44.37	6.627		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Shortening is 4.83 and 4.47 respectively. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Shortening is 40.17 and 44.37 respectively. The difference between these means is not statistically significant according to independent T-test.

Table 27: Association between associated crepitus and scores of VAS scale and DASH scale (n = 25)

	Crepitus	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.33	1.033	- 0.298	0.572
	Yes	4.63	1.257		
DASH score difference between score at 6th week and score at 6th month	No	38.67	6.976	- 6.175	0.091
	Yes	44.84	6.543		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Crepitus is 4.33 and 4.63 respectively. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Crepitus is 38.67 and 44.84 respectively. The difference between these means is not statistically significant according to independent T-test.

Table 28: Association between co-morbidity of diabetes and scores of VAS scale and DASH scale (n = 25)

	Diabetes	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.33	1.237	- 0.810	0.130
	Yes	5.14	.900		
DASH score difference between score at 6th week and score at 6th month	No	43.83	6.573	1.690	0.600
	Yes	42.14	8.552		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Diabetes is 4.33 and 5.14 respectively. The difference between these means is not statistically significant according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Diabetes is 43.83 and 42.14 respectively. The difference between these means is not statistically significant according to independent T-test.

Table 29: Association between type of diagnosis and scores of VAS scale and DASH scale (n = 25)

	Diagnosis	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	Closed fracture	5.06	1.124	1.396	0.003
	Type 1 open fracture	3.67	.707		
DASH score difference between score at 6th week and score at 6th month	Closed fracture	45.81	6.853	6.813	0.017
	Type 1 open fracture	39.00	5.196		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to type of diagnosis, closed and type 1 open fracture is 5.06 and 3.67 respectively. The difference between these means is statistically significant (P = 0.003) according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to type of diagnosis, closed and type 1 open fracture, is 45.81 and 39.00 respectively. The difference between these means is not statistically significant according to independent T-test.

Inference: Among the study participants who closed fracture has shown good improvement according to VAS score.

Table 30: Association between need for blood transfusion and scores of VAS scale and DASH scale (n = 25)

	Blood transfusion	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.95	1.026	1.614	0.002
	Yes	3.33	0.816		
DASH score difference between score at 6th week and score at 6th month	No	43.32	7.696	- 0.184	0.957
	Yes	43.50	4.930		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Blood transfusion is 4.95 and 3.33 respectively. The difference between these means is statistically significant (P = 0.002) according to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of Blood transfusion is 43.32 and 43.50 respectively. The difference between these means is not statistically significant according to independent T-test.

Inference: Among the study participants who had no blood transfusion has shown good improvement according to VAS score.

Table 31: Association between disease complication and scores of VAS scale and DASH scale (n = 25)

	Complication	Mean	Std. Deviation	Mean difference	P - Value
VAS score difference between score at 6th week and score at 6th month	No	4.55	1.224	- 0.121	0.873
	Yes	4.67	1.155		
DASH score difference between score at 6th week and score at 6th month	No	44.77	6.256	11.773	0.004
	Yes	33.00	.000		

Comment: The mean VAS score difference between score at 6th week and score at 6th month among study participants according to absence and presence of complication is 4.55 and 4.67 respectively. The difference between these means is not statistically significant according

to independent T-test. The mean DASH score difference between score at 6th week and score at 6th month among study participants according to absence and presence of complication is 44.77 and 33.00 respectively. The difference between these means is statistically significant (P = 0.004) according to independent T-test.

Inference: Among the study participants who had no blood transfusion has shown good improvement according to DASH score.

Radiologically, in the study participants, all patients shows signs of callus formation in 6^{th} weeks follow-up, signs of union (obliteration of 3 cortex's) by 3months follow-up and complete consolidation of fracture line in 6months follow-up

Inference: Among the study participants, all has shown good improvement according in fracture healing radiologically

DISCUSSION

DISCUSSION

Fracture fixation made significant strides in the latter part of the 20th century and at the start of this decade in terms of concepts, method, and implants. As our knowledge of fracture healing has increased, we are able to repair many difficult fractures with better outcomes than in the past, thanks to current implants and fixation methods.

Complicated humeral shaft fractures are challenging to surgically treat because of the adversities in achieving reduction and fixation. You can also use the humeral MIPPO technique with LCP to treat these fractures. Many short series have shown that the MIPPO method has some preliminary efficacy in treating humeral fractures. As far as we are aware, the majority of the instruments employed in that investigations were conventional dynamic compression plates. A variety of curved plates with specially designed hole combinations are included in the newly developed LCP system, allowing it to be used as both a locked internal fixator and a standard compression plate. These qualities might be helpful for the humeral reduction and healing. Unlike traditional plates, the LCP does not need to be precisely shaped to meet the ventral surface of the humerus when utilised as an internal fixator. Screw's locking head also keeps plate from immediately pressing against the bone, leaving some

room in between. This lack of periosteal contact may facilitate the development of bone union.[80]

Our research examined the functional and radiological results of managing humerus fractures with locking compression plate osteosynthesis. LCP was used to treat 25 patients with humerus shaft fractures with open reduction and internal fixation.

Comparison of baseline characteristics of the study participants with similar studies

The participants in the current study were 33 years old on average, with a 9-year standard deviation. The study carried out by Kumar et al. had study participants who were on average 41.04yrs old (ranges from 24 - 57yrs).[78] In a similar vein, Jiang et al study's found that the moderate age of study participants was 42.9yrs.[80] In contrast to our study, Capitani et al study's had study participants who were on average 55.45 years old.[84] because the investigations were carried out in various contexts, there was a variance in the mean age between the studies.

Unlike the study by Kumar et al, where 80 percent of the samples were men, more than half (60%) of the samples in the current investigation were men.[78] The study conducted by Jiang et al. revealed a similar percentage of males (66.7%) to our study.[80] The study by Boben et al. had a male prevalence of almost 84 percent, in contrast to our findings.[31]

In the current study, injuries from auto accidents were reported by about 64% of the population. The study by Jiang et al. found that, in contrast to our study, over 81 percent of people experience traffic accidents.[80] as per analysis given by Boben et al., it was noted that 70% of the participants suffered road traffic accidents, which is comparable to our study.[31] Only 29 percent of the population in the prospective study conducted by Capitani et al. reported having a road traffic accident, in contrast to our study's results. [84] The most frequent cause of insult is road traffic accidents because of increase number of motor vehicles.

Approximately 76 percent of the participants in the current study experienced right side injuries, compared to 46 percent of those in the study by Kumar et al.[78] 62 percent of participants in the Jiang et al study, which is comparable to ours, had involvement from the right side.[80] In contrast to our study almost 54 percent has right side involvement and it was noticed in the analysis given by Boben et al.[31] In contrast to our study almost 44 percent has right side involvement and it was noticed in the prospective study carried by Capitani et al. [84] The most frequent side of injury is right side because the dominant side of usage is right for most of the humans.

About 64% of the participants in the current study had closed fractures, whereas the remainder participants had type 1 open fractures. The study

carried out by Jiang et al. found a similar percentage of closed fractures (81%) to our investigation.[80] In contrast to our study almost 84 percent presented with closed type of fractures in the study conducted by Boben et al.[31] This selection of participants is based on the kind of fractures since closed type fractures are more common than open type fractures.

Comparison of Functional outcome by DASH score with similar articles

The DASH questionnaire gave a clear picture of how the patients felt about their function. The samples' respective mean DASH scores after 6 weeks, 3 months, and 6 months were 55.24 10.721, 31.20 9.097, and 11.88 4.781. Between the durations of 6 weeks and 6 months, there is a noticeable decline in DASH scores among the study participants. In contrast to our study, Gowda et al study's found that the mean DASH score of the samples at 6 weeks, 3 months and 6 months was 25.55 4.41, 16.75 4.07, and 6.05 3.47, respectively.[85] Similar to this, it was found in the study conducted by Akbar Ali et al. that the mean Quick DASH score of the samples at 8 weeks, 3 months and 6 months were 30.51 6.12, 15.05 4.67, and 3.57 5.21, respectively.[86] Similar findings were made in the analysis by Sachit Malhan et al, where the samples' mean DASH scores at 3 months and 6 months were 35.1 and 8.9, respectively.[87] One of the factors contributing to a poor or moderate DASH score in the current

investigation was issues with the other upper limb. We also discovered that although participants experienced some pain in the recovered upper limb, it wasn't too bad, and they were still able to go about their everyday lives. Early limb mobilisation and partial physical treatment are key to functional recovery. An immediate boost in function followed an operation's more predictable alignment and immediate stabilisation.

Comparison of radiological outcome with similar articles

There are no cases of mal-union, delayed union, or non-union among the study participants in the current study. The study by Govindasamy et al. came to the same conclusion that there were no delayed unions or nonunions. [88]

In contrast to our study, which had a unionisation rate of nearly 97 percent and a non-unionization rate of 3 percent, this difference was noted in the analysis by Boben et al. after a check-up of 6months.[31]

In contrast to our study almost 92 percent had union and 8 percent had delayed union and it was noticed in the study conducted by Kumar et al.[78]

For comminuted fractures of shaft, the MIPO approach offers the biomechanical advantage. Recently, the MIPO approach was also applied to straightforward fractures, providing the potential advantages of less soft tissue exposure and stripping. Since it may result in less soft-tissue

problems, the MIPO approach for shaft fractures that uses the relative stability principle has grown in prominence.

Through either an anterolateral or posterior approach, open reduction and internal fixation necessitates extensive soft-tissue and local vascularity disruption, which may reduce the possibility for fracture healing and raise the risk of iatrogenic radial nerve injury and deep infection.

Internal fixation is incredibly useful for producing superior outcomes, such as minimal deformity, early mobilisation, and strong unionisation. In terms of shorter union times, improved joint function, and decreased need for repeat surgery, locking compression plate is a better option for fixation of humeral shaft fractures.

Strict adherence to AO principles during fixation, painstaking attention to maintaining asepsis during surgery, patient education, and a well-planned rehabilitation programme are required for better postoperative outcomes. If these guidelines are properly followed for treating humeral shaft fractures with LCP fixation, patients will experience greater patient satisfaction with fewer sequelae.

CONCLUSION

CONCLUSION

Based on the data, it is concluded that Locking Compression Plate (LCP) is safe and dependable in attaining union in patients of any age group and activity level since it can be applied at all levels of the humeral shaft and can result in 100% union when used with the correct principles and excellent osteogenic stimulus.

It is implied that the using a locking compression plate is a great choice for treating humeral shaft fractures since it has a good functional and radiological outcome and few side effects.

Bony union might not be the end of a successful course of treatment for a humeral shaft fracture. The focus today is on providing patients with holistic treatment, and the orthopaedic surgeon who is treating the patient has additional authority to intervene and enhance the patient's quality of life. An understanding of anatomy, surgical indications, procedures and implants, as well as patient expectations and functions, is necessary for the successful treatment of a humeral shaft fracture.

RECOMMENDATION

To assess meaningful differences, a large number of patients must participate in a randomised control trial with long-term follow-up that is preferably triple blinded or at least double blinded in nature. For better comparison of functional and radiological outcomes, as well as problems such superficial, deep infection, nerve injury, and range movements after surgery, this trial should be multicentric and compare with different procedures. It is necessary to perform more study on biomechanical stability to compare the results of the various fixation techniques to clinical applications in the real world.

LIMITATION

LIMITATION

An experimental study with a Randomized Controlled Trial might produce better associations because this is an observational study.

Due to the lack of a control group and the small number of patients included in this study, it cannot be compared to other techniques.

During follow-up, complications including infections and nerve damage could be assessed.

The follow-up time frame is brief but could be increased to more than a year.

SUMMARY

SUMMARY

About 3% of all fractures of long bones are humeral shaft fractures. Surgical fixation techniques have attained popularity because they promote early joint mobilisation and fracture healing. The best surgical procedure is still plate and screw fixation. Open reduction with internal fixation is often used to treat diaphyseal humerus fractures in adults because it helps in prevention of neurovascular damage by direct vision and also spares elbow and shoulder injury. The main disadvantage of plate fixation is soft tissue rupture, which raises the possibility of infection and also nerve damage. It has been demonstrated that plate fixing lowers the frequencies of mal-union and also non-union.

Present study conducted with the aim and objective to describe the functional outcome by VAS & DASH scoring systems and radiological status of fracture of shaft of humerus managed with locking compression plate.

Present study was conducted among 25 cases with fracture of shaft of humerus admitted at orthopaedic department R.L. Jalappa Hospital attached to Sri Devaraj Urs Academy of Higher Education and Research, Tamaka, Kolar during December 2020 to July 2022 after ethical permission of IEC. Patients were selected using inclusion and exclusion

criteria. Collected data has been entered in the excel data sheet and data analysis done with the help of MS Excel and then examined by SPSS 23.0.

Highest number of participants were from 20-60 years age group and mean age was 33 years. Male: Female ratio was 3:2. Highest number of participants (64%) were injured in 'road traffic accident' and most of participants (88%) were injured by direct injury. Almost 76% participants had right sided injury. Middle third of the shaft of the humerus was the most common part injured among study participants. Most of the participants (64%) were noted with closed fracture and about 36% are open type-1. 'U slab' was the most common method (80%) used to preliminary immobilize the injured part of humerus after injury.

Mean VAS score at 6 month follow up was 2.52 with 0.963 SD which is excellent and Mean DASH score at 6 month follow up was 11.88 with 4.781 SD which is very good functional outcome.

The mean VAS score, at 6 weeks follow up was 7.08 which was reduced to 2.52 at 6 months follow up. According to mean DASH score, at 6 weeks follow up was 55.24 which was reduced to 11.88 at 6 months follow up. The fracture consolidation at 6 months follow up was found to be excellent. There were no post-operative complications noted in this study.

Based on the data, it is concluded that Locking Compression Plate (LCP) is safe and dependable in attaining union in patients of any age group and activity level since it can be applied at all levels of the humeral shaft and can result in 100% union when used with the correct principles and excellent osteogenic stimulus.

Bony union might not be the end of a successful course of treatment for a humeral shaft fracture. The focus today is on providing patients with holistic treatment, and the orthopaedic surgeon who is treating the patient has additional authority to intervene and enhance the patient's quality of life. An understanding of anatomy, surgical indications, procedures, and implants, as well as patient expectations and functions, is necessary for the successful treatment of a humeral shaft fracture.

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ANNEXURES

ANNEXURE – I

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

PATIENT INFORMATION SHEET

STUDY TITLE: "EVALUATION OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HUMERAL SHAFT FRACTURE TREATED WITH LOCKING COMPRESSION PLATE"

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj UrsMedical College, Tamaka, Kolar.

Details- Patients diagnosed with fracture shaft of humerus admitted in Orthopaedics ward from opd and casualty at R.L.JALAPPA. HOSPITAL AND RESEARCH CENTRE, attached to SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR

Patients in this study will have to undergo routine Blood Investigations:- CBC, BT, CT, Blood grouping, RBS, RFT, HIV, HBsAg status, Radiological investigation: Plain x-ray of involved Arm-AP & lateral views.

Please read the following information and discuss with your family members. You can askany question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by

the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

CONFIDENTIALITY

Your medical information will be kept confidential by the study doctor and staff and will notbe made publicly available. Your original records may be reviewed by your doctor or ethics review board. For further information/ clarification please contact

Dr. BANDARU HRUSHIKESH (Post Graduate), DEPARTMENT OF ORTHOPAEDICS, SDUMC, Kolar.

Mobile No: 9573361020

ANNEXURE – II

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

INFORMED CONSENT FORM

Case no:

IP no:

TITLE: EVALUATION OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HUMERALSHAFT FRACTURE TREATED WITH LOCKING COMPRESSION PLATE

I,aged_____, after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice HUMERAL SHAFT FRACTURE TREATMENT WITH LOCKING COMPRESSION PLATE which is a surgical procedure to be performed on me. The nature and risks involved in the procedure have been explained to me to my satisfaction. I have been explained in detail about the Clinical Research on **"**EVALUATION OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HUMERAL SHAFT FRACTURE TREATED WITH LOCKING COMPRESSION PLATE**"** being conducted. I have read the patient information sheet and I have had the opportunity to ask any

question. Any question that I have asked, have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research. I hereby give consent to provide my history, undergo physical examination, undergo the operative procedure, undergo investigations and provide its results and documents, etc to the doctor / institute etc. For academic and scientific purpose the operation / procedure, etc may be videographed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc responsible for any untoward consequences during the procedure / study. A copy of this Informed Consent Form and Patient Information Sheet has beenprovided to the participant.

Signature/Thumb impression & Name of patient

Signature & Name of Pt.

Attender

Relation with patient:

Witness:

Signature & Name of Research person /doctor

ANNEXURE – III

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

ಶ್ರೀ ದೇವರಾಜ್ ಅರಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಸಂಸ್ಥೆ,
ಟಮಕ, ಕೋಲಾರ - 563101.

ತಿಳುವಳಿಕೆ ಸಮ್ಮತಿ ನಮೂನೆ

ಪ್ರಕರಣ ಸಂಖ್ಯೆ:
ಐಪಿ ಸಂಖ್ಯೆ:

ಶೀರ್ಷಿಕೆ:ಲಾಕಿಂಗ್ ಕಂಪ್ರೆಷನ್ ಪ್ಲೇಟ್ನೊಂದಿಗೆ ರಚಿಸಲಾದ ಹ್ಯೂಮರಲ್ ಶಾಫ್ಟ್ ಫ್ರ್ಯಾಕ್ಚರ್ನ ಕ್ರಿಯಾತ್ಮಕ ಮತ್ತು ರೇಡಿಯೊಲಾಜಿಕಲ್ ಕಾರ್ಯದ ಮೌಲ್ಯಮಾಪನ"

ನಾನು, _____ ವಯಸ್ಸಿನ _____, ಅಧ್ಯಯನದ ಉದ್ದೇಶ ಮತ್ತು ಕಾರ್ಯವಿಧಾನದ ಅಪಾಯಗಳು ಮತ್ತು ತೊಡಕುಗಳ ಬಗ್ಗೆ ನನ್ನ ಸ್ವಂತ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಿದ ನಂತರ, ಯಾವುದೇ ಬಲ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಸಮ್ಮತಿಯನ್ನು ಇಲ್ಲಿ ನೀಡುತ್ತೇನೆ ಲಾಕಿಂಗ್ ಕಂಪ್ರೆಷನ್ ಪ್ಲೇಟ್ನೊಂದಿಗೆ ನನ್ನ ಮೇಲೆ ಮಾಡಬೇಕಾದ ಶಸ್ತ್ರಚಿಕಿತ್ಸಾ ವಿಧಾನವಾಗಿದೆ. ಕಾರ್ಯವಿಧಾನದಲ್ಲಿ ಒಳಗೊಂಡಿರುವ ಸ್ವರೂಪ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನ್ನ ತೃಪ್ತಿಗೆ ವಿವರಿಸಲಾಗಿದೆ.
ನಡೆಸುತ್ತಿರುವ "ಲಾಕಿಂಗ್ ಕಂಪ್ರೆಷನ್ ಪ್ಲೇಟ್ನೊಂದಿಗೆ ಹ್ಯೂಮರಲ್ ಶಾಫ್ಟ್ ಫ್ರ್ಯಾಕ್ಚರ್ನ ಕ್ರಿಯಾತ್ಮಕ ಮತ್ತು ರೇಡಿಯೊಲಾಜಿಕಲ್ O ಟ್ಕಮ್ನ ಮೌಲ್ಯಮಾಪನ" ಕುರಿತು ಕ್ಲಿನಿಕಲ್ ರಿಸರ್ಚ್ ಬಗ್ಗೆ ನನಗೆ ವಿವರವಾಗಿ ವಿವರಿಸಲಾಗಿದೆ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ಯಾವುದೇ ಪ್ರಶ್ನೆ ಕೇಳುವ ಅವಕಾಶ ನನಗೆ ಸಿಕ್ಕಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಒಪ್ಪುತ್ತೇನೆ. ನನ್ನ ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆಗೆ ಒಳಗಾಗಲು, ಆಪರೇಟಿವ್ ಕಾರ್ಯವಿಧಾನಕ್ಕೆ ಒಳಗಾಗಲು, ತನಿಖೆಗೆ ಒಳಗಾಗಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ವೈದ್ಯರಿಗೆ / ಸಂಸ್ಥೆಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ.
ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ ಇತ್ಯಾದಿಗಳನ್ನು ವೀಡಿಯೊಗ್ರಾಫ್ ಮಾಡಬಹುದು ಅಥವಾ ಛಾಯಾಚಿತ್ರಮಾಡಬಹುದು. ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಬಳಸಬಹುದು. ಕಾರ್ಯವಿಧಾನ / ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳನ್ನು ಹೊಣೆಗಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.
ಭಾಗವಹಿಸುವವರಿಗೆ ಈ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಒಪ್ಪಿಗೆ ನಮೂನೆ ಮತ್ತು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯ ನಕಲನ್ನು ಒದಗಿಸಲಾಗಿದೆ.

ಸಹಿ / ಹೆಬ್ಬೆರಳು ಅನಿಸಿಕೆ ಮತ್ತು ರೋಗಿಯ ಹೆಸರು ಸಹಿ ಮತ್ತು ಪಂ. ಅಟೆಂಡರ್
ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ:

ಸಾಕ್ಷಿ: ಸಹಿ ಮತ್ತು ಸಂಶೋಧನಾ ವ್ಯಕ್ತಿ / ವೈದ್ಯರ ಹೆಸರು

ANNEXURE – IV

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

CASE PROFORMA

Case no:

IP no:

TITLE:

"**EVALUATION OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HUMERALSHAFT FRACTURE TREATED WITH LOCKING COMPRESSION PLATE"**

NAME: I.P NO:

AGE: DATE OF ADMISSION:

SEX: DATE OF SURGERY:

DATE OF DISCHARGE:

ADDRESS:

1) PRESENTING COMPLAINTS:
2) HISTORY OF PRESENTING ILLNESS:

A) MODE OF INJURY

-MOTOR VEHICLE ACCIDENT

-MOTOR CYCLE ACCIDENT

-FALL FROM HEIGHT

-ASAULT

-OTHERS

B) MECHANISM OF INJURY

-DIRECT. -INDIRECT

C) ASSOCIATED INJURIES

3) TREATMENT HISTORY:

YES OR NOIF YES

-OSTEOPATHS

-GENERAL PRACTITIONER

-ORTHOPAEDICIAN

4) PAST H/O INJURY / INJURIES

5) GENERAL EXAMINATION

Built	Icterus
Nourishment	Cyanosis
Pallor	Lymphadenopathy

VITALS:

PR: BP: RR:- TEMP:

6) SYSTEMIC EXAMINATION

CVS:- P/A:-

RS:- CNS:-

7) LOCAL EXAMINATION

A.INSPECTION

-SIDE INVOLVED: RT/LT

-OVERLYING SKIN

-ATTITUDE OF LIMB

-DEFORMITY

-SWELLING

-SHORTENINGB.PALPATION

-TEMPERATURE

-TENDERNESS

- ABNORMAL MOBILITY

- CREPITUS

-BONY IRREGULARITY

-TRANSMITTED MOVEMENTS

-WOUND EXAMINATION

a) PRESENCE OF FOREIGN BODY

b) COLOUR OF MUSCLES

-DISTAL NVD

C. MEASUREMENTS: RT LT

-LONGITUDINAL

D. MOVEMENTS:

- SHOULDER

- ELBOW

8) ASSOCIATED INJURIES:

-SHOULDER

-ELBOW

-RADIUS

-ULNA

-OTHERS

9) NEUROLOGICAL STATUS:

10) VASCULAR STATUS:

11) INVESTIGATIONS (PRE-OP ASSESSMENT)

Blood Investigations:

-CBC

-BT,CT, Blood grouping

-RBS, RFT

-HIV, HBsAg status

-FBS, PPBS, HBa1C (if needed)

Radiological investigation:

X-ray of arm – AP & Lateral view

12) CLINICAL DIAGNOSIS:

13) MANAGEMENT:

a) IMMEDIATE

-I.V FLUIDS

-PARENTERAL ANTIBIOTICS & ANALGESICS

-BLOOD TRANSFUSION

-SPLINTING

U- SLAB

b) SURGICAL MANAGEMENT

- DOS:

-. TYPE OF ANAESTHESIA

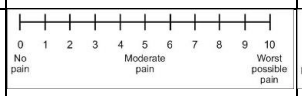
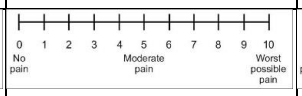
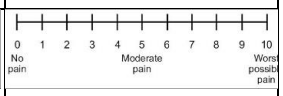
-. POSITION OF PATIENT

-. APPROACH

- METHOD

-. IMMOBILIZATION AFTER SURGERY

14) POST-OP PERIOD AND FOLLOW UP

FOLLOW-UP	6 Weeks	3 Months	6 Months
Pain, swelling			
VAS Score			
DASH Score			
Check X-ray(Signs of bone union)			
Complication(if any)			

DISABILITIES OF THE ARM, SHOULDER AND HAND

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5
20. Manage transportation needs (getting from one place to another).	1	2	3	4	5
21. Sexual activities.	1	2	3	4	5

DISABILITIES OF THE ARM, SHOULDER AND HAND

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? *(circle number)*	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? *(circle number)*	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

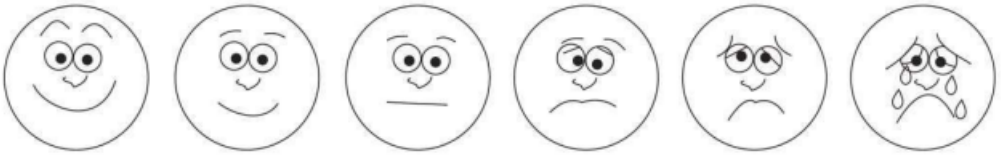
	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. *(circle number)*	1	2	3	4	5

DASH DISABILITY/SYMPTOM SCORE = _____ ([(sum of n responses / n) - 1] x 25, where n is the number of completed responses.)

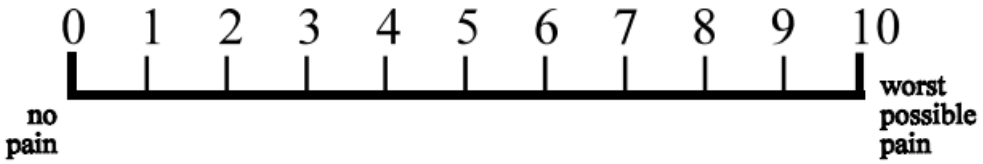
A DASH score may <u>not</u> be calculated if there are greater than 3 missing items.

Faces Pain Scale



0	2	4	6	8	10
Very happy, no hurt	Hurts just a little bit	Hurts a little more	Hurts even more	Hurts a whole lot	Hurts as much as you can imagine (don't have to be crying to feel this much pain)

Visual Analog Scale (VAS)



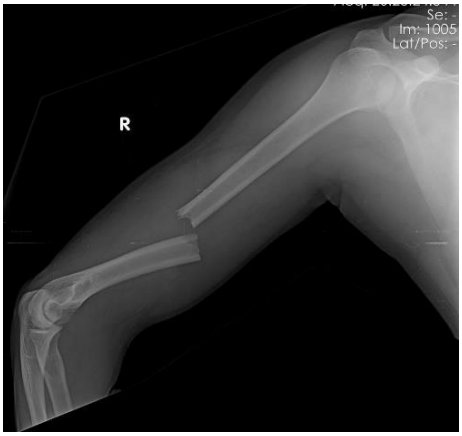
ANNEXURE – V

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

DATA COLLECTION PHOTOS

LOCKING COMPRESSION PLATES AND INSTRUMENTS SET

CASE 2

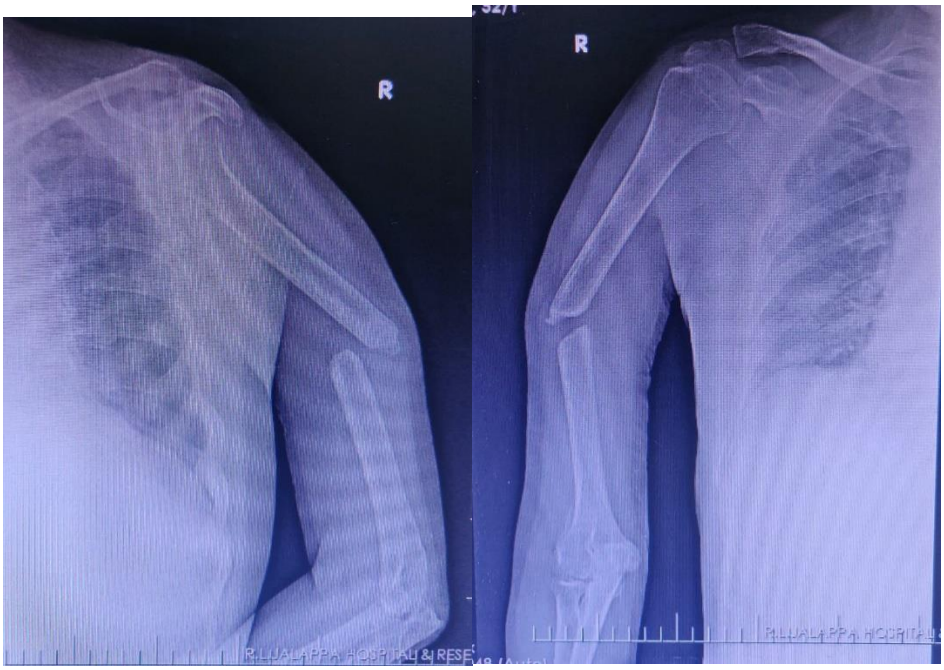


Pre-op and post op x-rays of 40/M Case of Closed displace shaft of right humerus fracture

CASE 3

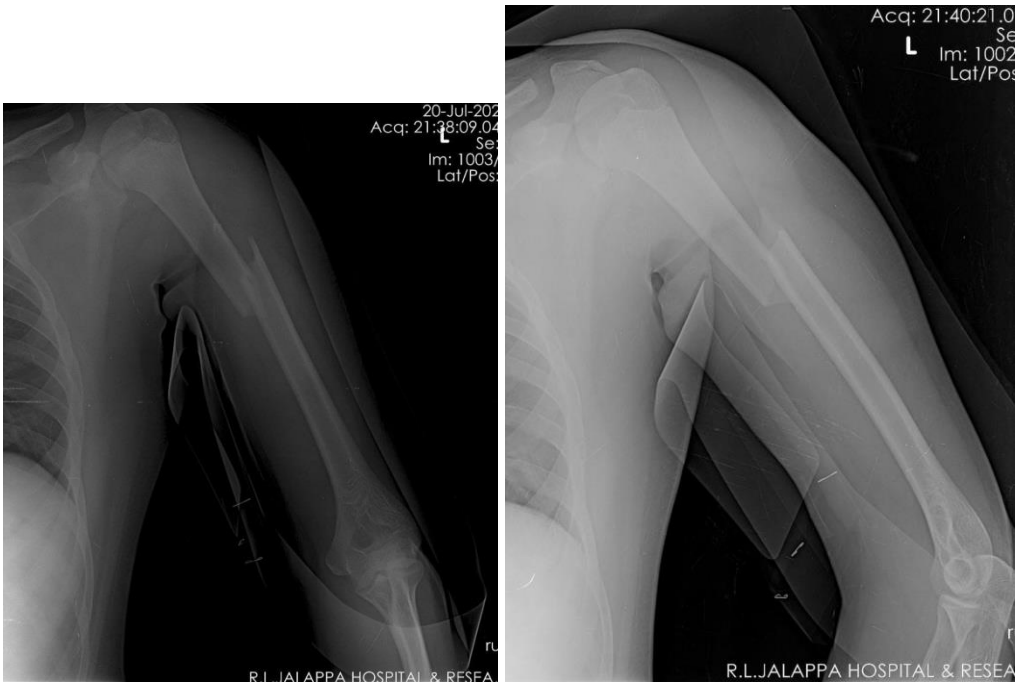
Pre-op and post op x-rays of 45/F Case of Closed displace shaft of right humerus fracture

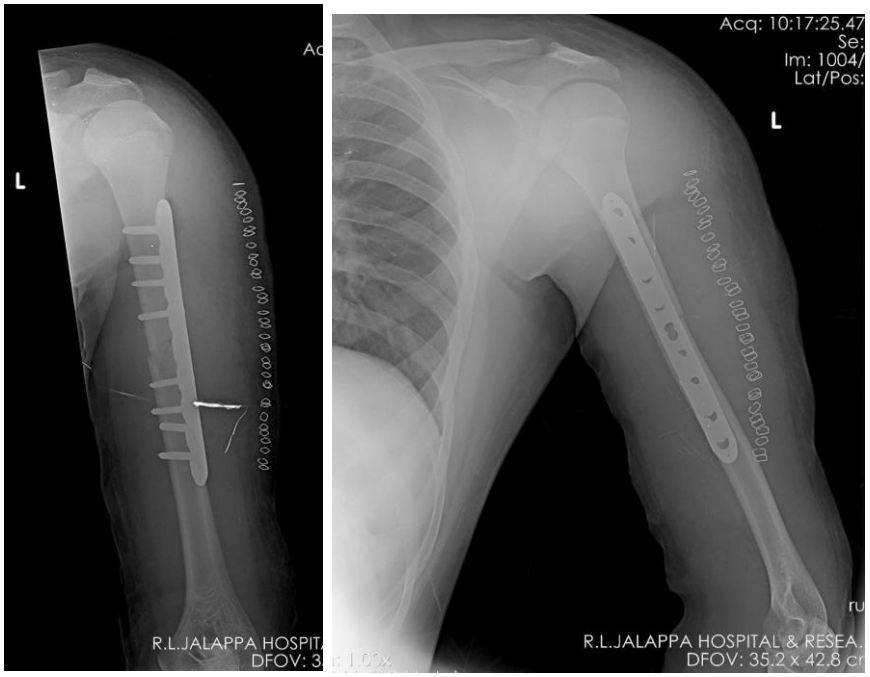
CASE 9



Pre-op and post op x-rays of 21/M Case of Closed displace shaft of right humerus fracture

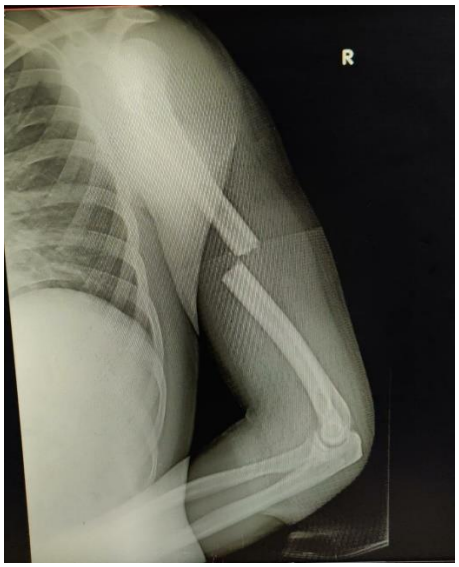
CASE 16





Pre-op and post op x-rays of 41/M Case of Closed displace shaft of left humerus fracture

CASE 18



Pre-op and post op x-rays of 40/M Case of Closed displace shaft of right humerus fracture

CASE 20

Pre-op and post op x-rays of 27/M Case of Closed displace shaft of right humerus fracture

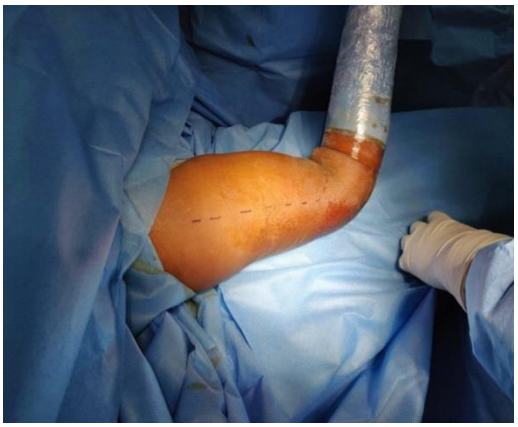
INTRA-OPERATIVE IMAGES

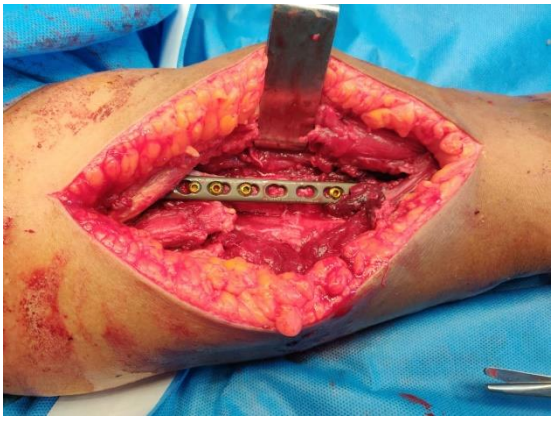
CASE 21



Intraoperative picture of the fractured site and locking compression plate fixation

CASE 25





Intraoperative picture of fracture reduction and plate fixation

FOLLOWUP IMAGES

CASE 3

CASE 24

CASE 17

MASTER CHART

ANNEXURE – VI

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

KEY TO MASTER CHART

SR.NO	Serial number
M	Male
F	Female
UHID No	Unique hospital identification number
RTA	Road traffic accident
F/H	Fall from height
As	Assault
Lt.	Left
Rt.	Right
Y	Yes
N	No
NAD	No abnormality detected
#	Fracture
C	Closed
O	Open type-1
M/3	Middle third
D	Direct
Id	Indirect
ORIF	Open reduction internal fixation
LCP	Locking compression plate
Wk	Weeks
M	Months
VAS	Visual analog score
DASH	Disability of the arm, shoulder, and hand score

SL.NO	UHID	AGE	SEX	LOCALITY	MODE OF INJURY	MECHANISM OF INJURY	PAST HISTORY OF INJURY TO SAME LIMB	HYPERTENSION	SIDE OF INVOLVEMENT	SWELLING	SHORTENING	DIABETES	NEUROLOGICAL STATUS	VASCULAR STATUS	DIAGNOSIS	BLOOD TRANSFUSION	VAS SCORE 6 WEEKS	VAS SCORE 3 MONTHS	VAS SCORE 6 MONTHS	DASH SCORE 6 WEEKS	DASH SCORE 3 MONTHS	DASH SCORE 6 MONTHS	COMPLICATIONS	FRACTURE CONSOLIDATION
1	939949	21	M	Rural	As	D	No	N	Rt	Y	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	Y	6	4	3	68	44	20	NIL	ACHIEVED
2	933681	40	M	Urban	RTA	Id	No	N	Rt	Y	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	7	4	2	72	42	19	NIL	ACHIEVED
3	931724	45	F	Rural	RTA	D	No	Y	Rt	Y	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	8	5	3	59	38	14	NIL	ACHIEVED
4	926392	27	M	Urban	RTA	D	No	N	Rt	N	Y	Y	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	9	5	4	58	33	9	NIL	ACHIEVED
5	888944	38	F	Rural	RTA	D	No	N	Lt	Y	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of left humerus	Y	5	4	2	49	29	10	NIL	ACHIEVED
6	878776	33	M	Urban	RTA	D	No	N	Rt	Y	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of right humerus	N	7	5	3	53	24	8	NIL	ACHIEVED
7	863556	20	F	Urban	RTA	D	No	N	Rt	N	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of right humerus	Y	6	4	2	42	19	9	NIL	ACHIEVED
8	62029	41	M	Rural	F/H	D	Yes	Y	Lt	Y	N	Y	NAD	NAD	Closed displaced fracture midshaft of left humerus	N	8	5	4	40	20	7	NIL	ACHIEVED
9	55415	21	M	Rural	As	D	No	N	Rt	Y	N	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	Y	6	4	1	68	44	20	NIL	ACHIEVED
10	40522	40	M	Urban	RTA	Id	No	N	Rt	Y	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	7	4	2	72	42	19	NIL	ACHIEVED
11	937247	45	F	Rural	RTA	D	No	Y	Rt	Y	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	8	3	1	59	38	14	NIL	ACHIEVED
12	110072	27	M	Urban	F/H	D	No	N	Rt	N	Y	Y	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	9	4	3	58	33	9	NIL	ACHIEVED
13	108768	38	F	Rural	RTA	D	No	N	Lt	Y	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of left humerus	Y	5	3	2	49	29	10	NIL	ACHIEVED
14	873946	33	M	Urban	RTA	D	No	N	Rt	Y	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of right humerus	N	7	5	4	53	24	8	NIL	ACHIEVED
15	178923	20	F	Urban	RTA	D	No	N	Rt	N	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of right humerus	N	6	3	2	42	19	9	NIL	ACHIEVED
16	989021	41	M	Rural	F/H	D	No	Y	Lt	N	Y	Y	NAD	NAD	Closed displaced fracture midshaft of left humerus	N	8	6	4	40	20	7	NIL	ACHIEVED

SL.NO	UHID	AGE	SEX	LOCALITY	MODE OF INJURY	MECHANISM OF INJURY	PAST HISTORY OF INJURY TO SAME LIMB	HYPERTENSION	SIDE OF INVOLVEMENT	SWELLING	SHORTENING	DIABETES	NEUROLOGICAL STATUS	VASCULAR STATUS	DIAGNOSIS	BLOOD TRANSFUSION	VAS SCORE 6 WEEKS	VAS SCORE 3 MONTHS	VAS SCORE 6 MONTHS	DASH SCORE 6 WEEKS	DASH SCORE 3 MONTHS	DASH SCORE 6 MONTHS	COMPLICATIONS	FRACTURE CONSOLIDATION
17	45908	21	M	Rural	As	D	No	N	Rt	N	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	Y	6	4	3	68	44	20	NIL	ACHIEVED
18	10275	40	M	Urban	RTA	Id	No	N	Rt	N	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	7	3	1	72	42	19	NIL	ACHIEVED
19	10987	45	F	Rural	RTA	D	No	Y	Rt	Y	Y	N	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	8	4	2	59	38	14	NIL	ACHIEVED
20	119831	27	M	Urban	F/H	D	No	Y	Rt	Y	Y	Y	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	9	5	3	58	33	9	NIL	ACHIEVED
21	200941	38	F	Rural	RTA	D	No	N	Lt	Y	Y	N	NAD	NAD	Open type 1 displaced fracture midshaft of left humerus	Y	5	3	2	49	29	10	NIL	ACHIEVED
22	290093	33	M	Urban	RTA	D	No	N	Rt	Y	N	N	NAD	NAD	Open type 1 displaced fracture midshaft of right humerus	N	7	3	2	53	24	8	NIL	ACHIEVED
23	23849	20	F	Urban	RTA	D	No	N	Rt	Y	N	N	NAD	NAD	Open type 1 displaced fracture midshaft of right humerus	N	6	4	2	42	19	9	NIL	ACHIEVED
24	10379	41	M	Rural	F/H	D	Yes	Y	Lt	Y	N	Y	NAD	NAD	Closed displaced fracture midshaft of left humerus	N	8	5	2	40	20	7	NIL	ACHIEVED
25	990347	38	F	Rural	RTA	D	No	Y	Rt	N	N	Y	NAD	NAD	Closed displaced fracture midshaft of right humerus	N	9	5	4	58	33	9	NIL	ACHIEVED