

Managing fractures in geriatrics: Current approaches and update

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ABSTRACT

Literature Review

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Geriatric fractures refer to fractures that occur in older people, typically resulting from low-energy trauma and accompanied by osteoporosis. The bone remodelling process imbalance significantly contributes to age-related bone loss in geriatric, which reduces bone mass, making them more susceptible to fractures. Managing geriatric fractures poses unique challenges due to the presence of other comorbid conditions that can interfere with the healing process. Thus, restoring stability is prioritised over reversing anatomy and biology. The use of medication is often helpful in treating osteoporosis. Diagnosing and managing geriatric fractures is a complex process that requires careful consideration of various comorbid factors associated with older patients. Both non-operative and operative management requires thorough preparation. The primary goal of fracture management in older people is to achieve patient independence. Factors such as age, gender, comorbid conditions, pre-fracture functional abilities, and fracture type can impact the outcome regarding ambulation, daily activities, and quality of life. Therefore, it is essential to consider all these factors while managing geriatric fractures.

Fraktur geriatrik merujuk pada fraktur yang terjadi pada orang lanjut usia (lansia), biasanya akibat trauma energi rendah dan disertai osteoporosis. Ketidakseimbangan dalam proses remodelasi tulang adalah faktor utama dalam pengeroposan tulang terkait usia pada lansia, yang ditandai dengan penurunan massa tulang, sehingga membuat mereka lebih rentan terhadap fraktur. Mengelola fraktur geriatrik memiliki tantangan tersendiri karena adanya kondisi penyerta lain yang dapat mengganggu proses penyembuhan. Oleh karena itu, memulihkan stabilitas menjadi prioritas utama daripada membalikkan anatomi dan biologi. Penggunaan obat-obatan sering membantu dalam pengobatan osteoporosis. Mendiagnosis dan mengelola fraktur geriatrik merupakan proses yang kompleks yang memerlukan pertimbangan cermat terhadap berbagai faktor penyerta yang terkait dengan pasien lanjut usia. Baik manajemen non-operatif maupun operatif memerlukan persiapan yang matang. Tujuan utama manajemen fraktur pada lansia adalah untuk mencapai kemandirian pasien. Faktor seperti usia, jenis kelamin, kondisi penyerta, kemampuan fungsional pra-fraktur, dan tipe fraktur dapat berdampak pada hasil terkait ambulasi, aktivitas sehari-hari, dan kualitas hidup. Oleh karena itu, penting untuk mempertimbangkan semua faktor ini dalam mengelola fraktur geriatrik.

INTRODUCTION

Geriatric fractures refer to fractures that occur in older people, typically as a result of low-energy trauma, and are often accompanied by osteoporosis.¹ Fracture is a condition of complete or incomplete damage to the bone, or it is often called a condition where the continuity of the bone is broken, which causes mechanical instability of the bone.² Geriatrics is a branch of medicine focusing on premature ageing and managing

diseases related to old age.³ Geriatrics or older people have a chronological age of 65 or more.⁴

With the increase in the population's life expectancy, the number of older people will also increase. Thus, the rise in the number of geriatric patients has led to increased health problems among older people. Musculoskeletal disorders are one of the most common problems in geriatric patients, and fractures are often found in geriatric patients due to risk factors.^{5,6} As an

injury, the fracture has difficulties from diagnosis to management in older people. This review will illustrate the management of geriatric patients that suffer from fractures per recent scientific developments.

Epidemiology

In Indonesia, the most prevalent fractures in geriatrics are vertebral fractures (25%), hip fractures (24%), wrist fractures (13.6%), proximal humeral fractures (7.2%) and fractures in other places 30.2%. The number of female patients is three times that of male patients. The prevalence of vertebral and hip fractures was significantly higher than fractures elsewhere. Based on the cause, domestic accidents are the most prevalent mechanism of injury in 80% of all fracture cases in geriatrics who come to the emergency room.⁷

In America, the incidence of fractures in geriatrics, according to the skeletal site, includes spine fractures (27.1%), hip fractures (23.3%), wrist fractures (15.6%), pelvic fractures (7.6%), and others (26.4%).⁸ The location of fractures that most often occurs in geriatrics is the lower trunk (pelvis, hip, lower spine) as much as 34%, followed by the upper trunk (upper spine, clavicle, ribs) by 13% up to 2014. Other body parts that often experience fractures are the upper arm and wrist (an average of 7%).⁹

Due to the presence of other comorbid factors that impede the physiological processes of post-traumatic outcomes, the management principles for rehabilitating geriatric fractures differ significantly from those for fractures in younger individuals. This is because older individuals typically have additional health conditions that can affect their recovery.¹⁰

Bone remodelling mechanisms

Bones have a mechanism to maintain bone density through a process known as remodelling. This essential process continuously renews the cortical and trabecular envelopes throughout life, involving the resorption of old bone and the formation of new bone after complete bone growth.¹¹ The remodelling process consists of four phases: activation, resorption, reversal, and formation.¹²⁻¹⁵

Phase 1: Activation

This phase is the activation process of

mononucleated osteoclast precursors from the circulation to the site of the aged bone surface to form multinucleated pre-osteoclasts in the damaged bone. Osteoblasts and marrow stromal cells (possibly T cells) emit signals to stimulate differentiation from pre-osteoclasts and initiate basic multicellular units. Systemic factors such as growth hormone, parathyroid hormone, and vitamin D; local factors including interleukin (IL)-1, IL-6, receptor activator of NF- κ B ligand (RANKL); and colony-stimulating factors, more specifically monocyte-colony stimulating factors (M-CSF) play a role in the interaction between osteoblasts and osteoclasts.^{13,14}

Osteoprotegerin (OPG)/RANK/RANKL

RANKL is a major factor in the calling and differentiation of osteoclasts. These ligand proteins are produced and expressed on the surface of osteoblasts and marrow stromal cells and interact with the RANK receptor on pre-osteoclasts. This interaction initiates the differentiation and maturation of the osteoclasts, which then coalesce and absorb bone. In contrast, OPG is a peptide chain member of the TNF receptor. OPG is a free-floating, soluble decoy receptor that binds to RANKL and inhibits osteoclastogenesis and bone resorption (Figure 1).¹³

Phase 2: Resorption

During this phase, an erosive cavity forms on the surface of the bone. Activated osteoclasts will transfer protons to the area to be resorbed and lower the pH by secreting hydrogen ions via proton pumps. Around the osteoclast is a "ruffled border", where the plasma membrane folds to form finger-like projections and contains lysosomal enzymes that digest mineral matrix. A "clear zone" surrounding the ruffled border maintains a firm bond to the surface and contains only actin-like filaments. Matrix and minerals are mixed in the erosion cavity by releasing proteases and a local acidic milieu. In a study of mice with osteoporosis, no ruffled border and clear zone were found. The enzyme tartrate-resistant acid phosphatase (TRACP), cathepsin K, and the matrix metalloproteinase-9 (MMP-9) or collagenase or gelatinase aid the resorption of collagen and non-collagen matrix components. When the resection is complete (about two weeks), the osteoclasts will undergo apoptosis, and phase 3 or reversal begins.¹³

Phase 3: Reversal

This phase occurs after osteoclast resorption. Mononuclear cells prepare a new bone surface for osteoblasts to form a new layer of bone. They begin with a lacuna filled with osteocytes, monocytes, and pre-osteoblasts. Osteoblasts adhere to the surface, synthesise primary matrix proteins, and form collagen type 1, known as osteoid, which provides the foundation/scaffold for bone mineralisation. Sclerostin, produced by osteocytes, blocks the Wingless-type (Wnt) signalling pathway and regulates bone formation. The Wnt pathway stimulates bone formation by signalling via Runx2-like OPG.

The cement line is the soft surface layer associated with the matrix surrounding the bone and can transfer energy in the case of slowed fracture growth to the cortical bone. The osteopontin protein is thought to be key in regulating this process. Recruitment activity in bone formation is known as coupling, where the resorption and formation processes must be at equilibrium points to maintain bone mass.

The factors involved in coupling include transforming growth factor (TGF)- β , insulin-like growth factor (IGF)-1 and IGF-2, bone morphogenetic proteins (BMPs), platelet-derived growth factor (PDGF), and fibroblast growth factor

(FGFs). TGF- β is a potent osteoclast differentiation inhibitor that reduces RANKL production and limits bone resorption.¹³

Phase 4: Formation

Bone formation has 2-step processes. First, when osteoblasts form an osteoid layer, and second, form a work field to promote mineralisation. Enzymes that degrade minerals are inhibited, and calcium-phosphorus are concentrated in the lacunae and canaliculi. With a fairly weak hypothesis, the communication mechanisms between osteocytes transmit information about mechanical changes concerning the bone surface and the remodelling process. Mineralisation begins when the lacunae are filled with osteoid, and this process occurs around the end of the month and has new optimal bone strength and density. Once their work is completed, osteoblasts may undergo several changes. Some may undergo apoptosis, while others may transform into osteocytes or bone-lining cells. This layer of bone-lining cells regulates the movement of ions, particularly calcium, in and out of the bone. It also plays a vital role in modulating local bone formation, remodelling, and reactivation from a quiescent state in response to mechanical loading.

Remodelling takes place in both the cortical

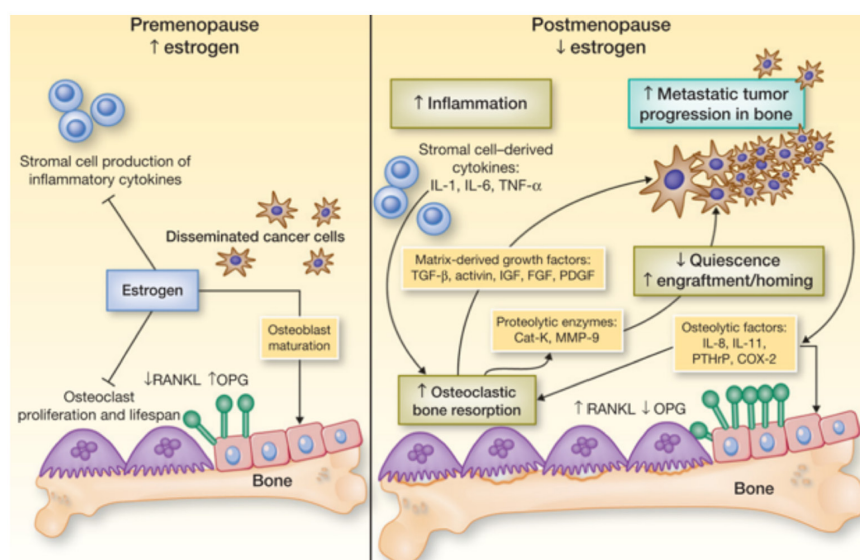


Figure 1. A molecular mechanism, (left) at pre-menopausal, the involvement of estrogen can suppress osteoclast activity; (right) postmenopausal, the production of estrogen decreases, as well as the increase in tumour cells as a process that aggravates bone resorption activity.¹⁵

TNF- α = Tumour necrosis factor- α , IL=interleukin, RANKL=Receptor activator of NF- κ B Ligand, OPG=osteoprotegerin

and trabecular layers of bone. However, as it ages, there is a shift in the balance of the remodelling process on the periosteal and endosteal surfaces. This shift results in a thickness reduction of the cortical bone layer and a decrease in the density of the trabecular layer. The loss of bone is more pronounced in the trabecular layer than in the cortical bone layer. Consequently, bones with a larger surface area, like the vertebrae and distal radius, are more susceptible to fracture.¹³ The four phases of the bone remodelling cycle are shown in Figure 2.

Pathophysiology of fracture in geriatrics

Remodelling in geriatric patients has some differences compared to young adult patients. This is affected by some conditions, such as vitamin D deficiency that induces hypocalcaemia, and the increase of serum OPG concentration.¹⁶

Vitamin D is a prohormone that plays an important role in bone health. In older people, many factors or comorbidities may be the aetiology of vitamin D deficiency, including low intake (malabsorption syndrome), reduced synthesis or storage problems (older people, chronic kidney disease, obesity), insufficient sun exposure (black skin, clothing which closes all the body, rarely leaves the house), and increased degradation (drugs that cause liver enzyme induction, such as anticonvulsants).¹⁷

Low vitamin D levels result in reduced intestinal absorption of calcium. The parathyroid glands' calcium-sensing receptor detects the resulting reduction in serum calcium, which increases the synthesis and release of parathyroid hormone (PTH). PTH restores serum calcium levels by

increasing bone resorption, increasing calcium retention in the kidneys, and increasing vitamin D activation.¹⁸

The serum OPG concentration increases with age, which may be a compensatory response to promote bone resorption in conditions of estrogen deficiency or age-dependent bone loss. Vitamin D3, PTH, prostaglandin E2 (PGE2), IL-1, IL-4, IL-6, IL-11, IL-17, and TNF- α may stimulate osteoclastogenesis through dual actions from inhibiting OPG production and stimulating the production of RANKL. Estrogens inhibit the production of RANKL and RANKL-stimulated osteoclastogenesis. Therefore, the prevalence of geriatric fracture is found to be higher in women than in men.¹³

The decreased physiological function of bone remodeling causes a porous condition of the bones known as osteoporosis. Osteoporosis (porous bones) is characterized by low bone mineral density (BMD) and changes in bone quality with microarchitectural and biomechanical abnormalities.¹⁹

Osteoporosis is widely regarded as one of the major epidemics of the 21st century, affecting an estimated 200 million people worldwide and significantly impacting morbidity and mortality rates. The condition is most prevalent in older women, with the highest incidence rates observed among this population.²⁰ Osteoporosis is a serious public health problem that leads to low bone mass, microdamage to the bone structure, and an increased risk of fractures due to fragility.^{21,22} Table 1 illustrates bone remodelling abnormalities of bone loss related to age and osteoporosis in postmenopausal women.

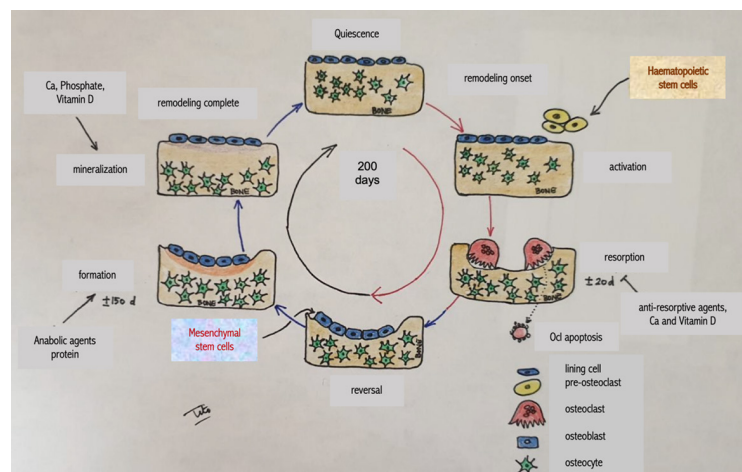


Figure 2. Bone remodelling cycle. The sequence of events includes activation, resorption, reversal, and new bone formation.¹³

Osteoporosis may also be defined using a diagnostic tool quantitatively based on the measurement of BMD proposed by the World Health Organization (WHO). As defined by the WHO, osteoporosis occurs when BMD is 2.5 standard deviation (SD) or below the average value for younger healthy women (a T-score of less than -2.5 SD). A second, higher threshold describes "low bone mass" or osteopenia as a T-score between -1 and -2.5 SD (Table 2). This diagnostic criterion may be made by measuring the spine, pelvis, and forearm using photon absorptiometry (usually dual-energy X-ray absorptiometry or DXA) in postmenopausal women.^{14,19,23}

In addition, various other comorbidity diseases in older people are known to affect the bone remodelling process, including drugs that affect bone metabolism and induce osteoporosis, such as glucocorticoids, anticonvulsants, antimetabolic agents (chemotherapy drugs for prostate and breast cancer), cyclosporine, excessive intake of vitamin A (derived from nutritional supplementation), heparin, warfarin, thiazide diuretics, beta-blockers, exogenous thyroid hormone, proton pump inhibitors, medroxyprogesterone acetate, statins, anti-selective serotonin reuptake inhibitor (SSRI) depressants, are drugs that are widely used

by geriatric patients.¹²

Remodelling occurs in both bone layers, namely cortical and trabecular bone. However, as individual ages, the balance of the remodelling processes on the periosteal and endosteal surfaces changes, resulting in a decrease in the thickness of the cortical bone layer and thinning of the trabecular layer. Notably, the loss of bone is more pronounced in the trabecular layer than in the cortical bone layer. Consequently, bones with a larger surface area, such as the vertebrae and distal radius, are at a higher risk of fracture.²⁴

Uncoupling and increased bone turnover may lead to loss of trabeculae components and increased porosity in the bone resulting in osteoporosis.¹⁴ The markers of bone turnover, including osteocalcin, N-telopeptide (NTX), C-telopeptide (CTX), and bone-specific alkaline phosphatase (ALP), are commonly used for therapy monitoring purposes of osteoporotic patients. They appear to be higher in older women with low BMD.²⁵ High levels of NTX, deoxypyridinoline (DPD), CTX, and serum bone ALP are associated with an increased risk of osteoporotic fracture in postmenopausal women. On the other hand, bone formation indicators such as procollagen peptide were reported not to increase proportionally.²⁶

Table 1. Bone remodelling abnormalities in age-related bone loss and postmenopausal osteoporosis¹²

Aspects	Age-related bone loss	Post-menopausal osteoporosis	Remodelling phase
Number of remodelling locations	↓	↑	Activation
Osteoclast activities	↔	↑	Resorption
Size of erosion pit	↔	↑	
Overview of Mesenchymal Stem Cells (MSCs)	↔	↔	Reversal
Proliferation and differentiation MSCs	↓	↔	
Osteoblast maturation	↔	↔	Formation
Osteoblast activities / Osteoid formation	↓	↔	
Matrix mineralisation	↔	↔	
Pit restoration	↓	↓	Quiescence

↑= increase; ↓= decrease; ↔:no changes

Table 2. Quantitative definition of osteoporosis.¹⁴

Bone Mineral Density T-Score	Diagnosis
More than -1.0	Normal
Less than -1, more than -2.5	Osteopenia
Less than -2.5	Osteoporosis
Less than -2.5 + easy fracture	Severe osteoporosis

Risk factors for fracture in geriatrics

Falling threatens geriatrics' health, activity independence, and quality of life. Two risk factors, intrinsic and extrinsic, cause falls in older people (Table 3). In general, the mortality rate among the geriatric population due to trauma is higher among all trauma cases in the adult population. Patients over 74 who experienced trauma had a higher mortality risk than those under 74 (younger geriatric group). Other data showed that severe and extremely severe injuries and low systolic blood pressure in geriatric patients who experience trauma are significant risk factors for increased mortality.²⁷ Prevention of falls in the older people community (community-dwelling older people) in Teheran is more common in certain age groups, namely women and the age range of 80-84 years.²⁸

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trauma are significant risk factors for increased mortality.²⁷

A fairly recent study has reviewed the incidence of fractures due to electrically automated massage chairs (EAMC) (Figure 3). It was concluded that patients with or without osteoporosis should pay attention and increase awareness when choosing deep tissue massage mode when using this machine.²⁹

Diagnosis fracture in geriatrics

The principles of diagnosing fractures in geriatric patients are essentially the same as for other age groups, but more comprehensive history and physical examination are needed to determine the appropriate management. Collaboration with other experts is also required for pre-operative assessment to avoid complications during and after surgery. Screening for other diseases, including pneumonia, sepsis, dehydration, or congestive heart failure, is crucial. Additionally, routine visual, hearing, and neurological screenings should be conducted. The clinician should assess the presence or absence of conditions that may affect mobility, such as Parkinson's disease or cerebrovascular disease with focal weakness.

Table 3. Risk factors and causes of falls in older people

Intrinsic factors	Extrinsic factors
Cognitive and functional impairment	Polypharmacy
Postural hypotension	Restraints
Musculoskeletal neuromotor dysfunction	Troubled footwear
Complicated disease	Environmental factor
Sensory problems	Risk area, slippery
Visual	Low lighting
Auditory	The absence of a handle
Vestibular	Low accessibility for meals, handphones, and others.
Neuropathy	Irrelevant clothes



Figure 3. Illustration picture of electric automated massage chair (EAMC).²⁹

Psychomotor conditions should also be considered, including weakness, tremulousness, or paucity of movements.³⁰

Imaging plays an important role in evaluating the features of trauma in geriatric patients. Geriatrics have a slightly different injury illustration than young adults and can experience serious injury from only minor trauma. Clinical evaluation in geriatric patients is quite difficult due to frailty, other comorbidity diseases, and those who have previously taken routine medications. Specific things that need to be considered include the use of anticoagulants, steroids, and bisphosphonates.³¹

In general, using radiography, computed tomography (CT) scan, and magnetic resonance imaging (MRI) is useful for imaging the fracture configuration and evaluating bone density.³² Radiologists should use age-appropriate algorithms for radiography, CT scan, and MRI in geriatric patients and are particularly concerned about using intravenous contrast for impaired renal function. In addition, there is also a sufficient focus on risk factors for cancer with the use of radiation at this age; therefore, a CT scan is the main choice in the trauma setting in geriatrics.³¹

Fracture and dislocation classification from Arbeitsgemeinschaft für Osteosynthesefragen (AO)/Orthopaedic Trauma Association (OTA) may be applied to fractures in geriatrics. However, there are several fracture-specific approaches to osteoporotic fractures.³³ Vertebrae classification of osteoporotic fractures based on the recommendation of the spine section of the German Society for Orthopaedics and Trauma (Deutsche Gesellschaft für Orthopädie und Unfallchirurgie, DGOU) are shown in Figure 4.

OF 1: no vertebral deformation (vertebral body oedema in MRI-STIR only), rare, stable injury, clearly visible on MRI-STIR magnetic Resonance Imaging-Short Tau Inversion Recovery sequence only; X-rays and Computer Tomography scan do not show vertebral deformation.

OF 2: deformation with no or only minor involvement of the posterior wall (<1/5), affects one end-plate only (impression fracture), stable injury; posterior wall can be involved, but only minor.

OF 3: deformation with distinct involvement of the posterior wall (>1/5), affects one end-plate only but shows distinct involvement of the anterior and posterior wall (incomplete burst fracture); unstable fracture and may collapse further over time.

OF 4: loss of integrity of the vertebral frame structure, vertebral body collapse, or pincer-type fracture, consists of three fracture types, integrity loss of vertebral frame structure both end-plates and the posterior wall are involved (complete burst fracture). Vertebral body collapse is typically seen as a final consequence of a failed conservative treatment and can impose as a plain vertebral body. Pincer-type fractures involve both end plates and may lead to severe deformity of the vertebral body; unstable fractures and intravertebral vacuum clefts are often visible.

OF 5: injuries with distraction or rotation, rare injury but shows substantial instability; includes the anterior column and the posterior bony-ligamentous complex; can be caused either by direct trauma or by ongoing sintering and collapsing of an OF 4.³⁴

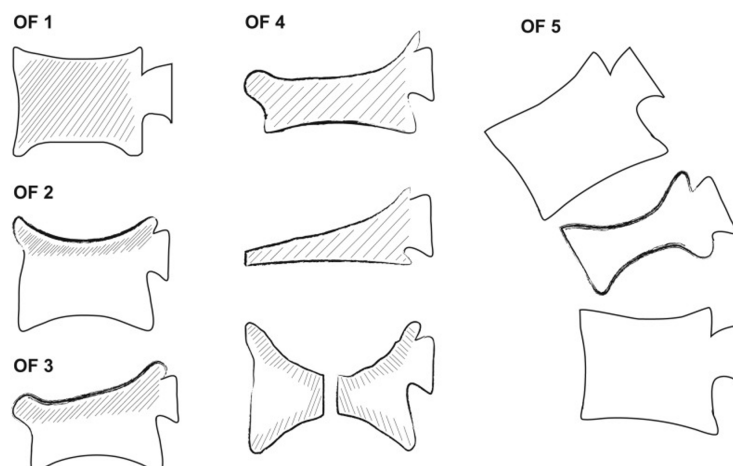


Figure 4. Classification of osteoporotic thoracolumbar spine fractures.³⁴

Semi-quantitative grading scale could be used to determine the presence of deformities in the vertebral bodies, as depicted in Table 4.

A hip fracture occurs at the top of the thigh bone (Femur) (Figure 5). Typically, a fracture in an individual with healthy bones requires considerable force. However, certain diseases and conditions may render bones fragile, leading to fractures even with minimal force, such as a fall from a standing height or less. Such fractures are referred to as 'minimal trauma fractures'.³⁶

Scoring predictors in geriatrics

Frailty is a geriatric syndrome closely related to health problems among the older population. Socio-economic status and accessibility to health services in marginalised communities can increase frailty. A study by Huang et al. showed that better education, good Instrumental Activity Daily Living (IADL) score, and Mini-Mental State Examination (MMSE) score might be protective factors against frailty. Frailty is associated with several independent factors, including the presence of depressive symptoms, urinary incontinence, abnormal Timed Up and Go (TUG), and the risk of malnutrition.³⁷

One of the frailty indexes is made to predict mortality rates. This index can help health professionals and clinicians to identify geriatrics at risk of decreased health and mortality. This index is also necessary for health services and interventions that may be carried out in certain places as a preventive measure.³⁸

The Cardiovascular Health Study (CHS), the frailty questionnaire (FRAIL scale), and the Study for Osteoporosis and Fracture (SOF) criteria are some evaluation methods. A history of falls was used as a comparative predictor. Independent predictors were identified in the Classification and Regression Tree (CART) analysis to evaluate screening high-risk fallers. SOF and FRAIL may provide additional prediction value for fall history in older women but not for men. FRAIL may be useful clinically to identify the risk of older women for recurrent falls, especially in those who have a single fall history.³⁹

Cognitive impairments increase the risk of falling in older adults. Dual-task testing is the approved way of assessing the interaction between cognition and mobility; deterioration of walking (gait) with an assessment of dual-task testing compared to single-task performance was

Table 4. Semi-quantitative grading scale³⁵

Grade	Description
Grade 0	No observed deformity
Grade 1	20–25% reduction in height and 10–20% reduction in projected vertebral area
Grade 2	26–40% reduction in height and 21–40% reduction in projected vertebral area
Grade 3	> 40% reduction in vertebral height and projected vertebral area

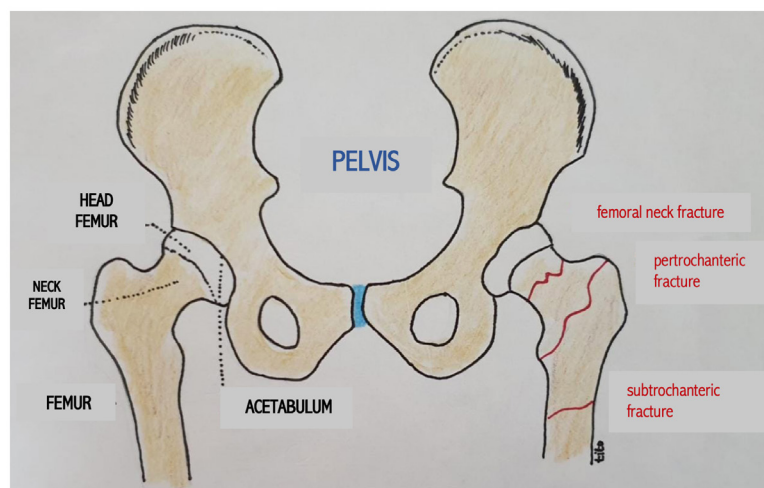


Figure 5. Type of minimal trauma hip fracture in osteoporosis.³⁶

found to be associated with an increased risk of falls. Changes in gait under dual-task testing were predicted to be associated with the risk of falling in the future, and this relationship was stronger than with single-task conditions.⁴⁰

Each individual's risk of developing a fracture depends on their risk profile. Several algorithms have been developed to measure fracture risk. The Fracture Risk Assessment Tool (FRAX) algorithm is the most commonly used, which may measure fracture risk over the next ten years. BMD examination may be performed on individuals with a high fracture risk when calculated using the FRAX algorithm. Other indications include a history of fractures associated with osteoporosis, radiological osteopenia, use of glucocorticoids, and disease associated with osteoporosis (thyrotoxicosis, rheumatoid arthritis, early menopause). Patients with osteoporosis have a high risk of pathological fractures that cause morbidity, mortality and poor quality of life. The risk of developing osteoporosis increases with age and is higher in women than in men, where 30% of women compared to 12% of men have osteoporosis in their lifetime. The prevalence of osteoporosis in Europe is currently estimated at 22 million women and 5.5 million men between the ages of 50 and 84, with 3.5 million susceptible to fracture.¹⁹

The WHO's FRAX was developed to identify the risk of fragility fracture (FF).⁴¹ Recent research suggests that CT-based structural rigidity analysis (CTRA) and finite element (FE) analysis offer advantages that increase specificity (true negative rate), but are still limited by tool availability.⁴²

Management fracture in geriatrics

The Geriatric Fracture Center (GFC) is a standardised management model in the approach of fracture patients in geriatrics. Five basic principles are carried out to optimise this model.

Surgical fracture management is the standard therapy most likely to restore physical function and time to stay in the hospital, improve pain management, and reduce mortality.⁴³ Rommens et al. concluded that there is a paradigm shift in managing fractures in geriatrics. The basic principles of stabilisation surgery in geriatric fractures are anatomical reduction using an open technique, striving for stable internal fixation, maintaining blood supply, and early

postoperative motion. Anatomical reduction is intended for managing intra and periarticular fracture cases, whereas bridging osteosynthesis is introduced for fractures in the diaphysis. Biological osteosynthesis is introduced and focused on maintaining blood supply to the bones. In geriatric patients, restoring stability is more important than restoring anatomical and biological conditions. The advantages and disadvantages of surgical procedures in geriatric fractures are scored proportionately to conservative management. Fractures in the lower extremities require surgical treatment more frequently than fractures in the upper extremities. Surgery should be minimally invasive. Implants are expected to use long bony corridors for bridging or splinting, should be inserted with a minimum of incision, and placed in deep skin; some reports of intramedullary technique have many advantages. Conservative management is the best alternative in patients with a single fracture and little functional requirement.¹⁰ Surgical treatment is mandatory in patients with unstable fractures of the spine, pelvis, hip and lower extremities.⁴⁴

Early operative intervention is important. The recommended time for operative management, particularly in hip geriatrics fractures, is 24-48 hours (early) to reduce complications associated with prolonged bed rest, such as venous thrombosis, skin ulceration, hospital-acquired infections, and pulmonary complications. In addition, prompt treatment could reduce prolonged bed rest and pain or morbidity.^{43,44}

Collaborative therapy with another expert is needed. Usually, the orthopaedic surgeon is fully responsible for managing fracture patients. However, a collaboration between teams in the GFC for co-management, which demands a division of responsibilities, is needed. Co-managed is planning services with geriatricians, anaesthetists, nurses, physiotherapists or medical rehabilitation doctors, and other necessary personnel.⁴³

An important principle to achieve the best functional target is to plan an individual rehabilitation program by the rehabilitation team that is carefully and as needed.^{45,46} The main goals of physical therapy and fracture rehabilitation in older people are to improve quality of life, be able to carry out daily activities independently, reduce

mortality and morbidity such as pain, prevent falls in the future, prevent muscle atrophy, cardiopulmonary and vascular complications, psychological changes, and prevent depression. What distinguishes rehabilitation at a young age is the intensity, duration and time to initiate rehabilitation.⁴⁷

Patient-centred, for the best service standardisation.⁴⁸ Management that starts from the emergency room (ER), such as proper stabilisation, laboratory examinations, pain management, and prevention of decubitus ulcers, accelerates the admission filing process during preparation, and selection of the best intervention, until postoperative treatment. Usually, fracture patients are dehydrated and require adequate rehydration. Perform urinalysis screening in the ER for geriatric patients who often do not cause symptoms of urinary tract infections.

Early discharge planning focuses on early functional rehabilitation. In the process of postoperative patient self-reliance, discharge planning in the community is needed. Education by trained nurses to those directly related to the patients is very important to get the best support during the rehabilitation period at home.⁴⁹

Complications

Complications due to fracture in geriatrics are determined by the type and location of the fracture, the number and severity of comorbidity diseases present, and the time of surgical intervention. According to the data, geriatric patients who receive surgical management sooner have shorter hospital stays, leading to a reduced risk of acute complications during their hospitalisation.⁵⁰

Zajonz et al. identified risk factors for early periprosthetic joint infection (PJI) after hemiarthroplasty in 305 patients with 312 femoral neck fractures. It was found that high pre-operative CRP values, long-term use of glucocorticoids, high body mass index and prolonged surgery were risk factors for PJI. Therefore, managing patients with these characteristics should be more careful, especially if it finds early signs of infection. Immediately take steps to prevent acute postoperative infections, one of which is by debridement and good surgical wound care.⁵¹

Lutz et al. compared complications in non-surgical management with surgery for distal radius fracture in geriatric patients. The most frequent complication after surgical management was infection (12%), while the most frequent non-surgical complication was median nerve neuropathy (11%). Complex Regional Pain Syndrome (CRPS), extensor tendon rupture and implant irritation were also reported as complications.⁵² Malunion is a complication due to non-surgical management, reported in 89% of cases.⁵³

Dementia is an indirect complication or a chronic complication following a fracture. Research by Lai et al. obtained data that the incidence of dementia increased between 1 and 2 years mortality rate after hip fracture in geriatric internal fixation, compared with hemiarthroplasty (HA). Dementia in patients with HA, particularly in women or ages 65 - 84 years, lasts better to 1 to 2 years than in those receiving internal fixation.⁵⁴ Nondemented, non-delirious older people in hip fracture patients have poorer cognitive function immediately after the fracture inhibits cognitive improvement for more than one year, especially those with good educational levels. This is related to brain resilience due to age, comorbid diseases, and frailty.⁵⁵

Prognosis

Geriatric fractures, particularly hip fractures, constitute a major source of disability and diminished quality of life in older people. Age, gender, comorbid conditions, pre-fracture functional abilities, and fracture type impact the outcome regarding ambulation, activities of daily living, and quality of life. The ability to walk on discharge and the prognosis for survival deteriorate with age. Surgical cases achieve better walking ability than conservatively treated cases, and efforts should be made to achieve a better functional prognosis even in older patients, including surgery, early ambulation, and rehabilitation.⁵⁶ Complications due to fractures, postoperative complications, loss of ambulation and rehabilitation programs after surgery are poor prognostic factors and medication for osteoporosis is thought to improve the prognosis in this patient.^{27,46}

CONCLUSION

Geriatric fractures have their difficulties from diagnosis to management. Management non-operatively and operatively needs complete preparation, especially various comorbid factors that have been possessed by older people patients are things that must be considered in the management of geriatric fractures. The GFC continues to be developed and implemented. This is the key to successfully managing geriatric fractures to achieve patient independence which is the main target in fracture management in older people.

CONFLICT OF INTEREST

All authors state that there is no conflict of interest regarding this study

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