TO EVALUATE FUNCTIONAL OUTCOME OF ACUTE MINIMALLY DISPLACED SCAPHOID WAIST FRACTURES TREATED WITH PERCUTANEOUS HEADLESS COMPRESSION SCREW FIXATION- A PROSPECTIVE STUDY

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MASTER OF SURGERY IN

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ABSTRACT

Background and Objective : Scaphoid fracture incidence has increased recently due to increased participation of people in sports and increased road traffic accidents and easy availability of diagnostic tools like computed tomography, which help in easily diagnosing scaphoid fractures which may be missed on routine radiographs. This study helps in assessing the functional outcome of scaphoid fractures managed by percutaneous headless compression screws.

Methods: Patients with acute scaphoid fractures treated by percutaneous headless compression screw fixation between February 2021 to June 2022 were included in this study.

Results: A total of 55(n=55) patients were included in the study of which 43 were males, and 12 were females. 19 of these patients had injuries due to Road Traffic accidents, 17 were sports injuries and 19 were due to direct trauma.

All patients were managed by percutaneous headless compression screw fixation. Among these ,27% showed excellent, 24% showed and 4% showed fair outcomes.

Conclusion: Our study shows that percutaneous fixation of minimally displaced scaphoid fractures results in early symptomatic relief and functional recovery. It shows that percutaneous fixation using a headless compression screw has similar functional outcomes and less hospital stay and patient scarring than in open fixation methods. Functional recovery is faster with percutaneous fixation than in non-operative and open fixation .

Keywords: Fixation, Herbert screw, Trauma

Abbreviations used –

RTA – Road traffic Accidents

SI – Sports injury

DT – Direct Trauma

DASH – Disability of arm, shoulder and hand

MMWS – Modified Mayo Wrist Score

VAS – Visual Analogue Score

HCS – Headless compression screw

ASB – anatomical snuff box

ST – Scaphoid Tenderness

LCT – Longitudinal compression of thumb

ORIF – Open reduction internal fixation

INTRODUCTION

Fractures of the scaphoid comprise around 2% - 7% of all fractures, with the peak occurrence seen in men of the age group of 20-30years [1]. Its incidence is approximately 8 per lakh population in women and 38 per lakh population in men[2]. Being the most commonly fractured carpal bone, it accounts for 82-89% of all carpal bone fractures[3].

Adults most frequently experience scaphoid fractures that involve the waist (70%) and others, including fractures of the distal pole of scaphoid which are 10 to 20% , fractures of the proximal pole of the scaphoid which are 5 to10%, and scaphoid tubercle fractures which are 5 to 7%[4].

Fractures of the scaphoid bone are
frequently problematic since standard radiographic diagnosis using radiographs is challenging, and treatment may be delayed or incorrectly diagnosed.

Fractures of the scaphoid
bone are particularly prone to avascular necrosis, which occurs in 13 to 50% of the cases[5]. Other complications seen with its fracture include non-union, malunion, radiocarpal arthritis and carpal iinstability

Orthopaedicians should be extremely cautious and precise when analysing the results of the clinical examination and radiography. Therefore, for a better prognosis, early diagnosis and treatment are essential. Even with appropriate care, 10 and 35% of these fractures fail to heal[6]. Changes in carpal biomechanics result in discomfort, reduced wrist mobility, decreased grip strength, and carpal arthritis.

Percutaneous fixation techniques have replaced open surgical methods as the preferred management method for patients with un-displaced and minimally displaced acute scaphoid fractures or delayed union, respectively. These procedures consistently speed up fracture healing and enable patients to return to work or their sport sooner than the conventional cast treatment that was previously recommended to them[7].

Because reported union rates for the scaphoid following a fracture varied between 10% and 50%, it might be challenging to predict good healing after a fracture. Displaced fractures of scaphoid, fractures of scaphoid with ligamentous injuries, and proximal pole scaphoid fractures are the most important causes of non-union. A ten to twelve percentage failure rate is observed with cast immobilisation of a supposedly stable fracture is confirmed by long-term studies[8].

Scaphoid fractures which are stable will take around 6-8weeks to heal. However, if the injury is not stabilised enough, this may lead to poor fracture healing and might require surgery and recovery time will be prolonged. All types of immobilisation will restrict hand function when the patient is being treated, and this may require supportive physiotherapy following the mobilisation of the joint. However, inadequate immobilisation may increase the risk for non-union in approximately thirty percentage of cases[9].

Though there is a low failure rate for stable fractures, one needs to weigh the likelihood of fracture healing for upto three to six months of cast immobilisation, particularly in the case of adolescent patients who are more active and less tolerant of protracted immobility.

The advantage of Herbert screw fixation is that fracture reduction and fixation may be completed without further harm to the wrist's stabilising ligament and scaphoid blood supply. Results following open reduction and internal fixation of misplaced, unstable, and delayed-union scaphoid fractures with the Herbert screw are encouraging. The goal of our study was to evaluate the functional, clinical, and radiological results of surgical intervention with Herbert screw fixation for scaphoid fractures. To substantiate the available literature to return to preoperative status and achieve good compression at the fracture site, we are taking up this study to evaluate the outcome.

OBJECTIVE OF THE STUDY

To evaluate the functional outcome of scaphoid waist fractures treated with percutaneous headless compression screw fixation.

To study complications associated with percutaneous headless compression screw fixation of scaphoid fractures.

REVIEW OF LITERATURE

HISTORICAL REVIEW

In 1984, **Herbert and Fisher**[10] offered a categorisation of fractures of scaphoid and a grading system for predicting outcomes in addition to describing the procedure of open fixation for unstable fractures of scapjoid. The headless compression screw fixation provided enough stability in their study of 158 acute fractures of scaphoid and non-unions to enable scaphoid healing without subsequent cast immobilisation. The union rate was more than eighty percent for all types of acute fracture, suggesting that internal fixation with headless compression screw improves the prognosis for healing.

In their investigation on the management of scaphoid fractures, **Smith et al.**[11] observed that headless compression screw fixation, along with bone grafting whenever required, is an effective and dependable treatment for the fractures of the scaphoid bone. All types of the fractures of scaphoid, including proximal pole fractures, showed acceptable rates of fracture healing and union and satisfactory functional outcomes. Also, early post-operative mobilisation plays a part in these positive clinical outcomes.

In their study, **Elizabeth et al.**[12] found that the Herbert screw may be utilised to treat acute scaphoid fractures as well as non-union of scaphoid bone. Although the insertion method is technically challenging, the advantages of stabilitsation and early mobilisation are key for achieving a functional painfree wrist.

In their study, **Moran and Curtin et al.**[13] distinguished the outcomes of Herbert screws with other traditional screws and arrived at the conclusion that the Herbert screw is a useful internal fixation method for treating unstable fractures of the scaphoid as well as delayed union of scaphoid fractures.

In a prospective randomised experiment, **Dias and colleagues**[14] compared fixation with a headless compression screw (HCS) to nonoperative management in a below-elbow plaster cast. They deduced from the study that 10 out of 44 nonoperative individuals had delayed union of scaphoid fracture at 16 weeks. In contrast to the conservative group, patients among surgical group recovered their range of motion and grip strength significantly faster.

53 patients with nondisplaced scaphoid fractures were randomly assigned by **Adolfsson and colleagues**[15] to either internal fixation using a headless compression screw or a below-elbow plaster cast in their research. The researchers discovered that the surgical group had an early improvement in

range of motion but no differences in union rates. In a study that randomly assigned military recruits with nondisplaced fractures of waist of the scaphoid bone to either conservative cast treatment or headless compression (herbert) screw fixation, patients treated with surgical intervention saw radiographic evidence of fracture healing and of fracture union at eight weeks earlier than the non-operative management group, and they were back to full routine duty on average seven weeks earlier.

Patients were randomly assigned to either surgery with a headless compression screw (HCS) or managed conservatively with cast in study by **McQueen and colleagues**[16], and they discovered that the surgical group experienced a quicker time to union. **Inoue, Shionoya and colleagues**[17] also observed that patients with operatively treated scaphoid waist fractures were more likely to return to work than patients with nonoperatively treated fractures.

According to **Davis et al's**[18] cost utility analysis, surgical management of all the fractures occurring at the waist of the scaphoid bone was more cost-effective than conservative management of fractures of scaphoid bone at the final follow-up.

The findings of newer studies of percutaneous Herbert screw fixation of fractures of scaphoid have depicted a complete 100% rate of union for surgically fixed fractures of scaphoid from both the volar and dorsal approach, according to **Vikas Gupta et al**[19] in their literature reviewed for the results of the headless compression screw in the management of fractures of scaphoid.

Numerous publications have stressed the significance of screw location in the scaphoid. The proximal fragment of the scaphoid must have the screw placed centrally for the procedure to be successful therapeutically.

According to a meta-analysis by **Bhandari and Hanson**[20], internal fixation led to a considerably sooner return to work (by 8 weeks) than casting did. Additionally, they maintained that the surgically treated patient's morbidity was lower than that of the control group.

Trumble et al.[21] studied and reported the outcome of open reduction internal fixation (ORIF) of fractures of the scaphoid among thirty-five patients and compared the Herbert–Whipple and AO/ASIF screw. A rate of union of 100% was found in both groups. An additional Kirschner-Wire was used in fractures of the scaphoid bone with excessive comminution for extra rotational stability and 17/35 cases required non-vascularized bone grafting.

Filan and Herbert[22] studied forty-nine patients with acute B2 type fractures of scaphoid from four hundred-thirty-one patients, who had open reduction and screw fixation. 14 of these 49 patients required an additional non-vascularised bone graft. They reported in 29 out of 33 reviewed patients a union rate of more than eighty-five percent, minimal complications and early recovery to normal Range of motion and grip strength.

Rettig et al.[23] studied fourteen patients with displaced fractures of the scaphoid waist and reported rate of union of ninety-three percent that is 13 out of 14 patients. Among eight cases one screw and in other six cases multiple K-wires were used for additional stabilization. In the study by **Trumble et al.** they also performed a non vascularized bone graft in 10 out off 14 patients. Using the double headless compression screw technique a 100% union rate was achieved without the use of bone graft augmentation.

Shih et al.[24] included displaced fractures of the scaphoid bone, but only 9 among the 15 patients had fractures of the scaphoid waist. In addition, 6 out off 9 displaced scaphoid waist fractures showed additional associated soft tissue injuries. Due to the soft tissue injures, the K-wire fixation was deemed necessary in 4 out off 9 patients. The study showed an equal range of motion and grip strength of 87% compared to the healthy hand after one year.

Chen et al.[25] treated 11 unstable fractures of scaphoid percutaneously using screw fixation in their study. They reported union in all cases with a mean of 11 weeks, but included only 9 out off 11 scaphoid waist fractures.they reported an average “good” result in the Green O’Brien score with an equal grip strength compared to the healthy side.

In study conducted by **S. Quadlbauer et al**.[26] Radiologically, 29 out off 32 (91%) of the scaphoid B2 type fractures showed union, 10 out off 10 (100%) in the two headless compression screw group and 19 out off 22 (86%) in the one headless compression screw group ($p < 0.05$). No significant differences could be found with respect to range of motion, grip strength, Visual Analogue Score between the groups. Screw removal was necessary in two patients in the two headless compression screw group and one in the one headless compression screw group.

In a study conducted by **Al-Ashhab, M.E. and Elbegawi, H.E.D.A**,[27] they evaluated clinical and radiologic outcomes of volar percutaneous screw fixation for 15 type B2 fractures of scaphoid bone (according to the Herbert and Fisher classification). With the follow-up period of an average of 33 months (range, 6–50 months). All fractures healed and radiographic union was achieved at an average of 57 days (range, 35–70 days), requiring no additional procedures.

ANATOMY OF SCAPHOID

The fracture of the scaphoid bone was first described in 1905 by Destot (French surgeon, anatomist and radiologist)[5]. From the Greek word skaphe, which means boat or skiff, comes the word scaphoid. When neighbouring bones and its vascular supply are taken into account, the scaphoid has a peculiar anatomy to its credit. The distal and proximal rows of the carpal bones are mechanically connected by the scaphoid.

The scaphoid lies radially in the wrist 45 degrees to the long axis of the radius in both the AP and LAT planes. It has an average length of 29.3 mm in men and 24.8 mm in women and is the third largest among the eight carpal bones[28].

The scaphoid bone has a complex 3-dimensional anatomy. It is boat or bean shaped but it is also twisted and not symmetrical in stem and stern. Additionally, the most of its surface is cartilage, and it has articulations with five other bones: a proximal large convex articulation with the radius, two distal smaller slightly convex joint surfaces with the trapezium and the trapezoid, an ulnar large concave articulation with the capitate, and an ulnar plane joint surface with the lunate.

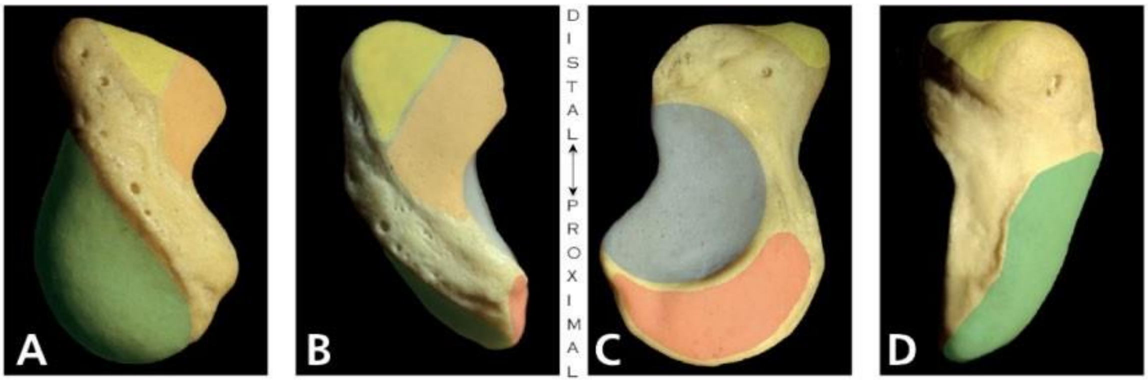


Figure : Scaphoid bone morphology.

A) Radial view, B)Dorsal view, C) Ulnar view and D) Volar view of the right scaphoid and its articular surfaces are colour coded. Greeen for the distal radius, yellow for trapezium, orange for trapezoid, blue for capitate, and red for lunate [29].

The triquetrum (triquetro-hamate joint) serves as the pivot point for rotation of the carpal bones, the scaphoid was a crucial stabiliser for the midcarpal joint (radial column), and the lateral and medial deviation was assisted by rotation of the scaphoid bone laterally and the triquetrum medially[30].

By the usage of micro-computed tomography (micro-CT) Lee et al have shown that the scaphoid has a higher bone density in the proximal pole as the trabeculae are denser and more tightly packed proximally in the scaphoid. The trabeculae are thinner and more widely distributed at the scaphoid waist, and thus this is where most fractures occur[31].

Developmental anatomy

Ossification of the scaphoid bone starts in the 1st decade of life. The ossific nucleus is visible in boys at the age of around 5-6 years and completes ossification in 15-16 years. The ossific nucleus is visible in girls at the age of around 4-5 years and completes ossification in 13-14 years.

Children under the age of six infrequently suffer scaphoid fracture, most likely as a result of the extensive cartilage that makes up the developing scaphoid. This is expected to safeguard the bone by acting as a cushion[32].

Surface anatomy

The distal pole of scaphoid is palpable on the volar aspect of the wrist at the thenar eminence in extension, the scaphoid waist can be palpated radially in the snuffbox in ulnar deviation, and the scaphoid proximal pole is palpated dorsally between the third and fourth extensor compartment of the wrist in flexion.

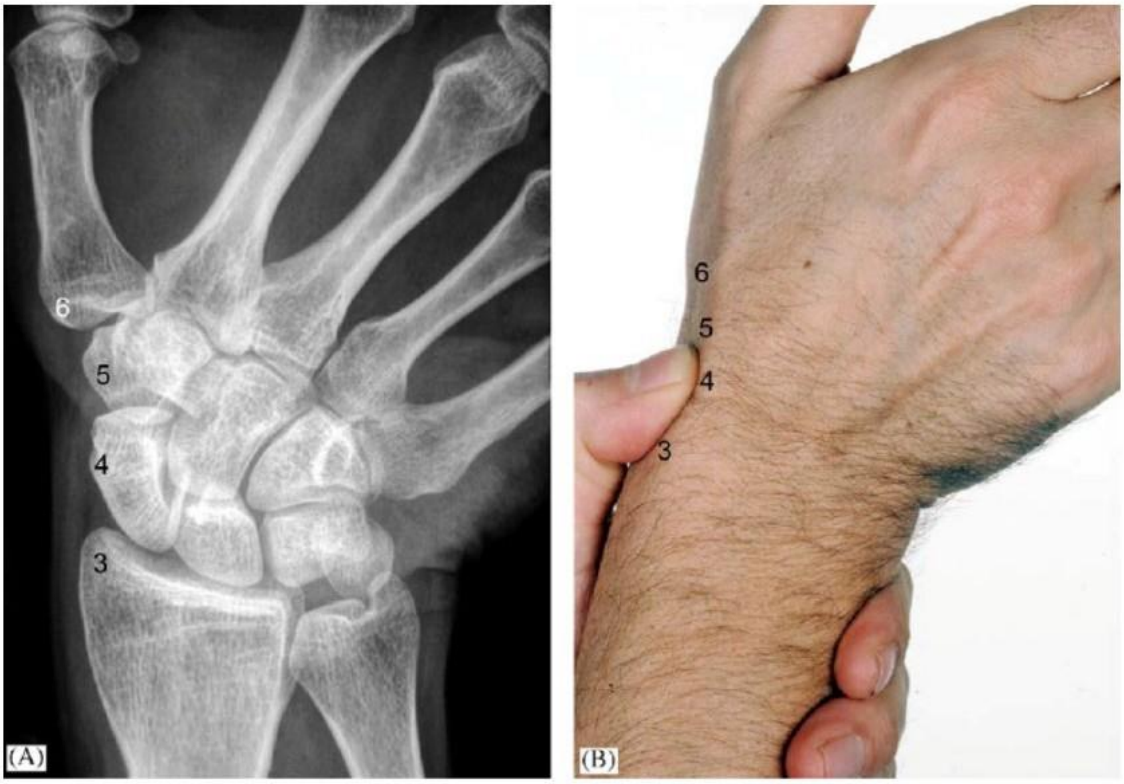


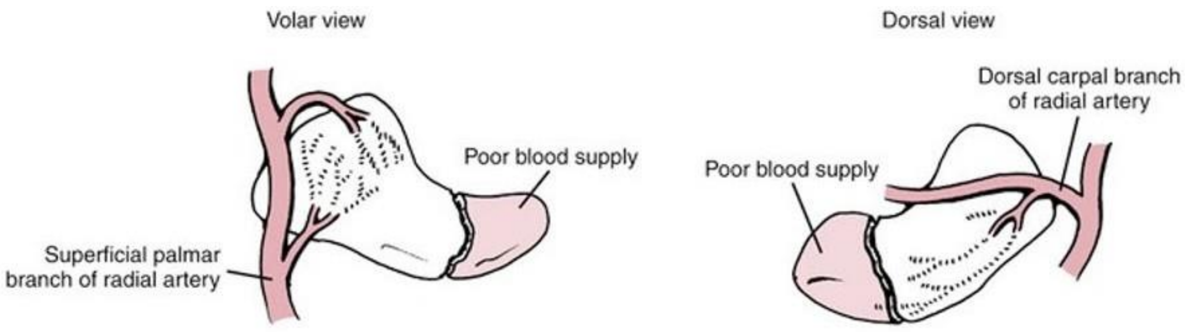
Figure : surface anatomy of scaphoid

(A) X-ray of the wrist in ulnar deviation. (B) Clinical picture of the wrist in ulnar deviation. The landmarks include (3) radial styloid process, (4) scaphoid waist, (5)trapezium, and (6) base of the first metacarpal. Reddy et al.[33]

Blood Supply

The radial artery directly supplies 70-80% of the proximal part of scaphoid by giving direct branches that enter through foramen in non articular surface along the dorsal region at the level of waist[34]. The interosseus vessels with retrograde flow supply the proximal pole in scaphoid.

Radial artery branch, the palmar (volar) scaphoid branch enters scaphoid bone close to the distal pole to deliver blood to the distal part that is 20% to 30% of the scaphoid[34].



The intramedullary vascular supply is the only source of blood for the proximal pole of the scaphoid. After a fracture through the waist, the proximal pole and the waist are vulnerable to avascular necrosis due to the unusually retrograde nature of the blood supply[35].

These fracture types require 3 to 6 months on average to heal, and 5 to 10% of them are said to result in non-union[5]. Nutrient arteries of scaphoid bone provides nourishment to the distal part of scaphoid through the area of the scapho-trapezium ligamentous attachment. Perforators are not found elsewhere[30].

Ligamentous Anatomy

The scaphoid is supported in volar aspect by – [36,37]

- two long and strong ligaments the radio-scapho-capitate (RSC) and the long radio-lunate ligament (LRL)
- three short ligaments the scapho-capitate (SC) and scapho-trapezo-trapezoid ligaments (STT)

The transverse carpal ligament adds to this volar support[38].

The scaphoid is supported dorsally by -

- the long intercarpal ligament (DIC), and
- radio-luno-triquetral ligament (RLT) to some extent [39].

The RSC ligament crosses the waist, functions as a sling across it, and permits rotation[30]. It is not linked to the bone itself. The scaphoid has no tendinous attachments. The scaphoid bone moves in two directions, gliding in one direction and rotating in the other, stabilising the midcarpal joint30. In open methods to the scaphoid, its repair and realignment are therefore crucial.

Finally the scaphoid bone is suspended proximal to the lunate by the scapho-lunate ligament complex (SL).

The volar and dorsal ligaments, as well as the membranous area between the two ligaments, make up this C-shaped complex[40].

The scaphoid is connected to the proximal row by the dorsal ligaments (SL and DIC), which also provide Flexion of scaphoid bone in radial deviation.

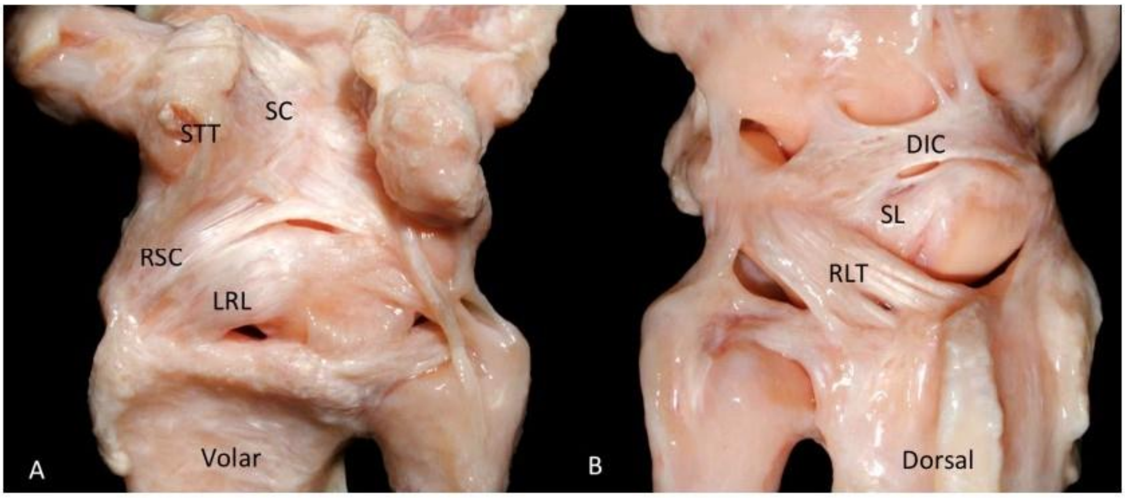
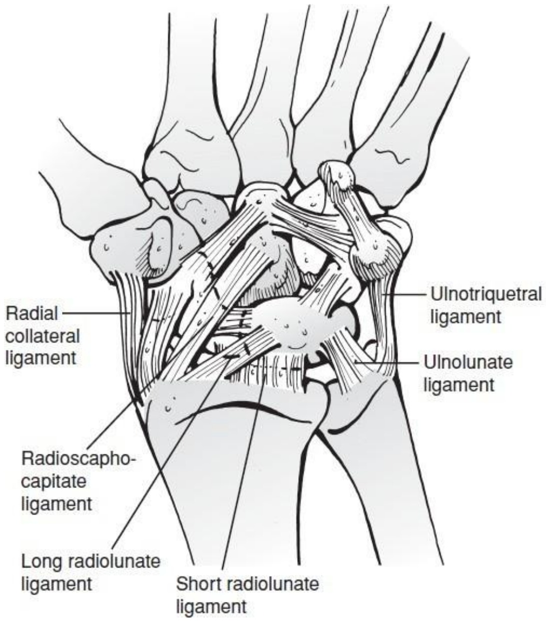


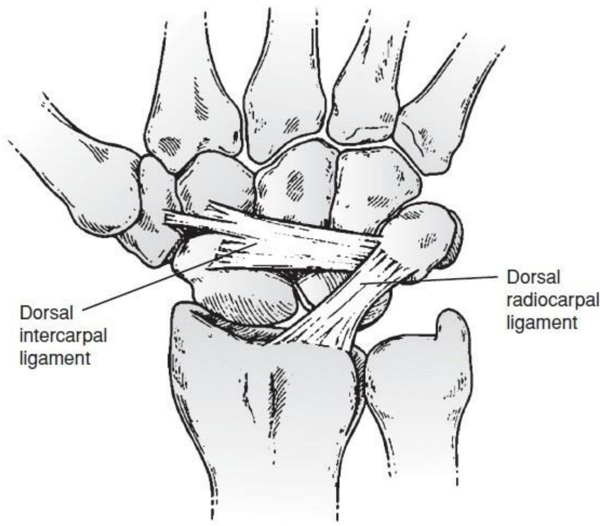
Figure : Anatomical specimen showing ligaments of wrist joint.

(A) Volar ligaments: long radio-lunate (LRL), radio-scapho-capitate (RSC), scapho-trapezio-trapezoidal (STT), scapho-capitate (SC). (B) Dorsal ligaments: dorsal intercarpal (DIC), scapho-lunate (SL), radio-luno-triquetral (RLT)

LIGAMENTS OF THE

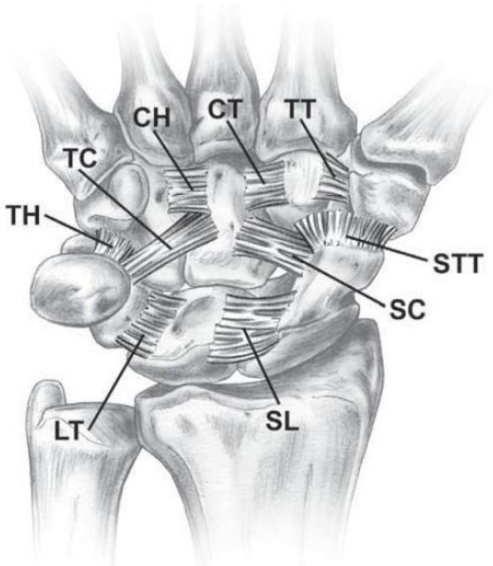
SCAPHOID

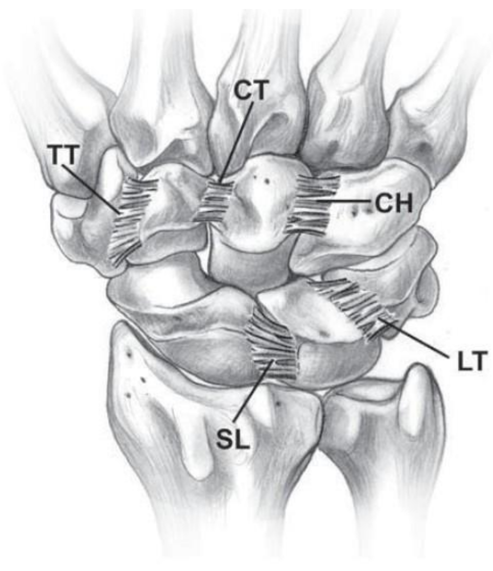




EXTRINSIC-LIGAMENTS-

INTRINSIC-LIGAMENTS-





Biomechanics

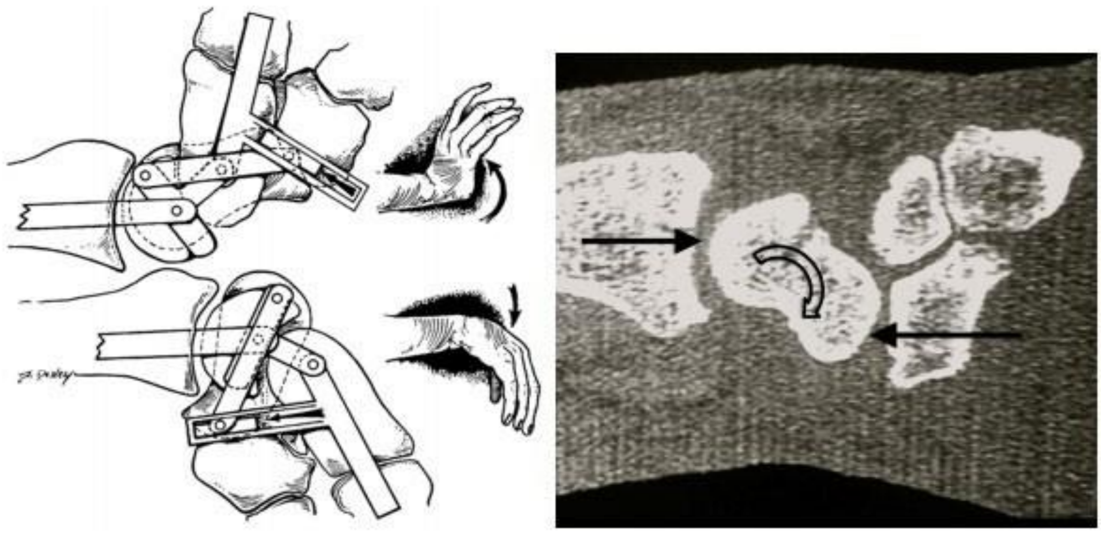
The internal 21 different articulations of the carpus are held together by their form and a ligamentous structure resembling an arch bridge. Only the flexor carpi ulnaris gets inserted on the carpus (pisiform and hook of the hamate) of the forearm's 19 muscles that position the hand.
As a result, the complex articulations, ligamentous insertions, and attachments control how the carpal bones move.

The scaphoid's three-dimensional (3D) architecture is intricate, and understanding its dynamic structure is much more challenging.
The scaphoid bone communicates with -

- five articular surfaces
- Multiple supportive and suspending ligaments
- the entire flexor and extensor mechanism

Both the radiocarpal joint and the midcarpal joint can flex and extend the wrist equally.

Radial deviation occurs mainly in the midcarpal joint, and ulnar deviation occurs equally divided between the radio- and midcarpal joints[41]. The scaphoid most importantly, serves as a mechanical connection between the proximal and distal carpal rows.



A B

Figure: Biomechanics.

(A) The scaphoid bone links the proximal and distal carpal bone rows through a slider crank mechanism (Illustration from Cooney[42]. (B) The Sagittal CT scan of a scaphoid fracture showing the biomechanical reasoning for the development of a humpback deformity in a scaphoid waist fracture.

Clinical Anatomy of scaphoid

The proximal pole of scaphoid (proximal third), the scaphoid waist (middle third), and the distal pole of scaphoid (distal pole) are the three components of the scaphoid. This equal third classification of scaphoid bone, which is used to describe the x-ray appearance of a fracture, is best applied to a x-ray of the scaphoid taken in a Stecher's projection[43] with the hand made into a fist and the wrist in maximum ulnar deviation to produce a picture of the scaphoid along its entire length.

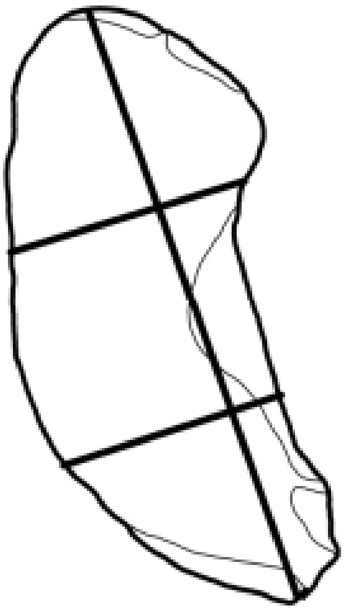


Figure : Clinically anatomy.

The equal third classification of Scaphiod

Mechanism Of Injury

The most frequent mode of injury is a fall on an outstretched, ulnarly deviated and pronated hand in which typically the wrist in more than ninety degrees of dorsiflexion, causing the scaphoid bone to collide against the distal radius causing trauma in the middle of the scaphoid[35]. Falls that involve the wrist in abduction increase the risk of proximal pole fracture[44]. A direct trauma or blow or axial stress with the wrist in neutral flexion or extension are two other mechanisms[30]. Patients may have moderate range-of-motion limitations and minimal oedema, which raises the possibility of missing an undetected fracture.

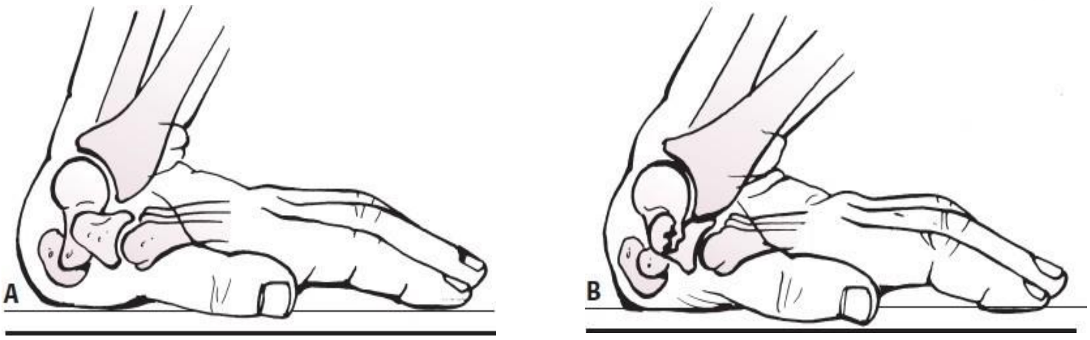


Figure : A) Shows mechanism of injury and B) Fracture

Until otherwise proven, any patients with radial wrist pain, snuffbox or scaphoid tubercle soreness, or both should be considered to have a scaphoid fracture[45]. It also helps in explaining that scaphoid waist fractures are the most common type of damage as the scaphoid waist is made up of fewer, thinner, and less denser trabeculae than the proximal pole[1].

According to cadaveric research, fractures happen when the wrist is maintained in an extended position of ninety to hundred degrees and a dorsiflexion force is transferred to the radial part of the wrist while maintaining the radio-scaph-ocapitate ligament as the fulcrum[46].

Dorsal intercalated segmental instability (DISI) occurs if the proximal carpal row is in extension. Scaphoid-carpal ligaments that are still intact withstand bending pressures that could cause wrist fractures. Direct contact induces fractures at the distal pole and tubercle, while forced ulnar deviation of wrist results in avulsion fractures at the radial collateral ligament attachment points[47].

Diagnosis

Traditional examination shows tenderness at the anatomic snuffbox and the volar aspect of the distal part of the scaphoid, as well as a positive compression test of scaphoid (pain on compression along the axis of the first metacarpal), indicate concerns that call for further investigation[48].

Snuff box discomfort, distal scaphoid tenderness, and axial compression test of thumb, all had 100% negative predictive value and sensitivity[30]. It has been established that pronation discomfort and pinching of the thumb and index finger are sensitive provoking techniques indicative of a scaphoid fracture[48].

Most of the times, acute fractures of scaphoid can be inaccurately diagnosed as ligamentous injury and treated without adequate X-rays and plaster cast immobilization. Fractures of scaphoid that are untreated or improperly treated can develop non-union, which can happen in 5% to 25% of cases[30].

In addition to the symptoms like short-term pain, weakness, and disability, stiffness, scaphoid non-union results in wrist arthritis in almost all patients- that, if left unattended, typically requires management with salvage procedures[30].

According to research by Unay et al.[49], pain during thumb-index pinching (sensitivity 73%, specificity 75%, positive predictive value 96%, and negative predictive value 23%) and pain during forearm pronation (sensitivity 79%, specificity 58%, positive predictive value 82%, and negative predictive value 54%) help diagnose scaphoid fractures, but are absent in 27% of cases. Overall, the mean positive predictive value was reported to be just 21%, and the specificity for clinical evaluation was only 74 to 80% as per the literature.

Other physical signs that may aid in the diagnosis of scaphoid fractures include diminished grip strength and limitations in the end arc of motion with flexion and radial deviation. Scaphoid fractures must therefore be detected quickly and suitably immobilised[48]. Occult fractures can be diagnosed with the help of imaging techniques.

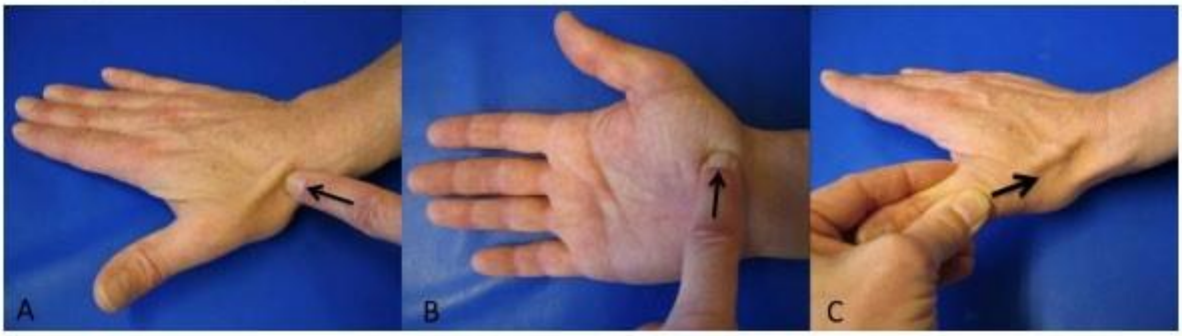


Figure : Clinical signs showing scaphoid fracture

(A) Tenderness of Anatomical snuffbox (ASB);

(B) Tenderness of scaphoid tubercle (ST);

(C) pain on longitudinal compression of the thumb (LCT)

Imaging

The PA, lateral, and ulnar-deviated images make up the typical Scaphoid series[30]. As the medial deviation of the wrist causes distraction of unstable scaphoid fracture fragments, the Postero-Anterior view in medial deviation (scaphoid view, Banana view, or Ziter view)[30] may be able to visualise the fracture. Scaphoid fractures have a sensitivity (true-positive rate) of about 70% on plain radiographs[50].

The best way to see the scaphoid's waist is from a semi-pronated oblique view, which may be necessary to make a proper diagnosis[51]. Only tuberosity and distal third fractures may be seen on lateral radiographs, but they are also necessary to illustrate the carpal arrangement and distal radioulnar joint alignment.

The pisiform is situated admist the distal part of the scaphoid bone and the body of the capitate in a correct perspective, which should display a co-linear capitate and radius[30]. An appreciable fracture line on x-rays should be considered as a displaced fracture since radiographs frequently underestimate real displacement.

Patients with no radiographic findings and clinical symptoms suspecting of a scaphoid fracture should undergo higher investigations like computed tomography (CT), which has an average sensitivity of ninety-four percent and specificity of ninety-six percent for detecting concealed fractures. In a study by Ty et al.[52], it was discovered to have an average negative predictive value of ninety-nine percent, meaning it is extremely difficult to miss a fracture of scaphoid bone. Additionally, it is also helpful for preoperative planning and fracture non-union. Additionally, CT is more affordable than magnetic resonance imaging and is easily accessible in urgent care settings (MRI).

The mean specificity and sensitivity of magnetic resonance imaging are both 99%[53]. In addition to helping to establish the vascularity of the proximal pole of scaphoid bone prior to surgery, it can help discover trabecular minute fractures and determine other reasons of wrist discomfort if a fracture could not be visualised. It is particularly helpful in determining the cause of proximal pole fractures of scaphoid, which may lead to avascular necrosis.

Normal or reduced T1 and increased T2 intensity are present in acute fractures. Low T1 and T2 marrow signal intensity frequently indicates non-union and reduced vascularity, which are associated with slow healing[5]. Notably, MRI is less likely to produce false-positive results than bone scans for detecting occult scaphoid fractures. As a result, it can help end immobilisation and reliably exclude patients without scaphoid fractures.

SCAPHOID SERIES OF RADIOGRAPHS

PA View

LATERAL View

SCAPHOID View

SEMISUPINATED OBLIQUE View

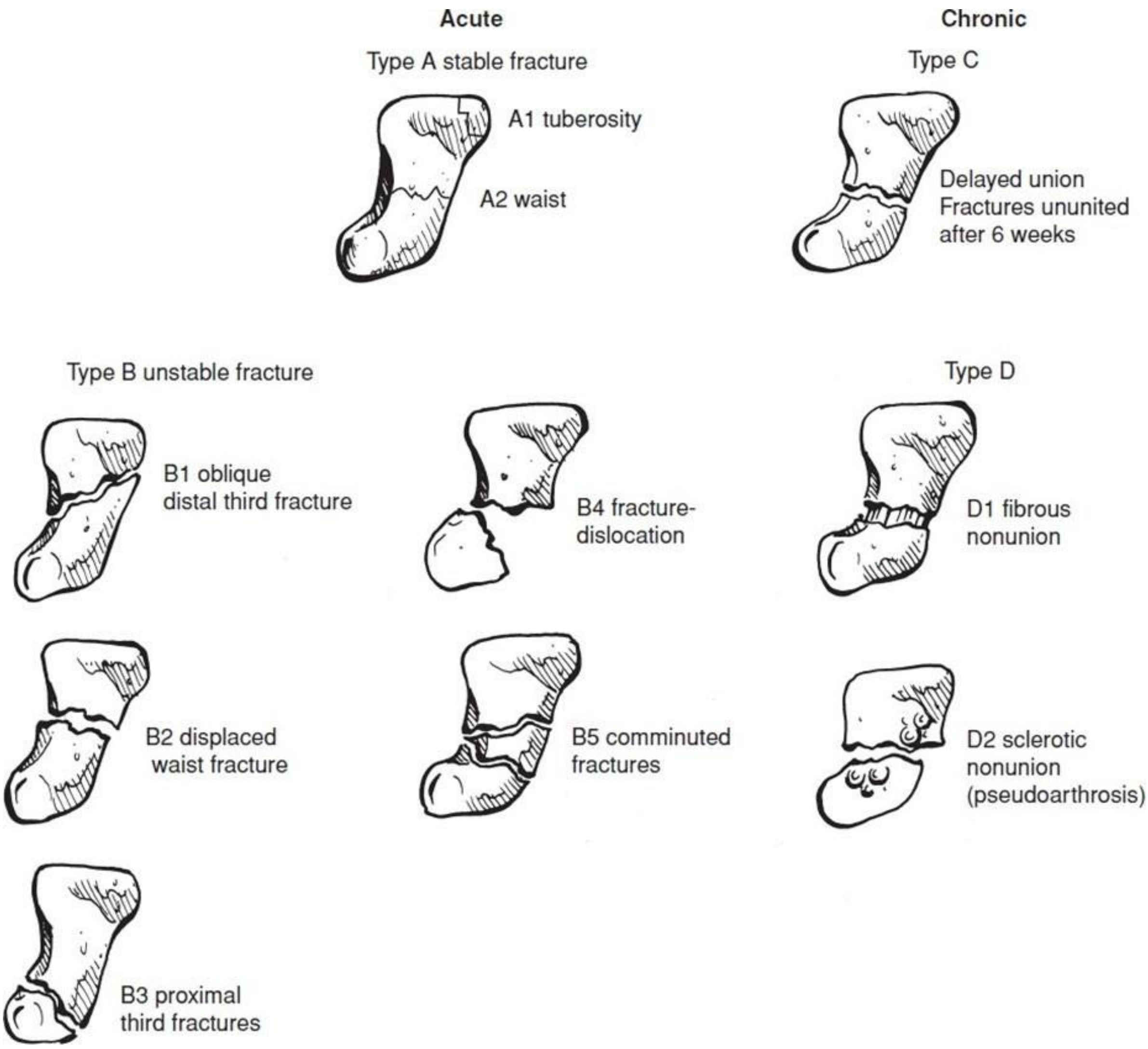
MRI can be used in cases of non-union for further management following fixation as bone marrow signals can be assessed even in the presence of titanium screw[54]. Carpal ligaments or triangular fibrocartilage complex injuries are frequently associated with fractures of scaphoid and reported in about thirty percent of affected patients and associated intercarpal soft tissue injury may be present in around eighty percent of instances[30].

Classification

Fractures of the scaphoid can be classified as follows -

1. Herbert and Fischer classification
2. Russe classification
3. AO classification
4. Mayo classification

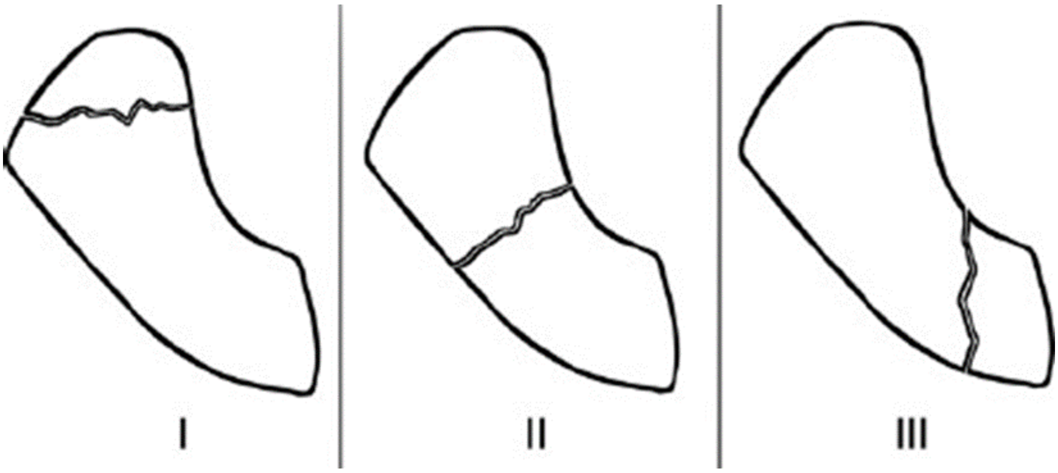
HERBERT FISCHER CLASSIFICATION[55]



Herbert proposes a straightforward yet effective technique of classification. The Herbert classification is the most popular since it distinguishes between stable and unstable fractures, a crucial distinction when deciding between surgical and nonsurgical treatment.

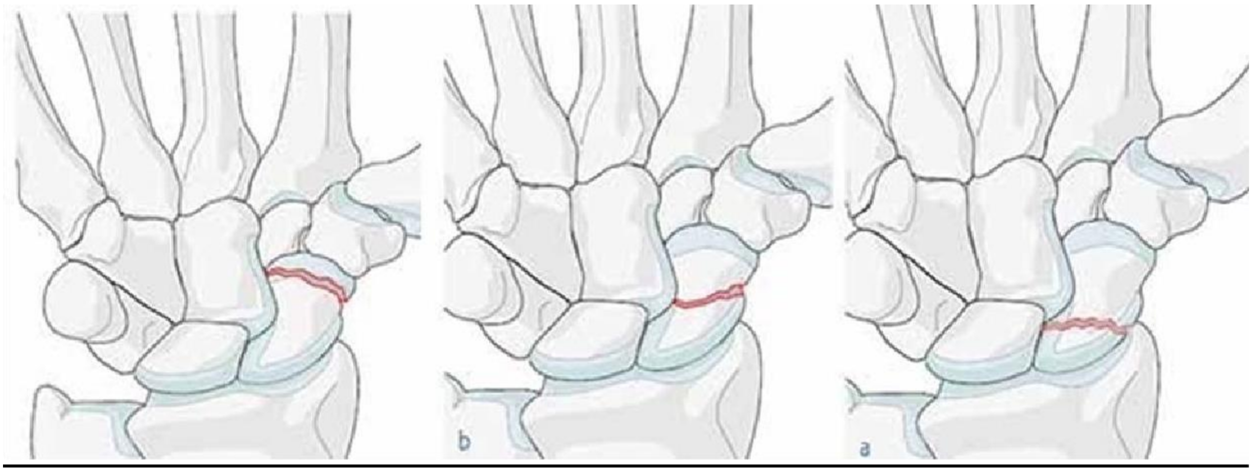
The Herbert classification method comes to a conclusion with delayed unions (type C) and established non-union (type D). The Herbert system defines unstable fractures as those that have a displacement between the fragments of more than 1 mm or an angulation of more than 15 degrees.

RUSSE CLASSIFICATION[56]



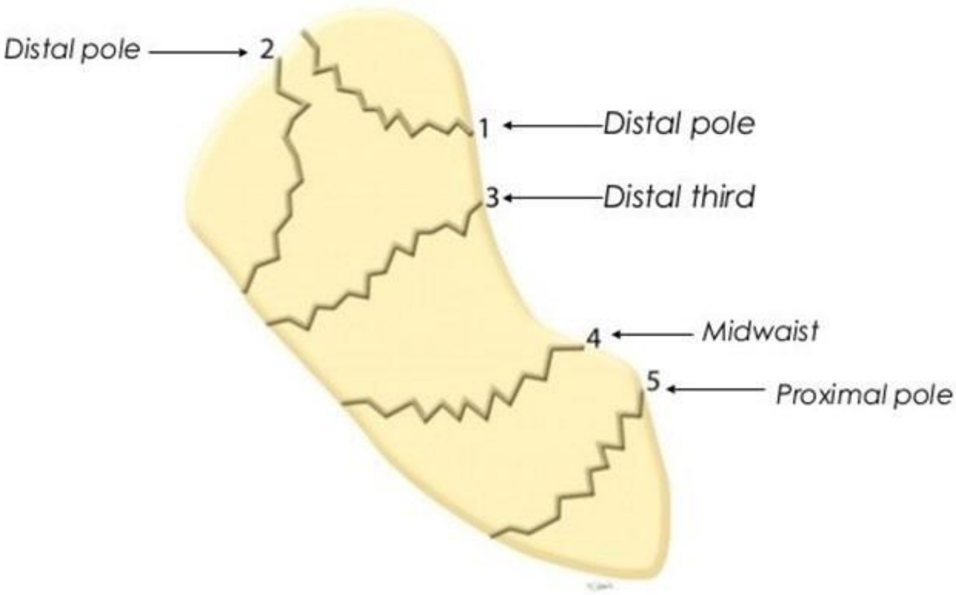
Based on the direction of the fracture line, the Russe classification classifies scaphoid fractures (horizontal, oblique, transverse, or vertical oblique). Russe concluded that due to shear stresses across the fracture site, vertical oblique fractures were the most unstable form. Given the greatest compressive force, horizontal oblique fractures were the most stable.

AO CLASSIFICATION[30]



AO classification divides the fracture of scaphoid into simple anatomic location(proximal and distal pole and waist) and comminution.

MAYO CLASSIFICATION[30]



Scaphoid fractures are broken down into proximal (10%), middle (70%) and distal (20%) fractures according to the Mayo classification. The distal articular surface and the distal tubercle are distinguished within the distal third.

Instability criteria as proposed by Mayo are:[30]

1. fracture displacement greater than 1mm
2. Bone loss or excessive comminution
3. Perilunate fracture-dislocation
4. DISI deformity
5. Proximal pole scaphoid fractures
6. Fracture Malalignment

MANAGEMENT

When deciding on the best course of action for scaphoid fractures, the surgeon must take many factors into account. Since waist of scaphoid bone fractures, which account for more than seventy percent of all fractures and show healing in two to three months, the site of the fracture is an important factor to take into account. It usually takes 6 to 8 weeks for distal pole fractures to heal, whereas proximal pole fractures take 12 to 24 weeks to do so. Proximal pole fractures are more likely to develop avascular necrosis and may benefit from screw fixation even if they are not displaced[57].

Because non-displaced fractures of scaphoid bone have good rates of union and displaced fractures are more prone to additional displacement and sometimes non-union, fracture displacement is an important factor in the surgical strategy[17]. Patient needs and expectations must also be taken into account. Compared to cast treatment, surgical treatment allows for a quicker return to work or participation in sports.

Even if any therapy that encourages fracture of scaphoid healing can be deemed successful, the ones that encourages primary healing iare unquestionably preferable because these fractures cannot heal through secondary bone healing and do not produce a callus.

The importance of early identification and therapy is highlighted by the fact that even a four-week delay in receiving treatment can result in significantly greater incidence of delayed union and non-union[58].

NON-OPERATIVE MANAGEMENT

The site of the fracture is a crucial indicator of how quickly nonoperative treatment will work. Proximal pole of scaphoid fractures, even when not displaced, usually take a lengthy duration to unite and are more prone to develop AVN; hence, surgery is preferable to cast management in these cases. The likelihood of pseudo-arthrosis after a scaphoid fracture increases by 30% when inadequate immobilisation is used.

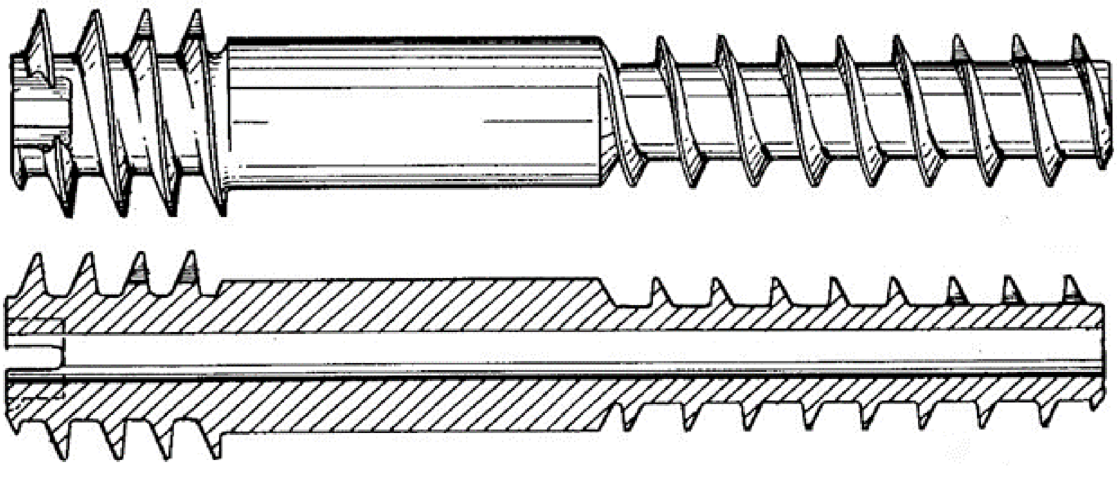
Short thumb spica casts can be used as a non-operative treatment for stable, non-displaced fractures for a duration of 6 to 8 weeks[19]. While prolonged immobilisation alters the homeostasis of collagen, losing the natural features of connective tissue, and increases the likelihood of carpal joint stiffness and delayed or non-union seen in about ten to fifty percent of displaced fractures[59].

OPEN REDUCTION AND INTERNAL FIXATION

Acute displaced fractures of scaphoid bone, proximal pole of scaphoid fractures, and all unstable fracture patterns mentioned under Herbert and Mayo classification are the most frequent indications for internal fixation.

HERBERT SCREW[60]

The Herbert screw is made of a durable titanium alloy screw with two threads. It has a diameter of 2.5 mm and a length range of 12 to 32 mm. Because the distal threads' pitch and diameter are larger than the proximal threads', the fracture site can be compressed. The screw is recessed beneath the articular surface, thus removal is not necessary. The screw was created to allow for early wrist mobilisation and secure fracture fixation. The difference in pitch between the proximal and distal threads allows for further compression of the fracture.



SURGICAL APPROACHES

The Dorsal approach and Palmar approach to Scaphoid are the two commonly used approaches for the open reduction and internal fixation of fractures of scaphoid bone.

More recent advances have led to an increased usage of the percutaneous technique in today's world.

VOLAR APPROACH[61]

Put the patient supine and under suitable anesthesia and prepare the hand and wrist.

Inflate a pneumatic torniquet. It is one of the best mode of exposure for distal pole fractures of scaphoid bone and those distal to the waist.

A linear longitudinal dermal incision is made on the volar aspect of the wrist, starting 3 to 4 cm proximal to the palmar wrist crease. It is extended distally till the palmar flexion crease and it is curved laterally toward the scapho-trapezial and trapezio-metacarpal joints.

Protect the superficial radial bundle. Reflect skin folds at the forearm fascia level. Retract the tendon radially, inscise the flexor carpi radialis sheath, and incise the sheath's deep surface. Open up the joint's palmar capsule over the radioscaphoid joint. nerves and the terminal branches of the median nerve's palmar cutaneous branch.

Release the capsule in the scaphoid bone's linear axis by slanting the incision toward the scapho-trapezial joint while extending the wrist in an ulnar deviation. Expose the fracture with a thorough dissection, cutting through the lengthy radiolunate and radioscaphocapitate ligaments while saving each leaf of these capsuloligamentous structures for subsequent repair.

To decide whether bone grafting is required, examine the fracture. Reduction and fixation are sufficient in the absence or absence of comminution. Obtain an iliac crest bone graft if there is considerable comminution, particularly on the palmar aspect and a tendency for the scaphoid to bend at the fracture.

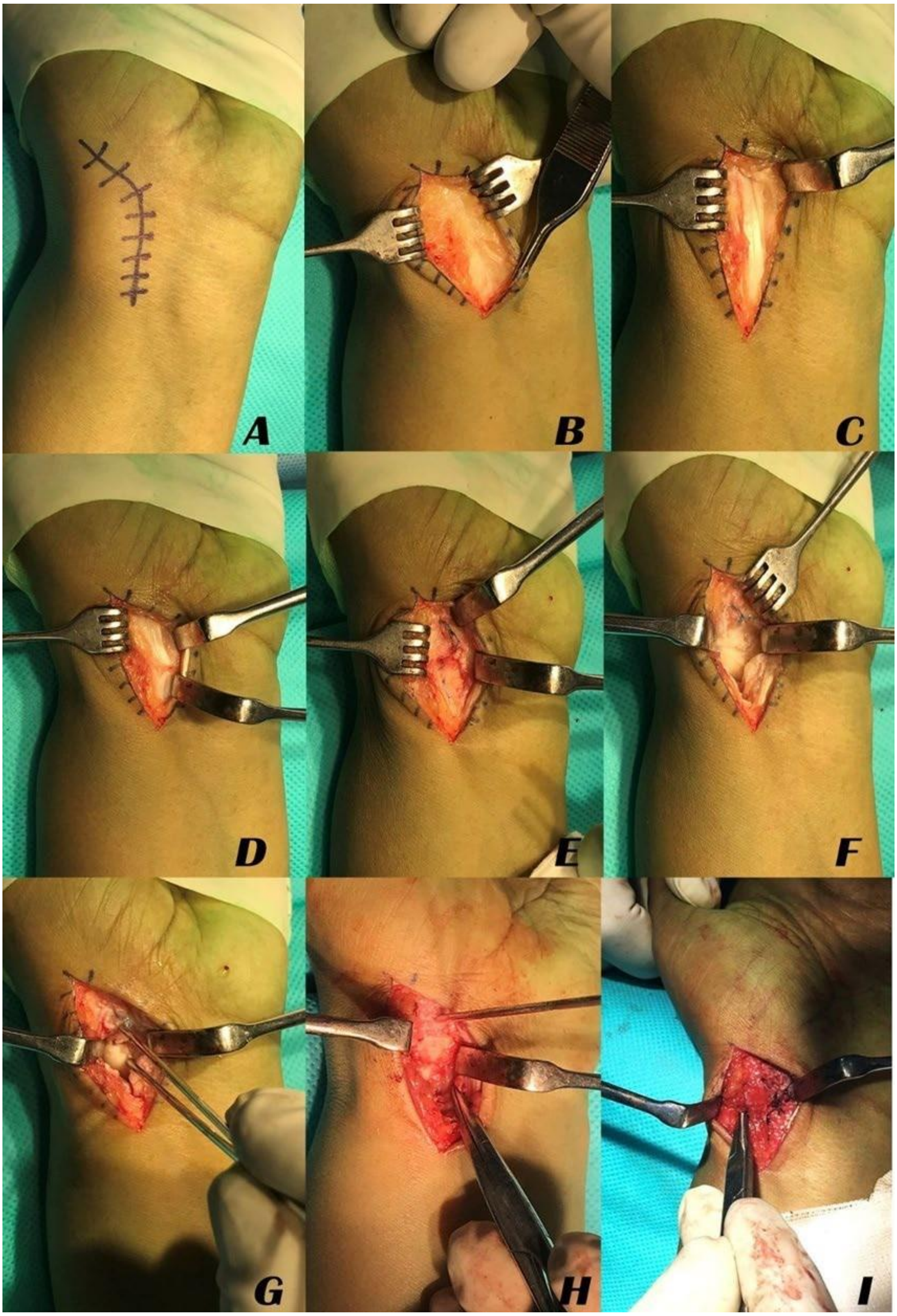
Kirschner wires used as toggle levers (or "joysticks") at the distal and proximal poles make it easier to move the pieces. Kirschner wires are used to reduce the fracture and fix it while preventing rotation and angulation. Check that the guiding wire is in the proximal and distal poles and is centred. This step benefits from image intensification utilizing C-arm fluoroscopy.

Insert the fixation device through a distal entry point for fractures of scaphoid bone across the waist. Open the scaphotrapezial joint with a longitudinal capsular incision to provide the distal entry point. A section of the trapezium can be removed, allowing the guidewire to be inserted from distal to proximal for better center-center placement. To countersink the screw beneath the articular cartilage, insert the screw till the head of the screw is flush with the subchondral layer of the scaphoid bone.

A slight radial deviation of the wrist, aligns the scaphoid vertically, facilitates the placement of Kirschner wires down the linear long axis of the scaphoid bone. Aim the wires dorsally into the scaphoid bone while holding the wrist in this position.

Check the reduction position and alignment, as well as the placement of the internal fixation screw, with the help of image intensification or radiography after achieving stable reduction and fixation. The tourniquet should be deflated to achieve hemostasis. If necessary, insert a drain and use nonabsorbable or long-lasting absorbable sutures to closure the wrist capsule. close the inscision. Apply a bandage that incorporates a thumb spica cast.

The volar approach is depicted in the figure below with A to F showing the exposure in the order of skin inscision, Flexor Carpi Radialis tendon sheath exposure, inscision over the palmar aspect sparing tendons, and exposure of carpal sheath. G displays the manipulation of the scaphoid bone fragments by using K wires as joysticks, H displays the attempt to reduce thefracture, and I displays the ligaments being sutured.



Figures showing the open volar approach to the scaphoid.

DORSAL APPROACH[61]

It is an excellent approach that can be used to expose the fracture site and implant internal fixation for non-comminuted fractures od scaphoid at the proximal pole. Make a 0.5 to 01 cm dorsal vertical incision grazing the anatomical snuff box to expose the space in between the first and second radiocarpal joints among the dorsal compartment. Shield the radial nerve and ulnar nerves' sensory branches. Dorsal veins should be preserved, cauterised, or ligated and divided.

Protection is required for the extensor tendons, more importantly the extensor pollicis longus tendon as it leaves the third dorsal compartment while making vertical incisions in the extensor retinaculum. The dorsal wrist capsule can be accessed by cutting the retinaculum.

Extensor tendons should be wrapped in a loop of umbilical tape before being pulled back ulnarly. Making a laterally based flap and cutting along the dorsal inter-carpal ligament and dorsal radio-triquetral ligament will allow you to release the dorsal capsule. Laterally retract the capsular flap to reveal the fracture site.

A Kirschner wire should be inserted proximally parallel to the scaphoid's longitudinal axis. To move the proximal fragment into a reduction position, use this wire as a joystick. Pass the initial wire across the fracture once it has been reduced for temporary interfragmentary fixing. With the use of C-arm fluoroscopy, centre the guiding wire at the proximal and distal poles of scaphoid.

One should choose right screw length before using it. Scaphoid bone is drilled, then insert the proper length screw. Using C-arm fluoroscopy, make sure the guide-wire for screw implantation is positioned in the middle along of the longitudinal axis of the scaphoid at proximal and distal poles. Repair the retinaculum flap and close the capsular flap. Apply a plaster splint and seal the skin.

The benefit of the dorsal technique is that the scapho-trapezial joint is not violated for the insertion of the screw track, preventing future iatrogenic scapho-trapezial arthritis complications.

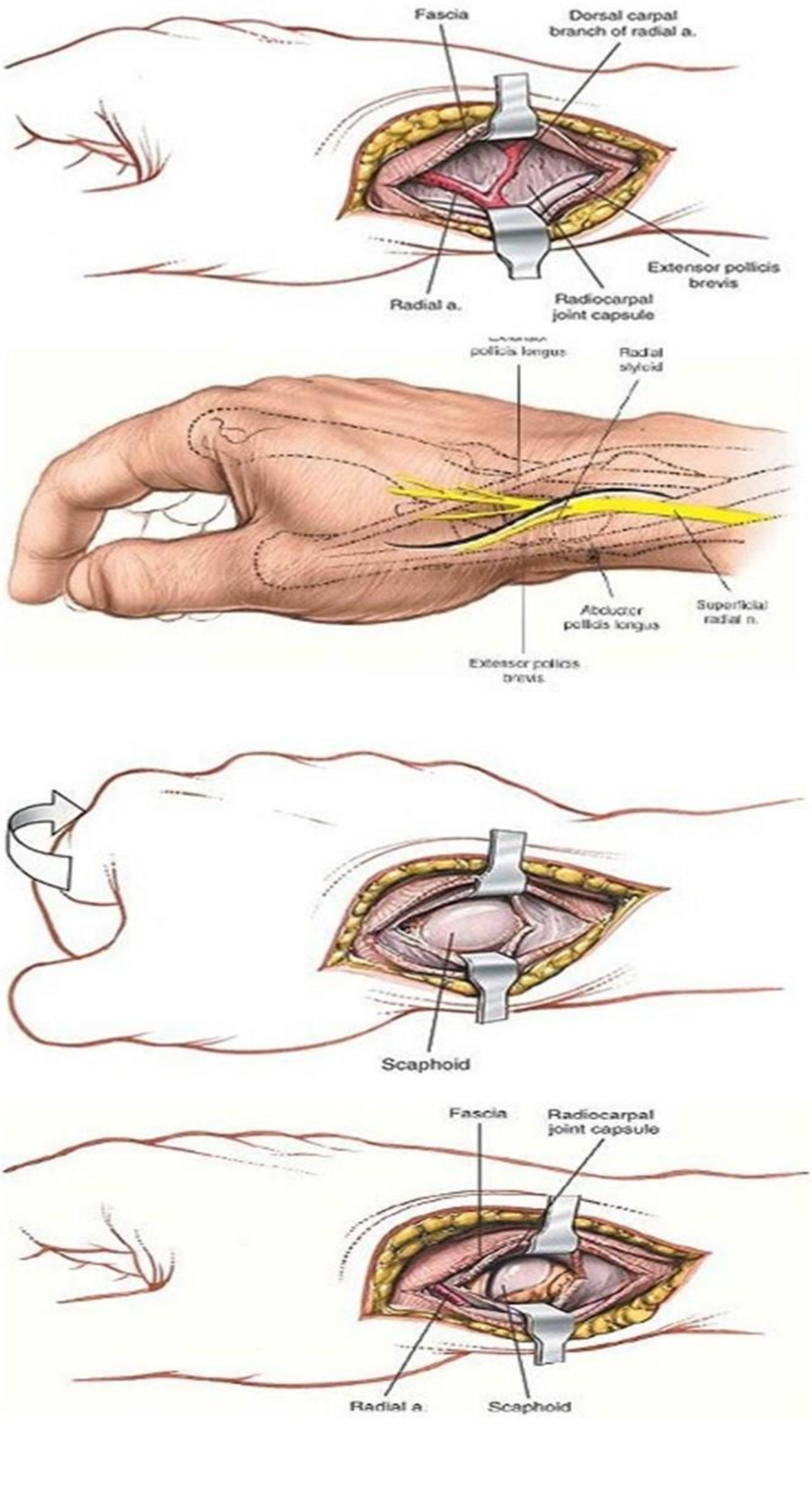


Figure showing the open dorsal approach to scaphoid.

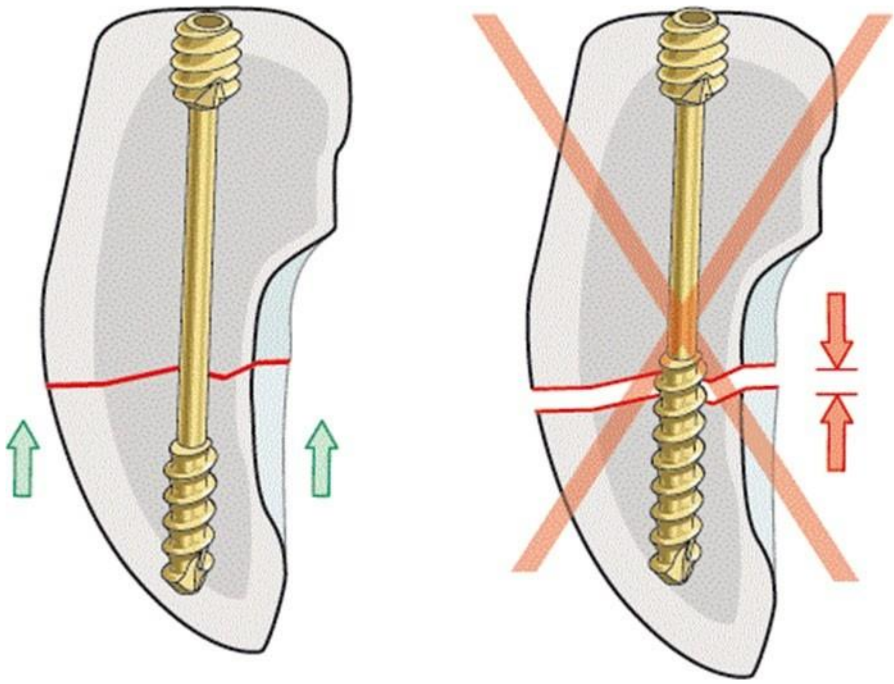


Figure depicting the ideal placement of headless compression screw across the fracture site of scaphoid bone

In order to allow fracture site compression, as illustrated in the above figure, the size of the screw must be picked as to keep fracture line bearing the smooth shank of the screw.

Yip et al.[62] recommended using the 45-degree supination oblique view to gauge the screw's length and prevent excessive penetration of the radio-scaphoid joint space. To prevent radio-scaphoid impingement, the headless compression screw must be completely buried within the articular cartilage.

The longest screw should be inserted into the distal scaphoid poles to provide optimal scaphoid fixation. The scaphoid poles have the highest bone density because they offer the best fixation[63]. In order to avoid damaging the dorsal blood supply, fractures of the distal 2/3rds can also be approached through volar approach

.

Proximal pole and oblique fractures are contraindicated for the volar approach because the screw fails to cross the fracture perpendicularly to obtain sufficient compression. The fracture is displaced as a result[64].

The disadvantage of using volar surgical techniques is that it might be challenging to achieve fracture reduction, which may lead to proximal scaphoid pole fractures that do not heal[65]. Due to the trapezium's orientation, it is challenging to insert a guiding wire along the central longitudinal scaphoid axis in such a way that the screw can also pierce the joint.

The scapho-trapezial joint's centre or the base of the thumb are the distal points targeted by the dorsal approach. As a result, a more central location in the distal pole is made possible[64]. The central axis guidewire can be inserted for screw insertion using the dorsal approach directly, unhindered access to the fractures of scaphoid at proximal pole. As the hold of the screw threads in the proximal fragment tends to be much higher, fracture fixation is improved.

incomplete exposure to the distal 1/3rds of the scaphoid, possible injury to extensor tendon injury, damaging of the articular cartilage of the proximal pole of the scaphoid, dorsal ligaments injury and risk of vascular injury are some drawbacks of this procedure. Furthermore, the wrist must be fully extended while inserting the screw via the most proximal region. Flexion of the wrist may lead the distal fracture part to be in a flexed posture and leads the proximal fragment to follow the lunate to be in an extended posture thus produces the hump-back deformity.

Distal pole scaphoid fractures are best fixed using the dorsal fixation technique since they can provide technical challenges for inserting a volar screw perpendicular to the fracture line[66].

To bury the screw completely under the chondral articular surface of the distal pole of scaphoid without poking the chondral surface of the proximal pole of scaphoid, 4 to 6 millimeters should be deducted from the measured screw length[58].

PERCUTANEOUS FIXATION:

A percutaneous technique is used to treat scaphoid waist fractures with minimum displacement following a complete preoperative radiographic assessment. Hyperextension and ulnar deviation of the wrist are part of the closed reduction maneuver, which facilitates any necessary reduction of the fracture. The trapezium can be brought dorsally to the scaphoid tubercle, where the guide wire is inserted, with the help of hyperextension. The scapho-trapezial joint is reached distally with a brief stab incision. Before inserting the threaded guide wire, use a 18 gauge needle to identify the insertion / entry point of the guide wire radiographically.

At the border of the scapho-trapezial joint, the insertion site is on the scaphoid tubercle distally. At the verified entrance site, a drill guide is used to insert the threaded guide wire. Use a protective sleeve if there is no drill guide available.

The guidewire's trajectory should be slanted 45 degrees medially and dorsally along the scaphoid's midline. The wire's position must be as perpendicular to the fracture line as is physically practicable. This rule might need to be relaxed with oblique fractures. The cortex at the proximal pole of the scaphoid should not be pierced.

The needed screw length can be determined using one of two techniques:

1. For a precise measurement, place the specialised measuring tool firmly on the tubercle by inserting it over the guiding wire across the drill guide.

2. If you don't have availability to the special drill guide, take one more additional guide wire that is of the same length and press the tip of it against the bone where the implant will be placed. The length of the drill hole required for the screw is shown by the difference in length between the two wires' protruding ends. To find the length of the screw, deduct 4 mm.

Utilize only the specific drill bit. In comparison to manual drilling, using a electric powered drill will apply a smaller, more controlled and presice force to the fragments, lowering the possibility of dislodging them. It is best to use a small, slow-rotating power drill. To reduce heat damage, cool the drill bit with Ringer lactate solution. Using image intensification, check the location of the drill bit's tip. If using self-tapping screws, manually tap the drill hole after each screw.

Manually place the screw over the guide wire. If inter-fragmentary compression is to occur, it is imperative that the threaded portion of the screw tip pass completely across the fracture site. Remove the guide wire before completing the tightening.

Ensure that the threads on the screw's near end are completely buried in the bone where it will be inserted. Using image intensification, verify the screw's ultimate location and the stability of the scaphoid.

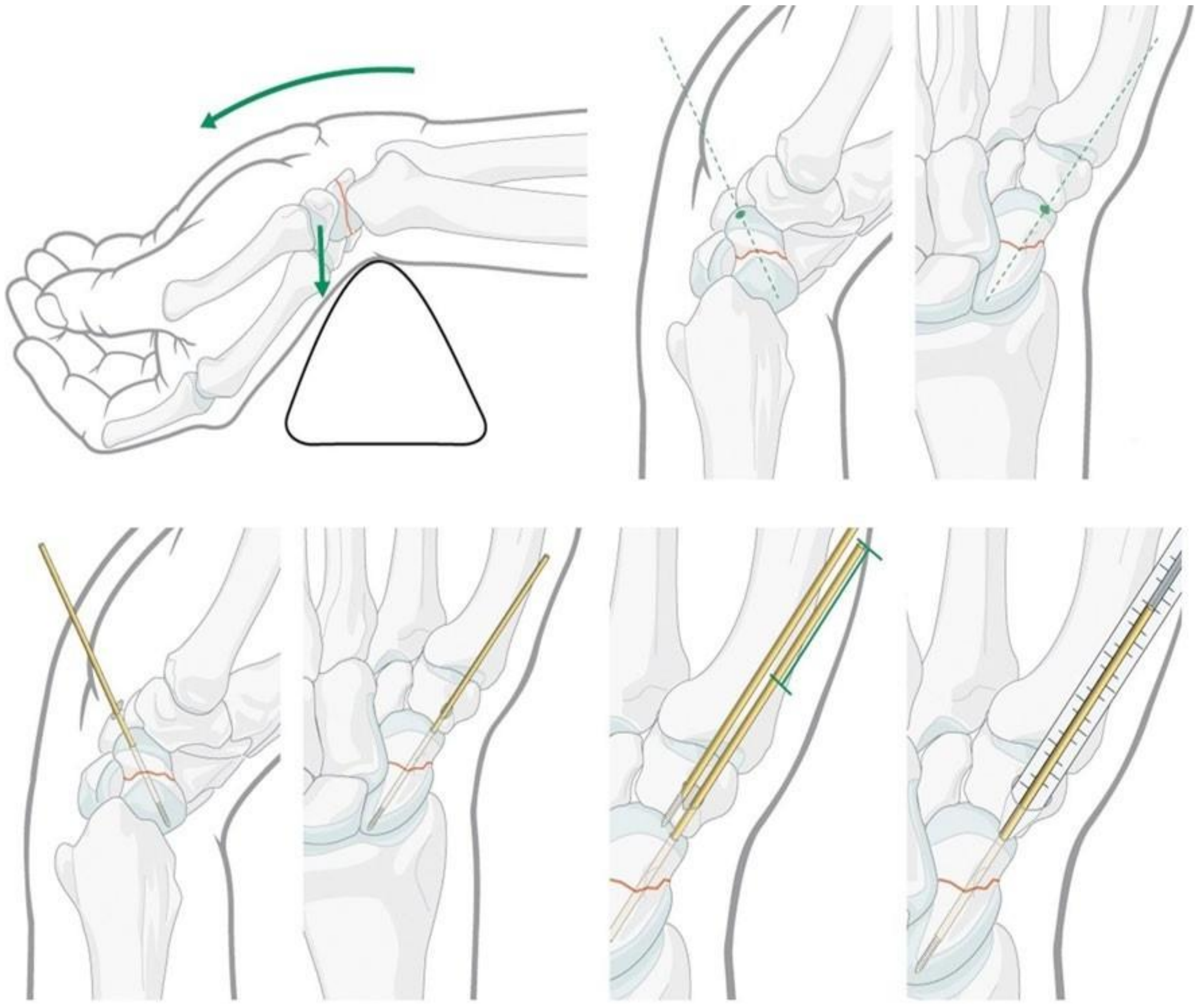


FIGURE: Percutaneous fixation technique of Scaphoid waist fracture.

POST-OPERATIVE CARE

At two weeks, the cast and sutures are both removed. A thumb spica plaster is used until the scaphoid union is assured as healing proceeds as demonstrated by radiographic evaluation at follow-up[61]. CT imaging can be useful to check for bridging trabeculae if healing cannot be verified with certainty. Throughout the recovery period, motion in the fingers, thumbs, and shoulders is encouraged. After the cast is removed, wrist and elbow range of motion are gradually increased, followed by strengthening exercises[67].

Technical difficulties are Herbert screw fixation's biggest drawback. The procedure calls for expertise and practice[22]. When operating on individuals who are at risk, the incision might be changed to lessen scar problems. After using a volar technique for internal fixation, there are no signs of severe osteoarthritic alterations in the scaphotrapezial joint.

The guiding wire should not cross the radiocarpal joint, making the palmar approach easier to locate the entry, less technically challenging, and easier to sustain fracture reduction when the wrist is placed in extension. Additionally, there is no possibility of harming the extensor tendons[68].

COMPLICATIONS

Hypertrophic scarring from surgery, carpal instability, screw protrusion and avascular necrosis(AVN) are all side effects of open repair[30]. Using the palmar technique, neurovascular injuries like the superficial branch of the radial artery, delayed union, complex regional pain syndrome(CRPS) and post-op infection have all been documented in the literature[64].

Technical difficulties is Herbert screw fixation's biggest drawback. The procedure calls for expertise and practise[22]. When operating on individuals who are at danger, the incision might be changed to lessen scar problems. After using a volar technique for internal fixation, we looked for signs of severe osteoarthritic alterations in the scaphotrapezial joint but couldn't find any.

The volar approach is advantageous in certain cases as it is easy to find the entry because the guiding wire will not cross the radiocarpal joint, it is technically easier and it is easier to maintain fracture reduction with wrist in extended position. Furthermore, there is next to no risk of injury to the extensor tendons[68].

MATERIALS AND METHODS

From November 2020 to June 2022, prospective research was done at Shri B M Patil Medical College, and BLDEDU deemed to be University, Vijayapura.

A total of 55 (43 males and 12 females) patients were admitted in the Department of Orthopedics in B.L.D.E. (DEEMED TO BE UNIVERSITY) Shri B.M.Patil's Medical College, Hospital and Research Centre, Vijayapura with the diagnosis of scaphoid fractures and willing to participate in this study, were included in this study.

All patients presenting with snuff box tenderness and a history of trauma to the hand at Shri B M Patil Medical College and BLDEDU, Vijayapura, got a full general and local assessment of the hand at the orthopaedic emergency and outpatient departments.

The assessment was made by history, clinical examination and radiographs.

INCLUSION CRITERIA

The patients meeting the following criteria were included from the study

- Age more than 18 years
- Patients with Scaphoid waist fractures
- Physical fitness for surgery
- Patients willing for surgery

EXCLUSION CRITERIA

The patients meeting the following criteria were excluded from the study

- Age less than 18 years
- Patients with ipsilateral upper limb injuries
- Patient not fit for surgery
- Compound fractures

METHODOLOGY

MANAGEMENT PROTOCOL

Scaphoid series of X-rays are used to evaluate radiologically patients presenting with typical signs raising suspicion of fracture of scaphoid bone. Postero-anterior view, lateral view, and postero-anterior view with wrist in ulnar deviation (scaphoid view) were all included in the scaphoid series (scaphoid view).

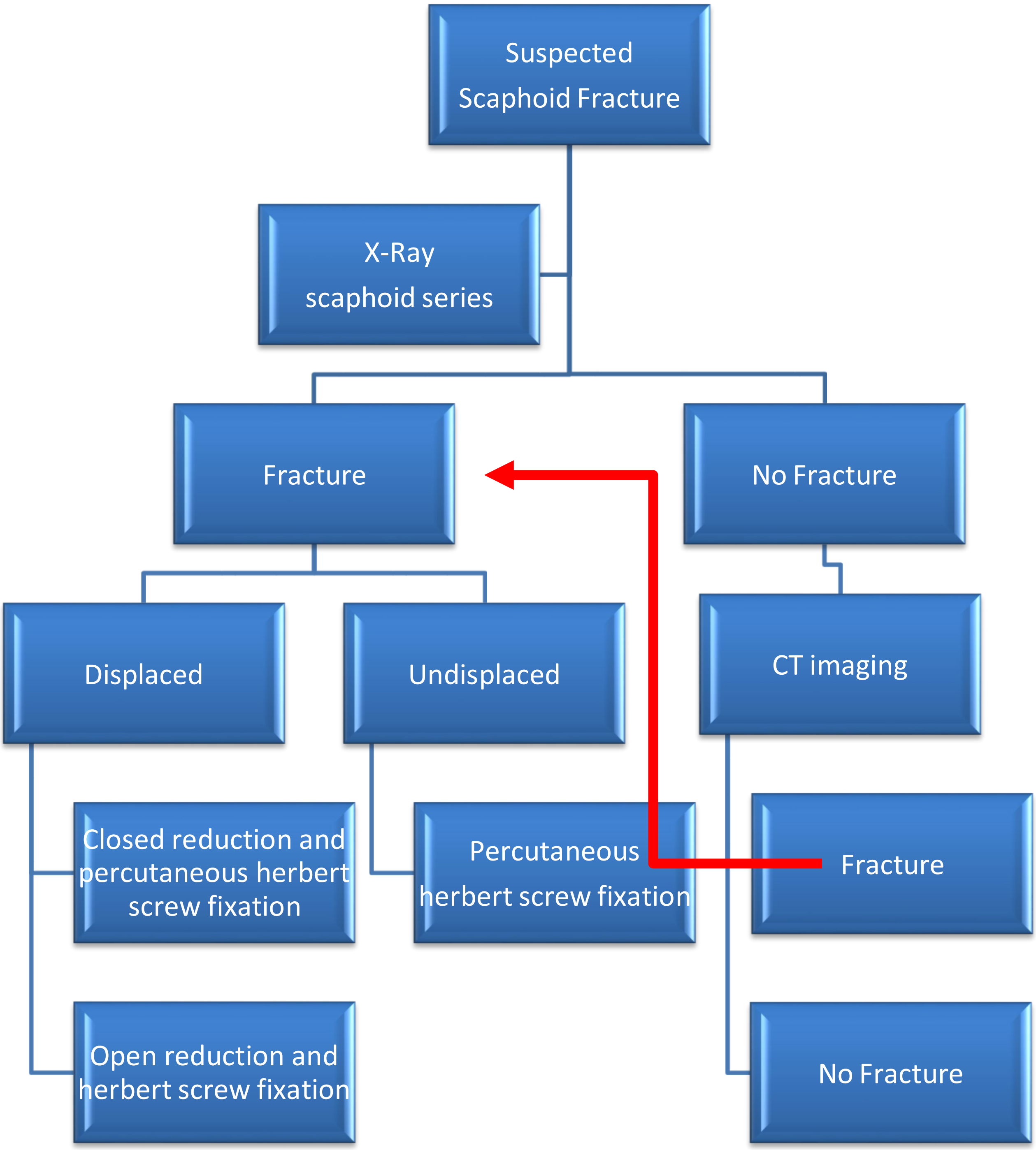
If a fracture of scaphoid bone is evident on the first x-ray, the patient is categorized using the Herbert Fisher classification and treated with percutaneous Herbert screw for internal fixation.

The patient is treated symptomatically if the first x-rays do not clearly show any fractures. But the existence of a strong suspicion that there may be one, a CT scan is advised. If the CT scan also does not reveal any fractures, the fracture has been ruled out.

If the CT displays signs of a fracture, its displacement and its pattern are examined, and fractures of the scaphoid are then categorized and treated as previously indicated. All waist fractures were treated using a percutaneous volar approach.

METHODOLOGY

MANAGEMENT PROTOCOL



PRE-OPERATIVE WORK UP

Investigations or interventions required in this study are routine standardized procedures. There is no animal experiment involved in this study.

Routine investigations include –

- X-ray of WRIST ANTEROPOSTERIOR, LATERAL and SCAPHOID view
- CT WRIST with 3d reconstruction(if required)
- Complete blood count.
- Bleeding time, Clotting time.
- Random blood sugar, Blood urea and Serum creatinine.
- HIV and HbsAg.
- Blood grouping and Rh- typing.
- ECG.
- Chest X-ray- Postero-anterior view.
- Other specific investigations, whichever is needed.

CONSENT

A written informed consent was taken. All of the patients in this study were informed about the injury and its type, diagnosis of the injury based on the above investigations, various management options and the most viable one, non-operative and operative complications, per-operative and post-operative complications, injury to surrounding structures, infection, compartment syndrome, anaesthesia risks, postoperative pain in the operated joint, and restriction of range of motion.

All of the participants in this research gave their permission to have surgery. Before surgery, all permission was acquired. The benefits and drawbacks of the operation were thoroughly addressed to patients and their attendants. The risk-benefit ratio was discussed.

SURGICAL TECHNIQUE

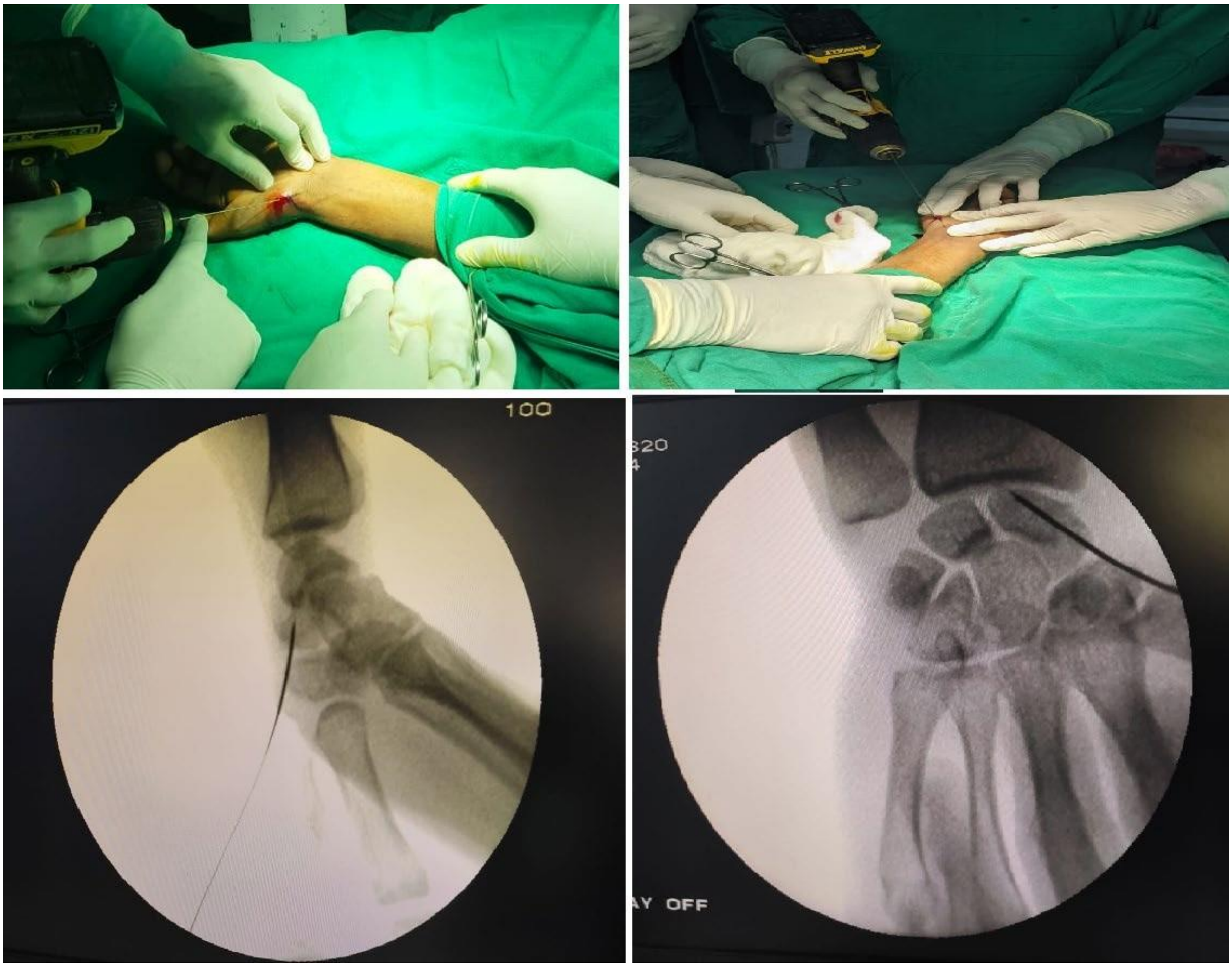
The following instruments are required for the procedure –

Surgical knife, drill bits, drill guide, guide wires, small tissue retractors,

Screw drivers etc.

SKIN INSCISION – a short stab incision was made distal to scapho-trapezial joint after marking it.

GUIDE WIRE INSERTION – the insertion point for the guide wire is on the distal surface over the scaphoid tubercle, near the end of scapho-trapezial joint. The guideing wire should be perpendicular to fracture line and should not cross proximal pole.



FIXATION – The required screw length is determined. Scaphoid is drilled using the dedicated drill bit.

The screw is inserted manually with screw driver over the guiding wire such that the threaded portion of the screw completely crosses the fracture line. Screw position is confirmed in all views and then the guide wire is removed before final tightening to achieve inter fragmentary compression.

CLOSURE – the incision is sutured. Post-op wound picture with suture.

POST-OPERATIVE PROTOCOL

Following surgery, intravenous antibiotics were prescribed for 5 days followed by oral antibiotics for five days.

The sutures were removed on the 12th postoperative day.

Scaphoid casts with windows were applied post-operatively to all patients, which was replaced by a removable immobiliser after postoperative day 14 and is continued for four weeks.

Physiotherapy of hand grip strengthening exercises and active assisted wrist range of motion exercises were started two weeks post-surgery.

All patients were followed up at six weeks, three months and six months post-surgery.

Patients were given a clinical and radiological evaluation with a scaphoid fracture profile at each follow-up. When there was no longer any discomfort at the scaphoid tubercle or the anatomical snuff box, and there was confirmation of the trabeculae crossing across the fracture site on at least two different views, the fracture was considered to have healed. A x-ray assessment of the screw position was done on every follow-up.

Upon the last follow-up the clinical assessment was performed based on the Modified Mayo Wrist Score (MMWS) and Disabilities of arm, shoulder and hand (DASH) score.

Grip strength was measured using a standard handheld dynamometer.

The range of motion was assessed using a goniometer.

MODIFIED MAYO WRIST SCORING CHART[69]

Category	Score	Findings
Pain (25 points)	25	No pain
	20	Mild pain with vigorous activities
	20	Pain only with weather changes
	15	Moderate pain with vigorous activities
	10	Mild pain with activities of daily living
	5	Moderate pain with activities of daily living
	0	Pain at rest
Satisfaction (25 points)	25	Very satisfied
	20	Moderately satisfied
	10	No satisfied, but working
	0	No satisfied, unable to work
Range of motion (25 points)	25	100% percentage of normal
	15	75% - 99% percentage of normal
	10	50% - 74% percentage of normal
	5	25% - 49% percentage of normal
	0	0% - 24% percentage of normal
Grip strength (25 points)	25	100% percentage of normal
	15	75% - 99% percentage of normal
	10	50% - 74% percentage of normal
	5	25% - 49% percentage of normal
	0	0% - 24% percentage of normal
Final result (total points)	90 - 100	Excellent
	80 - 89	Good
	65 - 79	Fair
	<65	Poor

DASH SCORE[70]

	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

	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 = $\left[\left(\frac{\text{sum of n responses}}{n}\right) - 1\right] \times 25$, where n is equal to the number of completed responses.

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

Dash score in local language

vÉÆÃ¼ÀÄ §Ädl ªÀÄvÀÛPÉ« PÀÄAUÀÄvÉÄÀÄ						
PÀ¼ÉzÀ ªÁgÀzÀF PÉ¼ÀV£À ZÀlÄÄªÀnPÉUÀ¼À£ÀÄß ¤ÃªÀÅ JµÀÄÖ ¸ÀPÀ® ªÀiÁrzÀÄÝÃj? ¸ÀPÀÅÖPÀ£À ªÀiÁr						
		Ai ÁªÀ ÀåÀ	¸ËªÀ Ãå	ª ÄzÀåÀÃ	wÃª ÀæÀ	C¸ÁzsÀå
PæªÀ		vÉÆAzÀgÉE®è	vÉÆAzÀgÉ	vÉÆAzÀgÉ	vÉÆAzÀgÉ	
1	©VAi ÁzÀ ÀCxÀªÁ º ÉÆ¸Àe ÁgÀï C£ÀÄß vÉgÉ ÀÄ	1	2	3	4	5
2	§gÉAiÀÄ ÀªÀ ÀåÃ	1	2	3	4	5
3	QÃ° AiÀÄ£ÀÄß wgÀÄV¹	1	2	3	4	5
4	H l vÀAi Á¹	1	2	3	4	5
5	¨ ÁgÀzÀ ¨ ÁV®Ä vÉgÉ ÀÄ	1	2	3	4	5
6	zÀAi Ã« I ÄÖ¤ª ÃÄvÀ¯ÉAiÀÄ ª ÉÃ° gÀ ÀPÀÄÁn£À gÀ ÀªÃÛ	1	2	3	4	5
7	¨ Áj ª ÀÄ£ÉÃ®¸ÀUÀ¼ÀÀß ªÀÄr (UÉÆÃqÉ ÃPÀUÀ¼ÀÀß vÉÆÃ¼É ÀÄ	1	2	3	4	5
8	G z ÁÞ ÀCxÀªÁ UÀÄz ÀPÉ®¸ÀªÀÄr	1	2	3	4	5
9	º ÁUÉªÀÄÁr	1	2	3	4	5
10	±Á¦ AUï ¨ ÁåUï CxÀªÁ §mÉÖvÀÄA§Ä ÀaPÀÌ¥ÉÖÉM¬ ÀÄ	1	2	3	4	5
11	¨ ÁgÀzÀ ÀªÀÄÛUÀ¼ÀÀß M¬ ÀÄ (10 ¥ËAqï UÀÆVAvÀ° ÉZÀÄÑ	1	2	3	4	5
12	vÀ¯ÉAiÀÄª ÉÃ° £À¯ÉèmÌï §¯ïà§zÀ¯Á¬ Ä	1	2	3	4	5
13	¤ª ÀÄPÀÉzÀ£ÀÄß vÉÆ¼É ÀÄ CxÀªÁ Mt V¹	1	2	3	4	5
14	¤ª ÀÄ ¨ É£ÀÄß vÉÆ¼É ÀÄ	1	2	3	4	5
15	¥À¯ï Nªgï (vÀ¯ÉAiÀÄª ÉÃ¯É° ÁQPÉÆ¼ÀîÄ ÀPÉÆÃÄ ÀÄ¸É gïª ÉÃ¯É° ÁQ	1	2	3	4	5
16	D° ÁgÀªÀÄß PÀvÀÛj¹ ZÁPÀÄ §¼À	1	2	3	4	5
17	PÁªÀ ÉÃ±ÀæÃ CUÀvÀªÁgÀ ÀªÀÄ£ÀgÀd£Á ZÀlÄªÀnPÉUÀ¼À (G z Á	1	2	3	4	5
	zÀÄ¸ÀÛPÁ°ÀÀ) PÁqïÀ ¥ÉÃ¬ ÄAUï º ÉÆÃÉº ÁPÀÄ« PÉ					
18	¤ª ÀÄvÉÆÃ¼£À§ Ädl CxÀªÁ PÉÊAiÀÄª ÀÄE®PÀ¤ª À¸ÀÄà	1	2	3	4	5
	§® CxÀªÁ ¥ÀæªÁªÀÄß vÉÉ ÃPÉÆ¼ÀÄ ÀªÀÄ£ÀgÀd£Á					
	ZÀlÄªÀnPÉUÀ¼À (ZÉÆr £ÀDl , ¸ÃwÛÉ mÉ¸ï CxÀªÁ ZÉqÁ l)					
19	¤ª ÀÄvÉÆÃ¼ÀÀß ¤Ãª Àª ÃÄÆÀV ZÀ¸Ã ÀªÀÄ£ÀgÀd£Á	1	2	3	4	5
	ZÀlÄªÀnPÉUÀ¼À (G z Á¦ ÀgÀ £Ãr ¸Ã« PÉ¨ Áå ÀÄl £ï)					
20	¸ Áj UÉAiÀÄ£ÀÄß §¼À»¹ (MAz Ã ¸ ÉÜ¼ÀAz ÀªÀ ÄvÉÆÛz Ã	1	2	3	4	5
	¸ ÉÜ¼ÀPÉ° ÉÆÃUÀªÀ ÀåÀ					
21	¯ ÉÊVPÀ ZÀlÄªÀnPÉUÀ¼À	1	2	3	4	5
		E®èªÀ E®è	¸Àà	ª ÄzÀåÀÃ	¸Ààe Á Û	CvÀåvÀ
22	PÀ¼ÉzÀ ªÁgÀzÀ¤Ã ÀJµÀÄªÀ ÄnÖÉ¤ª ÀÄvÉÆ¼ÀÄ§ Ädl CxÀªÁ	1	2	3	4	5
	PÉ£ÉÆÃ«¤Az ÀPÀÄ ÀÄ§ ,UÉÆAiÀÄgÀ£ÉgÉAiÀÄ gÀÃ CxÀªÁ UÀÄA¥À					
	UÀ¼À°ÉÆA¥À¢Az À¤ª ÀÄ¸ ÁªÀÄ£ÀåZÀlÄªÀnPÉUÀ¼ÀÄß ªÀÄr ¢Ý?					
		¹ Ã« ÄÀvÀ®è	¸Àà¹ Ã« ÄvÀ	ª Äz À Ã ¹ Ã« ÄvÀ	§º ÀÀ¹ Ã« ÄvÀ	C¸ÁzsÀå
23	PÀ¼ÉzÀ ªÁgÀzÀ¤ª ÀÄPÉ®¸ÀzÀ CxÀªÁ ¨ ÉÃgÉAiÀÄgÀzÀz ÉÀ¢£À	1	2	3	4	5
	C£ÀÄPÀÆ ÀPÉ®¸À¤ª ÀÄPÉÊ PÉ®¸ÀzÀ Ä ÀÄw º ÉÆÃvÁÛ					
		E®è	¸ ËªÀ Ãå	ª ÄzÀåÀÃ	wÃª ÀæÀ	«¥ÀjÃvÀ
24	vÉÆÃ¼£À§ Ädl CxÀªÁ PÉÊ£ÉÆÃª À	1	2	3	4	5
25	vÉÆ¼À§ Ädl CxÀªÁ PÉÊ£ÉÆÃ«£Àz À¤Ã ÀAi Áª ÀåÀ	1	2	3	4	5
	¤¢ðµÀÖZÀlÄªÀnPÉAiÀÄ£ÀÄß¤ª À»¹ z ÁUÀ					
26	¤ª ÀÄvÉÆÃ¼£À§ Ädl CxÀªÁ PÉÊ AiÀÄ èdÄ ÉÆ¤ ¸Ã« PÉ	1	2	3	4	5
	(¦ £ïUÀ¼Àª ÃvÀÛ ¸ÀÆf UÀ¼À)					
27	¤ª ÀÄvÉÆÃ¼£À§ Ädl CxÀªÁ PÉÊ AiÀÄ èzË§ð®å	1	2	3	4	5
28	¤ª ÀÄvÉÆÃ¼£À§ Ädl CxÀªÁ PÉÊ AiÀÄ èwÃ«	1	2	3	4	5
		vÉÆAzÀgÉE®è	¸ ËªÀ Ãå vÉÆAzÀgÀ	ª ÄzÀåÀÃ vÉÆAzÀgÀ	wÃª ÀæÀvÉÆAzÀgÀ	§º ÀÀvÉÆAzÀgÉ
29	PÀ¼ÉzÀ ªÁgÀzÀ¤Ã ÀvÉÆ¼À§ Ädl , CxÀªÁ PÉÊ£ÉÆÃ«¤AzÀ	1	2	3	4	5
	¤Ã ÀJµÀÄÖPÀµÀÖ¥ÀnÖÃj (ª ÀAi Ã ¸ ÀS É					
		R Ar vÀ M¥Àà®è	M¥ÀàÀ®è	M¥ÀàÀ E®è	M¥ÀÄvÉÛÉ	§®ª ÁV M¥ÀÄvÉÛ
30	£ÀªÀ vÉÆ¼À§ Ädl , CxÀªÁ PÉÊ ¸ÀªÀÄ ÉÛAz ÁV £Á£À ¸ÀÄxÀå	1	2	3	4	5
	PÀ ÉÃ DvÀä±Áé ÀCxÀªÁ PÀ ÉÃ G¥ÀAiÀÄÄPÀÛ Az Ã ¨ Á« ¸ ÃvÉÛÉ					

SAMPLE SIZE CALCULATION :

Assuming the expected population standard deviation to be 10 and employing t-distribution to estimate sample size, the study would require a sample size of:

46 to estimate a mean with 95% confidence and a precision of 3.

By using the formula:

Formula used $$n = \frac{z^2\, p*q}{d^2}$$

Where Z= Z statistic at α level of significance

d^2= Absolute error

P= Proportion rate

q= 100-p

STATISTICAL ANALYSIS:

The data obtained will be entered into a Microsoft Excel sheet, and statistical analysis will be performed using a statistical package for the social sciences (Version 20).

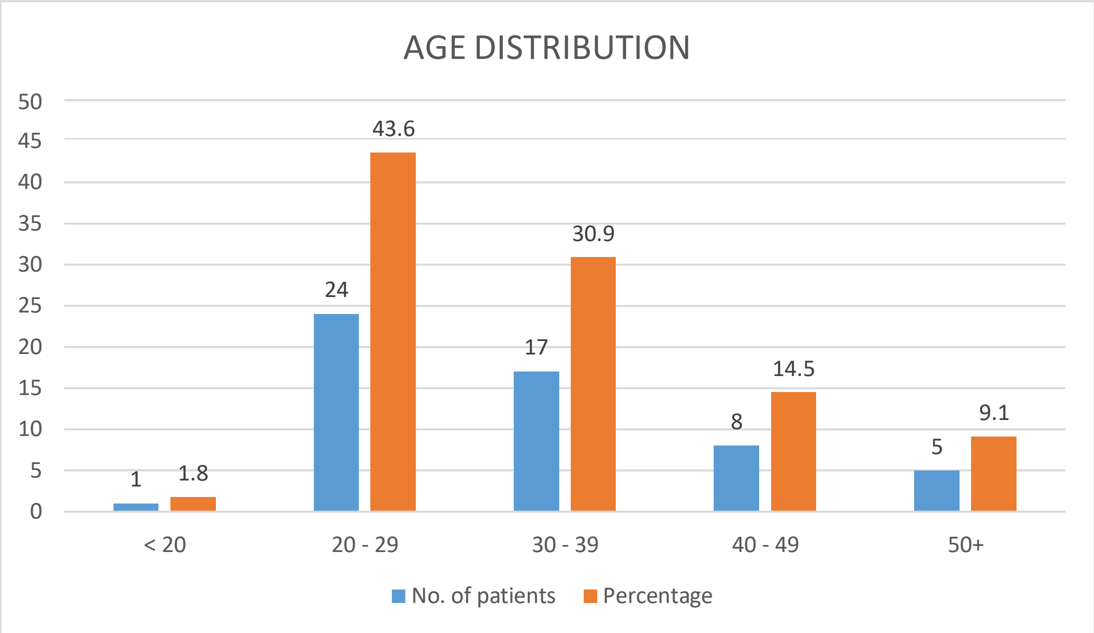
Results will be presented as Mean (Median) ±SD, counts and percentages and diagrams.

OBSERVATION AND RESULTS:

Age distribution

A total of 55 patients were included in the study, with mean age of 32.9 years and median age of 30 years. Age distribution chart showed a major predominance of scaphoid waist fractures in 3rd and 4th decade of life, when a person is most active physically as they constitute major working population of the society and are also actively involved in sports in this age group.

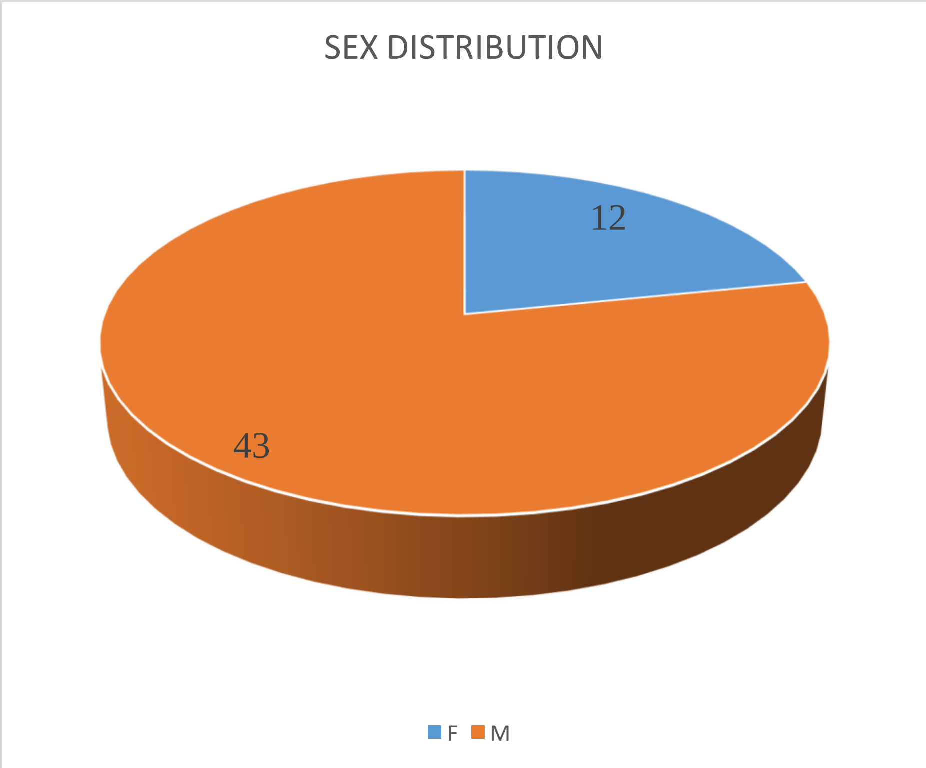
Age(Years)	No. of patients	Percentage
< 20	1	1.8
20 - 29	24	43.6
30 - 39	17	30.9
40 - 49	8	14.5
50+	5	9.1
Total	55	100



Sex distribution

This study included a total of 55 patients of which 12 (21.8%) were females and 43 (78.2%) were males, clearly showing a male predominance for scaphoid fractures.

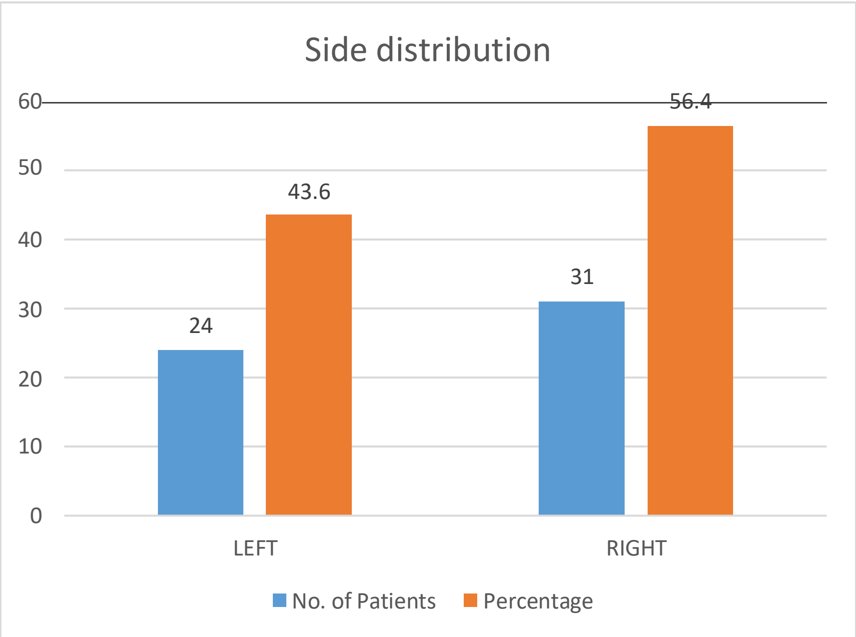
Gender	No. of patients	Percentage
F	12	21.8
M	43	78.2
Total	55	100



Side distribution

Among all the patients, 24 (43.6%) patients suffered a fracture of left the scaphoid and 31 (56.4%) patients suffered a fracture of the right scaphoid bone. Among the 55 patients included in the study, 51 patients had right predominance and 4 patients had left hand predominance. There was no significant relationship found between the dominant hand and the side of scaphoid fracture.

Side	No. of Patients	Percentage
LEFT	24	43.6
RIGHT	31	56.4
Total	55	100



Mode of injury

In this study, we classified all scaphoid fractures based on mode of injuries into 3 categories.

1) Road traffic accidents -

   It includes all high energy trauma caused by motor vehicle accidents.

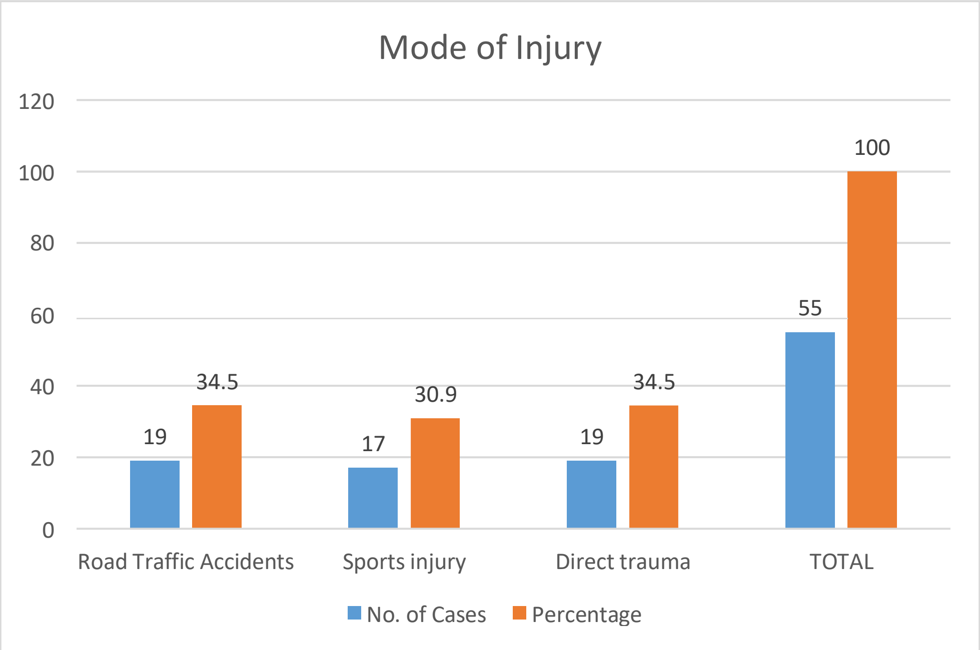
2) Sports injuries –

   It includes all traumas which occurred when a patient was engaged in the sports activity. Patients reported injuries while playing close contact and semi-close contact sports like Kabaddi, Kho-Kho, Cricket, Basketball, Volleyball etc.

3) Direct trauma –

   These include all trivial falls, blunt force trauma and twisting injuries.

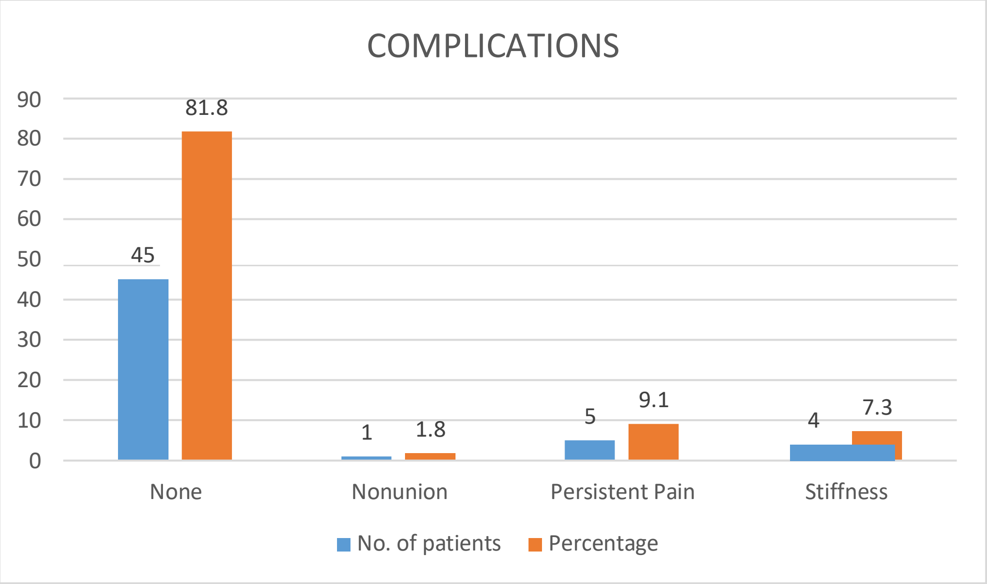
Mode of injury	No. of Cases	Percentage
Road Traffic Accidents	19	34.5
Sports injury	17	30.9
Direct trauma	19	34.5
TOTAL	55	100


Mode of Injury
120
100
80
60
40
20
0
19
34.5
17
30.9
19
34.5
55
100
Road Traffic Accidents
Sports injury
Direct trauma
TOTAL
No. of Cases
Percentage

Complications

Out of 55 patients included in the study, 45 (81.8%) patients had no complaints after 6 months post-surgery. 6 of the patients had pain at the end of 6 months, of which 5 cases showed union on radiographs and 1 was not united yet. These patients were managed conservatively with non-steroidal anti-inflammatory drugs. The patient with non-union was managed by bone grafting after 8 months post-surgery. 4 patients had stiffness of the wrist joint at the end of 6 months which was managed by physiotherapy and returned to normal work by the end of 9 months.

Complications	No. of Patients	Percentage
None	45	81.8
Non-union	1	1.8
Persistent Pain	5	9.1
Stiffness	4	7.3
Total	55	100

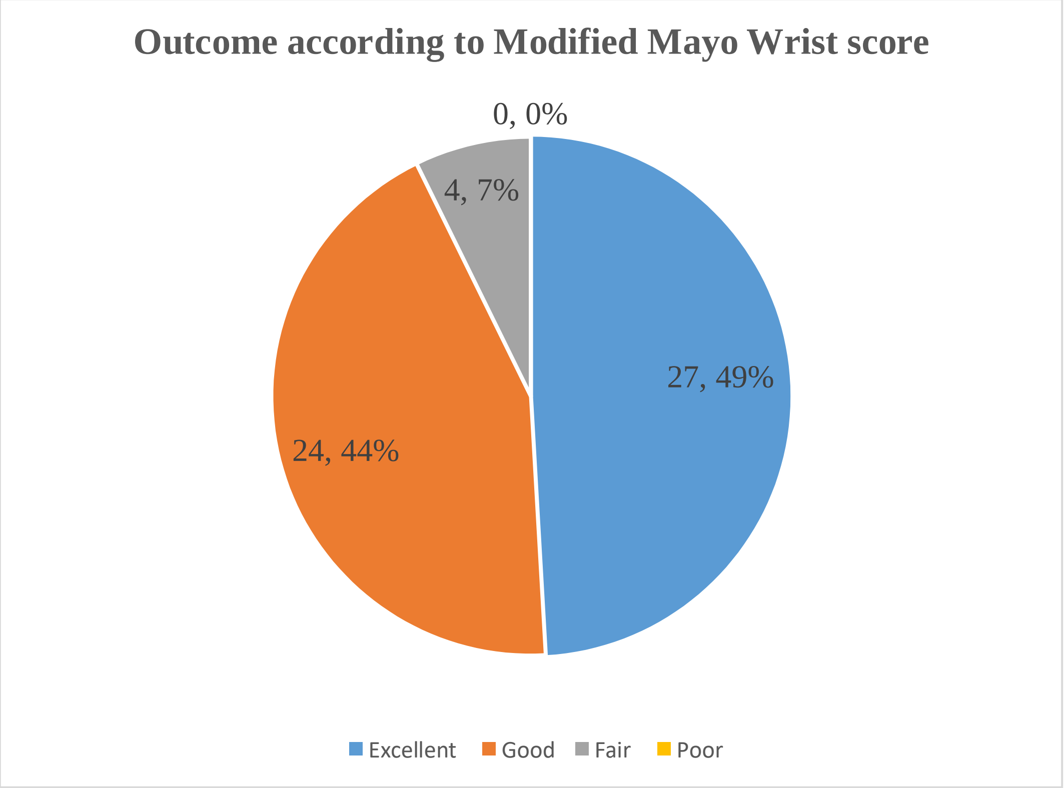


Scores and outcomes

Modified Mayo Wrist Score (MMWS)

According to MMWS with confidence interval of 95%, out of fifty-five patients, 27 (49%) patients had excellent outcome, 24 (44%) patients had good outcome, 4 (7%) patients had fair outcome and none had poor outcome. The mean MMWS was 90.91 and median was 90 with standard deviation of 5.781.

Outcome	Excellent	Good	Fair	Poor
No. of Patients	27	24	4	0



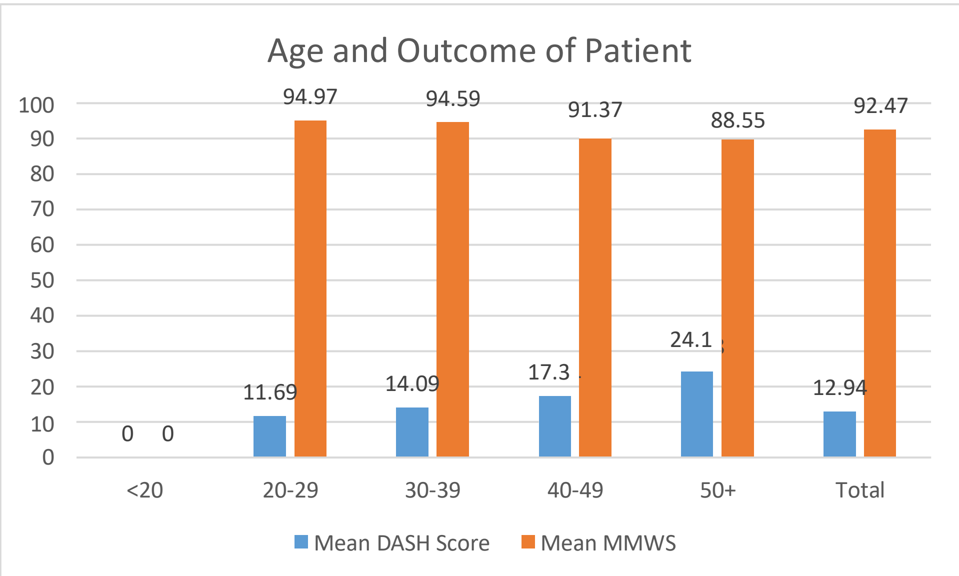
Disability of Arm, Shoulder and Hand (DASH) Score

Patients had a Mean final DASH score of 11.60 and a median of 11.00 with a standard deviation of 4.965. Dash score showed a significant improvement post-surgery. Mean final DASH score in road traffic accidents is 11.42, in direct trauma is 13 and it is 10.24 in sports injury patients.

Kruskal-Wallis test showed that the final DASH score and MMWS are not dependent on the mode of injury.

Kruskal-Wallis test showed a significant relationship between the age of the patient and their final DASH score and MMWS. It showed better outcomes in younger populations.

Age Group(Years)	Mean DASH Score	Mean MMWS
<20	0	0
20-29	11.69	94.97
30-39	14.09	94.59
40-49	17.31	91.37
50+	24.18	88.55
Total	12.94	92.47



CASE ILLUSTRATIONS

Case 1 –

Name – Mahesh

Age / sex – 40years/male

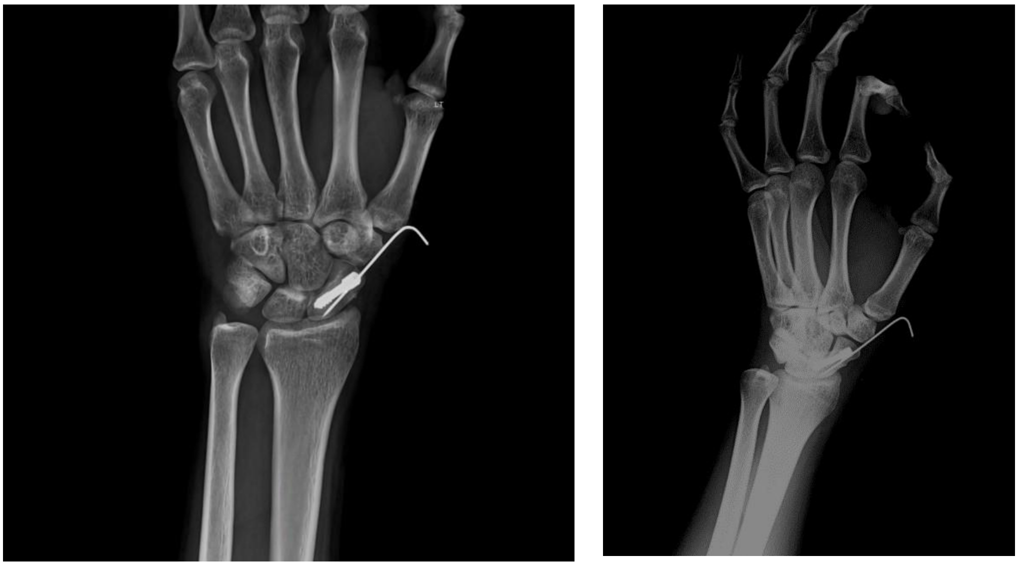
IP No. – 159668

Mode of trauma - DT

Pre-op Xray –

Immediate op x-ray –

1 month post-op xray



6 months post-op x-ray

Range of motion pictures -

Case 2 -

Name – Dayanand

Age / sex – 25/male

IP No. – 142386

Mode of trauma - RTA

Pre-op Xray –

Immediate post-op x ray –

Six months Post-op x ray –

Range of motion pictures

DISCUSSION

Scaphoid fractures are frequent and often challenging to diagnose and manage. In young people, where scaphoid fractures are most prevalent, they can result in extended morbidity and disruptions from work[71]. In our study 41 (74.5%) patients belonged to the young working class of the community in the age group of 21-40 years.

McLaughlin and Maudsley, and Chen[72,73] recommended open reduction and internal fixation of scaphoid fractures with a headless compression screw for reduced morbidity and early mobilisation of the patients. This technique of open reduction and internal fixation was first described by **Herbert and Fischer**[22] in 1984 and was a widely accepted method of management worldwide.

Fourteen patients with acute displaced scaphoid waist fractures were managed with open reduction and internal fixation with headless compression screws and Kirschner wires and were assessed by **Rettig ME et al**[23]. Eight of the 14 patients had Herbert screw fixation. Out of 14, 13 (93%) were successfully united in 11.5 weeks (range: 8–20 weeks). Conservative treatment was given to the distal and middle third of scaphoid fractures that were undisplaced (1 mm displacement).

In a prospective study, **Saeden B et al**[74] compared Herbert screw fixation with a short arm plaster immobilisation cast to treat acute scaphoid fractures in sixty-one patients with sixty-two fractures. They discovered that the surgical group was able to resume work more quickly. As a result, surgical stabilisation of these fractures has become increasingly common.

Davis EN et al.[18] compared surgical management to cast immobilisation for acute non-displaced fracture of scaphoid waist, they came to the conclusion that surgical fixation was more cost-effective from a societal standpoint than casting.

Both the palmar and dorsal approaches can be used to insert a Herbert screw. The palmar technique is beneficial for waist and distal pole of scaphoid fractures and protects the vital dorsal blood vessels; but, it causes damage to the palmar carpal ligaments and provides inadequate proximal pole exposure. Although a dorsal approach exposes the proximal pole, it could disrupt the fragile blood supply[75].

Percutaneous Herbert screw fixation for minimally displaced scaphoid fractures is recommended worldwide. **Naranje S et al**[76] used this technique in 32 patients to achieve a union rate of 100%.

Shin AY et al[77] in his study saw that the fracture union occurred at an average of 7.1 weeks with percutaneous Herbert screw fixation in contrast to 11.6 weeks when managed by cast immobilisation. Union rates were 94 to 100% and complication rates were 0 to 30% when volar percutaneous technique was used, which were comparable to open technique[68].

In our study, we have used percutaneous volar fixation of scaphoid fractures with Herbert screws and achieved a union rate of 98.1 % and early wrist mobilisation and return to day-to-day activities and work. Significant complications in the study were persistent pain, stiffness and non-union.

Other complications like hypertrophic scars, screw protrusion, arthritis of wrist joint, and sensitive scars were not seen in our study.

In our study, we found that the average size of the screw being used for scaphoid fixation used was 18mm. screws ranging from 14 to 22mm were used in our study.

Enough stress has been placed on the importance of screw position and size during Herbert screw fixation. A high union rate was achieved by using adequate screw length and proper positioning of the screw.

Non-union was seen in a single patient in our study. The reason might be attributed to the disruption of the precarious blood supply of the scaphoid during trauma.

The limitations of the study are as follows. This is not a comparative study between other modes of management. Our follow-up period consisted of only 6 months, and thus few long-term complications like arthritis, avascular necrosis of proximal fragment etc., could not be evaluated thoroughly.

CONCLUSION

Our study shows that percutaneous fixation of minimally displaced scaphoid fractures results in early relief of symptoms and early recovery of function. A review of these cases shows that percutaneous fixation using a headless compression screw has similar functional outcomes and less hospital stay and patient scarring than in open fixation methods. Functional recovery is faster with percutaneous fixation than in the non-operative group and open fixation group.

Proper positioning and the ideal screw size play a pivotal role in the functional outcome and preventing late complications.

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ANNEXURE-I (DASH SCORE)

	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

	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 = $\left[\left(\frac{\text{sum of n responses}}{n}\right) - 1\right] \times 25$, where n is equal to the number of completed responses.

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

ANNEXURE-II (Modified Mayo Wrist Score)

Category	Score	Findings
Pain (25 points)	25	No pain
	20	Mild pain with vigorous activities
	20	Pain only with weather changes
	15	Moderate pain with vigorous activities
	10	Mild pain with activities of daily living
	5	Moderate pain with activities of daily living
	0	Pain at rest
Satisfaction (25 points)	25	Very satisfied
	20	Moderately satisfied
	10	No satisfied, but working
	0	No satisfied, unable to work
Range of motion (25 points)	25	100% percentage of normal
	15	75% - 99% percentage of normal
	10	50% - 74% percentage of normal
	5	25% - 49% percentage of normal
	0	0% - 24% percentage of normal
Grip strength (25 points)	25	100% percentage of normal
	15	75% - 99% percentage of normal
	10	50% - 74% percentage of normal
	5	25% - 49% percentage of normal
	0	0% - 24% percentage of normal
Final result (total points)	90 - 100	Excellent
	80 - 89	Good
	65 - 79	Fair
	<65	Poor

ANNEXURE-III (DASH SCORE IN LOCAL LANGUAGE - KANNADA)

vÉÆÃ¼ÀÄ, §Äd ªÀÄvÀÄÛ PÉÊ «PÀ¯ÁAUÀvÉUÀ¼ÀÄ.

PÀ¼ÉzÀ ªÁgÀzÀ°è F PÉ¼ÀV£À ZÀlÄªÀnPÉUÀ¼À£ÀÄß ªÀiÁqÀÄªÀ ¤ªÀÄä ¸ÁªÀÄxÀåðªÀ£ÀÄß ªÀÈvÀÛ ºÁQ ¸ÀÆPÀÛ ¥ÀæwQæ¬Ä¹ gÉÃmï ªÀiÁr

PÀæ. ¸ÀA		AiÀiÁªÀ ÅzÉÃ vÉÆAzÀg É E®è	¸ËªÀÄå vÉÆAzÀg É	ªÀÄzÀå ªÀÄ vÉÆAzÀg É	wÃªÀæ vÉÆAzÀg É	C¸ÀªÀÄx Àð
1	©VAiÀiÁzÀ CxÀªÁ ºÉÆ¸À eÁgï C£ÀÄß vÉgÉ¬Äj	1	2	3	4	5
2	§gÉAiÀÄÄªÀÅzÀÄ	1	2	3	4	5
3	QÃ°AiÀÄ£ÀÄß wgÀÄV¹	1	2	3	4	5
4	Hl vÀAiÀiÁj¹	1	2	3	4	5
5	¨sÁgÀªÁzÀ ¨ÁV®Ä vÉgÉ¬Äj	1	2	3	4	5
6	zÀAiÀÄ«lÄÖ ¤ªÀÄä vÀ¯ÉAiÀÄ ªÉÄÃ°gÀÄªÀ PÀ¥Án£À°ègÀÄªÀ ªÀ¸ÀÄÛ	1	2	3	4	5
7	¨sÁj ªÀÄ£ÉPÉ®¸ÀUÀ¼À£ÀÄß ªÀiÁr(UÉÆÃqÉ,ªÀÄºÀrU À¼À£ÀÄß vÉÆÃ¼É¬Äj	1	2	3	4	5
8	GzÁå£À CxÀªÁ UÀdzÀ PÉ®¸À ªÀiÁr	1	2	3	4	5
9	ºÁ¹UÉ ªÀiÁr	1	2	3	4	5
10	±Á¦AUï ¨ÁåUï CxÀªÁ §mÉÖ vÀÄA§ÄªÀ aPÀÌ ¥ÉnÖUÉ M¬Äåj	1	2	3	4	5

11	¨sÁgÀªÁzÀ ªÀ¸ÀÄÛUÀ¼À£ÀÄß M¬Äåj(10 ¥ËAqï UÀ½VAvÀ ºÉZÀÄ)Ñ	1	2	3	4	5
12	vÀ¯ÉAiÀÄ ªÉÄÃ°£À ¯ÉÊmï §¯ïà §zÀ¯Á¬Ä¹	1	2	3	4	5
13	¤ªÀÄä PÀÆzÀ®£ÀÄß vÉÆ¼É¬Äj CxÀªÁ MtV¹	1	2	3	4	5
14	¤ªÀÄä ¨É£Àß£ÀÄß vÉÆ¼É¬Äj	1	2	3	4	5
15	¥ÀÄ¯ï NªÀgï(vÀ¯ÉAiÀÄ ªÉÄÃ¯É ºÁQPÉÆ¼ÀÄîªÀ PÉÆÃlÄ)¸ÉéÃlgï ªÉÄÃ¯É ºÁQ	1	2	3	4	5
16	DºÁgÀªÀ£ÀÄß PÀvÀÛj¸À®Ä ZÁPÀÄ §¼À¹	1	2	3	4	5
17	PÀrªÉÄ ±ÀæªÀÄ CUÀvÀå«gÀÄªÀ ªÀÄ£ÀgÀAd£Á ZÀlÄªÀnPÉUÀ¼ÀÄ(GzÁ:	1	2	3	4	5
	zÀ¥Àà PÁUÀzÀ)PÁqÀð ¥ÉèÃ¬ÄAUï ºÉuÉUÉ ºÁPÀÄ«PÉ					
18	¤ªÀÄä vÉÆÃ½£À §Äd CxÀªÁ PÉÊAiÀÄ ªÀÄÆ®PÀ ¤ªÀÅ ¸Àé®à	1	2	3	4	5
	§® CxÀªÁ ¥Àæ¨sÁªÀªÀ£ÀÄß vÉUÉzÀÄPÉÆ¼ÀÄîªÀ ªÀÄ£ÀgÀAd£Á					
	ZÀlÄªÀnPÉUÀ¼ÀÄ(ZÉAr£À Dl, ¸ÀÄwÛUÉ, mÉ¤¸ï CxÀªÁ ZÉAqÁl)					
19	¤ªÀÄä vÉÆÃ¼À£ÀÄß ¤ÃªÀÅ ªÀÄÄÄPÀÛªÁV ZÀ°¸ÀÄªÀ ªÀÄ£ÀgÀAd£Á	1	2	3	4	5

	ZÀlÄªÀnPÉUÀ¼ÀÄ (GzÁ:¦æ¹âÃ £ÀÄr¸ÀÄ«PÉ, ¨ÁåräAl£ï)					
20	¸ÁjUÉAiÀÄ£ÀÄß £ÀªÀð»¹(MAzÀÄ ¸ÀÜ¼À¢AzÀ ªÀÄvÉÆÛAzÀÄ	1	2	3	4	5
	¸ÀÜ¼ÀPÉÌ ºÉÆÃUÀÄªÀÅzÀÄ)					
21	¯ÉÊAVPÀ ZÀlÄªÀnPÉUÀ¼ÀÄ	1	2	3	4	5
		E®èªÉÃ E®è	¸Àé®à	ªÀÄzÀåª ÀÄ	¸Àé®à eÁ¹Û	CvÀåAvÀ
22	PÀ¼ÉzÀ ªÁgÀzÀ°è ¤ÃªÀÅ JµÀÖgÀ ªÀÄnÖUÉ ¤ªÀÄä vÉÆ¼ÀÄ,§Äd CxÀªÁ	1	2	3	4	5
	PÉÊ £ÉÆÃ«¤AzÀ PÀÄlÄA§,UÉ¼ÉAiÀÄgÀÄ, £ÉgÉAiÀÄªÀgÀÄ CxÀªÁ UÀÄA¥ÀÄ					
	UÀ¼À ºÀ¸ÀÛPÉëÃ¥À ¢AzÀ ¤ªÀÄä ¸ÁªÀiÁ£Àå ZÀlÄªÀnPÉUÀ¼À£ÀÄß ªÀiÁr¢Ýj?					
		¹Ã«ÄvÀª ÁV®è	¸Àé®à ¹Ã«ÄvÀ	ªÀÄzÀåªÀ Ä ¹Ã«ÄvÀ	§ºÀ¼À ¹Ã«ÄvÀ	C¸ÀªÀÄx Àð
23	PÀ¼ÉzÀ ªÁgÀzÀ°è ¤ªÀÄä PÉ®¸ÀzÀ°è CxÀªÁ ¨ÉÃgÉAiÀÄªÀgÀ zÉÊ£ÀA¢£À	1	2	3	4	5
	C£ÀÄPÀæªÀÄ PÉ®¸ÀzÀ°è ¤ªÀÄä PÉÊ PÉ®¸À ¥Àj«Äw ºÉÃVvÀÄÛ?					
		E®è	¸ËªÀÄå	ªÀÄzÀåª ÀÄ	wÃªÀæ	«¥ÀjÃvÀ

24	vÀÉÆ½£À §Äd CxÀªÁ PÉÊ £ÉÆÃªÀÅ	1	2	3	4	5
25	vÉÆ¼ÀÄ,§Äd CxÀªÁ PÉÊ £ÉÆÃ«£ÀAzÀ ¤ÃªÀÅ AiÀiÁªÀÅzÉÃ	1	2	3	4	5
	¤¢ðµÀÖ ZÀlÄªÀnPÉAiÀÄ£ÀÄß ¤ªÀð»¹zÁUÀ					
26	¤ªÀÄä vÉÆ½£À §Äd CxÀªÁ PÉÊ AiÀÄ°è dÄªÉÄäÃ¤¸ÀÄ«PÉ	1	2	3	4	5
	(¦£ïUÀ¼ÀÄ ªÀÄvÀÄÛ ¸ÀÆfUÀ¼ÀÄ)					
27	¤ªÀÄä vÉÆ½£À §Äd CxÀªÁ PÉÊ AiÀÄ°è zË§ð®å	1	2	3	4	5
28	¤ªÀÄä vÉÆ½£À §Äd CxÀªÁ PÉÊ AiÀÄ°è wÃ«	1	2	3	4	5
		vÉÆAzÀg É E®è	¸ËªÀÄå vÉÆAzÀg É	ªÀÄzÀåªÀÄ vÉÆAzÀg É	wÃªÀÀæ vÉÆAzÀg É	§ºÀ¼À vÉÆAzÀg É
29	PÀ¼ÉzÀ ªÁgÀzÀ°è ¤ÃªÀÅ vÉÆ¼ÀÄ §Äd, CxÀªÁ PÉÊ £ÉÆÃ«¤AzÀ	1	2	3	4	5
	¤ÃªÀÅ JµÀÄÖ PÀµÀÖ ¥ÀnÖ¢ÝÃj(ªÀ®AiÀÄ ¸ÀASÉå)					
		RArvÀ M¥ÀÄÄàª ÀÅ¢®è	M¥ÀÄÄàª ÀÅ¢®è	M¥ÀÄÄàª ÀÅzÉÃ E®è	M¥ÀÄÄàv ÉÛÃ£É	§®ªÁV M¥ÀÄÄàv ÉÛÃ£É
30	£À£Àß vÉÆ¼ÀÄ §Äd, CxÀªÁ PÉÊ ¸ÀªÀÄ¸ÉåAiÀÄAzÁV £Á£ÀÄ ¸ÀªÀÄxÀð	1	2	3	4	5
	PÀrªÉÄ DvÀä«±Áé¸À CxÀªÁ PÀrªÉÄ					

	G¥ÀAiÀÄÄPÀÛ JAzÀÄ ¨sÁ«¸ÀÄvÉÛÃ£É.					

ANNEXURE-IV (ETHICAL CLEARANCE CERTIFICATE)

IEC/NO.09/2021
Date-22/01/2021

B.L.D.E. (DEEMED TO BE UNIVERSITY)

(Declared vide notification No. F.9-37/2007-U.3 (A) Dated. 29-2-2008 of the MHRD, Government of India under Section 3 of the UGC Act, 1956)

The Constituent College

SHRI. B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Institutional ethical committee of this college met on 11-01-2021 at 11 am to scrutinize the synopsis of Postgraduate students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has been accorded Ethical Clearance

Title: To evaluate functional outcome of acute minimally displaced scaphoid waist fractures treated with percutaneous headless compression screw fixation – A prospective study

Name of PG student: Dr Basavaraj M K , Department of Orthopaedics

Name of Guide/Co-investigator: Dr R.B.Biradar, Professor of Orthopaedics

DR .S.V.PATIL
CHAIRMAN, IEC

Institutional Ethical Committee
B L D E (Deemed to be University)
Shri B.M. Patil Medical College,
VIJAYAPUR-586103 (Karnataka)

Following documents were placed before Ethical Committee for Scrutinization:

1. Copy of Synopsis / Research project
2. Copy of informed consent form
3. Any other relevant documents.

1

ANNEXURE-V (INFORMED CONSENT)

B.L.D.E. (DEEMED TO BE UNIVERSITY) SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTER, VIJAYAPURA-586103

INFORMED CONSENT FOR PARTICIPATION IN DISSERTATION/RESEARCH

I, the undersigned,________________, S/O D/O W/O__________________, aged ____years, ordinarily resident of_____________do hereby state/declare that Dr.Basavaraj M K of Shri. B. M. Patil Medical College Hospital and Research Centre has examined me thoroughly on_______________at_______________(place) and it has been explained to me in my own language that I am suffering from _________________ disease (condition) and this disease/condition mimic following diseases. Further Dr. Basavaraj M K informed me that he/she is conducting dissertation/research titled “A Prospective study To evaluate functional outcome of minimally displaced scaphoid waist fractures treated with percutaneous headless compression screw fixation”. under the guidance of Dr, Ramanagouda Biradar . requesting my participation in the study. Apart from routine treatment procedure, the pre-operative, operative, post-operative and follow-up observations will be utilized for the study as reference data.

Doctor has also informed me that during conduct of this procedure like adverse results may be encountered. Among the above complications most of them are treatable but are not anticipated hence there is chance of aggravation of my condition and in rare circumstances it may prove fatal in spite of anticipated diagnosis and best treatment made available. Further Doctor has informed me that my participation in this study help in evaluation of the results of the study which is useful reference to treatment of other similar cases in near future, and also I may be benefited in getting relieved of suffering or cure of the disease I am suffering.

The Doctor has also informed me that information given by me, observations made/ photographs/ video graphs taken upon me by the investigator will be kept secret and not assessed by the person other than me or my legal hirer except for academic purposes.

The Doctor did inform me that though my participation is purely voluntary, based on information given by me, I can ask any clarification during the course of treatment / study related to diagnosis, procedure of treatment, result of treatment or prognosis. At the same time I have been informed that I can withdraw from my participation in this study at any time if I want or the investigator can terminate me from the study at any time from the study but not the procedure of treatment and follow-up unless I request to be discharged.

After understanding the nature of dissertation or research, diagnosis made, mode of treatment, I the undersigned Shri/Smt_____________________________under my full conscious state of mind agree to participate in the said research/dissertation.

Signature of patient:

Signature of doctor:

Witness: 1.

2.

Date:

Place

ANNEXURE-VI (PROFORMA)

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, VIJAYAPURA - 586103

PROFORMA

CASE NO. :

NAME :

AGE/SEX :

I P NO :

DATE OF ADMISSION :

DATE OF SURGERY :

DATE OF DISCHARGE :

OCCUPATION :

RESIDENCE :

Presenting complaints with duration :

History of presenting complaints :

Family History :

Personal History :

Past History :

General Physical Examination

Pallor:	present/absent
Icterus:	present/absent
Clubbing:	present/absent
Generalized lymphadenopathy:	present/absent
Built:	poor/moderate/well
Nourishment:	poor/moderate/well

Vitals

PR: RR:

BP: TEMP:

Other Systemic Examination:

Right/ Left wrist

Inspection:

a) Attitude/ deformity

b) Abnormal swelling

- Site

- Size

- Shape

- Extent

c) Skin

Palpation:

a) Local tenderness

b) Bony irregularity

c) Crepitus

d) Swelling

Movements:

Wrist joint : dorsiflexion

Palmar flexion

Ulnar deviation

Radial deviation

Pronation

supination

ANNEXURE – VII (Masterchart)

Sl No.	Patient Name	Age	Sex	Inpatient no.	Side	Mode of injury	Score at final follow up		Complications
							DASH Score	Modified Mayo Wrist score	
1	Ramesh	40	M	154872	R	RTA	4.2	95	
2	Prashanth	56	M	34827	R	DT	13.3	85	STIFFNESS
3	Anil	26	M	65046	R	SI	5	95	
4	Sudesh	45	M	69380	R	DT	7.5	90	
5	Rekha	24	F	39395	L	SI	5	100	
6	Santosh	40	M	84811	R	RTA	7.5	90	
7	Shrimanth	44	M	91407	R	DT	17.5	85	
8	Karishma	45	F	107391	R	DT	9.2	90	
9	Chanappa	52	M	115714	L	RTA	14.2	90	
10	Rudrappa	55	M	114912	L	RTA	17.5	80	NON-UNION
11	Hanamanth	36	M	127667	R	RTA	20.8	80	PERSISTANT PAIN
12	Bhimappa	25	M	138837	R	SI	8.3	95	
13	Waseem	27	M	144000	R	RTA	10	90	
14	Akash	24	M	154501	R	SI	8.3	95	
15	Mahesh	37	M	159668	L	DT	11.7	90	
16	Chandrakala	24	F	162227	R	SI	10.8	95	
17	Rukmini	30	F	162448	L	DT	12.5	90	
18	Dayanand	25	M	142386	L	RTA	11.7	90	
19	Sumathi	34	F	170229	L	RTA	8.3	95	
20	Mahima	32	F	162218	R	RTA	13.3	95	
21	Ganesh	23	M	177366	R	SI	17.5	90	
22	Lingappa	26	M	185058	L	RTA	5	100	
23	Muthamma	45	F	193536	L	DT	18.3	85	PERSISTANT PAIN
24	Yamanappa	20	M	220429	L	SI	11.7	90	
25	Jagadish	26	M	220431	R	SI	5.8	95	
26	Nagamma	30	F	220459	L	RTA	6.7	100	
27	Yamanappa	28	M	229576	R	RTA	12.5	85	
28	Karthik	24	M	238843	L	DT	7.5	95	
29	Kumar	20	M	247499	R	SI	5	95	
30	Gowri	25	F	261221	L	SI	14.2	90	
31	Prakash	26	M	204536	R	DT	13.3	95	
32	Neelamma	36	F	253468	R	RTA	6.7	100	
33	Kamlesh	34	M	274371	L	RTA	11.7	95	
34	Kallappa	27	M	274372	R	SI	16.7	90	
35	Umesh	34	M	284257	R	DT	20.8	80	STIFFNESS
36	Vinayak	34	M	284328	R	DT	8.3	95	
37	Nithya	45	F	294960	L	DT	14.2	85	
38	Javeed	25	M	274630	L	SI	10	95	
39	Basappa	20	M	282699	R	SI	13.3	85	
40	Gopal	33	M	1003714	L	DT	5.8	95	
41	Appasaheb	42	M	178227	L	RTA	20	80	PERSISTANT PAIN
42	Praveen Bagali	24	M	1008304	R	SI	7.5	95	
43	Gurumath	27	M	13220	L	DT	8.3	95	
44	Arun	36	M	1017969	R	DT	11.7	90	
45	Parashuram	34	M	22958	R	RTA	17.5	85	PERSISTANT PAIN
46	Laxmi	29	F	27349	L	SI	16.7	85	STIFFNESS
47	Sanju	20	M	32251	R	RTA	5	100	
48	Wasim	19	M	35930	L	SI	8.3	95	
49	Govind	28	M	40739	R	DT	10.2	95	
50	Mahesh	31	M	40738	L	DT	10.8	90	
51	Govind	30	M	49606	L	SI	9.2	95	
52	Prakash	55	M	54292	R	DT	22.5	80	PERSISTANT PAIN
53	Dayanand	38	M	58689	R	RTA	11.7	85	
54	Manish	34	M	62697	L	RTA	10.8	95	
55	Chanappa	60	M	66979	R	DT	13.3	80	STIFFNESS