

Review Article

An Overview of Physiotherapy Intervention on Prevention and Management of Open Fractures - A Literature Review

Abdulkadir Abubakar Sulaiman¹, Dr. Vikas Sharma²

¹BPT Student Dept Of Physiotherapy Smas Galgotias University Greater Noida U.P

²Assistant professor Dept of Physiotherapy Galgotias University

Received: 20 August, 2023

Accepted: 21 September, 2023

Published: 27 September 2023

Abstract:

Study Design: A literature review was conducted in order to provide an overview of physiotherapy intervention on prevention and management of open fractures.

Objectives: In addition to determining the issue and choosing the best approach to decrease or get rid of the source of the loss of movement, this research will review the key functions of physiotherapy in relation to fractures. It is still debatable whether open fractures should be treated with irrigation and debridement (I&D) within six hours after the injury.

Materials and Methods: A narrative of the literature was performed by 21 articles with actual content based on relevant articles that were identified by a hard copy textbook, engines such as SCIENCE DIRECT, PUBMED, GOOGLESCHOLAR, ORTHOINFO and COCHRANE DATA BASE OF SYSTEMATIC REVIEW (www.cochrane.org), and CINALE. Website like physiopedia (www.physiopedia.com) was searched and published texts were also reviewed in these studies.

Results: For rapid primary wound closure in gustilo-anderson grade 1, 2, and 3 An open fracture, infection rates of 2 to 3 percent have been documented. When primary wound closure was attained for Gustilo-Anderson grade 3 B, complete wound healing, bone consolidation, and no need for secondary surgery were reported in 86.7% of cases.

Conclusion: The most frequent open fractures are tibial, phalangeal, forearm, ankle, and metacarpal. Open fractures have a high rate of morbidity and mortality. All patients with open fractures require coverage for antibiotics and current tetanus injections. Optimal outcomes will result from early surgical care with involvement from plastic and vascular surgery as needed.

Keywords: Lower extremity trauma; Masquelet; Open fracture; Reconstruction, Debridement, free flap, skin graft.

Introduction

A shattered bone refers to a bone that has been fragmented. It might be as trivial as a blemish or as major as a break. Bone may fracture in different ways, including lengthwise, transversely, or into many fragments. More often than not, bones break because they've been pushed to more pressure or force than they can handle. Excruciating pain is a common aftereffect of a fracture. The harm may worsen if you move or touch the affected region. In rare cases, you may even faint from the pain. The shock may also make you feel disoriented or chilled. A fracture may also present with these additional symptoms:

- a snapping or grinding sounds at the time of injury.
- •bruises, redness, and edema at the site of the incident
- difficulty of weight-bearing in the injured area
- physical deformity in the injured area
- Discolored skin around the affected area

Types of Fracture

- Stable fracture: The bone's shattered ends align and hardly seem out of position.

- Open, multiple fracture: The bone may enter the skin or the skin may be broken at the time of the fracture by a force. The bone may or may not be visible in the wound.
- Transverse fractures have a fracture line that is horizontal.
- Oblique fracture: This type of fracture has an angled pattern.
- Comminuted fracture: The bone breaks into three or even more fragments in this type of fracture.
- Spiral fracture: a fracture in which the bone has been twisted in at least one area.
- Compression (crush) fracture: This type of fracture typically affects the spine's spongy bone. For instance, osteoporosis may cause the front part of a vertebra in the spine to collapse. (1).

Types of Bone Fractures

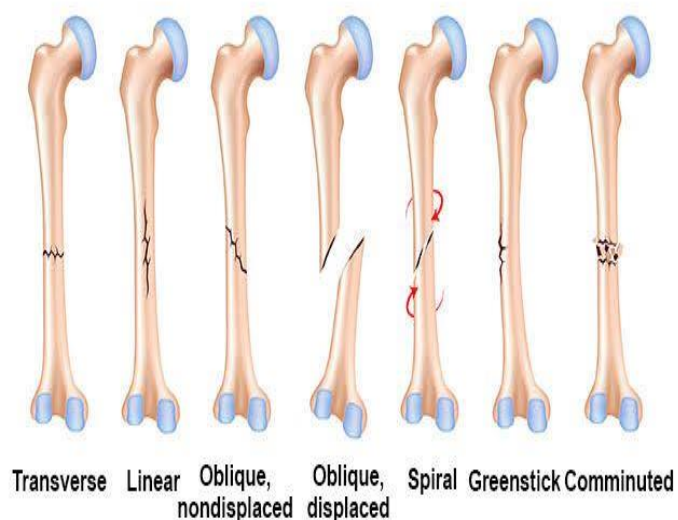


Figure-1. Types of Fracture.

Complications

The risk of complications in open injuries during fracture treatment necessitates the use of techniques such as immediate or emergent care and complete wound treatment, which includes and reduction of the bacterial load introduced by disruption of the so excision of all foreign substances, surgical removal of tissues with reduced blood flow, tissue envelope, Osteoporosis of grades IIIB and IIIC is treated by irrigating the open fracture incision with sterile abundant normal fluid and antibacterial beads, as well as systemic medicine (2)

Removing and/or killing bacteria is essential for better wound healing. In contrast, because of its questionable efficiency and possible toxicity, antiseptic irrigation should be avoided on a regular basis. Pulsed lavage assists in the elimination of pollutants from wounds, as well as the decrease of germs, inflammation, and debris. In comparison to higher pressure settings (70 psi), lower pressure levels (15–25 psi) seem better at balancing the potential for bone injury with the already well-established contaminant-clearing characteristics.

A later pathogen invasion cannot be predicted based on early wound culture results. Only 18% of the infections were caused by the same bacteria that had been found in the perioperative cultures. If wounds are covered as soon as possible, bacterial infection may be prevented (3).

Nailing severe open long bone fractures is difficult because of the risk of infection. Reaming and nailing an open tibia fracture results in an infection incidence of between 14 and 33%. When it comes to open tibial fractures of type II and III, external fixation was first indicated as the most effective treatment option. In open fractures up to grade III A and B, primary linked nailing after reaming is presently recommended after complete cleansing and irrigation to minimise loss of reduction, refracture, pin tract irritation, and non-union... Compound Gr

III fractures with a high level of contamination may benefit greatly from secondary IM nailing, which can significantly reduce the risk of sequelae.

For the most part, the limb should be immobilised in a plaster slab while the fixator is removed and the nail is inserted. In addition, when nails were inserted with reaming, there was no increased risk of infection. During the reaming process, periosteal blood flow has been demonstrated to increase in animal models, whereas a fractured callus and the total limb flow remain unaltered (4).

Because of the early soft tissue regeneration, the outcome of these fractures has been considerably enhanced! Traumatic musculoskeletal anomalies may be treated more reliably if neurovascular supply and microsurgical methods were well understood. Early bone grafting, which has enhanced fracture fixing, has lowered healing time for fractures. Soft tissue injuries are better treated when an orthopaedic surgeon and a plastic surgeon work together to address them, as does skeletal restoration after open fractures. It is now recommended that senior members of the team provide appropriate debridement and skeletal stabilisation as an urgent surgery.

Hemorrhage and shock, fat embolism, venous thrombosis and collapsed lung, Crush syndrome, and difficulties from extended recumbency are also common adverse effects.

Symptoms confined to the area surrounding the fracture site include early union, contracture, and joint instability. His atrophy and necrosis of the surrounding joint, as well as Damage to the soft tissues and nerves may occur as a result of osteoarthritis or rheumatoid arthritis. There is a ruptured or torn tendon, as well as tendonitis. damage to the pelvis, spinal column, or the rib cage

Compartment Syndrome:

The risk of complications in open injuries during fracture treatment necessitates the use of techniques such as immediate or emergent care and complete wound treatment, which includes and reduction of the bacterial load introduced by disruption of the so excision of all foreign substances, surgical removal of tissues with reduced blood flow, tissue envelope. A sterile, abundant amount of normal fluid, together with an antibacterial bead pouch and systemic medicine, is irrigated into the open fracture incision for grades IIIB and IIIC fractures (2)

A clean wound is essential to a faster recovery from infection. The use of antiseptic irrigation, on the other hand, should be limited owing to its questionable efficiency and potential toxicity when administered often. Pulsed lavage assists in the elimination of pollutants from wounds, as well as the decrease of germs, wound irritation, and debris from wounds.. Bone repair seems to be hindered by higher pressure settings (70 psi), whereas low to moderate pressure levels (15–25 psi) appear to reach a compromise between bone injury and proven contaminant-clearing characteristics..

It's difficult to predict a later pathogen invasion based on early wound culture results. Only 18% of the illnesses were caused by bacteria found in the perioperative cultures. Covering wounds early may help prevent the development of a hospital-

acquired bacterial infection (3).

As far as nailing severe open long bone fractures go, infection is the biggest problem. Reaming and nailing an open tibia fracture increases the risk of infection by 14 to 33%. Consequently, external fixation was first indicated as the preferable treatment for type II and III open tibial fractures. As an alternative, primary-linked nailing after reaming is presently recommended in open fractures up to grade III A and B after complete cleaning and irrigation to minimise loss in reduction, refracture and pin tract inflammation, and non-union... As an alternative, secondary IM nailing is an option for complex Gr III fractures with high levels of contamination, and it may significantly reduce the incidence of problems.

After three weeks of immobilisation in a plaster slab, the leg may be nailed in the middle of that time period. Furthermore, when nail insertion with reaming was carried out, there was no increased risk of infection. During the reaming process, periosteal blood flow has been found to increase in animal models, whereas the fractured callus and the total limb flow remain unaltered (4).

Because of the early soft tissue regeneration, the outcome of these fractures has been considerably improved! There is hope

for improved treatment for traumatic musculoskeletal anomalies because to advances in neurovascular supply research and microsurgical techniques. A fracture's healing period has been reduced as a result of enhanced fracture fixation and early bone grafting.' Reconstruction of open fractures by combining the skills of an orthopaedic and plastic surgeon has resulted in better outcomes and lower morbidity. Rather than recommending a subpar emergency surgery, we now recommend that senior members of the team do appropriate debridement and bone stabilisation as an urgent treatment."

Other common adverse effects include bleeding and shocks, fat embolism, venous thrombosis and collapsed lung, Crush syndrome, and difficulties from extended recumbency.

Anatomical problems: those affecting the bone directly surrounding the fracture site such as pre-mature union, contracture, and joint instability; His atrophy and necrosis of the surrounding joint, which affects his mobility Damage to the soft tissues and nerves may occur as a result of osteoarthritis or rheumatic arthritis. Tendon rupture and tendonitis are three common injuries. damage to the pelvis, spinal column, or ribs is all possible

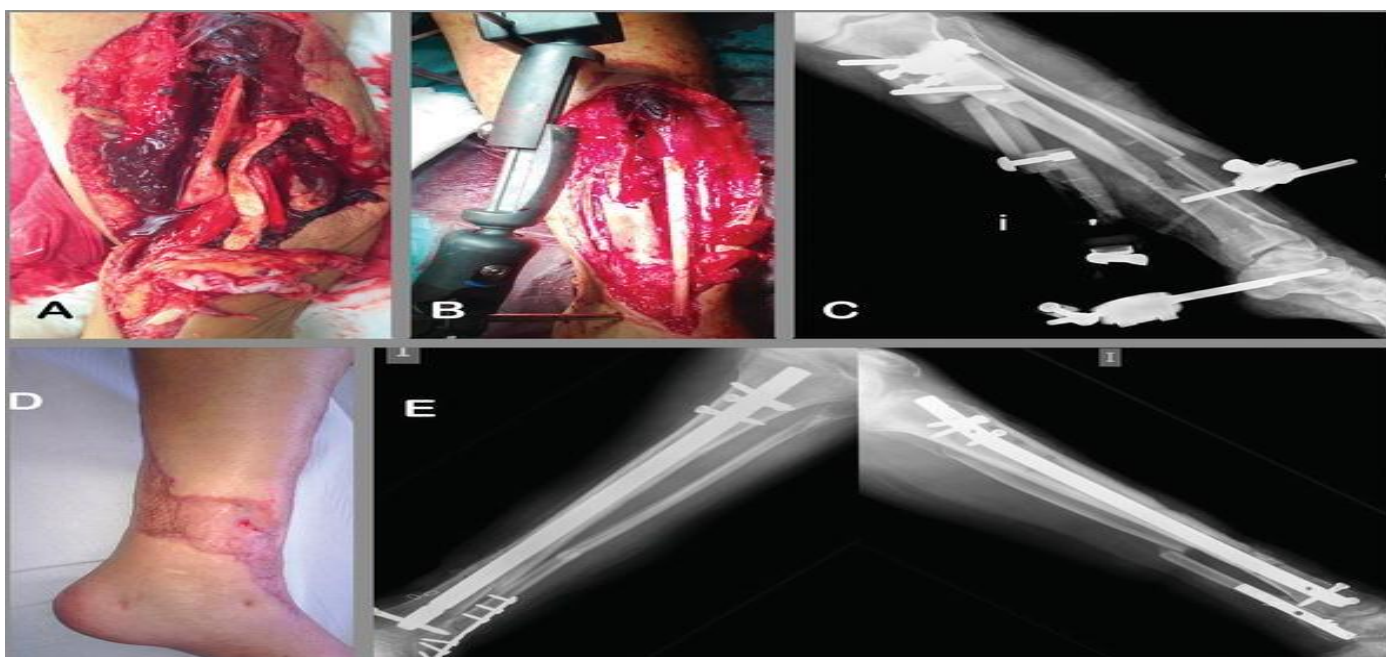


Figure- Internal and External fixation.

Review of Literature

Open fractures are prevalent, and their incidence is rising among the elderly. The economic and societal costs of open fractures are significant. The majority of open fractures occur in the lower extremities. When treating open fractures, using validated techniques will improve our results. The initial step was to correctly identify the fracture characteristics as well as the concealed soft tissue injuries. It is necessary to utilize an appropriate and early antibiotic prophylaxis, followed by proper irrigation and debridement. Finally, we must determine whether to use a temporary fixation approach or a definitive fixation method to treat the fracture. The establishment of specialist "orthoplastic" units has improved outcomes in high-

energy tibial fractures recently. ecause complications can result in high-energy open fractures at a rate of up to 50%, these fractures should be addressed in proper trauma centers that can handle all potential difficulties that may arise during the rehabilitation technique. (6).

Classification of Fracture:

A fracture is a rupture in a bone's structure. The aetiology, the way the fracture engages with its surroundings, the relocation, and the fracture pattern can all be used to categorize it.

1. Traumatic Fracture: Traumatic fractures are fractures that arise as a result of trauma. Healthy bone can endure a lot of

stress and only fractures under really harsh conditions. This category includes the majority of fractures encountered in daily practise, such as those caused on by falls, auto accidents, conflicts, etc.

2. Pathological Fracture: A pathological fracture is one that arises via a bone that has been weakened by an underlying illness. Such fractures may be caused by trivial or no force, such as a fracture through a bone that has been weakened by cancer.

3. Stress Fracture: This particular fracture occurs when bony trabeculae break as a result of chronic repeated damage (stress). These frequently simply cause pain and may not be detectable on X-rays. (7).

On Basis of Displacements:

1. Undisplaced Fracture: The lack of visible displacement enables these fractures simple to diagnose.

2. Displace Fracture: Any fracture could be relocated. The following are the causes of displacement: (the fracturing force, the muscle pull on the fracture fragments, and the gravity). The displacement could take the shape of a rotation, shift, or osteotomy.

On the Basis of Relationship with External Environment:

1. Closed Fracture: A closed fracture is one that is isolated from the surrounding soft tissue and does not interact with outside surroundings.

2. Open Fracture: An open fracture is one that has a break in the soft tissue and skin immediately above it, enabling it to communicate with the outside environment. There are two types of fractures: internally open fractures and externally open fractures

a) Internally open: The end of the fracture, which is sharp, tears the skin from the inside out, creating an open fracture.

b) Externally open (open from the outside): The fracture-causing substance tears the skin and surrounding soft tissues as it breaks the bone, leaving open fracture.

An open fracture is more vulnerable to infection since it is exposed to the outside surroundings. More people are at risk for externally open fractures. ().

Fracture Healing: A fracture begins to heal immediately after it occurs through a continuous sequence of stages, much like the recovery of soft tissue injuries, except that soft tissue heals with fibrous tissue while the final result of bone healing is mineralized fibroblast tissue.

Stages in Fracture Healing of Cortical Bone:

- Haematoma's stage
- Granulation tissue stage;

Callus stage

Remodeling (consolidation) stage;

Modeling (remodelling) stage

- **Haematoma's Stages:** This may persist up to seven days. Blood escapes from damaged bone veins during a fracture, creating a hematoma within around the fracture. The

fracture ends are stripped of the periosteum and the surrounding soft tissues.

- **Granulation Tissue Stages:** This phase lasts for two to three weeks. Sensitized spermatozoa (daughter cells) produce cells that organise and differentiate to build blood vessels, fibroblasts, and osteoblasts at this stage. Together, they create a soft granulation tissue in the gap between the fracture fragments.
- **Stage of Callus:** About 4 to 12 weeks are spent in this stage. The granulation tissue continues to improve at this stage and produces osteoblast. These cells create an intercellular matrix that quickly absorbs calcium salts. As a result, the callus, often known as "woven bone," is formed. The callus is the earliest X-ray-visible indication of the fusion 11
- **Stage of Remodelling:** Formerly referred to as the consolidation phase. At this stage, mature bone with a typical lamellar structure replaces the woven bone. This multicellular unit-based remodeling mechanism replaces a pocket of callus with a pocket of lamellar bone. It's a stretched process that can take up to two years.
- **Stage of Modelling:** Previously, it was known as the remodelling stage. The bone is gradually strengthened in this period. The endosteal and periosteal surfaces are where cortices sharpen. Local bone strains from weight-bearing load and muscular forces when the person begins exercise are the main stimuli for this process.
- **Diagnosis of Fracture:** If you fear you have a fracture, seek medical help right away. The doctor will most likely ask you about your symptoms and examine the affected region visually. You may also be asked to move the region in specific ways to look for pain or other damage indicators. The doctor will request X-rays. According to the American Academy of Orthopaedic Surgeons, X-rays are the most often used method for evaluating fractures. Your bone can be photographed to show any breaks or other damage. X-rays can also be used to identify a fracture's type and location. In some circumstances, your doctor may also prescribe a magnetic (CT scan) to examine your bones and the tissues around them. Magnetic resonance imaging (MRI)

Treatment of Fracture: A shattered bone has a fracture. It necessitates medical intervention. Call 911 or your local emergency number if a major accident or injury caused the broken bone.

Also, contact emergency services if needed. Additionally, if necessary, call emergency assistance.

The person is still, unresponsive, and not breathing. If there is no heartbeat or breathing, start CPR.

- The bleeding is drastic.
- Pain is caused by even slight pressure or movement

The bone has penetrated the skin; the limb or joint seems to be damaged.

- Prevent all bleeding. With a clean cloth, clean piece of clothing, or a sterilized bandage, apply direct pressure.
- Keep the injured area immobilized. Never attempt to correct the bone or push a protruding bone back in. Apply a splint to the region above and below the fracture sites if you have received manual therapy training and professional assistance is not immediately accessible. The splints can be made more comfortable by cushion

Apply ice packs to limit swelling and help relieve pain. Avoid placing ice on the skin directly. A towel, garment, or other material can be used to wrap the ice.

Treat for shock. If the person feels faint or is breathing in short, rapid breaths, lay the person down with the head slightly lower than the trunk and, if possible, elevate the legs(7).

Non-Operative:

- Immobilization
- Indications
- stable fracture forms without relocated joint surface
- patients who are critically ill or non-ambulatory • individuals at increased risk of getting skin conditions (diabetic, peripheral arterial disease, neuroma)

Technique

A fracture brace and ROM activities are used as an alternative to a prolonged leg cast for 6 weeks.

Outcomes

It is unlikely that misplaced fracture treatment will result in a reduction of intra-articular fragmentation.

The inability to evaluate soft tissue damage is a significant drawback because the loss of reduction is common.

Operative:

Temporizing spanning external fixation across ankle joint

Indications

Acute therapy stabilises fractures with rheumatoid joint depression or dislocation so that soft tissue healing can proceed until swelling decreases (about 10–14 day)

Open Reduction and Internal Fixation (Orif)

Indications

definitive fixation for majority of pilon fractures
limited or definitive ORIF can be performed acutely with low complications in certain situations

outcomes

ability to drive

brake travel time returns to normal 6 weeks after weight bearing(5).

Another point of disagreement is how open fractures, particularly in the femur and tibia, are stabilised in the early stages. Getting a good fixation is essential for easing patient pain, promoting wound healing, and facilitating manipulation. The treatment of open fractures of grades I and II seems to be comparable. Intra-medullary nails may be used for tibial fractures, and temporary plating can be used to accomplish

anatomical reduction. Surgical debridement and closure are used to close fractures when proper antibacterial prophylaxis has been administered. treatment of open fractures (14). The use of non-reamed intramedullary nails in fractures with a minimal bone defect in grade IIIA appears to be a good and safe option (better), with fewer complications and higher union rates than temporary external fixation

Fracture treatment choices are dependent on the kind of fracture and where it is located. Most of the time, the doctor's goal is to realign and stabilise the healing bones. It is essential that fractured bone pieces remain immobile as they heal. New bone will grow along the edges of the fractured fragments as they mend. If the new bone is properly positioned and sturdy, the fragments will ultimately come together.

using a cast to keep the shattered bone in place. The cast may be made of plaster or fibreglass. Stabilizing the wounded region and preventing the spread of fractured bone fragments are two of its many benefits throughout the healing process. Only in the rarest of cases may traction be required to keep the wounded region stable. The tendons and muscles around the bone are loosened by traction. Pulleys and weights are attached to a metal frame above the patient's bed and the doctor will use them to give it. The doctor may utilise this method to help stabilise the wounded part by gently pushing on it.

Surgery may be required for fractures that are more complicated or compound. An open reduction and internal or external fixation by the physician may be used to prevent the bones from shifting during healing.(8).

To begin, in open reduction and internal fixation, the doctor repositions the bone fragments into their correct positions. They'll then "sew" or "glue" the bone back together. A variety of methods may be used, including screws, metal plates, and both. Rods may be inserted into your bone in certain circumstances.

Pins or screws are inserted into the bone above and below the fracture site in external fixation. They will attach these pins or screws to a metal bar that is placed on the exterior of the skin. While the bone is healing, the bar will keep it in place.

A doctor also might prescribe medication to control other diseases or complications or to combat an infection or control discomfort. Following the initial stages of therapy, they could prescribe physical therapy or other techniques to aid the patient in restoring proper functioning.

Physical Therapy and Fractures:

Physical therapy for fractures is separated into two phases: treatment while immobility and management following fixing removal. The physic treatment must be cautious of anything that could cause the repair to be delayed or result in non-union. As a result, it is critical to understand the principles of fractures and to be aware of any special precautions or difficulties.

1) Physical rehabilitation when confined

The goals for this time frame are:

1. Reduce swelling: To avoid adhesion formation and to lessen pain, it is important to do this as soon as possible.
2. Help in enhancing the area's circulation.
3. Keep muscles working by performing either active or static

muscular contractions.

4. Preserve joint Stiffness.

5. Continue to function as the fracture and stabilization allow.

6. There will be classes on how to walk with canes, sticks, and frames. It is necessary to evaluate the patient before deciding on the best course of action. It is not necessary to treat the patient for the duration of this period if he can be trained to carry out his own activities. Patients must be aware of and motivated to comply with all of the instructions given to them. The patient's progress is being monitored by the physical therapist at this time. A physiotherapy clinic or a patient's home may be the best option for outpatients if more treatment is needed. It is possible to prevent some of the potential problems that may arise after the fixation is removed if necessary precautions are taken now.(2).

Patient Problems and Physiotherapy Techniques

Active or static muscular contractions may be used to reduce the formation of adhesions and tight joints by raising limbs. Swelling and adhesion development may be minimised and the risk of injury to soft tissues like the ankles and knees by engaging in exercises that are isotonic or static in nature.

Due to joint fixation, muscles that cannot move a joint will soon degenerate. Correctly and regularly executing isometric or isotonic contractions reduces the amount of waste. When a fixation is removed, increasing useful tasks may speed the recovery time. Patients and physiotherapists must be able to see the value in their therapy, and both parties must be able to communicate this to each other.(2).

Physiotherapy Guideline in P0st Removal of Fixation

2 Aside from the injury, each patient has unique issues that can be related to age, family, career, leisure, and personal psychological responses. Planning a treatment regimen and evaluating performance must take into account these considerations.

Aims of Treatment:

decrease any edema.

restore total joint range of motion.

restore complete muscle strength.

To fully re-educate functioning

1) Swelling

Swelling should not be a problem if the immobilisation period was spent engaging in physical activity. As a result, if the lower leg muscles are weak and the joints are restricted, veins may not be able to get the proper circulation. Any edoema must be reduced as quickly as possible since it will impede mobility and develop adhesions, which will prolong the healing period.

2) Range of joint movement

The swelling should not occur if the immobilisation period was spent engaging in physical activity, such as exercising or going on a walk. Muscle weakness and joint range reduction in the lower limbs may be a concern since these factors will prevent the veins from obtaining the proper pumping action that they need. Any edoema must be reduced as quickly as possible since it will impede mobility and develop adhesions, extending the

healing period.

3) Muscle power

There should be no swollen ankles if the immobilisation period was spent doing workouts and other normal daily activities. For example, veins may be unable to pump properly if their muscles are weak and their joints are restricted in their range of motion. Any edoema must be reduced as quickly as possible since it will impede mobility and develop adhesions, slowing the healing process.

4) Full function

However, if complete recovery is not attainable in the great majority of situations then optimal function must be achieved in order to minimise the difficulties that obstruct a full recovery. The patient's needs in terms of home, work, and leisure must all be taken into account throughout the planning process. For patients who are returning to work, it's crucial to know that they may have to work all day and know what sort of job they'll be doing—heavy labour, industrial work on a production bench, or office work that requires a range of different activities—to prepare them for their return to work.(2).

Physiotherapy Techniques:

- These are given and must be carefully selected following the assessment of the patient.
- The physical therapist must evaluate each treatment and change the techniques as required.
- Treatment should be progressive and intensive, especially in the later phases of recovery, but always within the patient's competence.
- Choose the right techniques and decide how they should be implemented. When it comes to movement strategies, for example, consider how many times each exercise should be completed and whether aid or resistance is needed (2).

Prevention of Fracture:

People are aware of the advantages of exercise, including enhanced muscular strength and endurance, a decreased risk of heart disease and stroke, the avoidance of obesity, and a lower chance of developing diabetes. It's possible that the need of regular physical exercise for strong bones goes unappreciated. Inactivity is a leading cause of bone loss. Over time, osteoporosis causes bones to weaken and break more easily. It may be caused by ageing, certain illnesses, or therapies. Menopausal women and older men are more likely to have this ailment than those who have not gone through it.

Strengthening our bones as we become older is just as important as strengthening our bones at a young age. In response to the stresses it endures, bone adapts and changes throughout time. Frequent exercise causes your bones to thicken and develop more bone. A diet rich in calcium and Vitamin D is essential for strong bones. As a plus, exercise enhances one's balance and coordination. (10).

Exercises for Strong Bones:

There are several forms of physical activity, all of which are beneficial to one's health. Strength training and weight-bearing exercise are the best ways to build bone density. Site-specificity

is important in bone-strengthening activities. Bones in the legs and spine may be strengthened by regular exercise, such as walking. Postural stretching and strengthening may help prevent or minimise upper spine drooping in older persons. Bending down to tie your shoes or sweep and mop may cause spine fractures in those with a high risk of spine fractures. Maintain a neutral spine in all of your endeavours.

Strength-Training Exercise:

All forms of physical activity offer health benefits. Two of the most important forms of exercise for building healthy bones are weight-bearing and strength training. Localized bone-strengthening activity is necessary. Strengthening the bones in the legs and spine, for example, may be achieved via regular walking. It is possible to avoid or minimise upper spine drooping in older persons by the use of postural stretching and strengthening techniques. Spine fractures may be caused by bending down to tie your shoes or sweep and mop, especially in those with a predisposition to this kind of injury. Maintain a neutral spine during your daily activities.

Other Form of Exercise

If you're looking to strengthen your bones, you may want to avoid high-impact workouts like yoga and tai chi. These workouts, which do not include weight-bearing such as swimming or cycling but instead focus on strengthening the heart and lungs, do not improve bone density. These are excellent alternatives if you are unable to engage in weight-bearing activities due to a musculoskeletal health issue, such as arthritis.

A Program for Bone Health Fitness

Bone health may be improved by weight-bearing exercise four or more times per week for 30 minutes each session. To keep yourself motivated, engage in an activity you find pleasurable. Thirty minutes of exercise may be squeezed into a single session or broken up into smaller ones. Drink water at least once every ten minutes.

Lifting weights, using weight machines at the gym or at home, or using your own body weight to stress a sequence of muscles and bones are all kinds of resistance. Strength exercise at least twice a week will help to build stronger bones.(10).

Basic Principles of Resistance Training:

1. **Program:** Your total fitness plan consists of a variety of activities, including aerobic training, flexibility training, strength training, and balance training.
2. **Weight:** Your entire fitness plan includes a variety of activities, including aerobic training, flexibility training, strength training, and balancing exercises.
3. **Exercise:** For example, the calf raise is meant to target a specific muscle or set of muscles, such as the hamstrings.
4. **Repetition Or Reps:** For each set, how many repetitions of the same exercise are performed.
5. **Set:** Squats with a rep count of 15 are considered a "no rest" set since the muscles are worked without a break in between sets.

6. **Variety:** Muscles are forced to adapt and get stronger when you vary your training programme and include new activities on a regular basis.
7. **Recovery:** After an exercise, muscles need time to recover and adapt. A decent rule of thumb is to allow the muscle group to rest for up to 48 hours before reactivating it(10).

Test: You may also go for Bone Mass Measurement:

- **Bone density test:**

Getting your bone mineral density (BMD) checked will give you a good idea of how healthy your bones are. It may diagnose osteoporosis, evaluate your risk of fractures (broken bones), as well as monitor your response to osteoporosis therapy.

Central dual-energy x-ray absorptiometry, or central DXA, is the most often utilised BMD test. It's like getting an x-ray, but without the agony. Bone density in the hips and lower back may be assessed with this procedure.

An x-ray is used to determine the amount of bone in the forearm, wrist, finger, or heel using peripheral bone density assays. They are often used for screening and might identify persons who could benefit from further hip and lumbar spine bone density testing.(14).

Management of Open Fractures

An open fracture is a shattered bone that has a physical injury or skin break nearby. The most typical cause of this incision is a bone piece that poked through the dermis during the trauma.

A fracture with no physical wound, requires a different treatment than an open fracture. This is because pollutants may penetrate the wound and lead illness after the skin is damaged. As a result, the focus of early therapy for an open fracture is on protecting being infected at the injury location. In a surgical procedure, It is necessary to clear the bone, muscles, and wound. In order for the lesion to recover, the shattered bone should be supported (17).

The severity of open fractures varies widely. Skin loss is common in high-energy traumas, also the bone can be observed broken through the lesion. In other circumstances, the lesion is as small as a puncture. Destroyed to the muscles and ligament around the bone. As a result, every acute fracture in the area with a physical lesion is observed as physical or open fracture. Includes,

- The dimensions and amount of fracture pieces
- The harm to the close-by soft tissues
- The wound's site and whether or not the muscle in the vicinity had proper cardiovascular function.

The majority of patients with open fractures will seek care in an emergency room. (2).

Medical Examination: A doctor will perform a first evaluation and check for other injuries in the emergency room. They'll also inquire about your medical history and how your injury occurred. After that, the doctor will inspect the incision and fracture site for soft tissue, nerve, and circulation damage. It is accepted that there is a physical fracture when there is a wound in the same place as a shattered bone.

Test:

X-rays will be ordered by the doctor to establish the extent of

the fracture. The position and degree of dislocation between the bony parts, the amount of shattered bone inside the bones, will be revealed by X-rays. A computerized tomography or other imaging investigation may be used if more information is needed.

Antibiotics and Tetanus: Antibiotics can be prescribed to you immediately in the emergency room to help avoid infection. In case of had not given a tetanus booster in the last 5 years, you will be given one. To make you more comfortable, analgesics will be administered intravenously. (3),(16).

Debridement and Irrigation: The initial stages in reducing the risk of infection are debridement and irrigation. During debridement, the doctor will eradicate all impurity and polluted matters from the wound, as well as any destroyed tissue. If the lesion is small, the doctor may have to strengthen of the involved muscles and bones. The lesion will subsequently be poured with different liters of saline solution or rinsed out. After cleaning the wound, the doctor will assess the fracture and stabilize the bones. Internal or external fixing is used to treat open fractures (11).

Internal Fixation:

During such an operation, metallic implantation, such as plates, rod, or screws, is placed under or on top of the injured bone. While the fracture heals, the implants will keep the bone in place and hold it together. Internal fixation can be utilized to manage physical fractures in which the following conditions exist:

The lesion is clean,

- There is small dermal or muscle damage, and
- The shattered bone piece may be properly positioned.

External Fixation:

If lesion and shattered bones cannot be lifetime implant, the wounded limb may be treated with external fixation. External fixation is used to stabilise the majority of severe open fractures.

During this surgery, the therapist places metallic pins or screw into bones around the outside fracture. The pins and screws protrude from the skin and connect to metal or carbon fiber bars. The outside fixator has the benefit of supporting the fractured bone while the therapist attends to the lesion. The wound may require additional healthy skin and tissue to graft and covered the broken bone in some circumstances. Despite the open incision, the patient may often get out of bed and move around with an external fixator in place.

In most circumstances, an external fixator is only used until internal fixation can be performed safely. However, until the bones mend completely, an external fixator is needed to keep them stable. When the fracture has healed, it is removed during a second treatment

Treatment of More Complex Wound

Extensive injuries of soft tissue with substantial skin are 3.

common with open fractures. These wounds are frequently too big to close. In this case, the doctor will apply a bandage to the wound to help prevent infection and aid healing.

There are a variety of temporary dressings available, but in most circumstances, To close the wound, a capillary walls dressing is applied. until it can be properly healed. Antibiotic beads are frequently inserted into wounds before they are sealed to deliver a high concentration of antibiotics to the damage. After a period of time, the wound will be closed with a permanent procedure. The following are permanent wound-covering techniques:

- Skin graft: If only skin loss is present, a portion of skin from another region of the body can be extracted and utilized to cover the wound.
- Local flap: To conceal the defect, muscle tissue from another part of the same limb might be rotated into the wound. The flap can subsequently be covered with a skin graft.
- Free flap: Tissue from another section of the body, generally the back or abdomen, can be transferred. A micro vascular surgeon who can establish blood circulation to the flap is commonly used in a free flap operation (9).

Methodology

Aim: To overview of physiotherapy intervention on prevention and management of open fractures.

Objectives: Review the primary function of physical therapy in relation to fractures, including diagnosing the issue's root cause and choosing the correct course of treatment to address it. It is still debatable whether open fractures should be managed with irrigation and debridement (I&D) within six hours just after fracture

Study Design: Narrative review of literature.

Materials and Methods: A structured literature search was done using various electronic data bases.

Data Sources: A hard copy textbook, engines such as SCIENCE DIRECT, PUBMED, GOOGLESCHOLAR, WHO, ORTHOINFO and COCHRANE DATA BASE OF SYSTEMATIC REVIEW www.cochrane.org.in CINALE. Website like physiopeedia was searched and published texts were `also reviewed in these studies.

Selection Criteria:

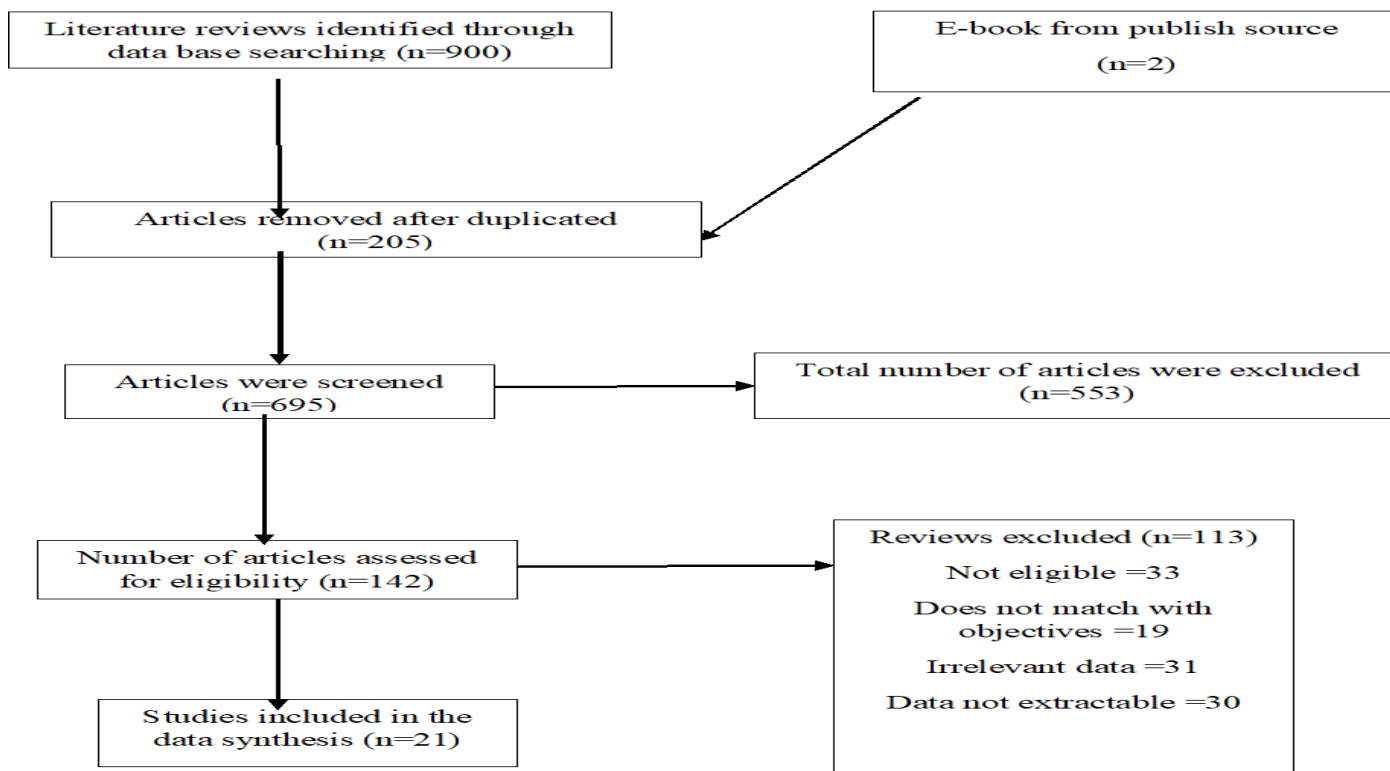
Inclusion Criteria:

1. Published studies about prevention and management of open fracture.
2. A review studies was included only.
3. Articles published between "1988-2021".

Exclution Criteria:

1. If the studies were not published or not peer reviewed.
2. If studies reviewed a whole discipline, not individual intervention.

PRISMA FLOW DIAGRAM



Result

4.1 Data Collection,

Analysis and Selection of Studies Eligibility assessment was conducted in a blinded standardized manner by scanning the titles, abstracts and keywords. The articles were screened then stored in the editor in order to remove and reduce duplicate citations Research indicate through a search technique were first evaluated based on the headline and content. The full content of the potential relevant study was retrieved, reviewed and carefully assessed. Studies that did not fit the criteria for inclusion were omitted, and copies of the full text of any references that might have been relevant were obtained and documented as part of the research. .

4.2 Data Extraction and Management

When necessary, requests for further information were issued by various authors to Pubmed and others in order to gather the available data utilising data extraction (s).

The below information was download from each article

1. General information: authors, country, publication year;
2. Study design and aim
3. size of sample, kind of control group
4. Study outcomes
5. Summary of finding

During the search phase, a Study was identified by searching the electronic data bases and additional 900 studies were identified through the manual searches of systematic reviews' references list. As many as 205 duplicates. Were removed and the titles and abstracts of remaining studies (n=145) were assessed for eligibility. 553 references were excluded because there`s no any physiotherapy role on them. Conference papers

(n=19), not English language (n=31). 21 articles were included in the systematic review.

Discussion

The rate of perioperative infected patients with open tibial fractures is highly depended on the Gustilo-Anderson classification level of the fracture and has little to do with when the initial debridement occurs. In addition, smoking is restricted prior to surgery, the patient's blood sugar is controlled, and the debridement operation time is kept to a minimum to prevent the spread of infection.

According to the results from this study, there is a significant correlation between cortical consistency and tibial shaft fracture nonunions and the requirement for repeated surgery. A fracture gap post-fixation, open fractures, as well as certain types of transverse fractures were covered in this study as risk factors for non - union and reoperations in tibial shaft fractures. In addition, the prognostic risk index proposed in an earlier study was reconfirmed. Cortical continuity mitigates the likelihood of fracture however soft tissue damage severity and fracture type are still unchangeable risk factors., Through the use of additional medical evaluation methods, such as computerized tomography (CT), radiological examinations can frequently be modified and monitored more effectively. It is essential for the surgeon to pay close attention to the existing technologies of the surgical procedure to align the fracture ends and prevent gaps. Since our research demonstrates that surgeons may be performing additional surgery to treat the anticipation of nonunion development, clinical evaluation of the effectiveness of invasive surgery for achieving bony union can help determine whether currently published prognostic risk factors

for nonunion requiring reoperation are accurate. However, surgeons can use this information to direct conversations regarding clinical outcome after open fracture surgery(20).

Conclusion

The most common open fractures are tibial, phalangeal, forearm, ankle, and metacarpal. Open fractures have such a high rate of morbidity and mortality. All patients with open fractures required treatment for antibiotics and appropriate tetanus injections. Optimal outcomes will result from prompt surgical care with the assistance from plastic and vascular surgery as needed. Look for any skin or tissue loss in the region surrounding . A safe and effective treatment for open femur and tibia shaft fractures is surrounding physical fixation followed by early closed interlocked nailing. The outcomes of this meta-analysis confirm that in open tibial fracture injuries, prolonged surgical treatment did not result in an increase in infection or non-union rates. To ensure that the proper management circumstances are in place and that getting to surgery quickly is not emphasized over the availability of surgical knowledge, competent staff, and equipment, a fair delay in the initial debridement is appropriate.

References

1. Maheswari and Mhaskar 5th Edition.
2. Shehab M. Abd El-kader professor of physical therapy 3rd Edition 2013.
3. Keating JF, Blachut PA, O'Brien PJ, Meek RN, Broekhuysen H. Reamed nailing of open tibial fractures: Does the antibiotic bead pouch reduce the deep infection rate. *J Orthop Trauma*. 1996;10:298–303.
4. Bhandari M, Guyatt GH, Swiontkowski MF, Schemitsch EH. Treatment of open fractures of the shaft of tibia: A systematic overview and meta-analysis. *J Bone Joint Surg Br*. 2001;83:62–8.
5. McGraw JM, Lim EV. Treatment of open tibia-shaft fractures: External fixator and secondary intramedullary nailing. *J Bone joint Surg Am*. 1988;70:900–11.
6. Ali AM, Noyes D, Cogswell LK. *Br J Hosp Med (Lond)*. 2013 Oct;74(10):577-80. doi: 10.12968/hmed.2013.74.10.577.
7. Marx JA, et al., eds. General principles of orthopedic injuries. In: Rosen's Emergency Medicine: Concepts and Clinical Practice. 8th ed. Philadelphia, Pa.: Saunders Elsevier; 2014. <https://www.clinicalkey.com>. Accessed Jan. 30, 2018.
8. Millman M. Cuts, scrapes and wounds. In: Mayo Clinic Guide to Self-Care. 6th ed. Rochester, Minn.: Mayo Foundation for Medical Education and Research; 2010.
9. What to do in a medical emergency: Broken bones. American College of Emergency Physicians. [- 101/Emergencies-A-Z/Broken-Bones/. Accessed Jan. 31, 2018.
 10. The British Editorial Society of Bone & Joint Surgery. ©2017
 11. Srour M, Inaba K, Okoye O, Chan C, Skiada D, Schnuriger B, et al. Prospective evaluation of treatment of open fractures: Effect of time to irrigation and debridement. *JAMA Surgery*. 2015;150\(4\):332-336
 12. Weber D, Dulai S.K, Bergman J, Buckley R, Beaupre L.A.\(Time to initial operative treatment following open fracture does not impact development of deep infection: a prospective cohort study of 736 subjects\). *J Orthop Trauma*. 2014; **28**: 613-619
 13. Court-Brown CM, Bugler KE, Clement ND, Duckworth AD, McQueen MM. The epidemiology of open fractures in adults. A 15-year review. *Injury*. 2012;43\(6\):891-897
 14. Godfrey J, Pace JL. Type I open fractures benefit from immediate antibiotic administration but not necessarily immediate surgery. *Journal of Pediatric Orthopedics*. 2016;36\(Suppl 1\):S6-S10
 15. Foote CJ, Guyatt GH, Vignesh KN, Mundi R, Chaudhry H, Heels-Ansdell D, et al. Which surgical treatment for open tibial shaft fractures results in the fewest reoperations? A network meta-analysis. *Clinical Orthopaedics and Related Research*. 2015;473\(7\):2179-2192
 16. Godfrey J, Pace JL. Type I open fractures benefit from immediate antibiotic administration but not necessarily immediate surgery. *Journal of Pediatric Orthopedics*. 2016;36\(Suppl 1\):S6-S10
 17. Daping Hospital and the Research Institute of Surgery of the Third Military Medical University. Production and hosting by Elsevier B.V. © 2018
 18. Harvey EJ, Sanders DW, Shuler MS, Lawendy AR, Cole AL, Alqahtani SM, et al. What's new in acute compartment syndrome? *Journal of Orthopaedic Trauma*. 2012;26\(12\):699-702
 19. *Oper Orthop Traumatol*. 2018 Oct;30\(5\):294-308. doi: 10.1007/s00064-018-0562-8. Epub 2018 Sep 4.
 20. Nicolaides M, Vris A, Heidari N, Bates P, Pafitanis G. *Diagnostics \(Basel\)*. 2021 Jun ;11\(6\):1017. doi: 10.3390/diagnostics11061017.
 21. *Am J Orthop \(Belle Mead NJ\)*. 2007 Apr;36\(4\):215-20.](http://www.emergencycareforyou.org/Emergency-</div><div data-bbox=)

Copyright (c) 2023 The copyright to the submitted manuscript is held by the Author, who grants the Clinical Medicine and Health Research Journal a nonexclusive license to use, reproduce, and distribute the work, including for commercial purposes.



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)