CHAPTER 2
THEORETICAL BACKGROUND

2.1 Anatomy Physiology of Bone

2.1.1 Structure of Bone

The adult human skeleton has a total of 213 bones, excluding the sesamoid bones. The appendicular skeleton has 126 bones, axial skeleton 74 bones, and auditory ossicles six bones. Each bone constantly undergoes modeling during life to help it adapt to changing biomechanical forces, as well as remodeling to remove old, microdamaged bone and replace it with new, mechanically stronger bone to help preserve bone strength (Standring, 2004).

The four general categories of bones are long bones, short bones, flat bones, and irregular bones. Long bones include the clavicles, humeri, radii, ulnae, metacarpals, femurs, tibiae, fibulae, metatarsals, and phalanges. Short bones include the carpal and tarsal bones, patellae, and sesamoid bones. Flat bones include the skull, mandible, scapulae, sternum, and ribs. Irregular bones include the vertebrae, sacrum, coccyx, and hyoid bone. Flat bones form by membranous bone formation, whereas long bones are formed by a combination of endochondral and membranous bone formation (Taichman, 2005).

The skeleton serves a variety of functions. The bones of the skeleton provide structural support for the rest of the body, permit movement and locomotion by providing levers for the muscles, protect vital internal organs and structures, provide maintenance of mineral homeostasis and acid-base balance, serve as a reservoir of growth factors and cytokines, and provide the environment for hematopoiesis within the marrow spaces (Taichman, 2005).

The long bones are composed of a hollow shaft, or diaphysis; flared, cone-shaped metaphyses below the growth plates; and rounded epiphyses above the growth plates. The diaphysis is composed primarily of dense cortical bone, whereas the metaphysis and epiphysis are composed of trabecular meshwork bone surrounded by a relatively thin shell of dense cortical bone. The adult human skeleton is composed of 80% cortical bone and 20% trabecular bone overall (Eriksen, 1994).

Different bones and skeletal sites within bones have different ratios of cortical to trabecular bone. The vertebra is composed of cortical to trabecular bone in a ratio of 25:75. This ratio is 50:50 in the femoral head and 95:5 in the radial diaphysis (Eriksen, 1994).

Cortical bone is dense and solid and surrounds the marrow space, whereas trabecular bone is composed of a honeycomb-like network of trabecular plates and rods interspersed in the bone marrow compartment. Both cortical and trabecular bone are composed of osteons (Eriksen, 1994).

Cortical osteons are called Haversian systems. Haversian systems are cylindrical in shape, are approximately 400 mm long and 200 mm wide at their base, and form a branching network within the cortical bone (Eriksen, 1994).

The walls of Haversian systems are formed of concentric lamellae. Cortical bone is typically less metabolically active than trabecular bone, but this depends on the species. There are an estimated 21×10^6 cortical osteons in healthy human adults, with a total Haversian remodeling area of approximately 3.5 m^2. Cortical bone porosity is usually <5%, but this depends on the proportion of actively remodeling Haversian systems to inactive cortical osteons. Increased cortical remodeling causes an increase in cortical porosity and decrease in cortical bone mass. Healthy aging adults normally experience thinning of the cortex and increased cortical porosity (Eriksen, 1994).

Cortical bone has an outer periosteal surface and inner endosteal surface. Periosteal surface activity is important for appositional growth and fracture repair. Bone formation typically exceeds bone resorption on the periosteal surface, so bones normally increase in diameter with aging. The endosteal surface has a total area of approximately 0.5 m^2, with higher remodeling activity than the periosteal surface, likely as a result of greater biomechanical strain or greater cytokine exposure from the adjacent bone marrow compartment (Eriksen, 1994).

Bone resorption typically exceeds bone formation on the endosteal surface, so the marrow space normally expands with aging. Trabecular osteons are called packets. Trabecular bone is composed of plates and rods averaging 50 to 400 mm in thickness (Eriksen, 1994).

Trabecular osteons are semilunar in shape, normally approximately 35 mm thick, and composed of concentric lamellae. It is estimated that there are 14×10^6 trabecular osteons in healthy human adults, with a total trabecular area of approximately 7 m^2 (Eriksen , 1994).

Cortical bone and trabecular bone are normally formed in a lamellar pattern, in which collagen fibrils are laid down in alternating orientation (Eriksen, 1994).

Lamellar bone is best seen during microscopic examination with polarized light, during which the lamellar pattern is evident as a result of birefringence. The mechanism by which osteoblasts lay down collagen fibrils in a lamellar pattern is not known, but lamellar bone has significant strength as a result of the alternating orientations of collagen fibrils, similar to plywood (Eriksen, 1994).

The normal lamellar pattern is absent in woven bone, in which the collagen fibrils are laid down in a disorganized manner. Woven bone is weaker than lamellar bone. Woven bone is normally produced during formation of primary bone and may also be seen in high bone turnover states such as osteitis fibrosa cystica, as a result of hyperparathyroidism, and Paget's disease or during high bone formation during early treatment with fluoride (Eriksen, 1994).

The periosteum is a fibrous connective tissue sheath that surrounds the outer cortical surface of bone, except at joints where bone is lined by articular cartilage, which contains blood vessels, nerve fibers, and osteoblasts and osteoclasts. The periosteum is tightly attached to the outer cortical surface of bone by thick collagenous fibers, called Sharpeys' fibers, which extend into underlying bone tissue. The endosteum is a membranous structure covering the inner surface of cortical bone, trabecular bone, and the blood vessel canals (Volkman's canals) present in bone. The endosteum is in contact with the bone marrow space, trabecular bone, and blood vessel canals and contains blood vessels, osteoblasts, and osteoclasts (Eriksen, 1994).

2.1.2. Bone Growth, Modeling, and Remodeling

Bone undergoes longitudinal and radial growth, modeling, and remodeling during life. Longitudinal and radial growth during growth and development occurs during childhood and adolescence. Longitudinal growth occurs at the growth plates, where cartilage proliferates in the epiphyseal and metaphyseal areas of long bones, before subsequently undergoing mineralization to form primary new bone (Kobayashi, 2003).

Modeling is the process by which bones change their overall shape in response to physiologic influences or mechanical forces, leading to gradual adjustment of the skeleton to the forces that it encounters. Bones may widen or change axis by removal or addition of bone to the appropriate surfaces by independent action of osteoblasts and osteoclasts in response to biomechanical forces. Bones normally widen with aging in response to periosteal apposition of new bone and endosteal resorption of old bone. Wolff's law describes the observation that long bones change shape to accommodate stresses placed on them. During bone modeling, bone formation and resorption are not tightly coupled. Bone modeling is less frequent than remodeling in adults (Kobayashi, 2003).

Modeling may be increased in hypoparathyroidism , renal osteodystrophy, or treatment with anabolic agents (Lindsay, 2006).

Bone remodeling is the process by which bone is renewed to maintain bone strength and mineral homeostasis. Remodeling involves continuous removal of discrete packets of old bone, replacement of these packets with newly synthesized proteinaceous matrix, and subsequent mineralization of the matrix to form new bone. The remodeling process resorbs old bone and forms new bone to prevent accumulation of bone microdamage (Lindsay, 2006).

Remodeling begins before birth and continues until death. The bone remodeling unit is composed of a tightly coupled group of osteoclasts and osteoblasts that sequentially carry out resorption of old bone and formation of new bone. Bone remodeling increases in perimenopausal and early postmenopausal women and then slows with further aging, but continues at a faster rate than in premenopausal women. Bone remodeling is thought to increase mildly in aging men (Lindsay, 2006).

The remodeling cycle is composed of four sequential phases. Activation precedes resorption, which precedes reversal, which precedes formation. Remodeling sites may develop randomly but also are targeted to areas that require repair (Parfitt, 2002).

Activation involves recruitment and activation of mononuclear monocyte-macrophage osteoclast precursors from the circulation, lifting of the endosteum that contains the lining cells off the bone surface, and fusion of multiple mononuclear cells to form multinucleated preosteoclasts. Preosteoclasts bind to bone matrix *via* interactions between integrin receptors in their cell membranes and RGD (arginine, glycine, and asparagine)-containing peptides in matrix proteins, to form annular sealing zones around bone-resorbing compartments beneath multinucleated osteoclasts (Roodman. 1999).

Osteoclast-mediated bone resorption takes only approximately 2 to 4 weeks during each remodeling cycle. Osteoclast formation, activation, and resorption are regulated by the ratio of receptor activator of NF-κB ligand (RANKL) to osteoprotegerin (OPG;), IL-1 and IL-6, colony-stimulating factor (CSF), parathyroid hormone, 1,25-dihydroxyvitamin D, and calcitonin. Resorbing osteoclasts secrete hydrogen ions *via* H^+-ATPase proton pumps and chloride channels in their cell membranes into the resorbing compartment to lower the pH within the bone-resorbing compartment to as low as 4.5, which helps mobilize bone mineral (Roodman. 1999).

Resorbing osteoclasts secrete tartrate-resistant acid phosphatase, cathepsin K, matrix metalloproteinase 9, and gelatinase from cytoplasmic lysosomes to digest the organic matrix, resulting in formation of saucer-shaped Howship's lacunae on the surface of trabecular bone and Haversian canals in cortical bone. The resorption phase is completed by mononuclear cells after the multinucleated osteoclasts undergo apoptosis (Roodman. 1999).

During the reversal phase, bone resorption transitions to bone formation. At the completion of bone resorption, resorption cavities contain a variety of mononuclear cells, including monocytes, osteocytes released from bone matrix, and preosteoblasts recruited to begin new bone formation. The coupling signals linking the end of bone resorption to the beginning of bone formation are as yet unknown (Roodman. 1999).

Proposed coupling signal candidates include bone matrix—derived factors such as TGF-β, IGF-1, IGF-2, bone morphogenetic proteins, PDGF, or fibroblast growth factor. TGF-β concentration in bone matrix correlates with histomorphometric indices of bone turnover and with serum osteocalcin and bone-specific alkaline phosphatase. TGF-β released from bone matrix decreases osteoclast resorption by inhibiting RANKL production by osteoblasts. The reversal phase has also been proposed to be mediated by the strain gradient in the lacunae (Roodman. 1999 Aug;).

As osteoclasts resorb cortical bone in a cutting cone, strain is reduced in front and increased behind, and in Howship's lacunae, strain is highest at the base and less in surrounding bone at the edges of the lacunae. The strain gradient may lead to sequential activation of osteoclasts and osteoblasts, with osteoclasts activated by reduced strain and osteoblasts by increased strain. The osteoclast itself has also been proposed to play a role during reversal (Roodman. 1999).

Bone formation takes approximately 4 to 6 mo to complete. Osteoblasts synthesize new collagenous organic matrix and regulate mineralization of matrix by releasing small, membrane-bound matrix vesicles that concentrate calcium and phosphate and enzymatically destroy mineralization inhibitors such as pyrophosphate or proteoglycans (Benjamin, 2013).

Osteoblasts surrounded by and buried within matrix become osteocytes with an extensive canalicular network connecting them to bone surface lining cells, osteoblasts, and other osteocytes, maintained by gap junctions between the cytoplasmic processes extending from the osteocytes. The osteocyte network within bone serves as a functional syncytium. At the completion of bone formation, approximately 50 to 70% of osteoblasts undergo apoptosis, with the balance becoming osteocytes or bone-lining cells (Benjamin, 2013).

Bone-lining cells may regulate influx and efflux of mineral ions into and out of bone extracellular fluid, thereby serving as a blood-bone barrier, but retain the ability to redifferentiate into osteoblasts upon exposure to parathyroid hormone or mechanical forces. Bone-lining cells within the endosteum lift off the surface of bone before bone resorption to form discrete bone remodeling compartments with a specialized microenvironment. In patients with multiple myeloma, lining cells may be induced to express tartrate-resistant acid phosphatase and other classical osteoclast markers (Benjamin, 2013**).**

The end result of each bone remodeling cycle is production of a new osteon. The remodeling process is essentially the same in cortical and trabecular bone, with bone remodeling units in trabecular bone equivalent to cortical bone remodeling units divided in half longitudinally. Bone balance is the difference between the old bone resorbed and new bone formed (Attar, 2013).

Periosteal bone balance is mildly positive, whereas endosteal and trabecular bone balances are mildly negative, leading to cortical and trabecular thinning with aging. These relative changes occur with endosteal resorption outstripping periosteal formation (Attar, 2013).

The main recognized functions of bone remodeling include preservation of bone mechanical strength by replacing older, microdamaged bone with newer, healthier bone and calcium and phosphate homeostasis. The relatively low adult cortical bone turnover rate of 2 to 3%/yr is adequate to maintain biomechanical strength of bone (Thomas, 2013).

The rate of trabecular bone turnover is higher, more than required for maintenance of mechanical strength, indicating that trabecular bone turnover is more important for mineral metabolism. Increased demand for calcium or phosphorus may require increased bone remodeling units, but, in many cases, this demand may be met by increased activity of existing osteoclasts. Increased demand for skeletal calcium and phosphorus is met partially by osteoclastic resorption and partly by nonosteoclastic calcium influx and efflux (Thomas, 2013).

Ongoing bone remodeling activity ensures a continuous supply of newly formed bone that has relatively low mineral content and is able to exchange ions more easily with the extracellular fluid. Bone remodeling units seem to be mostly randomly distributed throughout the skeleton but may be triggered by microcrack formation or osteocyte apoptosis. The bone remodeling space represents the sum of all of the active bone remodeling units in the skeleton at a given time (Thomas, 2013).

2.1.3 Function of Bone

According to Dewit & Susan on 2017, the function of bone are:

2.1.3.1 Bones provide shape to the body

2.1.3.2 The skeleton provides a rigid framework that supports the internal organs and the skin

2.1.3.3 He skeleton protect the internal organs of the body

2.1.3.4 The skeleton provides attacgments for tendons and ligaments and contributes to movement of the body

2.1.3.5 The red bone marrow in the spongry bones forms red blood cells, white blood cells, and platelets

2.1.3.6 The bone store and release minerals, such as calcium and phosporus

2.1.3.7 The blood and lymph vessel in the canals transport nutrients to the bone cells and remove wastes

2.1.3.8 Bone is maintained by remodeling: existing bone is resorbed into the body and new bone is built by osteoblasts to replace it.

2.2 Basic Concept of Fracture

2.2.1 Definition

According to Horak (1975), depending on the location of the fracture can be distinguished:

2.2.1.1 Fracture below the humeral head (subcapital fracture)

2.2.1.2 Placed fracture of the shaft between the head of the arm and elbow (fracture of the humeral shaft)

2.2.1.3 Fracture located just above the elbow (fracture distal)

The inner edge of the humeral head – just below the shoulder joint – the arm bone is relatively soft and small, and can be easily fractured during a coup or a serious fall on the arm. This fracture is among the most frequent. Fractures due to bone metastases of malignant tumors usually affect the area of the diaphysis of the arm. In about 5% of cases, the humeral head fracture that. The head of the arm bone, is relatively large, highly mobile and it is essential to restore exactly the bony contour, and retain high mobility. The supine position (arm extended along the body) allows the doctor to see a fracture of the humerus. The treatment is performed without surgery – for simple fractures. First, stabilization and specific therapeutic exercise are needed (Horak, 1975).

Fracture is a complete or incomplete disorder of bone structure continuity and is defined according to the type and extent. Fractures occur when the bone becomes a subject of greater pressure than it can absorb (Brunner, 2015).

A humerus fracture is a break of the humerus bone in the upper arm. Fractures of the humerus may be classified by the location into proximal region, which is near the shoulder, the middle region or shaft, and the distal region, which is near the elbow. These locations can further be divided based on the extent of the fracture and the specific areas of each of the three regions affected. Humerus fractures usually occur after physical trauma, falls, excess physical stress, or pathological conditions such as tumors. Falls are the most common cause of proximal and shaft fractures, and those who experience a fracture from a fall usually have an underlying risk factor for bone fracture. Distal fractures occur most frequently in children who attempt to break a fall with an outstretched hand *(Auth, P. C, 2012).*

2.2.2 Classification of Fracture

According Muttaqin (2011), the classification of fractures is :

2.2.2.1. Traumatic Fracture

Occur because of trauma that suddenly the big bone strength and bone is not able to withstand the trauma to fracture.

2.2.2.2. Pathologic Fracture

Occurred since the previous bone weakness due to pathology in the bone. Pathologic fractures occur in areas in the bones that have been weakened by the tumor or other pathological processes. Often show a decrease bone density. The most common cause of fractures semcam are tumors, both primary tumors and tumor metastasis (Muttaqin, 2011).

There are several kinds of fracture according to Belleza (2016), that may occur in a bone:

a. Complete fracture A complete fracture involves a break across the entire cross-section of the bone and is frequently displaced.
b. Incomplete fracture**.** An incomplete fracture involves a break through only part of the cross section of the bone.
c. Comminuted fracture**.** A comminuted fracture is one that produces several bone fragments.
d. Closed fracture**.** A closed fracture is one that does not cause a break in the skin.
e. Open fracture**.** An open fracture is one in which the skin or mucous membrane wound extends to the fractured bone.

2.2.3 Etiology

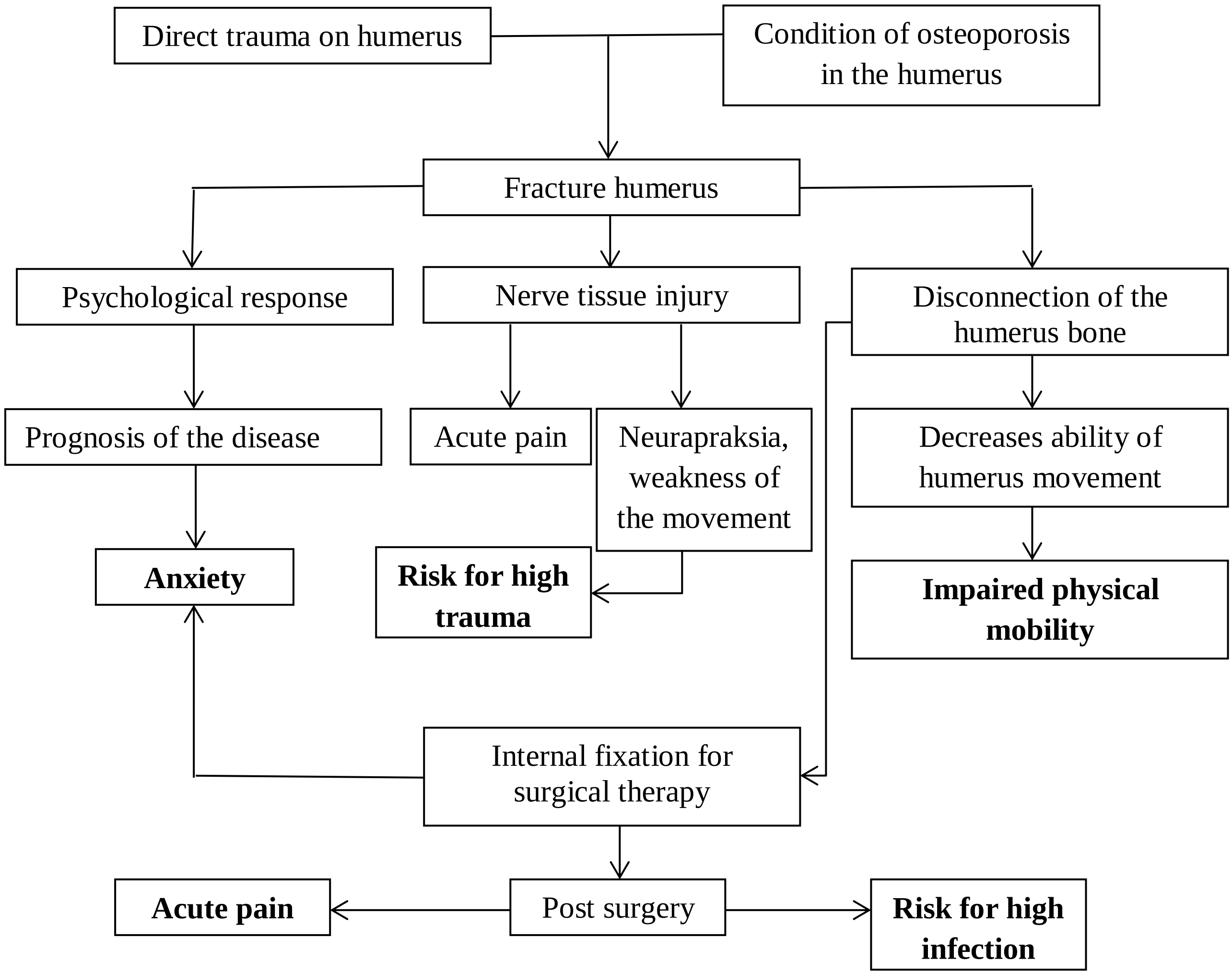
Humerus fractures usually occur after physical trauma, falls, excess physical stress, or pathological conditions. Humerus fractures most often occur among elderly patients with osteoporosis who fall on an outstretched arm. Less frequently, fractures occur from motor vehicle accidents, gunshots, and violent muscle contractions from an electric shock or seizure (Cameron, et al., 2014).

Other risk factors for fractures include having a low bone mineral density, having impaired vision and balance, and tobacco smoking. A stress fracture of the proximal and shaft regions can occur after an excessive amount of throwing, such as pitching in baseball. Middle fractures are usually caused by either physical trauma or falls. Physical trauma to the humerus shaft tends to produce transverse fractures whereas falls tend to produce spiral fractures (Cameron, et al., 2014).

Metastatic breast cancer may also cause fractures in the humerus shaft. Long spiral fractures of the shaft that are present in children may indicate physical abuse. Distal fractures usually occur as a result of physical trauma to the elbow region. If the elbow is bent during the trauma, then the olecranon is driven upward, producing a T- or Y-shaped fracture or displacing one of the condyles. Falls that produce humerus fractures among the elderly are usually accompanied by a preexisting risk factor for bone fracture, such as osteoporosis, a low bone density, or vitamin B deficiency (Cameron, et al., 2014)

2.2.4 Pathway

(Muttaqin, 2011)



2.2.5 Pathophysiology

Fractures usually occur after falling with outstretched hand positions, or without strong trauma to osteoporosis clients with impaction fracture conditions in the proximal humerus.

Clinical conditions of proximal humerus fractures cause client complaints of pain, physical mobility impairment, risk of trauma due to ignorance in mobilization, psychological response of anxiety. Medical interventions with surgical action lead to complaints of post-surgical pain, infection risk, and information fulfillment (Muttaqin, 2011).

2.2.6 Clinical Manifestation

According to Jitowiyono and Kristinayasari, 2012 :

2.2.6.1. Deformity

The appeal of muscle strength makes moving a single bone fragment and rupture balance changes occur such as shortening the rotation of the bone or bone suppression.

2.2.6.2. Swelling

Swelling rapidly emerging on the location and estravasasi in tissue adjacent to the fracture.

2.2.6.3. Echimosis of bleeding subculaneous

2.2.6.4. Muscle spasm

2.2.6.5. Tenderness

2.2.6.6. Pain

2.2.6.7. Numbness

2.2.6.8. Abnormal movement

2.2.6.9. Shock Hypovolemic

2.2.6.10. Crepitations

2.2.7 Diagnostic Examination

Examination performed according to Belleza (2016), for examination of the humerus fracture:

2.2.7.1 X-ray examinations: Determines location and extent of fractures/trauma, may reveal preexisting and yet undiagnosed fracture(s).

2.2.7.2 Bone scans, tomograms, computed tomography (CT)/magnetic resonance imaging (MRI) scans: Visualizes fractures, bleeding, and soft-tissue damage; differentiates between stress/trauma fractures and bone neoplasms.

2.2.7.3 Arteriograms: May be done when occult vascular damage is suspected.

2.2.7.4 Complete blood count (CBC): Hematocrit (Hct) may be increased (hemoconcentration) or decreased (signifying hemorrhage at the fracture site or at distant organs in multiple trauma). Increased white blood cell (WBC) count is a normal stress response after trauma.

2.2.7.5 Urine creatinine (Cr) clearance: Muscle trauma increases load of Cr for renal clearance.

2.2.7.6 Coagulation profile: Alterations may occur because of blood loss, multiple transfusions, or liver injury.

2.2.8 Treatment

Treatment of the fracture divided into two, there are :

2.2.8.1. Medical Treatment

Management of a patient with fracture can belong to either emergent or post-emergent:

a. Immediately after injury, if a fracture is suspected, it is important to immobilize the body part before the patient is moved.

b. Adequate splinting is essential to prevent movement of fracture fragments.
c. In an open fracture, the wound should be covered with sterile dressing to prevent contamination of the deeper tissues.
d. Fracture reduction refers to restoration of the fracture fragments to anatomic alignment and positioning and can be open or closed depending on the type of fracture.

2.2.8.2. Nursing Treatment

a. The nurse should instruct the patient regarding proper methods to control edema and pain.
b. It is important to teach exercises to maintain the health of the unaffected muscles and to increase the strength of muscles needed for transferring and for using assistive devices.
c. Plans are made to help the patients modify the home environment to promote safety such as removing any obstruction in the walking paths around the house.
d. Wound management. Wound irrigation and debridement are initiated as soon as possible.
e. Elevate extremity**.** The affected extremity is elevated to minimize edema.
f. Signs of infection**.** The patient must be assessed for presence of signs and symptoms of infection.

(Belleza, 2016).

2.2.9 Prognosis

Each method of humeral shaft fracture treatment is associated with a union rate of higher than 90%. Each fracture must be considered separately and treated accordingly. Connolly et al assessed the outcome of immediate open reduction and internal fixation (ORIF) in 46 patients with open humeral diaphyseal fractures. All fractures united primarily in satisfactory angulation of less than 5º in coronal and sagittal planes. In 40 patients, mean time to union was 18.4 weeks; in six, union was delayed (mean time to union, 42.5 weeks). No patient required subsequent surgery to obtain union (Lawless, 2016).

Complications were rare (including amputation in three patients and dysesthesia in one), with no deep infections, nonunions, or iatrogenic nerve injuries. Two implants were removed because of discomfort. Heineman et al conducted a meta-analysis of four trials comparing treatment of humeral shaft fractures with different implants (plates and nails). After calculating the data from the four trials (203 patients), they did not find any statistically significant differences between plates and nails with respect to complications, nonunion, infection, nerve palsy, or reoperation. In a retrospective study, Pretell et al reported that 17 of 19 patients with fractures of the humeral shaft treated with anterograde locked intramedullary nailing were satisfied with the results. The mean duration of hospitalization after surgery was 4.3 days; there were no complications related to the implants; there were no operative complications; and the average operation time was 48 minutes. The consolidation rate was 80% (Lawless, 2016).

2.2.10 Complication

Complications of fractures may either be acute or chronic.

2.2.10.1. Hypovolemic shock resulting from hemorrhage is more frequently noted in trauma patients with pelvic fractures and in patients with displaced or open femoral fractures.

2.2.10.2. Fat embolism syndrome. After fracture of long bones and or pelvic bones, or crush injuries, fat emboli may develop.

2.2.10.3. Compartment syndrome. Compartment syndrome in an extremity is a limb-threatening condition that occurs when perfusion pressure falls below tissue pressure within a closed anatomic compartment.

(Belleza, 2016)

2.3 Basic Concept of Nursing Care

2.3.1 Nursing Assessment

2.3.1.1. Focus assessment

In the focus assessment that needs to be noticed in pharmacist patients referring to the theory according to Muttaqin (2011), there are various kinds including:

a. History History of Current Disese

Examine the chronology of the trauma that causes fractures, what help can be obtained. In addition, by knowing the mechanism of the occurrence of accidents, the nurse can know the injuries of the other. The presence of angular trauma will result in a fracture of the conversal type or short oblique. While rotational trauma will cause spiral type.

b. Health History of Previous Disease

Certain diseases such as bone cancer or cause pathological fractures so bones are difficult to connect. In addition, clients with highly injured diabetes are at risk for acute and chronic osteomyelitis and diabetes inhibits bone growth.

c. Health History of Family Disease

Family diseases such as osteoporosis are common in some breeds and bone cancers that tend to be genetically inherited.

d. The Pattern of Health Functional (Pre op and Post op)

1) Activity/Rest

   Because of the post-op pain the motion becomes limited and the activity becomes reduced.

2) Circulation Statue

   a) Hypertension (sometimes seen as a pain or anxiety response) or hypotension (blood loss)
   b) Tachycardia (stress response / hypovolemic)
   c) Decreased / no pulse on the injured distal, slow capillary refill, central to the affected part.
   d) Tissue swelling or hematoma mass

3) Neurosensory

   a) Loss of movement / sensation, muscle spasm
   b) Numbness / tingling (paresthesia)
   c) Local deformity: abnormal angulation, shortening, rotation, crepitation (creaking sound), muscle spasms, visible weakness / loss of function
   d) Agitation (possibly pain / anxiety or other trauma)

4) Pain/Comfort

   a) Severe sudden pain at the time of injury (may be localized to the tissue area / bone damage to immobilization), no pain due to nerve damage
   b) Spasms / muscle cramps after immobilization

5) Safety

a) Laceration of the skin, alvuse tissue, bleeding, discoloration

b) Local swelling (may increase gradually or suddenly)

e. The Pattern of Perception and Self-Concept (Post op)

The impact that arises from the client fracture is arising fear and disability due to fracture experienced, anxiety, the inability to perform activities normally and views against him wrong.

f. The Pattern of Sensory and Cognitive (Pre op and post op)

The client's touch fracture is reduced mainly in the distal part of the fracture, while the other senses and cognitive are not impaired. In addition, there is also pain due to fracture and due to surgery ORIF installation, pain assessment with PQRST pre and post op.

2.3.1.2. Physical examination

According to Mutatqin (2011), there are 2 kinds of physical examination that is general examination (general satus) to get general description and local examination (local), that is:

a. General condition pre and post op

Good situation bad client, signs that need to be noted:

1) Client’s awareness: apathetic, sopor, coma, anxious, compos mentis that depends on the client
2) Pain, illness, acute, chronic, mild, moderate, severe
3) Vital signs that are not normal because there are local disturbances, both function and form
4) B1 (Breathing)

On examination of the respiratory system there is no interference in patients with fractures of the humerus, right and left balanced fremitus vocals, no additional breath sounds.

5) B2 (Blood)

   Palpation: increased pulse rate

6) B3 (Bone)

   The presence of fractures on the humerus will interfere locally both motor function, sensory and circulatory.

7) In the intagume system there is erythema, the temperature around the trauma area increases, swelling, edema, tenderness. Note the presence of compartment syndrome in the distal arms of the humerus fracture characteristic of compartment syndrome in the humeral fracture is non-abnormal perfusion of the distal, such as the fingers, forearm, on the swollen fracture side, the presence of pain complaints on the arm, and arise when Many cover the lower part of the humeral fracture. In the event of an open fracture there are signs of soft tissue trauma to damage to skin integrity. A spiral oblique fracture results in shortening of the humerus stem, assessing signs of injury and possible neurovascular involvement. Assess for tenderness and crepitations in the upper arm area.

8) In the upper extremity there is movement disturbance (mobilis) in the injured area. The pre and post op extremity assessment includes:

   a) Look : On inspection generally notice the facial features of the client (whether seen in pain), skin color, skin texture, lunka tissue ie blood vessels, nerves, muscles, tendons, ligaments, fat tissue, fascia, lymph nodes, bones, joints, scars, color Redness or blueness (livide) or hyperpigmentation, lumps, swelling, basin or abnormality, position and shape of the extremity (deformity).

b) Feel : Skin temperature, palpable palpation, soft tissue palpation for muscle spasms, muscle atrophy, synovial membrane state, thickening of synovial tissue, presence of fluid inside or outside joints, presence of swelling, presence of tenderness of local pain or referred pain , Note the shape of bone, whether there is a bulge

c) Move : The movement of the joints both active and passive, whether the movement causes pain, whether the movement accompanied krepitasi, examination of joint stability primarily, ROM (Range Of Motion), examination of active or passive motion restrictions.

2.3.2 Nursing Diagnoses

Based on Wiley Balckwell on Nursing Diagnoses *Definitions and Calssification* (2014), the diagnoses are :

2.3.2.1. Acute pain related to physical injury agent

2.3.2.2. Impaired physical mobility related to decreased muscle strength

2.3.2.3. Anxiety related to major change (health status)

2.3.2.4. Risk for infection

2.3.2.5. Risk for trauma

2.3.3 Nursing Intervention

Based on Muttaqin (2011), there is nursing intervention on client with close fracture proximal humerus :

No.	Nursing Diagnosis	Goal	Intervention	Rational
1	Acute pain related to physical injury agent	After a 1x6 hour action is expected the pain is resolved, with the result criteria: a. Subjectively the client reported that the pain is reduced b. Vital signs within normal limits c. Can identify activities that can increase or decrease pain d. Client seems relaxed / uneasy, e. Pain scale is 0	**Independent:** a. Assess the pain scale with PQRST b. Assess vital signs c. Arrange immobilization in the arm d. Teach non-pharmacological relaxation techniques relax deep breath when pain arise **Collaboration:** e. Collaboration with doctech for analgesic administration	a. Disorders of the joints, bones or muscles can have an impact on comfort b. Know the changes in blood pressure, pulse, temperature, and respiration rate c. Adequate immobilization can reduce the movement of bone fragments that are the main causes of pain d. Relaxation techniques will accelerate blood peredarah so that O2 on the network is met and the pain will be reduced e. Analgetic block the path of pain so that the pain will be reduced.
2	Impaired physical mobility related to decreased muscle strength	After a nursing action for 1x6 hours is expected the client is able to perform physical activities in accordance with its ability, with the criteria of the results: a. Client can participate in the exercise program b. No joint contractures c. Increased muscle strength d. Client showed	**Independent:** a. Assess the mobility and observation of motor function regularly with look, feel, move b. Arrange immobilization on the upper arm c. Teach and support clients perform	a. Knowing the level of ability of the client in the activity b. Adequate immobilization can reduce the movement of bone fragments c. Active movement provides mass, tone,

		action to improve mobility	active motion exercises on unhealthy extremities d. Help clients perform active ROM and self-care according to tolerance **Collaboration:** e. Collaborate with physiotherapists to physically train clients f. Collaboration with nutritionists on diet high in carbohydrates, high in protein, and high in calcium	and muscle strength as well as improve heart and respiratory function d. To maintain flexibility of joints according to ability e. The ability of limb mobilization can be enhanced by physical exercise f. Protein to accelerate wound healing operations, carbohydrates as an energy source, calcium to help the bone recovery process
3	Anxiety related to major change(health status)	After the act of 1x6 hour anxiety is reduce, with the result criteria: a. Clients recognize his/her feelings b. Can identify the cause or factors that affect it c. Declare its anxiety is reduced	a. Assess verbal or nonverbal anxiety signs. Assist clients and take action when clients show destructive behavior b. Avoid confrontation c. Start taking action to reduce anxiety. Give a quiet environment and a restful atmosphere d. Increase client sensation control	a. Verbal and nonverbal reactions can show a sense of agitation, anger, and anxiety b. Confrontation can increase anger, decrease cooperation, and possibly slow healing c. Reduces unnecessary external stimuli d. Control client sensation (in reducing fear) by providing information about the state of the client,

				emphasizing respect for positive coping sources (self defense), helping with relaxation exercises and transfer techniques, and providing positive feedback
			e. Orient clients to the stages of expected operating and activity procedures f. Give the client a chance to reveal his anxiety g. Provide privacy to clients and people closest	e. Orientation of stages of surgical procedure can reduce anxiety f. Can relieve tension to unexpressed concerns g. Gives time to express feelings, eliminate anxiety, and adaptation behaviors. The existence of family and friends that the client chooses to engage in activities and diversions curts feelings of isolation.
3	Risk for infection	After nursing action during 1x6 hours, risk for infection problem can be solved, with criteria: a. Client know the risk of factor b. Client know how to avoid or reduce the risk of factor infection	**Independent:** a. Assess and monitor wound post op every day b. Do dressing wound care c. Limits the visitors **Collaboration:** d. Collaboration to give antibiotic	a. To detect early sign and symptom of inflammation cause wound post op b. Right dressing wound care's technique can reducee contaminate of germs c. To reduce the risk of infection contact from outside d. One or more agents are administered that depend on of the phatogen and the

				infections that occur
4	Risk for trauma	After nursing action during 1x6 hours, risk for infection problem can be solved, with criteria: a. Clients are willing to participate in the prevention of trauma	**Independent:** a. Maintain immobilization in the upper arm b. When the client uses a cast, monitor local emphasis and peripheral circulation c. When attached a bebate, support the fracture with a pillow or coil of blankets to keep the position neutral d. Evaluation of the bleeding against edema resolution **Collaboration:** e. Collaboration of antibiotics f. Evaluate signs and symptoms of tissue injury extension (local / systemic inflammation, such as increased	a. Minimizes pain stimulation due to friction between bone fragments and surrounding soft tissues b. Detects the presence of compartment syndrome and assesses premature circulatory disturbance in the distal portion of the forearm c. Prevent change of position while maintaining comfort and safety d. When the edema phase has passed, the possibility of loose bumps may occur e. Antibiotics are bactericidal / bacteriostatic to kill or inhibit the development of germs f. Assess client problem development

			pain, edema, and fever)	