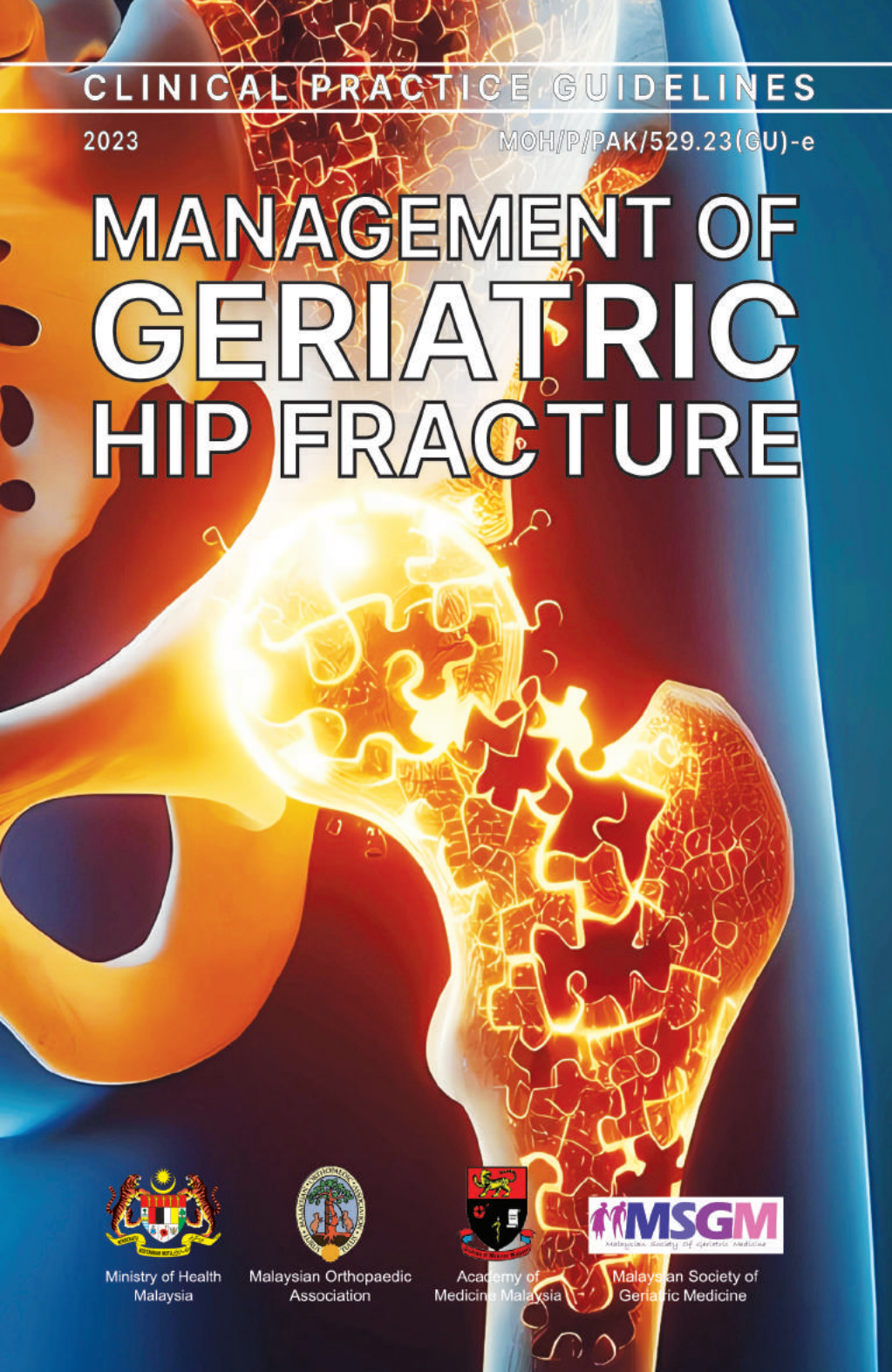
CLINICAL PRACTICE GUIDELINES

2023

MOH/P/PAK/529.23(GU)-e

MANAGEMENT OF GERIATRIC HIP FRACTURE



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STATEMENT OF INTENT

The clinical practice guideline (CPG) is meant to be a guide to clinical practice based on the best available evidence at the time of development. The guideline should not override the responsibility of the practitioners to make decision appropriate to the circumstances of the individual. This should be done in consultation with the patients and their families or guardians, taking into account the management options available locally.

UPDATING THE CPG

These guidelines were issued in 2023 and will be reviewed in a minimum period of four years (2027) or sooner if there is urgent need to do so. When it is due for updating, the Chairman of the CPG or National Advisor of the related specialty will be informed about it. A discussion will be done on the need for a revision including the scope of the revised CPG. A multidisciplinary team will be formed and the latest systematic review methodology used by MaHTAS will be employed.

Every care is taken to ensure that this publication is correct in every detail at the time of publication. However, in the event of errors or omissions, corrections will be published in the web version of this document, which is the definitive version at all times. This version can be found on the websites mentioned above.

TABLE OF CONTENTS

No.	Title	Page
	Levels of Evidence and Formulation of Recommendation	i
	Key Recommendations	ii
	Guidelines Development and Objectives	iv
	Development Group	vii
	Review Committee	viii
	External Reviewers	ix
	Algorithm on Management of Geriatric Hip Fracture	x
1.	**INTRODUCTION**	**1**
2.	**RISK FACTORS**	**3**
3.	**SIGNS AND SYMPTOMS**	**4**
4.	**DIAGNOSIS**	**5**
5.	**REFERRAL CRITERIA**	**6**
6.	**TREATMENT**	**7**
	6.1 Pre-operative Optimisation and Criteria for Safe Surgery	7
	6.2 Safe Anaesthesia	14
	6.3 Surgery	16
	6.4 Rehabilitation	24
	6.5 Discharge Plan and Follow-up	26
7.	**PREVENTION**	**27**
	7.1 Primary prevention	27
	7.2 Secondary prevention	28
8.	**IMPLEMENTING THE GUIDELINES**	**29**
	8.1 Facilitating and Limiting Factors	29
	8.2 Potential Resource Implications	29
	References	31
	Appendix 1 Example of Search Strategy	37
	Appendix 2 Clinical Questions	38
	Appendix 3 Principles of Analgesic Prescriptions in the Elderly and Pre-operative Analgesia in GHF	39
	Appendix 4 Comprehensive Geriatric Assessment (CGA) for GHF	41
	Appendix 5 Guidelines on Time Intervals Before and After Neuraxial Blocks Related to the Use of Antiplatelet Agents and Anticoagulants	42

TABLE OF CONTENTS

No.	Title	Page
Appendix 6	Assessment of Falls Risk Factors and Interventions to Reduce Identified Risk Factors Algorithm on Risk Stratification, Assessment and Interventions for Community-Dwelling Older Adults	46
	List of Abbreviations	48
	Acknowledgement	49
	Disclosure Statement	49
	Source of Funding	49

LEVELS OF EVIDENCE

Level	Study design
I	Properly powered and conducted randomised controlled trial; well-conducted systematic review or meta-analysis of homogeneous randomised controlled trials
II-1	Well-designed controlled trial without randomisation
II-2	Well-designed cohort or case-control analysis study
II-3	Multiple time series, with or without the intervention; results from uncontrolled studies that yield results of large magnitude
III	Opinions of respected authorities, based on clinical experience; descriptive studies or case reports; reports of expert committees

SOURCE: *U.S. Preventive Services Task Force. U.S. Preventive Services Task Force Procedure Manual. Rockville, MD: USPSTF; 2015.*

FORMULATION OF RECOMMENDATION

- In line with the new development in CPG methodology, the CPG Unit of MaHTAS is adapting **Grading Recommendations, Assessment, Development and Evaluation (GRADE)** in its work process. The quality of body of evidence and related effect size are carefully assessed/reviewed by the CPG DG.
- Recommendations are formulated based on **certainty of evidence** and the wording used denotes the **strength of recommendations**. This takes into account:
  - quality and level of the evidence
  - balance of benefits and harms of the options
  - patient's preference and values
  - resource implications
  - relevancy and applicability to the local target population
- The more criteria being fulfilled, the more certain is the evidence leading to strong recommendations using the word "should" being considered. Otherwise, weak recommendations use the word "may" in proposing an action to be made.
- In the CPG, a yellow box ☐ highlights important message(s) in the management while a blue box ☐ contains evidence-based recommendation(s) for the particular condition.

KEY RECOMMENDATIONS

The following recommendations are highlighted by the CPG Development Group as the key recommendations that answer the main questions addressed in the CPG and should be prioritised for implementation.

a. Diagnosis

- Patients with suspected geriatric hip fracture (GHF) should have plain radiographs according to standard views to confirm the diagnosis.
- Those with occult GHF (presence of symptoms and signs of hip fractures despite normal plain radiographs) should have computed tomography scan or magnetic resonance imaging done to rule out the fracture.

b. Treatment

- Analgesia should be prescribed adequately in geriatric hip fractures (GHF).
  - Peripheral nerve block may be considered if pain persists and resources are available.
- Traction should not routinely be used in GHF.
- Comprehensive geriatric assessment should be performed by the attending physician for all frail geriatric patients with hip fracture.
- Oral nutritional support should be considered for all patients with GHF.
- Patients with GHF should be given venous thromboembolism (VTE) prophylaxis (chemoprophylaxis and/or mechanical prophylaxis).
  - Low molecular weight heparin (LMWH) is the preferred choice for chemoprophylaxis peri-operatively.
  - Post-operatively VTE prophylaxis should be extended up to 4 - 5 weeks with either an anti-coagulant (LMWH, direct oral anticoagulants, warfarin) or anti-platelet (aspirin only) according to individual deep vein thrombosis risk assessment.
- Patients with GHF may be offered regional or general anaesthesia for hip surgery according to individual's risk and benefit assessment.
  - Caution has to be taken to avoid hypotension intra-operatively.
- Cemented stem should be offered for arthroplasty in displaced neck of femur fracture in geriatric patients.
- Arthroplasty is the preferred choice in non-displaced fracture neck of femur in geriatric patients for early full weight-bearing ambulation.
- In GHF,
  - cephalomedullary nail (CMN) or extramedullary device may be offered for stable intertrochanteric fracture.
  - CMN is the preferred choice for unstable intertrochanteric fracture.

- Surgery should be performed within 48 hours of admission in medically stable GHF patients.
- Analgesia should be provided peri-operatively in GHF.
  - Multimodal analgesia is the preferred choice.
- Early mobilisation should be advocated as early as on post-operative day 1, e.g. sitting at the edge of the bed, unless contraindicated.
- Rehabilitation should be offered to all patients with GHF post-operatively with the aim to improve mobility and functional recovery.
  - A multidisciplinary approach is the preferred choice.

c. Prevention

- Geriatric population should be screened and assessed for falls risk.
  - Education about falls prevention should be offered accordingly.

GUIDELINES DEVELOPMENT AND OBJECTIVES
GUIDELINES DEVELOPMENT

The members of the Development Group (DG) for these Clinical Practice Guidelines (CPG) were from the Ministry of Health (MoH) and the Ministry of Higher Education. There was active involvement from a multidisciplinary Review Committee (RC) during the process of the CPG development.

This is the first edition of an evidence-based CPG on the Management of Geriatric Hip Fracture (GHF). Literature search was carried out using the following electronic databases: mainly Medline via Ovid and Cochrane Database of Systemic Reviews and others e.g. Pubmed (refer to **Appendix 1** for **Example of Search Strategy**). The search was limited to literature published on humans, in English and last 15 years. In addition, the reference lists of all retrieved literature and guidelines were searched to further identify relevant studies. Experts in the field were also contacted for studies related to the issues addressed. All searches were conducted from 3 January 2022 to 28 February 2022. Literature searches were repeated for all clinical questions at the end of the CPG development process, allowing any relevant papers published before 1 July 2023 to be included. Future CPG updates will consider evidence published after this cut-off date. The details of the search strategy can be obtained upon request from the CPG Secretariat.

References were also made to other guidelines on GHF as listed below:

- American Academy of Orthopaedic Surgeons - Management of Hip Fractures in Older Adults Evidence-Based Clinical Practice Guideline (2021)
- National Institute for Health and Care Excellence - Hip fracture: Management (2023)

A total of five clinical questions were developed under four sections (diagnosis, risk factors, treatment and referral/follow-up). Members of the DG were assigned individual questions within the sections (refer to **Appendix 2** for **Clinical Questions**). The DG members met 43 times throughout the development of these guidelines. All literature retrieved were appraised by at least two DG members using Critical Appraisal Skill Programme checklist when applicable, presented in evidence tables and further discussed in DG meetings. All statements and recommendations subsequently formulated were agreed upon by both the DG and RC. Where evidence was insufficient, the recommendations were made by consensus of the DG and RC. This CPG is based largely on the findings of systematic reviews and clinical trials, with local practices taken into consideration.

The literature used in these guidelines were graded using the US/ Canadian Preventive Services Task Force Level of Evidence (2015), while the grading of recommendation was done using the principles of GRADE as much as possible (refer to the preceding page). The writing of the CPG strictly followed the requirements of Appraisal of Guidelines for Research and Evaluation (AGREE) II.

Upon completion, the draft of the CPG was reviewed by external reviewers. It was also posted on the MoH Malaysia official website for feedback from any interested parties. The draft was finally presented to the Technical Advisory Committee for CPG, and the Health Technology Assessment and ClinicalPractice Guidelines Council MoH Malaysia for review and approval. Details on the CPG development methodology by MaHTAS can be obtained from the Manual on Development and Implementation of Evidence-based Clinical Practice Guidelines published in 2015 (available at https://www.moh.gov.my/moh/resources/CPG_MANUAL_MAHTAS.pdf).

OBJECTIVES

The objective of this CPG is to provide evidence-based recommendations on the management of GHF on the following aspects:

a) diagnosis and risk factors
b) treatment
c) referral and follow-up

CLINICAL QUESTIONS

Refer to **Appendix 2**

TARGET POPULATION

Inclusion Criteria

- Patients with suspected and confirmed GHF (evidence on patients aged 60 years old and above).

TARGET GROUP/USERS

This document is intended to guide health professionals and relevant stakeholders in primary and secondary/tertiary care in the management of GHF, including:

i. doctors
ii. allied health professionals
iii. trainees and medical students
iv. policymakers
v. patients and their advocates
vi. professional societies

HEALTHCARE SETTINGS

Primary and secondary/tertiary care settings

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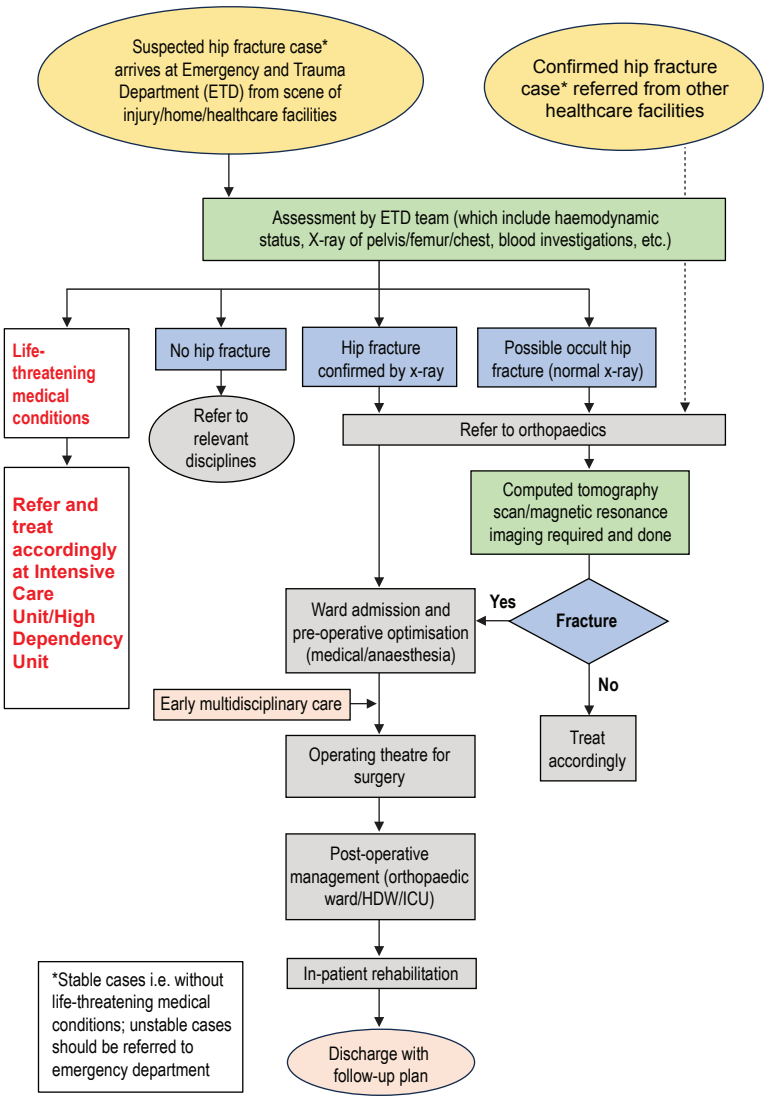

1. INTRODUCTION

A hip fracture is a break in the proximal part of the femur bone and/ or around the hip joint. In older adults, it usually occurs following low energy trauma. The decline in bone mineral density and increase in frequency of fall among the older adults are the main reasons for the high incidence of hip fracture among them.

The Centers for Disease Control and Prevention, United States of America (CDC) states that more than 300,000 people >65 years old are hospitalised for hip fractures yearly. More than 95% of these fractures are caused by falls and women account for three-quarters of all cases.[1]

Based on 2004 - 2006 figures, the residual lifetime risk of hip fracture ≥50 years of age in Japan was estimated to be 5.6% for men and 20% for women. The highest incidence of hip fractures from Asia had been reported from Singapore where the annual rates were 152 in men and 402 in women per 100,000 based on 1991 - 1998 data.[2, level III] In Malaysia, a comprehensive study on 56 public and private hospitals between 1996 to 1997 showed an overall incidence of hip fracture of 90/100,000 population aged 50 years and above.[3, level III]

In an annual report by National Orthopedic Registry Malaysia (NORM) Hip Fracture 2009, analysis on patient above 50 years old with GHF revealed the incidence being highest among those in 70 - 79 years old age group which accounted 41.4% of all cases. The incidence was also higher in women than men with the ratio of 2:1. In terms of ethnicity, majority of cases were Chinese (44.5%) followed by Malays (40%) and Indians (13.9%).[4, level III]

Hip fractures are associated with increased morbidity and mortality. Individuals with hip fractures utilise significant healthcare resources as their hospital treatments consume large number of inpatient bed-days. Majority of them require surgical fixation and many on discharge need some form of support for daily living.[5 - 6, level III] Despite constituting only 14% of osteoporosis-related fractures, hip fractures account for nearly 75% of the economic burden related to osteoporotic fracture. These fractures are associated with significant morbidity and mortality, with one-year mortality after the fracture approaching 30%.[7 - 8, level II-2; 9, level III] In a retrospective analysis of patients with hip fractures admitted to the Department of Orthopaedics in a Singapore tertiary hospital, the mean cost of hospitalisation was SGD 13,313.81 per patient.[10, level III]

In general, the definitive management for geriatric hip fracture (GHF) is surgery. The type of surgery performed depends on type of fracture and patient's pre-morbid functional status.[11, level III] Elderly patients with hip fractures have complex medical, surgical and rehabilitation needs,

and a well-coordinated multidisciplinary team approach is essential for the best outcomes.[12, level III]

Similarly in Malaysia, the speed of increase in both proportion and absolute numbers of older adults is unprecedented. In 2010, only 5% (1.43 million) of the population were 65 years and over but by 2040 this will increase to 14.5% (6.02 million). Many of the older adults will also live longer with the average life expectancy projected to increase from 73.6 to 78.9 in men and 78.5 to 82.9 in women from 2020 to 2050.[13] In view of the increased number of ageing populations, the risk of hip fractures among them is anticipated which will impact the health services in country.

Thus, the development of clinical practice guidelines (CPG) on the management of GHF is timely to reduce variation in practice. It will be the first evidence-based CPG that will guide healthcare providers locally on the best practice in the management of the condition. Recommendations will emphasise the importance of early surgery and coordinating care through a multidisciplinary approach to help the patients recover fast and regain their mobility.

2. RISK FACTORS

Identifying risk factors for GHF is important as it can help to prevent the occurrence of the fracture in in the susceptible groups. Established risk factors are:[14]

- increasing age
- low bone density
- impaired gait and balance
- poor vision
- hazardous living environments (e.g. cluttered spaces, loose rugs and mats or handrails and grab bars where appropriate)

Other risk factors are as below:

- women have a higher risk of hip fracture primarily due to the decline in oestrogen levels after menopause[15, level III]
- history of previous fractures, particularly in the hip or spine[15, level III]
- certain medications e.g. glucocorticoids, proton pump inhibitors and selective serotonin reuptake inhibitors.[16, level III]
- chronic heavy alcohol consumption[15, level III]
- cognitive impairments e.g. dementia[15, level III]

In two large meta-analyses of observational studies, the following were found to be significant risk factors for a contralateral hip fracture in elderly patients with initial hip fracture:

- female[17 - 18, level II-2]
- advanced age[18, level II-2]
- initial trochanteric fracture[18, level II-2]
- osteoporosis[17 - 18, level II-2]
- living in institutions[17, level II-2]
- low vision[17, level II-2]
- dementia[17, level II-2]
- respiratory diseases[17, level II-2]

The quality of primary studies in the two meta-analyses was moderate to high. The heterogeneity was mainly insignificant.[17 - 18, level II-2]

In a recent meta-analysis of cohort studies, a sub-group analysis showed that sarcopenia was a risk factor for hip fracture in elderly (HR=1.89, 95% CI 1.16 to 3.08).[19, level II-2] Apart from that, a systematic review of 11 studies showed that hand grip strength among elderly patients with hip fracture was significantly lower than those without hip fractures.[20, level II-2]

Other evidence which included a geriatric population increased risk of hip fracture in those with:

- lower Alternative Healthy Eating Index scores[21, level II-2]
- current cigarette smokers[22, level II-2]

- Modifiable risk factors for GHF e.g. impaired gait and balanced, low vision, low bone density, alcohol consumption, cigarette smoking and hazardous living environment are important to be identified and addressed.

3. SIGNS AND SYMPTOMS

Patients with GHF often present with a history of fall and may complain of:

- hip pain and/or
- inability to weight bear or walk

Patients with occult GHF may present with vague pain at the buttock, groin, knee or thigh. Those with minimally impacted fracture may continue to bear weight or walk.

The principles of physical examination in GHF are to look, feel and move. Examinations may reveal the following:

- the affected lower limb may be externally rotated and shortened (in a displaced hip fracture)
- bruising, deformity, swelling and ecchymosis can occur at the site of fracture (in intertrochanteric and subtrochanteric fractures)
- palpation on the affected hip joint may elicit localised tenderness
- patient cannot perform straight leg raising
- movement of the affected hip joint causes pain

- Geriatric patients with hip pain following a fall need to be assessed to rule out hip fracture.

4. DIAGNOSIS

- Diagnosis of GHF is confirmed by imaging investigations.
  - Plain radiographs are the main imaging modalities for patients with suspected hip fractures.
- The majority of GHF are easily identified on plain radiographs; however, a normal plain radiograph does not exclude a fractured hip.

The plain radiographs of the affected hip should include the following views:

- anterior-posterior (AP) view of femur
- lateral view of femur
- AP pelvis view (with 15° lower limb internal rotation in neutral abduction-adduction)

Comparison with the unaffected hip can be helpful.

However, patients with highly suspicious hip fracture, despite normal radiographs, may require alternative forms of imaging. They are those with:

- persistent hip pain after fall
- inability to bear weight, pain on attempted straight leg raising, passive rotation or axial loading tests

In occult GHF, computed tomography (CT) is the modality of choice as it is widely available locally even though magnetic resonance imaging (MRI) has higher accuracy. A cross-sectional study showed that CT scan detected 20% femoral neck fractures and 10.7% isolated greater trochanter fractures in geriatric patients with radiologically occult (normal plain radiograph) hip fractures.[23, level III] This is supported by a recent a meta-analysis of 35 cohort studies that showed CT scan was able to detect 39% occult GHF.[24, level II-2]

National Institute for Health and Care Excellence (NICE) recommends MRI to be offered if hip fracture is suspected despite negative plain radiograph of the hip. If it is not available within 24 hours or is contraindicated, CT scan should be considered.[25]

Recommendation 1

- Patients with suspected geriatric hip fracture (GHF) should have plain radiographs according to standard views to confirm the diagnosis.
- Those with occult GHF (presence of symptoms and signs of hip fractures despite normal plain radiographs) should have computed tomography scan or magnetic resonance imaging done to rule out the fracture.

5. REFERRAL CRITERIA

There is no retrieval evidence on referral criteria of GHF. The CPG DG opines that the following criteria should be used to refer to orthopaedic services e.g.:

- confirmed GHF (by imaging) for further management
- suspected occult GHF (normal plain radiographs) for confirmation of diagnosis
- late presentation of GHF

6. TREATMENT

The definitive treatment for GHF is surgical intervention with the aims to control pain, allow early mobilisation and good functional outcomes. Non-surgical or conservative treatment is rarely an option and only considered when the risk of the surgery outweighs benefits (e.g. approaching end of life, severe acute medical illness, etc.) or patient's refusal. However, such treatment is associated with prolonged pain. A systematic review revealed that non-surgical treatment following hip fracture were associated with substantially higher complication and mortality compared with surgery.[26, level I] Hence, the decision for surgery should be re-evaluated if patient's medical condition improves.

All patients with GHF should receive early multidisciplinary care to ensure optimal analgesia, immobilisation and appropriate medical management.

6.1 Pre-operative Optimisation and Criteria for Safe Surgery

a. Analgesics

Adequate analgesia is key in GHF care and should be initiated at the first encounter. Unfortunately, pain is often undertreated and may increase the risk of other medical conditions including delirium.[27, level II-2]

Treatment of pain is a combination of pharmacological and non-pharmacological modalities. The approach to management of acute pain is as stated in the Ministry of Health's "Pain as the 5th Vital Sign" guideline with strong emphasis on pain assessment and pharmacotherapy. World Health Organization (WHO) analgesic pain ladder is used to guide for pain management as choice of pharmacological agents in elderly is highly individualised.[28]

In the Guidelines of Pain Management in the Elderly by MoH, the followings were recommended:[29]

- paracetamol is considered as the first-line treatment for acute pain in older patients due to its effectiveness and good safety profile
- opioid therapy may be considered for patients with moderate or severe pain
- selective cyclooxygenase-2 (COX-2) inhibitors must be used with caution in older people
- non-selective non-steroidal anti-inflammatory drugs may be cautiously used if other safer treatments have not provided adequate pain relief

If pain persists and resources are available, regional nerve blocks with ultrasound guidance can be administered to reduce pain and minimise sedation and other potential complications caused by opioids. In an RCT on GHF comparing pre-operative nerve stimulator-guided femoral nerve block and fascia iliaca compartment block, the result showed:[30, level I]

- nerve blocks contributed in mean reduction of pain score
- femoral nerve block was more effective in pain reduction and also required less morphine

A recent Cochrane systematic review compared peripheral nerve blocks (PNBs) used as pre- and post-operative analgesia or as a supplement to general anaesthesia with no nerve block (or sham block) for adults with hip fracture. PNBs was shown to be effective in reducing:[31, level I]

- pain on movement within 30 minutes after block placement (SMD= -1.05, 95% CI -1.25 to -0.86)
- risk of acute confusional state (RR=0.67, 95% CI 0.50 to 0.90)
- risk of chest infection (RR=0.41, 95% CI 0.19 to 0.89)
- time to first mobilisation (MD= -10.80 hours, 95% CI -12.83 to -8.77)

These were based on GRADE assessment where the evidence was of moderate to high certainty quality.

Training, credentialing and privileging are required to perform the nerve blocks procedures.

Recommendation 2

- Analgesia should be prescribed adequately in geriatric hip fractures.
  - Peripheral nerve block may be considered if pain persists and resources are available.

Refer to **Appendix 3** on **Principles of Analgesic Prescriptions in the Elderly** and the choice of analgesia that can be offered in GHF.

b. Acute care and immobilisation on early admission

GHF patients should be immobilised in bed by resting the affected limb in a comfortable position to reduce pain. Traditionally this is done by applying skin traction over the affected leg while awaiting surgery. However, current evidence shows no advantages of skin traction as stated below.

- A Cochrane systematic review of 11 RCTs found that routine use of traction for GHF did not appear to have any benefit with regards to pain relief nor analgesia use prior to surgery and reduced incidence of pressure sores. The review used mainly evidence published before 2006. The quality of primary papers were generally low.[32, level I]
- In an RCT on GHF comparing skin traction against non-traction also found no difference in pre-operative pain score, post-operative analgesia and quality of reduction.[33, level I]

American Association of Orthopaedic Surgeon (AAOS) guidelines recommend that pre-operative traction should not routinely be used for patients with hip fracture. Only in some instances, the traction may be required e.g. specific cases with peri-trochanteric fractures.[14]

Recommendation 3
- Traction should not routinely be used in geriatric hip fracture.

c. Early multi-disciplinary care

Older adults who sustain hip fractures are often of advanced age and, may have cognitive and functional impairment with multiple co-morbidities. The risk of perioperative complications is also higher in this group of vulnerable individuals. Hence, multidisciplinary care involving orthopedic surgeons, geriatricians and others is important in improving the outcomes of hip fracture surgery.

The orthogeriatric care is a multidisciplinary care model with systematic orthopedic fracture management and geriatric optimisation of patients peri-operatively. The orthogeriatric input also involves multidisciplinary comprehensive geriatric assessment by relevant health providers including allied health professionals to tailor treatment according to patient's needs.

A prospective cohort study showed that orthogeriatric approach improved hip fracture outcomes e.g. shorter time to surgery (OR=2.62, 95% CI 1.40 to 4.91), shorter length of hospitalisation (p=0.045) and lower one-year mortality (OR=0.31, 95% CI 0.10 to 0.96) compared with standard orthopaedic care.[34, level II-2]

- **Comprehensive geriatric assessment**

Comprehensive geriatric assessment (CGA) is a multidisciplinary diagnostic and treatment process that addresses the medical, psychosocial and functional limitations of the frail older patients. This is performed with the help of a coordinated team to provide a rapid optimisation of fitness for surgery, early identification of individual goals to recover independence and the sustenance of long-term well-being.

A Cochrane systematic review showed that CGA reduced delirium rates (RR=0.75, 95% CI 0.60 to 0.94) and discharge to an increased level of care (RR=0.71, 95% CI 0.55 to 0.92) for the older patients with hip fracture during their hospitalisation.[35, level I] In another meta-analysis on a similar group of study population admitted to a surgical service, interdisciplinary approach, compared with routine orthopaedic care, showed that patients post-operatively:[36, level I]

- regained the same activities of daily living (ADL) performance level as before fracture at three months (OR=2.34, 95% CI 1.53 to 3.29) and 12 months (OR=1.76, 95% CI 1.11 to 2.78)
- regained the same level of walking ability at three months (OR=1.84, 95% CI 1.42 to 2.39) and 12 months (OR=2.17, 95% CI 1.52 to 3.10)

- were discharged from hospital to the same place of residence (OR=1.67, 95% CI 1.26 to 2.21)

However, randomised controlled trials (RCTs) had illustrated that the use of CGA in patient above 60 years old with GHF did not show any difference in length of stay[37, level I] and in-patient morbidity or mortality up to 12 months of follow-up post-surgery.[36, level I] There was also no difference with regards to readmission rates.[35, level I]

Refer to **Appendix 4** on **Components of CGA**.

Recommendation 4
- Comprehensive geriatric assessment should be performed by the attending physician for all frail* geriatric patients with hip fracture.

*Frailty is an aging-related syndrome of physiological decline, characterised by marked vulnerability to adverse health outcomes.[38 - 39, level III]

- **Assessment of delirium**

Delirium is a common complication among older patients with hip fractures as these patients often suffer from various co-morbidities and have poor compensatory capacity. The assessment of delirium can be conducted using validated tools e.g. 4AT Delirium Detection Tool. Meta-analyses of cohort studies on older patients with post-hip fracture surgery showed that significant predictors for incident delirium included those aged >80 years old and living in institutional residential care.[40 - 41, level II-2]

Risk of delirium increases in those with co-morbidities e.g. visual impairment, depression, stroke,[40, level II-2] cardiac failure and dementia.[40 - 41, level II-2] In addition, those with post-operative infection e.g. pneumonia or urinary tract infection[40, level II-2] and the use of morphine[41, level II-2] also have increased risk of developing delirium.

Therefore, it is important to closely monitor for delirium and institute delirium prevention and treatment strategies for the older patients with hip fracture, as it has been shown that patients with hip fracture who develop delirium have an increased perioperative, 30-day and overall mortality at follow-up.[42, level II-2]

- **Optimum nutritional support**

Optimal nutrition is important for recovery following a hip fracture. Older adults with hip fractures are often undernourished or at risk of malnutrition on admission to the hospital. Poor nutritional status is associated with unfavourable outcomes following hip fracture e.g. increased risk of post-operative complications, impaired post-operative rehabilitation and functional recovery, and mortality.

Mini Nutritional Assessment-Short Form (MNA-SF) is a nutritional assessment tool that can predict mortality in older adult undergoing surgery for hip fractures as shown by a meta-analysis of cohort studies where patients with low MNA-SF scores had a higher risk of mortality compared with those with higher scores (OR=3.61, 95% CI 1.70 to 7.70).[43, level II-2]

Two meta-analyses of low grade RCTs reported that patients with hip fracture who received oral nutritional supplementation had reduced post-operative complications compared with those receiving standard care. The interventions were:[44 - 45, level I]

- oral multinutrient feeds that provided non-protein energy, protein, vitamins and minerals given within the first month following hip fracture (RR=0.71, 95% CI 0.59 to 0.86)
- protein-based oral nutrition supplements given pre-operatively (OR=0.48, 95% CI 0.26 to 0.89)

In terms of mortality, there were no significant differences in the risk reported between the two groups.

NICE guidelines on nutrition support for adults recommends that healthcare professionals should ensure that overall nutrient support is offered peri-operatively to all patients.[46]

Recommendation 5

- Oral nutritional support should be considered for all patients with geriatic hip fractures.

- **Safe haemoglobin level**

Hip fractures put the patients at higher risk of blood loss as a consequence of the fracture itself or from the surgical intervention rendered to them. Judicious use of red blood cell transfusion is pertinent to minimise the risk related to this procedure.

A Cochrane systemic review of six RCTs compared the liberal red blood cell transfusion thresholds (10 g/dL) and restrictive transfusion thresholds (8 g/ dL) in surgery for hip fracture. The analysis on patients with mean age range of 81 - 87 years old showed:[47, level I]

- no difference in mortality post-hip fracture surgery -
  - at 30 days (RR=0.92, 95% CI 0.67 to 1.26)
  - at 60 days (RR=1.08, 95% CI 0.80 to 1.44)
- no difference in functional recovery at 60 days (RR=1.00, 95% CI 0.87 to 1.15)
- no difference in post-operative morbidity e.g.
  - thromboembolism stroke
  - wound infection
  - respiratory infection
  - new diagnosis of congestive heart failure

However, the study found a 41% lower risk of myocardial infarction in the liberal group (RR=0.59, 95% CI 0.36 to 0.96). The primary papers were graded as low quality.

- Ideally, a haemoglobin (Hb) level of ≥10 g/dL is aimed for surgery on GHF. However, patients with Hb 8 - 10 g/dL may undergo the surgery if they are asymptomatic of anaemia and with no underlying ischemic heart disease, provided that blood is available in operating theatre.

- **Prophylaxis for venous thromboembolism**

Perioperative immobility in GHF places the patients at risk of developing venous thromboembolism (VTE) which comprises of deep venous thrombosis and pulmonary embolism. These may lead to significant mortality, morbidity and financial burdens to the patient and the carers. Existing international guidelines recommend the use of either mechanical prophylaxis with intermittent pneumatic compression and potent chemoprophylaxis especially in those with high risk of VTE. However, there is a scarcity of evidence on effectiveness and safety of any specific chemoprophylaxis.[14, 48, 49]

An RCT compared the effectiveness and safety of rivaroxaban, low molecular weight heparin (LMWH) and sequential therapy of LMWH and rivaroxaban in post-surgery GHF. There was no significant difference in the incidence of VTE between the three arms. However, both LMWH therapy and sequential therapy had significantly lower post-operative drainage.[50, level I]

In a large cohort study on the use of anticoagulants in post-GHF surgery, enoxaparin and apixaban had no significant difference in 90-day VTE risk, whereas warfarin had greater odds of 90-day VTE compared with apixaban (OR=1.58, 95% CI 1.28 to 1.96). Apixaban also had significantly half the odds of transfusions compared with enoxaparin.[51, level II-2]

In the local CPG on Prevention and Treatment of Venous Thromboembolism, LMWH has been recommended as one of the chemoprophylaxis in patients with hip fracture surgery.[52] Recent guidelines suggest duration of post-operative VTE prophylaxis to be 4 - 5 weeks for either an anti-coagulant (LMWH, direct oral anticoagulants (DOACs), warfarin) or anti-platelet (aspirin only) according to individual deep vein thrombosis risk assessment.[53, 54]

There is no evidence on prophylaxis VTE on GHF alone. The recommendation formulated is based on extrapolation of evidences on other study population.

Recommendation 6

- Patients with geriatric hip fracture should be given venous thromboembolism (VTE) prophylaxis (chemoprophylaxis and/or mechanical prophylaxis)
  - Low molecular weight heparin (LMWH) is the preferred choice for chemoprophylaxis peri-operatively.
  - Post-operatively VTE prophylaxis should be extended up to 4 - 5 weeks with either an anti-coagulant (LMWH, direct oral anticoagulants, warfarin) or anti-platelet (aspirin only) according to individual deep vein thrombosis risk assessment.

- **Plan for post-operative care**

Patients with GHF usually have multiple co-morbidities, hence the post-operative care after their major hip surgery is an important consideration to optimise medical care. However, the decision to transfer these patients post-operatively to a critical care setting e.g. Intensive Care Unit (ICU) usually causes delay to the surgery because of limited resources in most healthcare institutions. Therefore, evidence plays an important role to identify patients who truly require ICU admission post-operatively that will benefit their clinical outcomes.

A large retrospective cohort study in a critical care unit in the United Kingdom investigated the epidemiology, critical care interventions and outcomes of patients with hip fracture. The significant reasons for critical care admission (respiratory and cardiovascular support) and its timing (before surgery or two days after surgery) were major determinants of mortality. In fact, many patients admitted to this unit required no organ support but monitoring and, attention to oxygenation and fluid balance.[55, level II-2]

Another prospective cohort study identified that American Society of Anesthesiologists (ASA) status and prolonged ICU stay (>3 days) were independent risk factors affecting 6- and 12-month mortality, and nursing care dependency.[56, level II-2] There was also no significant difference in early post-operative mortality rates between patients admitted to ICU vs orthopaedic ward after surgery on ASA III patients operated under spinal anaesthesia when patients had been evaluated thoroughly in the pre-operative period.[57, level III]

Identifying risk factors for ICU admission is important. A study found that age (≥80 years), pre-operative pulmonary disease, peri-operative anaemia (haemoglobin <8 g/dL), peri-operative lactic acid level (>2 mmol/L), ASA classification (III/IV) and types of anaesthesia were independent risk factors for GHF requiring transfer to ICU post-operatively. Using these variables, a risk stratification index (RSI) was developed to guide ICU assignment. Patients with RSI scores of >4

were required for ICU admission. Thus, using this index significantly reduced the number of patients transferred to ICU post-operatively and unplanned transfers from the general ward to the ICU within 24 hours.[58, level III]

In a large retrospective cohort, a clinical nomogram was developed using significant predictors of unplanned ICU admission after hip fracture surgery which were age, coronary heart disease, chronic heart failure, chronic obstructive pulmonary disease, Parkinson disease, serum creatinine and albumin concentration. It was validated and had shown good discrimination on unplanned ICU admission with AUC of 0.96 (95% CI 0.91 to 0.99).[59, level II-2]

- Pre-operative evaluation of GHF patients is important in identifying those who require ICU admission post-operatively. Risk factors e.g. increasing age, cardiac and pulmonary disease, are important to be identified in determining the need for ICU admission.

6.2 Safe Anaesthesia

a. Methods of anesthesia

In GHF patients, method of anesthesia is important in assisting a safe surgery. The option for either regional or general anesthesia is often debated as the method of choice for lowest mortality and post-operative complications.

Two studies comprising of a Cochrane systematic review of moderate quality RCTs and a large RCT compared regional anesthesia using neuroaxial block and general anesthesia and, found no significant difference in post-operative short-term mortality. Other secondary outcomes e.g pneumonia, acute myocardial infarction, cerebrovascular accident, acute confusional state and ability to walk independently were also not significantly different.[60 - 61, level I]

NICE guidelines recommend to offer a choice of spinal or general anaesthesia after discussing the risks and benefits to the patients.[25] However, careful delivery of anaesthesia may be of greater importance than the type of anaesthesia delivered.[62, level III]

In a secondary analysis of outcomes on a large post-surgery hip fracture, the risk of death increased as blood pressure fell. The OR for mortality within five days after surgery was 0.983 (95% CI 0.973 to 0.994) for each 5 mmHg intra-operative increment in systolic blood pressure and 0.980 (98% CI 0.967 to 0.993) for each mmHg increment in mean pressure. The equivalent ORs for 30-day mortality were 0.968 (95% CI 0.951 to 0.985) and 0.976 (95% CI 0.964 to 0.988) respectively.[63, level III]

Recommendation 7
- Patients with geriatric hip fracture may be offered regional or general anaesthesia for hip surgery according to individual's risk and benefit assessment.
  - Caution has to be taken to avoid hypotension intra-operatively.

b. Patients on anti-platelets

Patients with GHF and on anti-platelets, especially clopidogrel, are at risk of bleeding during surgery. Surgery will usually be delayed for 5 - 7 days after withholding the drug. However, delaying the surgery is associated with increased risks of complications and mortality.

A meta-analysis of 24 cohort studies looked into the outcomes of surgery on GHF patients with anti-platelets. In the first analysis of early surgery (<5 days), the risk of blood transfusion is higher in patients with anti-platelets compared with those without anti-platelets (OR=1.21, 95% CI 1.01 to 1.44). There were no differences in other outcomes including mortality and length of stay. For the second analysis on patients with anti-platelets, early surgery had lower mortality (OR=0.43, 95% CI 0.23 to 0.79) and shorter length of stay (MD= -6.05, 95% CI -7.06 to -5.04) than delayed surgery (>5 days).[64, level II-2] The quality of the primary studies was high.

Two case-control studies showed that, by withholding clopidogrel for <5 days in patients with GHF, there was no significant differences in estimated perioperative blood loss[65 - 66, level II-2] and blood transfusion rate.[65, level II-2] One of the studies also showed no significant differences in perioperative complications, 30-day mortality and one-year mortality.[65, level II-2] The other study revealed no significant difference in intraoperative blood loss according to different surgical procedures.[66, level II-2]

As there is no evidence on the difference in outcomes between spinal and general anaesthesia, for patients on anti-platelet and anti-coagulation who have contraindications to spinal anaesthesia, general anaesthesia may be administered for them.

For guidelines on the use of neuraxial bocks in patients on antiplatelet agents and anticoagulants, refer to **Appendix 5**.

6.3 Surgery

Out of all GHF, the proportion of extracapsular and intracapsular fractures were 60% and 40% respectively.[67, level II-2] Fracture neck of femur can be classified using Garden's Classification as shown in

Figure 1 (Type 1 and Type 2 are nondisplaced fractures while Type 3 and Type 4 are displaced fractures).

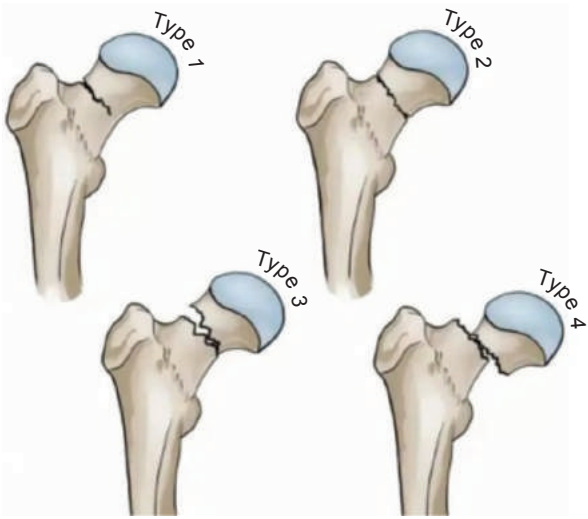

Figure 1: Garden's classification neck of femur fracture

a. Arthroplasty in displaced neck of femur fracture

The geriatric neck of femur fracture is most commonly displaced at presentation. Surgical options include total hip replacement and hemiarthroplasty. The type of surgical intervention depends on assessment of the patient's:

- cognitive status
- pre-fracture mobility
- co-morbidities and frailty

Two meta-analyses on geriatric hip fracture showed that cemented femoral stem was associated with less implant-related complications by 60 - 70% and reoperation rate by 40 - 50% compared with cementless stem. There was no difference in mortality at three months. The quality of primary papers in the two meta-analyses was moderate to high.[68 - 69, level I]

Comparison between total hip arthroplasty (THA) and hemiarthroplasty (HA) in patients more than 70 years old with hip fracture was studied in two meta-analyses. THA had significantly lower risk of erosion rate but higher dislocation rate.[70 - 71, level I] Apart from that, revision rate was reduced in HA for RCTs <5 years follow-up (OR=2.19, 95% CI 10.9 to 4.40) and in THA for RCTs >5 years follow-up (OR=0.25, 95% CI 0.12 to 0.53).[71, level I] The functional Harris Hip Score (HHS) was higher in THA

up to five years.[70, level I] The primary papers of the two meta-analyses were of moderate to high quality.

NICE recommends total hip replacement for people with a displaced neck of femur fracture who meet all of the following criteria:[25]

- able to walk independently outdoors with or without the use of a stick
- no co-morbidity that makes the procedure unsuitable for them
- expected to be able to carry out ADL independently beyond two years

Recommendation 8

- Cemented stem should be offered for arthroplasty in displaced neck of femur fracture in geriatric patients.

b. Surgery in non-displaced fracture neck of femur

Among patients with intracapsular hip fracture, between 5% and 15% of them have an undisplaced fracture.[25]

A meta-analysis of 29 cohort studies on patients with undisplaced (Garden type I or Garden type II) femoral neck fracture), internal fixation had a higher union rate than conservative treatment (92.6% vs 68.8%; p<0.001). The rates of secondary displacement, non-union and bed rest-related complications were also significantly lower. Although the rate of avascular necrosis was higher in the conservative treatment, the result was non-significance. Most primary studies were moderate in methodological quality assessment.[72, level II-2]

In a multicentre RCT on nondisplaced femoral neck fracture, hemiarthroplasty had better mobility (MD=6.2 seconds, 95% CI 1.9 to 10.5) and less major reoperation rate (p=0.002) compared with internal fixation.[73, level I] In another RCT, arthroplasty was associated with a reduction in the odds of mortality within 24 months of injury compared with internal fixation in patients with displaced femoral neck fracture (OR=0.56, 95% CI 0.44 to 0.72).[74, level I]

- In patients with stable (impacted/non-displaced) femoral neck fractures, hemiarthroplasty, internal fixation or non-operative care may be considered for surgical treatment.[14]

Recommendation 9

- Arthroplasty is the preferred choice in non-displaced fracture neck of femur in geriatric patients for early full weight-bearing ambulation.

c. Mode of fixation for intertrochanteric fracture of femur

Intertrochanteric fractures can be categorised into stable and unstable fractures. Pertrochanteric fracture has been designated code 31A according to Arbeitsgemeinschaft für Osteosynthesefragen Foundation and Orthopaedic Trauma Association (AO/OTA) classification.[75, level III] These fractures can be further subdivided into stable (31A1) and unstable (31A2 & 31A3) fracture patterns. **Figure 2** shows stable intertrochanteric femur fractures.

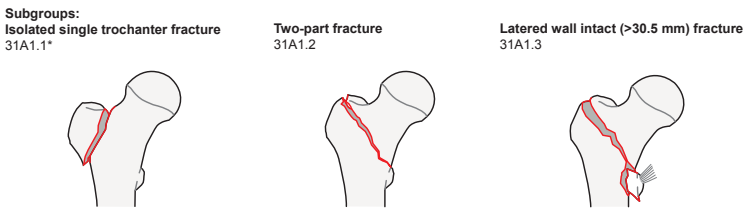

Figure 2. Stable intertrochanteric femur fracture pattern (31A1 and its subtypes)

A fracture is considered unstable in the presence of one or more of the following features as seen in **Figure 4** and **5.**

i. incompetent lateral wall (<20.5 mm) and more than one intermediate fragment
ii. incompetent lateral wall (<20.5 mm) and posteromedial buttress fracture
iii. reverse oblique fracture pattern
iv. subtrochanteric fracture extension

The lateral wall thickness is taken at a point 3 cm below the innominate tubercle of the greater trochanter angled 135° upward to the fracture line on the anteroposterior radiographs. Thickness must be less than 20.5 mm to be considered an 31A2 fracture. Refer to **Figure 3**.

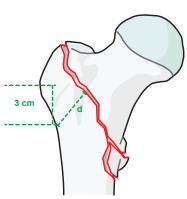

Figure 3. Measurement of lateral wall thickness (d)

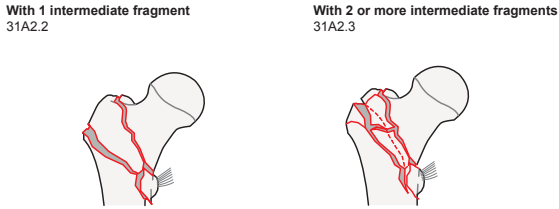

Figure 4. Unstable intertrochanteric femur fracture pattern with compromised lateral wall and posteromedial buttress fracture (31A2 and its subtypes)

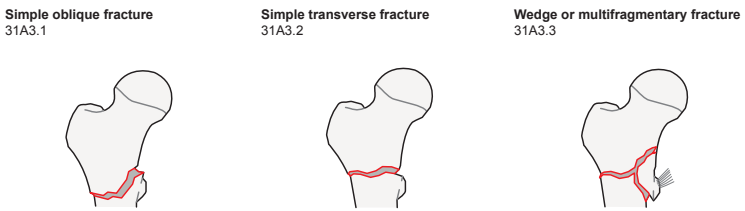

Figure 5. Unstable intertrochanteric femur fracture with reverse oblique pattern (31A3 and its subtypes)

In intertrochanteric femur fracture, the proximal femur blood supply is usually preserved and therefore there is a higher chance of union compared to femoral neck fracture. Intertrochanteric fractures are often treated with either a cephalomedullary nail (CMN) e.g. proximal femoral nail (PFN) or extramedullary device (EMD) e.g. dynamic hip screw (DHS). In recent years, CMN has become more popular as it is biomechanically stronger compared with EMD. Refer to **Figure 6** on **Features of DHS and PFN**.

(a) **(b)**

(a) Picture of an intertrochanteric fracture with a DHS in-situ. Proximal femur has been partially removed to show the internal position of the DHS.
(b) Picture of a PFN. This cephalomedullary device is inserted into the proximal femur.

Figure 6. Features of DHS and PFN

In a meta-analysis of 14 RCTs on patients >60 years old who had either proximal femoral nail anti-rotation (PFNA), Gamma nail or DHS for peritrochanteric femur fractures, there was no difference in mortality, operative time and risks of complication e.g. pneumonia and wound infection between the three interventions. However, PFNA compared with DHS had lower:[76, level I]

- operative blood loss (MD= -253.86, 95% CI -270.25 to -237.47)
- fixation failure (MD=0.20, 95% CI 0.07 to 0.59)

Jadad score showed moderate quality of primary papers in the meta-analysis.

A recent Cochrane systematic review comparing CMN and EMD for intertrochanteric femur fracture in older adults found no significant difference in the following outcomes:[77, level I]

- functional status at four months
- delirium
- deep infections
- unplanned return to theatre
- mortality at four and 12 months

However, CMN had less:

- superficial infections (RR=0.71, 95% CI 0.53 to 0.96)
- non-union (RR = 0.55, 95% CI 0.32 to 0.96)

but more:

- intra-operative fractures (RR=2.94, 95% CI 1.65 to 5.24)
- post-operative fractures (RR=3.62, 95% CI 2.07 to 6.33)

Most of the primary papers used early generations of CMN implant. GRADE gave a moderate quality to the evidence used in the review.

A meta-analysis of 12 RCTs compared PFN and DHS for throchanteric fractures AO 31A2 and 31A3 in older patients and found that the former was associated with:[78, level I]

- shorter operative time (MD= -9.49 minutes, 95% CI -18.74 to -0.25)
- less intraoperative blood loss (MD= -158.2 mL, 95% CI -203.05 to -113.34)

The level of evidence based on GRADE were low and very low respectively. Apart from that, PFN had lower risk of non-union, implant failure and revision surgery although they were non-significant. The evidence level was moderate for these outcomes.

In another meta-analysis of 11 RCTs on unstable femoral intertrochanteric fracture AO 31A2 and 31A3 in patients older than 60 years old, comparison between CMN with DHS found no significant difference in many outcomes including operative time, blood transfusion, adverse events (AE) and hospital stay. However, CMN had:[79, level I]

- better functional scores (SMD= 0.43, 95 % CI 0.14 to 0.73)
- less blood loss (SMD= -0.94, 95 % CI -1.77 to -0.11)

CMN also showed lower risk in screw cut out, non-union, implant failure and re-operation rate although they were non-significant. The quality of the primary papers was moderate.

AAOS guidelines recommend DHS or intramedullary nail (IMN) for stable intertrochanteric fractures while IMN for the unstable fractures.[14] NICE guidelines recommend extramedullary implants e.g. a sliding hip screw in preference to an intramedullary nail with trochanteric fractures and including the lesser trochanter except reverse oblique.[25]

Recommendation 10

- In geriatric hip fractures,
  - cephalomedullary nail (CMN) or extramedullary device may be offered for stable intertrochanteric fracture
  - CMN is the preferred choice for unstable intertrochanteric fracture

d. Mode of fixation for subtrochanteric fracture of femur

Subtrochanteric femur fractures are defined as fractures of the proximal femur that occur within 5 cm below the lesser trochanter. They occur in the older adults from low energy trauma e.g. fall from standing. The fractures are unique due to its deforming anatomical forces and often difficult to manage. They are mainly treated with extramedullary plates or intramedullary nails, with the latter being more biological and have become the gold standard in the treatment of this fracture pattern.

In a meta-analysis of five RCTs on elderly patients with subtrochanteric femur fracture, CMN had lower fracture fixation complications compared with extramedullary device in terms of:[80, level I]

- revision rate (RR=0.17, 95% CI 0.05 to 0.60)
- fixation failure rate (RR=0.24, 95% CI 0.07 to 0.89)
- non-union rate (RR=0.23, 95% CI 0.07 to 0.81)

However, there was no difference in neck of femur fracture rate and, intra-operative parameters and post-operative complications. The quality of the primary papers was generally moderate.

A mixed cohort study compared treatment of subtrochanteric fractures using CMN with open technique cerclage wiring and close CMN technique in geriatric patients. The former was significantly better in the following outcomes:[81, level II-2]

- EQ-5D (health-related quality of life) Index at 12 months
- Jensen Index at 12 and 18 months
- shorter length of stay (average of two days)
- better fracture reduction
- shorter time to union

However, duration of surgery was longer (average of 16 minutes; p=0.024). There was also no difference in one-year mortality and complications rate.

- CMN is the preferred surgical fixation technique in subtrochanteric fracture in older adults.
  - Certain fractures configuration may require additional cerclage wiring to improve fracture reduction and shorten time to union.

e. Appropriate waiting time for surgery

Waiting time is an important issue in GHF management but there is no definitive time on proper time of surgery. The waiting time is very much influenced by the availability of operation theatre (OT), co-morbidities of the patients and human resource factors.

In a large meta-analysis of 28 prospective cohort studies on impact of surgery timing in elderly hip fracture patients:[82, level II-2]

- comparison surgery within 24 hours vs surgery after 24 hours
  - no significant difference in short-term and long-term mortality
  - mortality was slightly significantly reduced from surgery within 24 hours in those with co-morbidities
- comparison surgery within 48 hours vs surgery after 48 hours
  - 20% smaller risk of long-term mortality i.e within one year (RR=0.80, 95% CI 0.66 to 0.97) but no difference in short-term mortality (within one month)
  - in patients 90 years and above with POSSUM scores of ≥42, delayed surgery (after 48 hours) had significantly higher mortality
  - based on Instrumental Activities of Daily Living scores, 1-year mortality increased significantly in group 1 (dependence) and group 2 (intermediate level) with HR of 1.14 (95% CI 1.06 to 1.22) and 1.21 (95% CI 1.09 to 1.34) respectively but no difference in group 3 (high independence)

In terms of perioperative complications, evidence showed that surgery within 48 hours was associated with decreased odds of the pressure ulcers, pneumonia and urinary tract infection. Primary papers used in the meta-analysis are of mixed quality.

A later meta-analysis on 27 studies comparing early vs delayed surgery on proximal femoral fractures in elderly patients showed the following outcomes:[83, level I]

- early surgery reduced perioperative complication with OR of 0.57 (95% CI 0.35 to 0.95) for surgery within 72 hours, 0.39 (95% CI 0.19 to 0.79) for surgery within 48 hours and 0.59 (95% CI 0.44 to 0.78) for surgery within 24 hours than later surgery
- early surgery also reduced mortality with RR of 0.77 (95% CI 0.65 to 0.93) for surgery within 24 and 0.72 (95% CI 0.71 to 0.73) for surgery within 48 hours compared with later surgery

The quality of the primary papers was moderate to high.

A recent cross-sectional study showed that operation waiting time of >36 hours was significantly associated with increased risks of pneumonia, myocardial infarction and heart failure in geriatric patients with hip fracture but not with 30-day mortality.[84, level III]

Guidelines by AAOS states that hip fracture surgery within 24 - 48 hours of admission may be associated with better outcomes.[14]

Recommendation 11
- Surgery should be performed within 48 hours of admission* in medically stable geriatric hip fracture patients.

*after physical consultation by orthopaedic team

f. Analgesics in post-operative period

Inadequate pain relief after hip fracture surgery in older adults may be associated with prolonged bed rest, disruption in physical therapy and delay in mobilisation. These potentially increased the risks of thromboembolism, functional impairment and longer hospitalisation. Oral analgesia may be offered post-operatively for pain relief.

Multimodal techniques were compared with control for perioperative pain relief on elderly patients undergoing hip fracture surgery in a well-conducted RCT. They involved using different analgesic agents that act on different sites of pain pathway i.e. pre-emptive oral analgesia with intra-articular and periarticular injections of local anaesthetic agents during total joint arthroplasty. The interventions significantly reduced post-operative pain (day one and four) and fentanyl consumption. There was no difference in incidence of nausea, vomiting and delirium between the groups.[85, level I]

Regional anaesthesia with peripheral nerve blocks e.g fascia iliaca compartment block (FICB) is another analgesic technique that can be used to provide superior pain relief for pain management after hip surgery in the older adults. In a systematic review of 27 RCTs, FICB application was proven to be beneficial in pain reduction peri-operatively. It also showed:[86, level I]

- reduction in risk of perioperative complications e.g. delirium, pruritus, nausea and vomiting
- decrease in length of hospital stay
- acceleration of functional recovery

The quality of the primary papers was generally moderate.

Recommendation 12
- Analgesia should be provided peri-operatively in geriatric hip fractures.
  - Multimodal analgesia is the preferred choice.

Refer to **Appendix 4** on **Principles of Analgesic Prescriptions in the Elderly**.

6.4 Rehabilitation

Rehabilitation addresses the impact of a health condition on a person's everyday life by optimising their function and reducing their experience of disability. Anyone may need rehabilitation at some point in their life due to injury/illness or simply because declining function with advancing age. In relation to these, GHF result in impaired mobility and ability to perform activities of daily living (ADL). NICE recommends to offer people a physiotherapy assessment and mobilisation on the day after surgery unless medically or surgically contraindicated.[25]

An RCT assessed different post-operative outcomes among patients aged ≥70 years old with femoral neck fracture. Compared with conventional care, multidisciplinary intervention was more effective in terms of:[87, level I]

- reduction of fall [IRR of 0.38 (95% CI 0.20 to 0.76) for total sample and 0.07 (95% CI 0.01 to 0.57) for dementia sample]
- shorter post-operative in-hospital stay (p=0.028)
- significantly lesser post-operative complications e.g. delirium, delirious days, urinary tract infections, sleeping disturbances, nutritional problems and decubitus ulcers

A systematic review of moderate quality mixed studies on the elderly looked into the effectiveness of different interventions and settings in hip fracture rehabilitation. The findings were:[88, level I]

- clinical pathway, a multidisciplinary treatment approach provided within acute care setting, improved functional recovery, decreased length of stay and led to more favourable discharge destination
- early supported discharge during acute care reduced risk of fall (improved falls efficacy) and improved short-term functional recovery at three months

- occupational therapy combined with physical therapy in acute care improved short-term functional recovery at two months
- weight-bearing exercise for inpatient setting improved ambulation and reduced requirement for walking aid

A meta-analysis on GHF compared multidisciplinary rehabilitation and usual care post-operatively. The former was more effective in improving ADL/physical function (SMD=0.32, 95% CI 0.17 to 0.47) and mobility (SMD=0.32, 95% CI 0.12 to 0.52). However, there was no difference in survival or chance of living in one's own home after discharge. The quality of the primary papers was generally moderate based on Pedro scale.[89, level I]

Comprehensive geriatric care (CGC-multidisciplinary team approach) when compared with orthopaedic care alone in an RCT of geriatric patients after hip fracture surgery showed significantly better:[90, level I]

- upright time and number of upright events on day 4
- Short Physical Performance Battery scores on day 5

However, Cumulated Ambulation score did not significantly differ between the groups.

In a recent and large Cochrane systematic review on older adults with post-hip fracture surgery, multidisciplinary rehabilitation (MDR) was compared with usual care. The former was more effective in preventing death or deterioration of functional status leading to increased dependency/admission to institutional care, all-cause mortality at follow-up and readmission rate to the hospital. However, these were not statistically significant. The quality of the primary papers was generally moderate.[91, level I]

In a meta-analysis on older people with post-hip fracture surgery, OT post-operatively improved health perception and emotion compared with conventional care without OT (SMD=0.391, 95% CI 0.104 to 0.678). It is measured by using Goldberg General Health Questionnaire-28. However, there was no difference in performance of ADL, physical function and occurrence of fall. The quality of the primary papers was generally moderate.[92, level I]

- Communication between multidisciplinary team members is crucial to determine suitable timing and level of weight bearing which will depend on the aspects of hip fracture, types of hip surgery and findings at the time of surgery.
- Before patient is discharged, review by any members of the rehabilitation team (doctor/ physiotherapist/occupational therapist) shall be done to provide education on mobilisation activites and post-surgery function.

Recommendation 13
- Early mobilisation should be advocated as early as on post-operative day 1, e.g. sitting at the edge of the bed, unless contraindicated.
- Rehabilitation should be offered to all patients with geriatric hip fracture post-operatively with the aim to improve mobility and functional recovery.
  - A multidisciplinary approach is the preferred choice.

6.5 Discharge Plan and Follow-up

Osteoporotic treatment should be initiated prior to discharge. Bone mineral density for osteoporosis assessment can be performed before discharge or during follow-up.

Patients after hip fracture surgery should be followed-up.[25] Upon discharge, patients should be followed-up by the orthopaedic team to look for surgical site infection, fracture healing (intertrochanteric and subtrochanteric fractures), joint stiffness and ambulation capability.

7. PREVENTION

7.1 Primary Prevention

Prevention of GHF can be directed towards reducing the risk factors as mentioned in **Chapter 2**.

- **Prevention of GHF**

A Cochrane systematic review showed non-significant results of hip protectors in reducing hip fracture among participants in nursing/ residential care settings compared with participants in the community. The adherence to hip protector was at 24 - 80% and the incidence of skin irritation with hip protectors was at 0 - 5%. Most studies in the review were generally at low risk of bias for fracture outcomes.[93, level I]

In another Cochrane systematic review, supplements of vitamin D and calcium may prevent new hip fracture (RR=0.84, 95% CI 0.74 to 0.96). GRADE assessment showed high quality of evidence in new hip fracture outcome. However, there was a small but significant increase in gastrointestinal symptoms and renal disease. This review also found that there was no increased risk of death from taking calcium and vitamin D.[94, level I]

- **Prevention of fall**

CDC reports that >95% of GHF are caused by falls.[1] Two guidelines recommend opportunistic screening at least annually on older adults of their risk of falls during a medical encounter.[95 - 96] Three key questions have good sensitivity in screening risk of falls i.e.[95]

  - Have you fallen in the past year?
  - Do you feel unsteady when standing or walking?
  - Do you have worries about falling?

All older adults should be advised on falls prevention and physical activity. Individuals at high risk of falls should be offered a comprehensive multifactorial falls risk assessment.[95] Refer to **Assessment of Falls Risk Factors and Interventions to Reduce Identified Risk Factors** and Algorithm on Risk Stratification, Assessment and Interventions for Community-Dwelling Older Adults in **Appendix 6**.

For further information on the management of osteoporosis and fall prevention, refer to CPG on Management of Osteoporosis (3rd Edition).[96]

Recommendation 14

- Geriatric population should be screened and assessed for falls risk.
  - Education about falls prevention should be offered accordingly.

7.2 Secondary prevention

Fracture liaison service (FLS) is a coordinated system of care that streamlines bone health management for an effective follow-up strategy. FLS identifies patient following a hip fracture, investigates the patient and initiates appropriate treatment to reduce risk of a subsequent fracture. The delivery of the service should also incorporate the integration of primary and secondary/tertiary care.

A meta-analysis which included 16 RCTs looked into the clinical impact of FLS in predicting outcomes for older persons with osteoporotic-related fractures. The pooled results of the RCTs showed:[97, level I]

- a 23% increase in bone mineral density testing
- a 14% increase in initiation of osteoporosis treatment

Although FLS had favourable outcomes in treatment adherence, reduced risk of re-fractures and reduced mortality but they were not significant:

- a 22% increase in treatment adherence
- a 5% reduction in absolute risk of re-fracture
- a 3% reduction in mortality

Majority of the RCTs in the meta-analysis were considered of high quality.

In 2021, the National Osteoporosis Guideline Group had strongly recommended a multidisciplinary, coordinator-based FLS as a model of care for fracture prevention on patients who have sustained fragility fractures.[98]

- Fracture Liaison Service has become an important component of management in secondary fracture prevention.

8. IMPLEMENTING THE GUIDELINES

Implementation of this CPG is important as it helps in providing quality healthcare services based on the best and most recent available evidence applied to local scenario and expertise. Various factors and resource implications should be considered for the success of the uptake in the CPG recommendations.

8.1 Facilitating and Limiting Factors

The facilitating factors in implementing the CPG are:

i) availability of CPG to healthcare providers (hardcopies and softcopies)
ii) conferences and updates on or include topics on management of GHF including those involving professional bodies (e.g. Malaysian Orthopaedic Association and Malaysian Society of Geriatric Medicine)
iii) public awareness campaigns on geriatric populations (e.g. International Day of Older Persons)

Limiting factors in the CPG implementation include:

i) different levels of care and wide variation in practice due to expertise, facilities and financial constraints
ii) limited awareness and knowledge in management of GHF among healthcare providers
iii) lack of awareness of hip fracture injury and its management by the public
iv) lack of resources in maintaining National Orthopaedic Registry Malaysia Hip Fracture

8.2 Potential Resource Implications

The resource implications in the management of GHF falls mainly on the treatment part of the condition. The CPG recommends surgery to be conducted within 48 hours of admission after physical consultation by orthopaedic team on medically stable GHF patients. However, this may not be feasible in view of optimisation of patients, availability of operating theatre and arrangement to acquire the suitable implant. In the unstable intertrochanteric fracture, CMN has been recommended but cost is the hindering factor in obtaining it. Thus, patient may have to opt for less suitable implant which is DHS.

In line with the key recommendations in this CPG, the following is proposed as clinical audit indicator for quality management of GHF:

$$\text{Percentage of patients with GHF operated within 48 hours of admission*} = \frac{\text{Number of patients with GHF operated within 48 hours of admission* in a period}}{\text{Total number of patients with GHF operated in the same period}} \times 100\%$$

*after physical consultation by orthopaedic team and after excluding those medically unfit for early surgery and refuse surgery

Target of above indicator is at 75% yearly

Implementation strategies will be developed following the approval of the CPG by MoH which include Quick Reference and Training Module.

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Appendix 1

EXAMPLE OF SEARCH STRATEGY

Clinical Question: What are the effective and safe arthroplasty in displaced fracture neck of femur?

1. HIP FRACTURES/
2. (fracture* adj1 (hip or intertrochanteric or subtrochanteric or trochanteric)).tw.
3. FEMORAL NECK FRACTURES/
4. (femoral neck adj2 fracture*).tw.
5. (femur neck adj2 fracture*).tw.)
6. fracture neck of femur.tw.
7. 1 or 2 or 3 or 4 or 5 or 6
8. ARTHROPLASTY, REPLACEMENT, HIP/
9. (hip replacement adj2 arthroplast*).tw.
10. (total hip adj2 arthroplast*).tw.
11. (hip prosthesis adj2 implantation*).tw.
12. (total hip adj2 replacement).tw.
13. HEMIARTHROPLASTY/
14. (hemi adj1 arthroplast*).tw.
15. hemi-arthroplast*.tw.
16. hemiarthroplast*.tw.
17. 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18. 7 and 17
19. limit 18 to (english language and humans and “middle aged (45 plus years)” and “systematic review” and last 15 years)

Appendix 2

CLINICAL QUESTIONS

1. What are the accurate imaging modalities to diagnose geriatric hip fracture?
2. What are the risk factors for geriatric hip fracture?
3. What are the effective and safe primary prevention strategies for geriatric hip fracture?
4. What are the effective and safe analgesics pre-operatively for geriatric hip fracture?
5. What are the effective and safe prophylaxis for venous thromboembolism pre-operatively for geriatric hip fracture?
6. What are the pre-operative optimisation/criteria for safe surgery in geriatric hip fracture?
7. What are the effective and safe method of anaesthesia for geriatric hip fracture?
8. What are the effective and safe arthroplasties in geriatric displaced fracture neck of femur?
9. What are the effective and safe surgeries in geriatric non-displaced fracture neck of femur?
10. What are the effective and safe mode of fixations for:
    a. geriatric intertrochanteric fracture of femur?
    b. geriatric subtrochanteric fracture of femur?
11. What is the recommended appropriate waiting time for surgery for geriatric hip fracture?
12. What are the effective and safe treatments following surgical operation of geriatric hip fracture?
13. What are the effective and safe rehabilitations for post-operative geriatric hip fracture?
14. What are the effective and safe follow-up post-operatively for geriatric hip fracture?

Appendix 3

PRINCIPLES OF ANALGESIC PRESCRIPTIONS IN THE ELDERLY

1. Timing of medication administration is important.
   - Severe, episodic pain requires treatment of a rapid onset of action and short duration.
   - For continuous pain, regular analgesia is the most effective, possibly using modified release formulations.
2. Start with a low dose single agent at a time, followed by low incremental dose titration.
3. Allow adequate intervals for assessment of the effect before considering another agent.
4. Combination therapy using agents with different mechanisms of action may have synergistic effects to provide greater pain relief with fewer side effects than higher doses of a single agent.
5. Consider the use of non-pharmacological strategies, e.g physiotherapy and cognitive behavioural approaches, in combination with medication.
6. Treatment should be monitored regularly and adjusted if required to improve effectiveness and minimise side effects.
7. On choosing an analgesic agent, co-morbidity, contraindications and possibilities of drug-disease and drug-drug interactions should be considered.

PRE-OPERATIVE ANALGESIA IN GHF

Drug	Recommended dose	Comments
Paracetamol	325 - 500 mg 4-hourly or 500 - 1,000 mg 6-hourly per oral (PO)	• Maximum dose usually 4 g daily • Reduce maximum dose 50% to 75% in patients with hepatic insufficiency or history of alcohol abuse
Celecoxib Etericoxib	200 mg twice daily (BD) for 2 - 5 days, then 200 mg once daily (OD) PO 90 mg OD PO	• Higher doses are associated with higher incidence of gastrointestinal (GI) and cardiovascular side effects • Consider prescribing proton-pump inhibitor to reduce GI side effects and when patients on aspirin
Morphine	2 - 3 mg 4 - 6-hourly (subcutaneous (SC) or PO)	• Most commonly used for episodic or breakthrough pain • Intravenous (IV) morphine may be considered in severe pain (refer to Guidelines of Pain as 5th Vital Sign)
Oxycodone	2.5 - 5 mg 4 - 6-hourly PO	• Useful for acute recurrent, episodic or breakthrough pain

Drug	Recommended dose	Comments
Dihydrocodeine tartrate (DF118)	30 - 60 mg 6 - 8-hourly PO	• Useful for acute recurrent, episodic or breakthrough pain
Tramadol	50 mg 6 - 12-hourly PO	• Monitor side effects e.g. confusion, drowsiness, constipation and nausea • Risk of seizures in high doses • May precipitate serotonin syndrome if used with selective serotonin reuptake inhibitors • Use with caution in renal impairment; if creatinine clearance (CrCl) <30 millilitres per minute (mL/min), requires dose reduction

Adapted:

1. Ministry of Health, Malaysia. Guidelines for Pain Management in the Elderly 1st Edition. Putrajaya: MoH; 2018
2. Ministry of Health, Malaysia. Management of Cancer Pain. Putrajaya: MoH Malaysia; 2010

Appendix 4

COMPREHENSIVE GERIATRIC ASSESSMENT (CGA) FOR GHF

The main dimensions covered in a CGA should include the following assessments:

Physical	Functional	Psychological	Social
• Presenting complaint • Acute medical issues which include cardiac assessment • Past medical history • Medication review • Nutritional status (e.g. MNA-SF) • Frailty assessment (e.g. Clinical Frailty Scale) Note: Advanced directives should also be explored	• Activities of daily living (e.g. Barthel Index) • Functional ability • Balance and gait stability • Mobility	• Delirium assessment (e.g. 4AT Delirium Detection Tool) • Baseline cognition [e.g. Mini Mental State Examination (MMSE), Abbreviated Mental Test Score (AMTS)] • Mood [e.g. Geriatric Depression Scale (GDS)]	• Social support • Caregiver stress • Living arrangements (domestic support) • Living environment • Financial circumstances

Adapted: National Clinical Programme for Older People. Specialist Geriatric Team Guidance on Comprehensive Geriatric Assessment. (Available at: https://www.hse.ie/eng/services/publications/clinical-strategy-and-programmes/comprehensive-geriatric-assessment-document-.pdf)

GUIDELINES ON TIME INTERVALS BEFORE AND AFTER NEURAXIAL BLOCKS RELATED TO THE USE OF ANTIPLATELET AGENTS AND ANTICOAGULANTS

A. Antiplatelet agents

Antiplatelet agent	Timing of initiation of neuraxial block after agent is stopped	Restarting agent with neuraxial catheter in-situ	Restarting agent after neuraxial block/catheter removal
Aspirin	No additional precaution	No additional precaution	No additional precaution
NSAIDS	No additional precaution	No additional precaution	No additional precaution
Clopidogrel	5 - 7 days	• Start 24 hours post-operatively • Acceptable to maintain catheter for 1 - 2 days provided no loading dose given	Immediately (loading dose may be given 6 hours after removal)
Prasugrel	7 - 10 days	Not recommended	Immediately (loading dose may be given 6 hours after removal)
Ticlopidine	10 days	• Start 24 hours post-operatively • Acceptable to maintain catheter for 1 - 2 days provided no loading dose given	Immediately (loading dose may be given 6 hours after removal)
Ticagrelor	5 - 7 days	Not recommended	Immediately (loading dose may be given 6 hours after removal)
Abciximab	24 - 48 hours	Contraindicated within 4 weeks of surgery	No specific guidance
Tirofiban	4 - 8 hours	Contraindicated within 4 weeks of surgery	No specific guidance
Eptifibatide	4 - 8 hours	Contraindicated within 4 weeks of surgery	No specific guidance
Dipyridamole	24 hours for extended-release formulation	Not recommended	6 hours after removal

B. Parenteral anticoagulant agents

Anticoagulant agent (parenteral)	Timing of initiation of neuraxial block after agent is stopped	Restarting agent with neuraxial catheter in-situ	Restarting agent after neuraxial block/catheter removal
Unfractionated heparin (UFH) SC	• Low-dose prophylaxis (5,000 units (U) BD/ thrice daily (TDS) • Higher-dose prophylaxis (7,500 - 10,000 U BD or <20,000 U daily total): 12 hours	• Ensure normal platelet count • Low dose: Acceptable to give whilst catheter in-situ; catheter removal 4 - 6 hours after administration • Higher dose (doses >5,000 U or daily total >15,000): Analyse risk/benefit in the patient; if given, institute neurological observation monitoring regimen	1 hour
UFH IV	4 - 6 hours after stopping the infusion and normal coagulation status	• Ensure normal platelet count and coagulation status • Catheter removal 4 - 6 hours after stopping infusion	1 hour
LMWH	• Prophylactic dose: 12 hours • Treatment dose: 24 hours	• Ensure normal platelet count • Prophylactic OD dose: First dose acceptable 4 hours after catheter placement; removal of catheter at minimum of 12 hours after last dose • Treatment dose: Not recommended	• Prophylactic dose: 4 hours • Treatment dose: 24 hours after surgery and removal of catheter
Parenteral heparin alternatives			
Fondaparinux	• Prophylactic dose: 36 - 48 hours • Treatment dose: 72 hours • Only for single puncture neuraxial blockade • Avoid indwelling neuraxial catheters	Avoid	6 hours

C. Oral anticoagulant agents

Anticoagulant agent (oral)	Timing of initiation of neuraxial block after agent is stopped	Restarting agent with neuraxial catheter in-situ	Restarting agent after neuraxial block/catheter removal
Rivaroxaban	• 72 hours; if earlier, consider rivaroxaban or anti-factor Xa level [(safe residual level for central neuraxial blockade (CNB) is unknown)] • Prophylactic dose: CrCl >30 mL/min; 18 hours • Treatment dose: CrCl >30 mL/min; 48 hours	• Not recommended • With unanticipated administration, hold rivaroxaban dosing for 22 - 26 hours or assess an anti-factor Xa assay calibrated to rivaroxaban before catheter removal	6 hours
Edoxaban	72 hours; if earlier, consider edoxaban or anti-factor Xa level (safe residual level for CNB is unknown)	• Not recommended • With unanticipated administration, hold edoxaban dosing for 20 - 28 hours or assess an anti-factor Xa assay calibrated to edoxaban before catheter removal	6 hours
Apixaban	72 hours; if earlier, consider apixaban or anti-factor Xa level (safe residual level for CNB is unknown)	• Not recommended • With unanticipated administration, hold apixaban dosing for 26 - 30 hours or assess an anti-factor Xa assay calibrated to apixaban before catheter removal	6 hours
Dabigatran	120 hours; if no additional risk factors for bleeding: • CrCl >80 mL/min: 72 hours • CrCl 50 - 79 mL/min: 96 hours • CrCl 30 - 49 mL/min: 120 hours • CrCl 30 mL/min: Avoid	• Not recommended • With unanticipated administration, hold dabigatran dosing for 34 - 36 hours or assess the dTT or ECT before catheter removal	6 hours

Anticoagulant agent (oral)	Timing of initiation of neuraxial block after agent is stopped	Restarting agent with neuraxial catheter in-situ	Restarting agent after neuraxial block/catheter removal
Warfarin	Ideally stop international normalised ratio (INR) 3 days before and INR "normalised"	• Not recommended when catheter in-situ, suggest bridging therapy appropriately • Check INR daily and, routine sensory and motor neurological testing	• Remove catheter when INR ≤1.5 • After catheter removal, continue neurological observations for 24 hours

D. Thrombolytic drugs

Thrombolytic agent	Timing of initiation of neuraxial block after agent is stopped	Restarting agent with neuraxial catheter in-situ	Restarting agent after neuraxial block/catheter removal
Thrombolytic agents (e.g. alteplase and streptokinase)	48 hours and documented normal clotting (including fibrinogen)	Not recommended; if unexpectedly given, measure fibrinogen to guide timing of catheter removal	No recommendation, but note that original contraindications to these agents state that they should not be given for 10 days after puncture of non-compressible

Adapted:
1. Ashken T, West S. Regional anaesthesia in patients at risk of bleeding. BJA Educ. 2021;21(3):84-94.
2. NYSORA. Regional Anesthesia in Anticoagulated Patients (Available at: https://www.nysora.com/topics/sub-specialties/regional-anesthesia-in-anticoagulated-patients/)

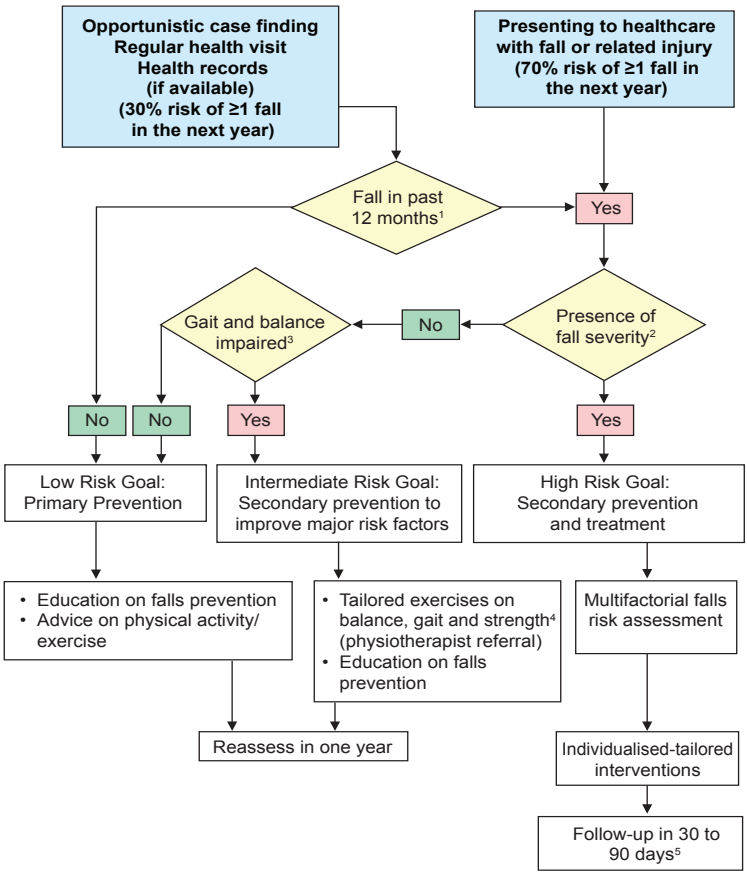
Appendix 6

ASSESSMENT OF FALLS RISK FACTORS AND INTERVENTIONS TO REDUCE IDENTIFIED RISK FACTORS

Assessment	Interventions
Evaluate lower limb muscle strength, gait, and balance *Timed Up and Go* *(high risk >13.5 sec)*	Poor gait, strength and balance • Refer for physical therapy • Engagement in exercise programmes that involve balance, functional exercise and resistance training
Identify medications that increase fall risk	Medication(s) likely to increase fall risk • Optimise medications by stopping, switching or reducing dosage (especially for psychoactive medications)
Ask about potential home hazards *(e.g. slippery bathroom floor, loose rugs)*	Home hazards likely to increase fall risk • Refer to occupational therapist to evaluate home safety assessment ± modification
Measure positional blood pressure *(supine and standing blood pressure measurement)*	Orthostatic hypotension observed • Review medications • Encourage adequate hydration • Consider use of compression stockings, abdominal binders or physical manoeuvres
Check visual acuity	Visual impairment observed • Refer ophthalmologist/optometrist • Avoid wearing multifocal glasses when walking, particularly on stairs
Assess feet and footwear	Feet or footwear issues identified • Appropriate treatment for foot problem identified • Advise wearing well-fitted shoes indoors and outdoors
Assess vitamin D intake	Vitamin D deficiency observed or likely • Recommend daily vitamin D (800 - 1000 IU) supplement for individuals with proven vitamin D deficiency
Previous history of falls OR fear of falling	• Provide falls education and information to all patients • Regular follow-up to ensure adherence to interventions

Source: Malaysian Osteoporosis Society (MOS). Management of Osteoporosis 2022 (3rd Edition). Kuala Lumpur; MOS: 2022

ALGORITHM ON RISK STRATIFICATION, ASSESSMENT AND INTERVENTIONS FOR COMMUNITY-DWELLING OLDER ADULTS



[1]To increase sensitivity, use **three Key Questions (3KQ)** with any positive answer to a) Has fallen in the past year? b) Feels unsteady when standing or walking? or c) Worries about falling? prompts to "fall severity" step.

Fall severity: fall with injuries (severe enough to consult a physician), laying on the ground with no capacity to get up, a visit to emergency room or loss of consciousness/ suspected syncope.

[2]**Assess fall severity (one is enough)**: ● injury ● ≥2 falls last year ● frailty ● lying on the floor/unable to get up ● loss of consciousness/suspected syncope (syncope suspicion should trigger evaluation/management)

[3]**Gait speed** ≤0.8 m/s or alternatively **Timed up and go** >15 seconds

[4]**Exercise on balance/leg strength** is recommended for the intermediate group which may also be **referred to a physiotherapist**.

[5]**High risk individuals** with falls can deteriorate rapidly and close follow-up is recommended which is guided on frequency of consequent health service utilisation.

Adapted: Montero-Odasso M, van der Velde N, Martin FC, et al. World guidelines for falls prevention and management for older adults: a global initiative. Age Ageing. 2022;51(9).

LIST OF ABBREVIATIONS

AO/OTA	Arbeitsgemeinschaft für Osteosynthesefragen Foundation and Orthopaedic Trauma Association
AAOS	American Association of Orthopaedic Surgeon
ACCP	American College of Chest Physicians
ADL	activities of daily living
AGREE	Appraisal of Guidelines for Research and Evaluation
AP	anterior-posterior
ASA	American Society of Anesthesiologists
AUC	area under curve
BD	twice daily
CGA	comprehensive geriatric assessment
CGC	comprehensive geriatric care
CI	confidence interval
cm	centimetre
CMN	cephalomedullary nail
CNB	central neuraxial blockade
COX-2	cyclooxygenase-2
CPG	clinical practice guidelines
CrCl	creatinine clearance
CT	computed tomography
DG	development group
DHS	dynamic hip screw
ETD	Emergency & Trauma Department
EMD	extramedullary device
FICB	fascia iliaca compartment block
FLS	fracture liaison service
g	gramme
GHF(s)	geriatric hip fracture(s)
GI	gastrointestinal
GRADE	Grading Recommendations, Assessment, Development and Evaluation
HA	hemiarthroplasty
Hb	haemoglobin
HR	hazard ratio
HHS	Harris Hip Score
ICU	intensive care unit
IMN	intramedullary nail
INR	international normalised ratio
IRR	incidence rate ratio
IU	International unit
IV	intravenous
LMWH	low molecular weight heparin
MaHTAS	Malaysian Health Technology Assessment Section
MD	mean difference
MDR	multidisciplinary rehabilitation
mg	milligramme
mL/min	millilitre per minute
mm	millimetre
mmHg	millimetre mercury
MNA-SF	Mini Nutritional Assessment-Short Form
MoH	Ministry of Health

NICE	National Institute for Health and Care Excellence
NSAIDs	non-steroidal anti-inflammatory drugs
OD	once daily
OR(s)	odds ratio(s)
OT	operation theatre
p	*p* value
PNBs	peripheral nerve blocks
PO	per oral
PPI	proton pump inhibitor
PFN	proximal femoral nail
PFNA	proximal femoral nail anti-rotation
RCTs	randomised controlled trial(s)
RC	review committee
RR	relative risk
RSI	risk stratification index
SGD	Singapore dollar
SMD	standardised mean difference
THA	total hip arthroplasty
UFH	unfractionated heparin
U	units
vs	versus
VTE	venous thromboembolism
WHO	World Health Organization

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