

A Guidebook for Fragility Fracture Management – The Holistic Approach

Kwok-Sui LEUNG
Tsz-Ping LAM
Jessica Tan CHAN
(Eds.)

Proceedings of the PSDAS workshops on
“Maintaining Bone Health and Preventing Falls and Fractures in the Elderly”

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Preface:

“Si jeunesse savait, si vieillesse pouvait”

---*Les Premice*

Henri Estienne, 1531-1598

Fragility fracture is a world-wide problem with an ever-increasing incidence. It has a profound consequence on individuals across the physical and psychosocial aspects. As for the society, the socio-economic implication is heavy. This problem deserves immediate attention. One should not just focus on the acute care and physical rehabilitation when treating fragility fractures. Primary, secondary and tertiary prevention must follow and be incorporated into the public health care system. Good results can only be achieved through orchestrated multi-disciplinary efforts among the medical, paramedical and community service professionals following a standardized, coordinated and holistic program.

This guidebook is a collection of presentation materials of the 2008 PSDAS workshops on “Maintaining Bone Health and Preventing Falls and Fractures in the Elderly”. The key elements that are fundamental to a holistic fragility fracture program are covered in details and should serve as good references not only for those taking care of the unfortunate elderly suffering from fragility fractures, but also for those who work to prevent fragility fractures from happening.

Professor Kwok-Sui LEUNG
and
the Fragility Fracture Prevention Team
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Introduction

Chapter 1

Fragility fractures in the elderly:- a global problem

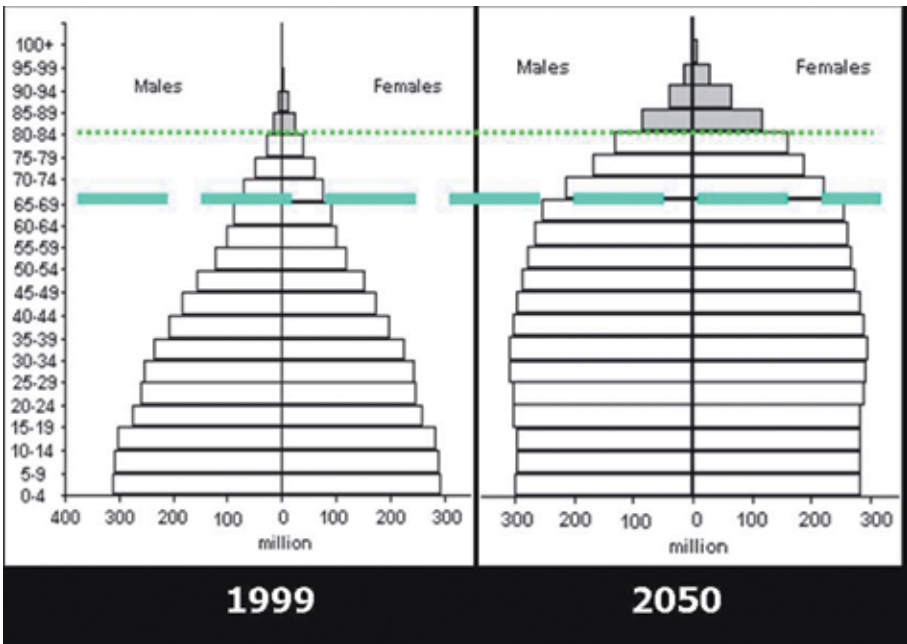
Prof. Kwok-Sui LEUNG

The ever-increasing incidence of fragility fractures is due to:

1. Ageing population
2. Prevalence of osteoporosis
3. Active lifestyle: increased risk of falls

The ageing population pyramid

According to WHO – 1999, the world population pyramid is as follows:



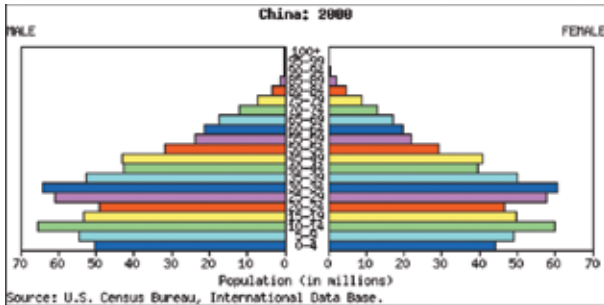
1999: 6 billion or 10% of population is > 65 years old
2050: 10 billion or 22% of population is > 65 years old

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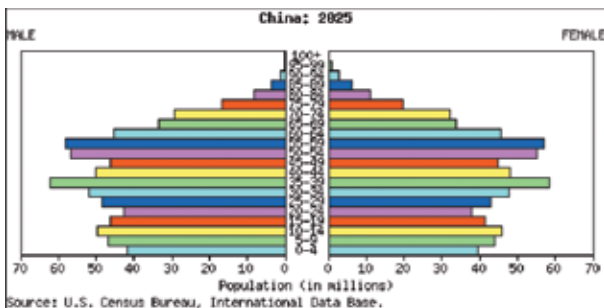
Chapter 1 Fragility fractures in the elderly:- a global problem

According to US Census Bureau, International Data Base: the population pyramid of China:

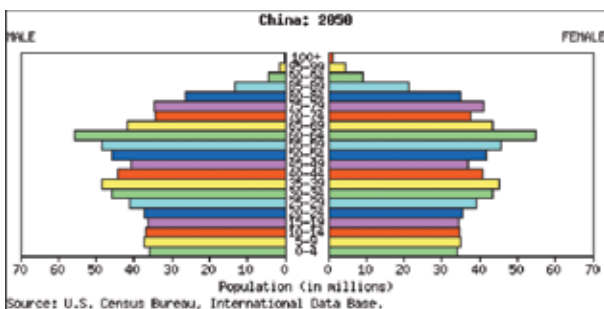
2000:



2025:



2050:



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Chapter 1 Fragility fractures in the elderly:- a global problem

The situation in Hong Kong



Fragility fractures mainly affect the elderly. It follows that with ageing population, fragility fracture will become more and more prevalent.

Introduction

Chapter 1 Fragility fractures in the elderly:- a global problem

Fall accounts for more than 90% of fragility fractures

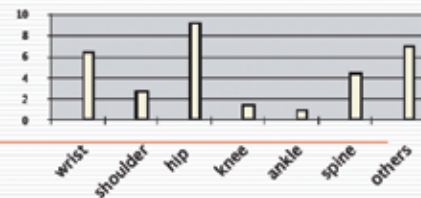
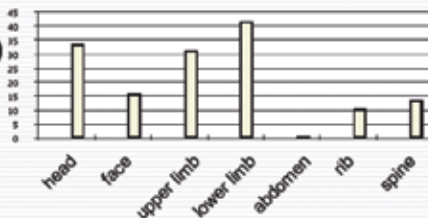
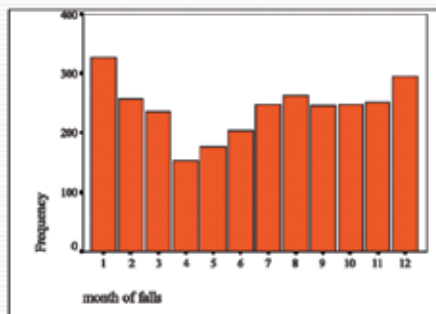
1. 35 to 45% of people > 65 years old fall annually
2. 10 to 25% of falls result in fractures
3. Falls entail 6% of medical expenditure for those > 65 years old
4. 5% of falls result in hospitalization
5. 40% of falls result in institutionalization

According to our survey conducted for year 2003:

Survey on 14 Accident and Emergency departments 2003:

Total no trauma cases: 58040

Injuries due to Falls: 38820 (65%)



Community – Survey 2800 elderly

- 51% have fall
- 16.8% had fall within 1 year
 - 1/3 had recurrent falls
- 68% needed medical care
- 3105 elderly attended PWH A&E for fall injuries
 - 46.7% of all trauma cases
 - Male: female = 3:1
 - Average age: 77 years old
- Orthopaedic wards
 - 875 fractures elderly within 18 month
 - All due to fall
 - Male: Female = 1:7
 - Average age = 79 years old



Introduction

Lifetime risk of fragility fracture

After 50 years old:

50% of women will get a fragility fracture in their remaining life

The figure is 30% for men

Proximal femoral fractures

1. Annual incidence around the world

a. 1992: 1.66 million

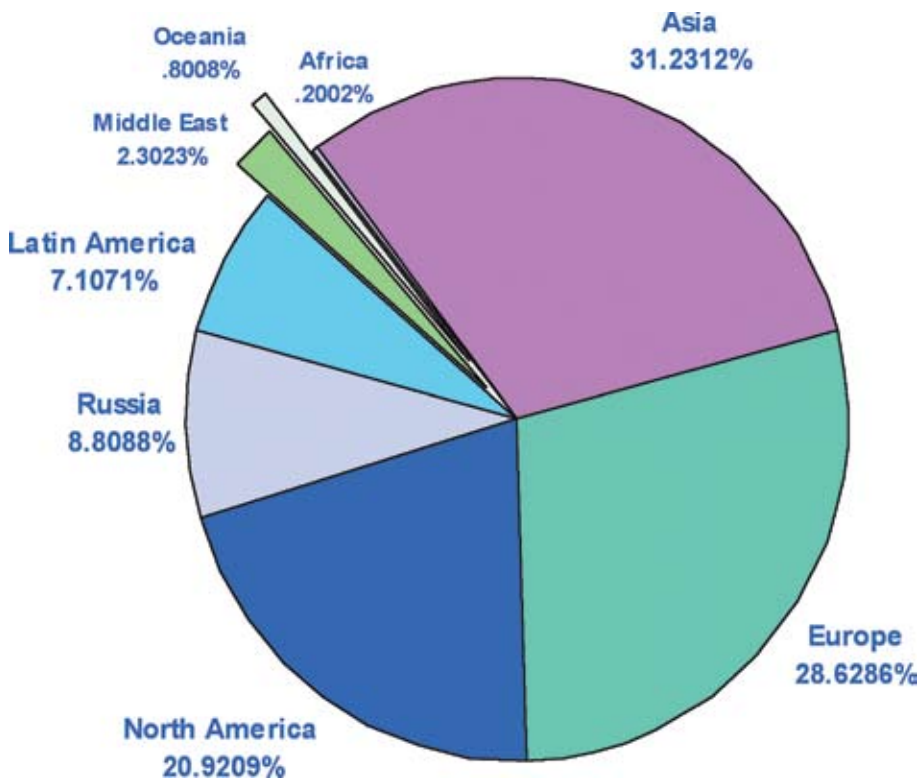
b. 2025: 3.94 million

c. 2050: 6.26 million

d. 89% of all these fractures are osteoporotic fractures

2. The continental distribution pie char (reference: Cooper C, Campion G, Melton LJ, 3rd. Hip fractures in the elderly: a world-wide projection. Osteoporos Int. 1992 Nov;2(6):285-9.)

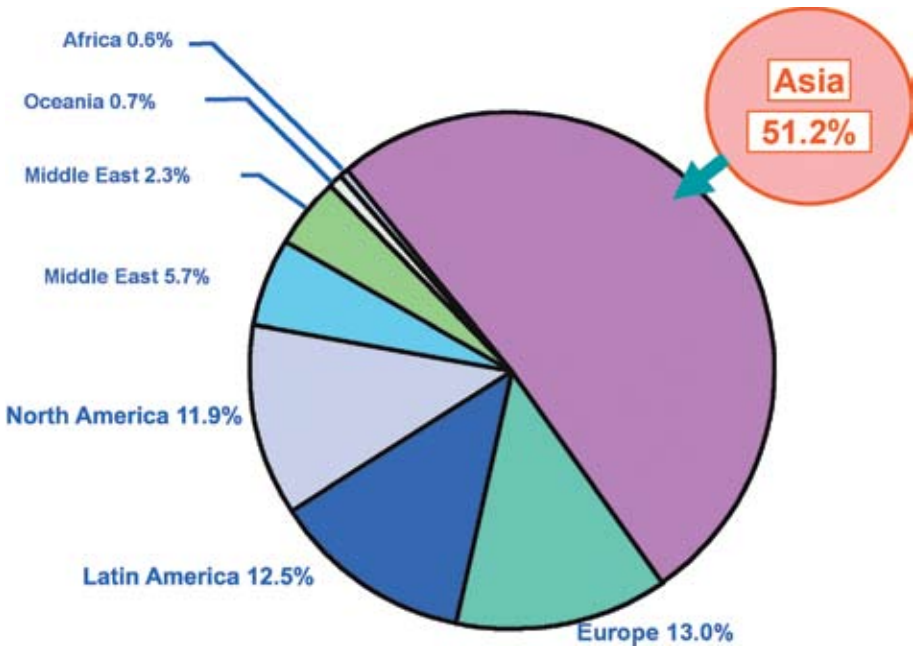
In 1999:



Introduction

Chapter 1 Fragility fractures in the elderly:- a global problem

In contrast, in 2050:



It is universally agreed that fragility fractures will increase exponentially within these few decades. Asia will be the epicenter of this inflating epidemic.

Socio-economical implication of geriatric hip fractures 2001

The cost

- | | |
|-----------------------|-------------|
| 1. USA | 17 billion |
| 2. UK | 1.7 billion |
| 3. Australia | 2.5 billion |
| 4. European community | 4 billion |
| 5. Hong Kong | 0.2 billion |
| 6. China | 2 billion |

Introduction

Chapter 1 Fragility fractures in the elderly:- a global problem

The dire effects of geriatric hip fractures

1. Mortality
 - a, 4% in the first 4 months
 - b, 15% higher in the first year of the fracture as compared to age and gender-matched controls
 - c, 40% within 4 years
2. Disability
 - a, Significant impairment of physical status
 - b, 80% deterioration in mobility
 - c, 10% become ADL dependent
 - d, 19% need long term nursing home
 - e, 30% become home bound
3. Quality of life (QOL)
 - a, Serious compromised QOL
4. Medical cost
 - a, A heavy burden to the health care system

Conclusion:

Fragility fracture is becoming a pandemic problem. No country is immune from its influence. Asia including Hong Kong will suffer the greatest impact. Immediate action is required to keep the situation from worsening. At the societal level, implementation of preventive measures is urgently needed. As for individual patients, efficient medical care should be available to minimize the health consequences after fragility fractures. This is a multi-faceted problem requiring a multi-disciplinary approach and the key elements for such will be covered in details in the chapters that follow.

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Chapter 2

Surgical management of fragility fractures

Prof. Kwok-Sui LEUNG

The anatomic sites of involvement

Fragility fractures commonly occur at three cardinal sites

1. proximal femur (ie geriatric hip fractures)
2. distal radius
3. vertebra

Other sites that can be involved include:

1. proximal humerus
2. distal femur
3. elbow
4. pubic rami
5. periprosthetic region

Geriatric hip fractures



1. commonest *in-patient* fractures
 - a. giving rise to huge patient loads
2. hip fracture surgery is the commonest operation performed for in-patient trauma cases
3. ever-increasing trends in incidence
4. associated with multiple social and family problems
5. accompanied by multiple medical problems which add towards the medical and anesthetic complexities in managing the cases
6. presence of poor bone quality (osteoporosis), thus increasing the technical difficulties of surgery
7. prolonged rehabilitation is the rule

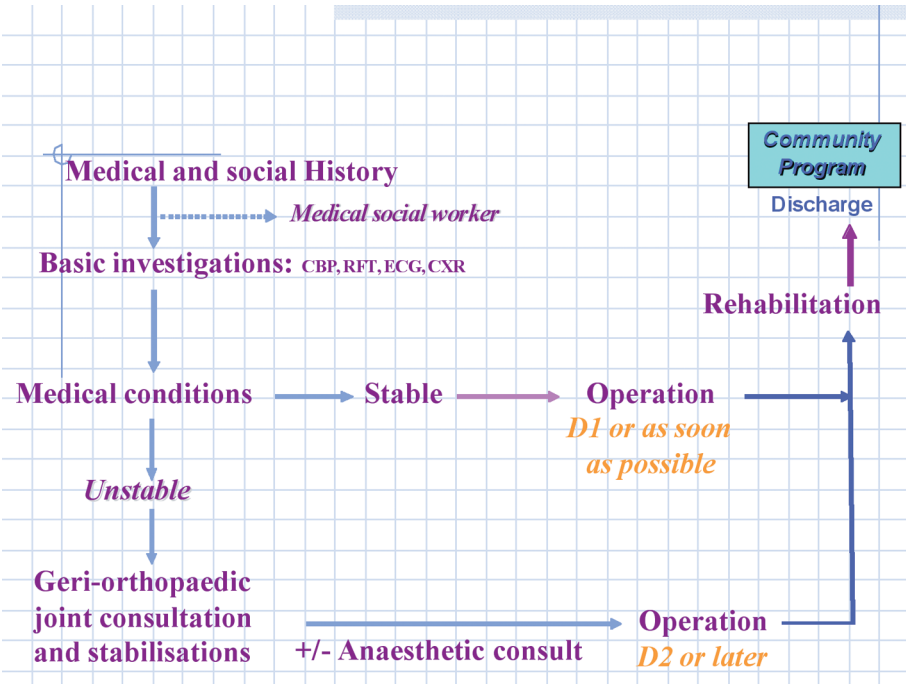
Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

An important point of consideration: when should we operate?

1. patient is fittest at the time of admission
2. highly desirable to have early mobility & independence
3. general consensus: early operative fixation is imperative as soon as the medical condition is optimized for surgery
4. Please refer to chapter 5 “Effective Arrangement Protocol for Management of Geriatric Hip Fractures” by Dr WY Shen for details

The Management Protocol

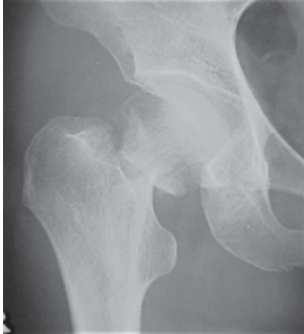


Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Two main groups of hip fractures

1. femoral neck fractures
 - a. patient is younger as compared to trochanteric fracture



2. trochanteric fractures
 - a. more common
 - b. patient is usually older with poorer general health



Aims of treatment

1. pain relief
2. early regain of independence
3. early restoration of self care
4. ensure comfort in walking and sitting
5. early mobilization
6. prevent deformities and surgical complications
7. facilitate fracture healing

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Management protocol for femoral neck fractures

There are two options: either femoral head preservation or femoral head replacement

Femoral head preservation procedure:

1. achieved with hip screw fixation



2. femoral head and hip joint are preserved
3. minimally invasive surgery: only requires a key-hole incision for percutaneous hip screw insertion
4. benefits:
 - a. long lasting painless movements can be achieved
 - b. option of choice if longevity of the patient is expected
 - c. better function at the involved hip
 - d. less expensive
5. Time factor is important for its success
 - a. Patient must be operated within 72 hours of fracture

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

6. Complications: 15-30% need revision surgery as a result of complications after hip screw fixation:

a. non-union: the fracture fails to heal



b. avascular necrosis: death of bone cells and tissues of the femoral head



Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Femoral head replacement procedure:

1. arthroplasty: either hemi or total



2. Benefits:

- a. “simple” operation
- b. allows early mobilization
- c. time factor is not crucial for its success

3. Complications

- a. periprosthetic fractures: ie, re-fracture at the vicinity of the prosthesis



(Periprosthetic fracture (red arrow) after hemiarthroplasty. The fracture is subsequently treated with screws, plate and circlage wiring)

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

b, protrusion: erosion of prosthesis into the acetabulum



c, infection

d, surgical trauma: it is more invasive than hip screw fixation

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Surgical treatment of trochanteric fracture

1. The implants that are commonly used include:

a. Gamma nail



or

b. Dynamic hip screw



Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Distal radial fractures

1. Commonest outpatient fractures
2. Can be treated with casting or operative implant fixation



(distal radius fracture after treatment with implant fixation)

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Vertebral fractures

1. Compression fracture
2. May be silent
3. It is treated conservatively with analgesics and braces or with vertebroplasty (meaning to inject bone cement percutaneously into the vertebral body to restore the height and shape of the vertebra)



(vertebral fracture before treatment)



(after treatment with vertebroplasty)

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Proximal humeral fracture

It is either treated conservatively with an arm sling or with operative implant fixation



(Proximal humeral fracture)

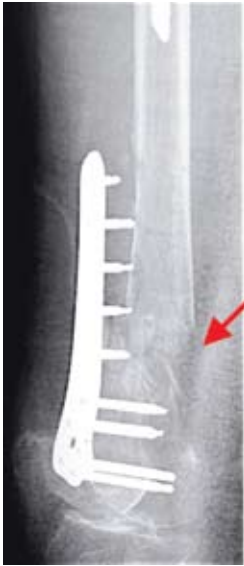


(proximal humeral fracture after treatment with implant fixation)

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Distal femoral fractures



(The fracture (red arrow) at the distal femur)

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Locked Plates: a powerful implant for fragility fractures:

1. a useful implant recently developed to treat fragility fractures
2. enhance fracture healing by providing biological environment for secondary fracture healing
3. minimal compression at the fracture site
4. acting as a bridging plate
5. can be achieved with a minimally invasive procedure
6. early mobilization is possible through achievement of mechanical stability
7. suitable for:
 - a. osteoporotic bones
 - b. comminuted diaphyseal fractures of the lower limbs
 - c. internal fixation of closely reduced fractures that anatomical reduction is not required.
 - d. periprosthetic fractures.



(Examples of fracture treated with Locked Plates)

Management of Fragility Fractures at the Acute Phase

Chapter 2 Surgical management of fragility fractures

Quality assurance of surgical outcome

It is important to ensure the quality of surgical care is maintained especially when the patients suffering from fragility fractures are elders with multiple medical problems adding towards the complexities with anesthetic, perioperative and post-operative cares. Important considerations include:

1. well structured training program for Orthopaedic Surgeons
2. organization of Fragility Fracture Program
3. Liaison and multidisciplinary approaches
4. Standardization of care at the various phases:
 - a. Preoperative
 - b. Intra-operative
 - c. fracture fixation
 - d. Post-operative
5. Training Program for Nurses and Paramedical Professions

(Please refer to Chapter 6: “A nursing protocol for effective in-patient management at the acute phase” by J Chan et al for details of a standardized in-patient nursing protocol)

Role of orthopaedic surgeons

Apart from performing an operation skillfully, orthopaedic surgeons should also observe the followings:

1. as the leader to prevent recurrent fractures
 - a. fracture is the first presentation of osteoporosis
 - b. post-operative follow up is the golden opportunity to engage the patients on fragility fracture prevention program.
2. understand the impact of fragility fractures on
 - a. patients
 - b. families
 - c. society
3. maintain a holistic perspective when managing patients with fragility fractures

Chapter 3

Anesthetic management for geriatric patients with fragility fractures

Dr. Pong-Tong CHUI

- Care for geriatric patients with fragility fractures is complex and challenging [1]. These patients are often frail, with impaired communication and cognition, and suffering from co-morbidities. Key elements of good anaesthetic care include comprehensive assessment and prompt resuscitation and optimization preoperatively. Intraoperative requirements include provision of surgical anaesthesia and meticulous attention to maintaining physiological and physical functions. Adequate postoperative analgesia will facilitate rehabilitation, and this will involve pain assessment and provision of effective pain management modalities with minimal side-effects.

Pre-operative Assessment and Preparation

- Patients with fragility fractures requiring operative treatment should have surgery as soon as possible if medically stable. In fractured hip patients, delays of surgery for more than 48 hours from admission will increase morbidity such as pressure sores, deep vein thrombosis, pneumonia, and urinary tract infection [2]. Early surgery within 24 hr of admission will reduce days of severe pain and length of stay [3].
- Patients with fragility fractures can be classified in two broad groups. The first are relatively healthy patients in whom the fractures occur after accidental falls. The other are patients with significant co-morbidities in whom the falls are often manifestation of underlying neurologic or cardio-respiratory diseases.

1. Standard Pre-operative Assessment

- A detailed history and physical examination, and basic observations such as heart rate, blood pressure, body temperature and arterial oxygenation by pulse oximetry. The circumstances leading to the fall may reveal underlying cardiac or neurologic diseases.
- Investigations should include electrocardiography, plasma electrolytes and glucose concentrations, renal and liver function tests, complete blood count, and coagulation studies, and x-rays of the chest, hip and pelvis. Blood type and screen as transfusion of blood products are often required.
- Further investigations may be indicated according to clinical conditions. Troponin T is indicated if the patient had chest pain, cardiac syncope, congestive cardiac failure or ECG changes.

Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

2. Pain management:

- Adequate pain control not only reduces suffering. In elderly patients with hip fractures, it also decreases length of stay, enhance functional recovery, and improve long-term functional outcomes [4].
- Unrelieved pain can result in the following complications:
 - immobility leading to lung atelectasis and infection, pressure sores, poor hydration and nutrition,
 - stress responses with cardiovascular complications, protein breakdown, glucose intolerance, and electrolyte disturbances, and
 - neuropsychiatric problems such as sleep disturbances, delirium, depression, chronic pain.
- Pain assessment tools improve monitoring and documentation of pain, and are pre-requisites for optimal pain control. In patients with normal mental state, simple pain scores, such as visual analog or verbal numeric scores, can be assessed six hourly. For patients with mental confusion or dementia, pain can be assessed using behavioral pain assessment scale (Table 1) [5].
- The following is a simple analgesic regimen:
 - paracetamol 500 mg q6h PO (unless liver disease or severe renal impairment with serum creatinine $>200 \mu\text{mol/L}$)
 - tramadol 50 mg q6h PO, and
 - morphine 5-10 mg q4h IM PRN for breakthrough pain.
 - If surgery may be delayed for a few days for medical reasons, femoral nerve catheter and continuous infusion of local anaesthetics can be considered in fractured hip patients.
 - Parenteral pethidine increases the incidence of delirium. NSAIDs causes peptic ulceration, fluid and electrolytes disturbances and renal impairment. Both should be avoided in the elderly.

3. General Management:

- Patients fluid input and output should be monitored closely. Adequate oral and intravenous fluids should replace blood loss and dehydration. However, But be cautious in frail older adults or those with known congestive heart failure.
- Anaemia should be treated with blood transfusion when Hb $< 10 \text{ g/L}$.
- A pressure reducing mattress is indicated for all patients with hip fractures. In very high risk patients, pressure ulcer risks should be assessed and managed by specialized nursing and skin care teams.
- Venous thrombo-embolism prophylaxis should be commenced according to institutional protocol. Low molecular weight heparin, if used, will need to be withheld for 12 hours before spinal anaesthesia.

Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

4. Management of Co-existing Medical Problems

- In elderly patients with fragility fractures, potentially reversible abnormalities in physical examination and laboratory investigations occur frequently and they significantly increase risks of perioperative complications [6].
- Major clinical abnormalities should be corrected prior to surgery, whereas for minor abnormalities, the patient may proceed to surgery with attention to these medical problems perioperatively (Table 2) [7].
- If general, the patient's medical conditions should be optimized expeditiously in order for surgery to be able to proceed within 24 – 48 hours of presentation. If medical co-morbidities may delay surgery, orthopaedic surgeon, geriatrician, and anesthesiologists should discuss and agree on a management plan.

5. Management of Specific Preoperative Medical Problems

a. Ischaemic Heart Disease

- The ACC/AHA 2007 guidelines offer a consensus approach to perioperative cardiovascular evaluation and care of patients undergoing noncardiac surgery [8]. Orthopaedic surgery for fragility fractures are intermediate-risk procedures, with risks of perioperative cardiac events about 1-5%.
- The risks of perioperative cardiac events are related to the following clinical risk factors:
 - history of ischemic heart disease,
 - history of compensated or prior heart failure,
 - history of cerebrovascular disease,
 - diabetes mellitus, and
 - renal insufficiency (preoperative serum creatinine level > 180 $\mu\text{mol/L}$ or 2 mg/dL)
- The presence of one or more of these conditions mandates intensive management and surgery should be delayed. Acute cardiac conditions include:
 - unstable coronary syndromes: unstable or severe angina, acute (< 1 wk) or recent MI (> 7 days, < 30 days),
 - decompensated heart failure,
 - significant arrhythmias (e.g. symptomatic bradycardia, high grade AV block, AF with ventricular rate > 100 /min), and
 - severe valvular disease (e.g. severe AS, symptomatic MI)
- Patients with functional capacity greater than or equal to 4 METs (e.g. can climb a flight of stairs) without cardiac symptoms can proceed to planned surgery.
- Patients with poor (less than 4 METs) or unknown functional capacity, and 3 or more clinical risk factors can proceed with planned surgery with heart rate and blood pressure control. In this group of patients, preoperative noninvasive testing (e.g. stressed echocardiography) is usually not indicated as preoperative coronary revascularization (e.g. CABG or percutaneous coronary intervention) is usually inappropriate.

Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

b. Non-ischemic cardiac disease (congestive heart failure, valvular disease, arrhythmia)

- Cardiology consultation is needed in the following situations [9]. If required, echocardiography should be appropriately prioritized.
 - more than one year since last echocardiogram in patients with valvular disease,
 - undiagnosed significant murmur (innocent murmur: asymptomatic, grade I/II systolic murmur at left sternal border, no other abnormal sounds or murmurs, and no evidence of ventricular hypertrophy or dilatation)
 - congestive heart failure, or
 - significant arrhythmia (including atrial fibrillation).

c. Diabetes mellitus

- Blood sugar control should be started at admission and continued through surgery and the post-operatively. Insulin is preferred method of inpatient glycemic control, and this can be given subcutaneously or by intravenous infusion. The blood sugar level should be maintained 6-10 mmol/L if possible.

d. Delirium prevention and management

- Elderly patients admitted to hospital following acute fragility fractures are prone to develop cognitive dysfunction, mental confusion, and even delirium. Geriatric consultation is recommended.
- All patients should have cognitive assessment before surgery and anaesthesia. Patients with cognitive impairment have higher risks of developing delirium, and should be managed with additional care.
- Many drugs can impair cognitive function, particularly in the elderly. The more commonly incriminated drugs include psychotropic drugs such as sedatives, anti-depressants, and antipsychotics, anticholinergic drugs such as sedating antihistamines (e.g. diphenhydramine), and antispasmodics (e.g. hyoscine), centrally acting antihypertensives (e.g. methyl dopa).
- Patients should also be monitored closely post-operatively for evidence of delirium and factors associated with delirium, including electrolyte disturbance, pain, severe anemia, and infection. This includes frequent brief cognitive assessment post-operatively, and use of confusion assessment method to detect early delirium [10].
- Management of acute delirium in the elderly patients with fragility fractures include:
 - Aggressively investigate the causes, including infection, electrolyte disturbance, inadequate pain treatment, medication problems, severe anemia, hypoxia and its causes.
 - Small doses of haloperidol (1-2 mg daily preferred; never more than 4 mg daily) or lorazepam (0.5-4 mg daily) are preferred treatment for acute agitation.
 - If patient is acutely agitated may initially give 1 mg of either haloperidol or lorazepam IM.

Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

Perioperative Care

- After initial evaluation and stabilization, patients with fragility fractures requiring orthopaedic surgery should be optimized expeditiously within 24 – 48 hours of presentation. Before booking for surgery, the orthopaedic team should follow a review checklist to ensure investigations and preparations are completed. A dedicated trauma operating room will minimize delay and after-hours surgery [11].
- Duty anaesthesiologist will complete anaesthetic assessment and consent evening before surgery. The anaesthesia and post-operative pain management plan should be discussed with the patient and relatives to enhance compliance. Blood type and screen results should be available. In general, cross-matched blood is not needed in the operating room unless preoperative Hb < 10 g/dL.

Intraoperative Anaesthetic Management

1. Anaesthesia Techniques

- Orthopaedic surgery for fragility fractures requires surgical anaesthesia of the affected limb, with adequate muscle relaxation to facilitate fracture reduction.
- Current evidence indicates that regional anaesthesia techniques provide superior analgesia and better postoperative mental status outcomes in elderly patients with fragility fractures.
- Spinal anaesthesia is the technique of choice in patients with hip fracture. Compared with general anaesthesia, spinal anaesthesia provides more favourable outcomes in 1 month mortality, surgical blood loss, and incidence of deep vein thrombosis and postoperative mental confusion [12].
- Side-effects of spinal anaesthesia include shivering, hypotension, bradycardia, impaired tidal breathing and cough. The severity of these are related to the height of the spinal anaesthesia. In the elderly patient with heart disease, invasive haemodynamic monitoring will facilitate cardiovascular support with vasopressors and intravenous fluid.
- Contra-indications to spinal anaesthesia include:
 - Absolute: raised intracranial pressure, coagulopathy, puncture site infection, and fixed cardiac output state (e.g. severe mitral or aortic stenosis)
 - Relative: systemic sepsis, hypovolaemia, neurologic diseases, and uncooperative patient
- General anaesthesia offers the advantages of control of cardiovascular parameters, and duration and depth of anaesthesia, and also complete control of patient's airway and breathing. It is preferred when there are contraindications to regional anaesthesia such as impaired coagulation and patient refusal.

2. Peripheral and Central Neural Blockade for Intra- and Postoperative Analgesia

- Peripheral neural blockade includes the use of three-in-one (femoral, obturator, and lateral cutaneous nerve of thigh) nerve block and fascia iliaca compartment block for fractured femurs, and brachial plexus block for upper limb fractures. Neural blockade may be used in conjunction with general or regional anaesthesia to decrease intraoperative anaesthetic requirements. The techniques will also provide superior analgesia than opioid alone, and reduction in opioid requirements to decrease opioid side-effects [13].

Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

- The use of catheter techniques and continuous local anaesthetics infusion can extend analgesia to several days postoperatively. Continuous fascia iliaca compartment block and brachial plexus block should be considered for high-risk patients with proximal long bone fractures of the upper and lower limbs respectively [14].
- The use of epidural for postoperative analgesia after hip fracture has been compared with parenteral opioids [15]. It provided superior pain control during dynamic exercises. However, unlike patients after elective joint replacement surgery, superior analgesia with epidural did not translate into enhanced rehabilitation. It suggests that postoperative pain is not a limiting factor on rehabilitation in older patients after surgery for hip fractures. The side-effects of orthostatic hypotension, urinary retention, pruritus, nausea and vomiting will also limit the use of epidural analgesia in patients with hip fractures.

3. Other Intraoperative Management

- Blood loss is usually not excessive in orthopaedic surgery for fragility fractures. However, pre-existing anaemia is common. In view of borderline cardio-respiratory reserve in older patients, blood transfusion to maintain Hb above 10 g/dL is indicated.
- Significant haemodynamic changes are possible in older patients with cardiovascular diseases undergoing general or spinal anaesthesia. Invasive haemodynamic monitoring, such as central venous and intra-arterial catheters, shall be considered to optimize intravascular fluid volume and cardio-vascular management.
- To reduce perioperative hypothermia, the operating room should be warmed to 22°C, and the patient should also be protected with additional warming devices, including heated water mattress, and convective air warmer.
- To minimize pressure injuries, the patient should be protected with pressure reducing mattress on the operating table, and additional padding to vulnerable areas such as elbows and heels.

Postoperative Care

- In general, preoperative care discussed above should be continued in the postoperative period, including adequate analgesia with frequent monitoring of pain scores and cognitive function, prophylaxis against venous thrombo-embolism, pressure ulcer prevention, fluid balance, blood transfusion and blood sugar control.
- In the initial 48 hr postoperatively, pulse oximetry monitoring and oxygen 3 L/min via nasal cannula to maintain SpO₂ > 95% will be indicated.
- The patients should be mobilized early in post-operative period, and have active physiotherapy and occupational therapy as indicated. Dietary consult should be considered if there is question of marginal or malnutrition.
- The urinary catheter should be discontinued as soon as practical, usually on day 2 post-operatively. Patients with cardio-respiratory instability and underlying urologic problems may need the catheter for longer.

Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

Conclusions

- Fragility fracture is a leading cause for emergency hospitalization in elderly patients, and surgery for fragility fracture contributes a significant workload in the operating room. Prompt, effective, and multidisciplinary management can improve patient outcomes and at the same time reduce costs. Delivery of high-quality care is an achievable goal that requires support and co-ordination of professionals from several clinical departments. Evidence-based practices and care pathway have been established to facilitate and standardize patient management [16]. Anaesthesia care contributes to returning patients with fragility fractures to their pre-morbid status.

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Management of Fragility Fractures at the Acute Phase

Chapter 3 Anesthetic management for geriatric patients with fragility fractures

Table 1: Behavioural Pain Assessment Scale: for patients unable to provide a self report of pain.

Observations:	Clinical Features:			Score
Face	0 Face muscles relaxed	1 Facial muscle tension, frown, grimace	2 Frequent to constant frown, clenched jaw	Face Score:
Restlessness	0 Quiet, relaxed appearance, normal movement	1 Occasional restless movement, shifting position	2 Frequent restless movement may include extremities or head	Restlessness Score:
Muscle Tone	0 Normal muscle tone, relaxed	1 Increased tone, flexion of fingers and toes	2 Rigid tone	Muscle Tone Score:
Vocalization	0 No abnormal sounds	1 Occasional moans, cries, whimpers or grunts	2 Frequent or continuous moans, cries, whimpers or grunts	Vocalization Score:
Consolability	0 Content, relaxed	1 Reassured by touch or talk. Distractible	2 Difficult to comfort by touch or talk	Consolability Score:
Behavioural Pain Assessment Scale Total (0 to 10)				/10

Table 2: Management of Co-existing Medical Problems

Surgery can proceed with optimization in progress:

- Anaemia: Hb < 10
- Hypovolaemia
- Uncontrolled hypertension
- Unstable diabetes mellitus

Surgery needs to be postponed until full optimization possible:

- Severe electrolyte imbalance or acute renal failure
- Acute coronary syndrome
- Congestive cardiac failure
- Rapid AF or other correctable arrhythmia
- Severe chest infection / exacerbation of COAD

(Adapted from Parker MJ. New development in hip fracture treatment. Trauma 2003; 5:43-49.)

Chapter 4

Fragility fracture:- the geriatric perspectives

Dr. David DAI, Dr. Wency HO, Dr. Kin-Wah LIU, Ms. Eliza LAU

(I) Frailty and fractures in elders

Hip fracture in elders is a geriatric syndrome characterized by old age, vulnerability, osteopenia and sarcopenia, falls, multiple comorbidities, peri-operative instability, hospitalization associated functional decline, psychosocial issues, the need for post-discharge support and clinical as well as psychosocial issues occurring within 1 year after the discharge.

Elders are prone to decompensation of declining reserves (ref 1), and hip fracture and associated hospitalization is a stressor particularly on the cardiorespiratory, central nervous and haemopoietic systems.

(II) Conjoint Orthogeriatric Programmes

Both the British Geriatric Society and the British Orthopedic Association regarded conjoint management of elder hip fracture patients to be of great benefit from admission to discharge and is to be advocated as the way forward. Expected benefits of acute orthogeriatric care resulted in superior medical care, optimal scheduling of fracture surgery, better communication with patients and relatives and within the multi-disciplinary team, research opportunities, reduction in adverse events, earlier initiation of rehabilitation and more effective use of discharge resources.(ref 2)

(III) The co-management programme at Prince of Wales Hospital

Conjoint programmes appear under different names, such as evidenced based clinical pathway, (ref 3) comprehensive geriatric intervention, (ref 4) hospitalist model and comanagement. (ref 5)

At Prince of Wales, the co-management programme takes the form of regular orthogeriatric rounds 3 times a week to see all hip fracture patients aged > 65 years without the need for referrals. A geriatric liaison nurse conducts an independent evaluation of the patient to collect background information on the clinical, premorbid and psychosocial status which are entered into a form (appendices 1a, b) before the round. The orthogeriatric round engages team members from both specialties and a designated houseman follows through the clinical decisions and instructions. (appendix 2) The geriatric assessment begins with greeting the patient which will yield clinical information on communicative deficits, mental status and localizing neurological signs. This is followed by a neurological examination to look for signs of mild stroke and parkinsonism which may account for the fall and fracture. The cognitive state is screened for dementia and delirium. The cardiovascular system is examined for congestive heart failure and atrial fibrillation and

Management of Fragility Fractures at the Acute Phase

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the presence of murmurs; the presence of aortic or mitral stenosis which may require prompt cardiology evaluation before anaesthetic assessment. The abdomen is palpated to look for constipation and bladder distension; the latter will be a common cause for sepsis and delirium in hip fracture patients related to pain, analgesics, multiple medications, immobility and constipation. All patients are routinely screened for urinary retention with the portable bladder scan and temporary Foley's insertion will be considered if the post void residual volume exceeds 150cc. The Chest X ray, ECG, blood routine and vital signs are reviewed to determine the fitness for operation. Polypharmacy and drug interactions, in particular warfarin and paracetamol in elevating the INR, dologestic and constipation, calcium channel blockers and incomplete bladder emptying are optimized. The Scottish Royal College, SIGN, advised surgery within 24 hours if medical condition permits but cautioned medically unfit patients should not be rushed to theatre before medical optimization.

(IV) Medical optimization in the peri-operative period

In a survey of 100 hip fracture patients in our programme from Oct to Dec 2006, 70% of patients were female with a mean age of 84 yr old (SD +/- 6 yrs); the male patients were younger with mean a age of 79 yr old (SD +/- 6.7 yrs). 89 patients underwent operation. The significant premorbid conditions included cardiovascular (70%), respiratory (11.2%), neurological (41.6%), and metabolic (46%) problems. The prevalence and profile of medical conditions requiring stabilization in the post-operative period matched with the premorbid conditions. Hence, pre-operative comorbidities can predict post-operative instability and close attention in this period is important.

Some medical conditions of concern deserve attention:

(A) Fever:

Common causes in the post-operative period include urinary infection, pneumonia, and flare up of gout. Unexplained fever should prompt a clinician to rule out thromboembolism. In our patients, prophylactic anticoagulation is not given, but this policy should be re-evaluated with further studies.

(B) Desaturation and shortness of breath:

Common causes include fluid overload, AECOPD, pneumonia, and general sepsis eg urosepsis. Edema should be diligently looked for in the flanks. (appendix 3) The authors would highlight the diagnosis of pulmonary embolism to warrant a high index of suspicion in hip fracture patients with sudden desaturation requiring high flow oxygen eg above 3-4 liters per minute, unexplained fever or tachycardia. An accurate and fast diagnosis relies on prompt investigation with spiral CT of the thorax. In highly suspected cases, low molecular weight heparin (LMWH) should be initiated before radiological confirmation. In a study on 747 patients from March to July 2007, 11 patients were confirmed with thromboembolism, giving an incidence of 1.5%. Appendix 4a and 4b show the ECG and spiral CT thorax of a male patient with COPD who presented with desaturation of SaO₂ of only 80% despite an oxygen supply of 10L/min. The ECG showed sinus tachycardia, and the CT thorax confirmed embolism of the right pulmonary artery. The pulmonary embolism later resolved with LMWH and warfarinisation.

Management of Fragility Fractures at the Acute Phase

Chapter 4 Fragility fracture:- the geriatric perspectives

(C) Haemoglobin drop:

This is a common finding in the post-operative period especially after the Gamma nailing procedure. Top up transfusion to haemoglobin of 10 gm/dl is essential for optimal cardiovascular functioning and rehabilitative exercise.

(D) Delirium:

A meta-analysis showed the incidence of delirium after orthopedic surgery was 35%. . The risk of delirium in hip fractures is higher than other elective surgeries. Most studies underrecognized hypoactive delirium. Post-operative delirium has multiple etiologies, some exerting influence in the post-operative period. (ref 6) Delirium occurring in the pre-operative period usually relates to pre-existing dementia, psychoactive medications, constipation, pain and neurovascular aetiologies. Delirium occurring after surgery may have different causes, including peri-operative drop in blood pressure, anaemia and infection and generally carry a better rehabilitative potential than the former group. (ref 7) Delirium in hip fracture patients is associated with increased morbidity and mortality at 1 year, increased length of stay and cost of care and functional decline. (ref 8, 9) Our group had found an incidence of delirium of 39.4%, of which 53% of patients had known diagnosis of dementia. The diagnosis of delirium rely on clinical recognition. In the post-operative period, the question "Have you undergone operation yet?" gave a sensitivity of 75% and specificity of 100% in the identification of delirium. Clinical tools useful in the documentation and monitoring of delirium are the MMSE, Confusion Assessment Method (CAM) (appendix 5) and the Memorial Delirium Assessment Scale (MDAS). (appendix 6) The nurse plays a pivotal role in the management of delirium. (ref 10) Proactive geriatric consultation, as we are doing, has also been reported to be beneficial for treating delirium through attention to saturation, fluid balance, pain reduction, avoidance of unnecessary medications, bladder and bowel care, adequate nutrition, early mobilization, optimization of post-operative complications and appropriate environmental stimulation. (ref 11) Patients who have recovered from delirium should be observed in the post-operative period for the emergence of dementia which may be as high as 50% in 2 years.

(V) The post operative 1 year period:

Relocation of the patient often occurs in this period. A study showed that of the patients who returned home after the fracture and intervention, 20% required 1 re-hospitalisation, 5% >2 rehospitalisations, and 26% became institutionalized. (ref 12) Hence, a closer follow up in this period may circumvent some of these occurrences.

(VI) Conservative treatment:

Hip fracture patients can be categorized into 3 paths. The person with good premorbid and who is younger often undergoes early surgery and a fast track recovery course. The person with unstable peri-operative medical state will require a more lengthy rehabilitative course. In our patients, 4.7% were managed conservatively, usually as a result of delayed presentation, cardiac and other medical causes, and the decision of family members for conservative management. In this group of patients, aggressive pain relief and comfort care is important.

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(VII) Outcome of geriatric intervention in our orthogeriatric programme

Since 2005, a cohort study was performed before and after the implementation of our program. Patients received comprehensive geriatric intervention during 2005-06 was recruited as the intervention group. Patients received conventional care before the program during 2004-05 was recruited as control group. The baseline characteristics were comparable between the two groups. Mean age was 82.4 yrs old (SD +/- 7.8). Since osteoporosis was more common in women, the ratio between women and men was 3:1. One quarter of them were living in residential homes. There was a significant reduction of in-hospital mortality from 4.0% to 1.1% ($p=0.03$) with an absolute risk reduction of 75% in the intervention group as compared with control group. Most of them died of hospital acquired pneumonia and acute coronary event. After one year, there was also a significant reduction in 1 year mortality from 19.3% to 10.6% ($p=0.004$) with an absolute risk reduction of 45.1%. On the other hand, there was a reduction in the waiting time from admission to surgery by one day in the intervention group.

Similarly, there was a reduction in length of acute hospital stay from 9.7+/-5.7 days to 8.3+/-4.4 days ($p=0.001$) with an overall reduction of acute orthopedic bed utilization by 10%. Since most of the medical complications were managed in the orthopedic ward without being transferred to medical unit for management, there was a reduction in acute and convalescence medical bed utilization by 62% and 100% respectively. Most common peri-operative medical complications include delirium, congestive heart failure and urinary retention associated with urinary tract infection. In conclusion, comprehensive geriatric intervention in elderly patients suffering from acute hip fracture is effective in improving patient's outcome, reducing waiting time to surgery, facilitating early transfer to rehabilitative setting and reducing hospital costs.

(VIII) Conclusion

- 1) Hip fracture is a geriatric syndrome managed effectively by a orthogeriatric co-management approach.
- 2) Geriatric intervention consists of a nurse-led assessment and close proactive medical attention in the peri-operative and post-operative period.
- 3) Commonly seen conditions include cardio-respiratory conditions, delirium, metabolic derangement, infection and urinary retention.
- 4) Geriatric intervention facilitates early surgical intervention and reduces short-term and long-term mortality.

Management of Fragility Fractures at the Acute Phase

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Appendix 1A

PWH Randomized Interventional Trial of Geriatric- Orthopedic Liaison on Acute Hip Fracture Elderly Data Entry Sheet 2007

Gum label (with address/ telephone no.)

1. Name 2. HK ID No. 3. Sex 4. Age

Ward _____ Bed no. _____

Date of assessment _____

5. 1. Interventional arm _____ 2. Conventional arm _____

6. Orthopedic Diagnosis 1. NOF (R)/(L)
2. Trochanteric (R)/(L)
3. Others (R)/(L)
7. Type of operation 1. DHS
2. Intra-medullary nail (Gamma)
3. AO screw
4. Hip screw
5. Hemiarthroplasty (AMA)
6. Open reduction of fracture
7. Girdlestone operation
8. Conservative

8. History of Hip fracture 1. Yes 2. No
9. Date of operation _____
10. Date of transfer/ discharge _____
11. Days from admission to day of operation _____
12. Days from operation to transfer/ discharge _____
13. Type of anaesthesia 1. GA 2. SA

14. Past Medical History

1. ACS/ MI
2. CHF
3. HT
4. PVD
5. DM
6. DM with complication
7. Respiratory disease
8. Liver disease
9. Peptic ulcer
10. Renal disease
11. Stroke
12. Dementia
13. Parkinson's disease
14. Connective tissue disease
15. Joint problem of LLS
16. Joint problem of LLS
17. Carcinoma site _____
18. Others _____

Premorbid Social and Functional Status

15. Marital status 1. Married 2. Widowed 3. Single
16. Residential status 1. Lives alone
2. Lives with spouse/ caregiver
3. Residential care
17. MFAC _____
18. Use of aids 1. Frame/ Rolater 2. Quadripod 3. Stick 4. none
19. Modified Barthel index _____/ 30
20. Norton Score _____/ 20

21. Drug History (before admission)

1. Total no of regular medications _____
2. No of CVS medications _____
3. No of analgesics _____
4. No of anti-psychotic medications _____
5. No of sedating medications _____
6. Anti-platelet agent _____

Cognitive status on admission

22. MMSE _____/ 30
23. MDAS _____/ 30
24. CAM 1. Yes 2. No

Management of Fragility Fractures at the Acute Phase

Chapter 4 Fragility fracture:- the geriatric perspectives

Appendix 1B

25. Pre op-medical intervention

- | | | | | | |
|--------------------|--------------------|-----------------------------|------------------|----------------|------------------|
| 1. CVS | 1. BP control | 2. CCF | 3. Arrhythmia | 4. ACS | 5. Heart murmurs |
| 2. Respiratory | 1. Chest infection | 2. COAD | | | |
| 3. Neurological | 1. Ischemic stroke | 2. Intra-cranial hemorrhage | | | |
| 4. Endocrine | 1. DM control | 2. Thyroid | | | |
| 5. Cognition | 1. Delirium | | | | |
| 6. Electrolytes | 1. Na | 2. K | 3. Ca | 4. Dehydration | |
| 7. Renal | 1. UTI | 2. Retention of urine | 3. Renal failure | | |
| 7. GI | 1. GIB | | | | |
| 8. Hematological | 1. DVT | 2. PE | | | |
| 9. Drug adjustment | | | | | |
| 10. Sepsis | | | | | |
| 11. Others | | | | | |

26. Risk Factors Identification

1. Gait, postural and neurological problems
2. Musculoskeletal problems
3. Medical condition
4. Neuropsychiatric condition
5. Impaired senses
6. Medications
7. Improper walking device
8. Environmental hazards
9. Trip
10. Others



Post-operative

27. Significant Medical Complication

- | | |
|------------------------|-------------------|
| 1. Delirium | 6. MI |
| 2. Retention of urine | 7. Arrhythmias |
| 3. Fluid overload/ CHF | 8. DVT/ PE |
| 4. Pneumonia | 9. Pressure ulcer |
| 6. Stroke | 10. Renal failure |
| 5. Sepsis | 11. Others _____ |

Delirium screening (post op day 1)

28. "Did you undergo surgery?" 1. Correct 2. Incorrect
29. "When?" 1. Correct 2. Incorrect
30. MDAS _____ /30
31. CAM 1. Yes 2. No

Upon discharge from PWH

32. Total length of stay at PWH _____
33. Total no of non-geriatric medical consultations (routine+ urgent) _____
34. Deceased 1. Yes 2. No
35. Functional status upon discharge
1. MFAC _____
 2. Use of aids 1. Frame/ Rollator 2. Quadripod 3. Stick 4. none
 3. Modified Barthel index _____ /20
36. Next care setting 1. TPH 2. Home/ usual living place 3. Medical unit (take over)
37. Geriatric ambulatory support 1. CNS (upon direct discharge) 2. CGAT 3. GDH 4. Arrange medical /geriatric clinic follow up

Management of Fragility Fractures at the Acute Phase

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Appendix 2



Appendix 3



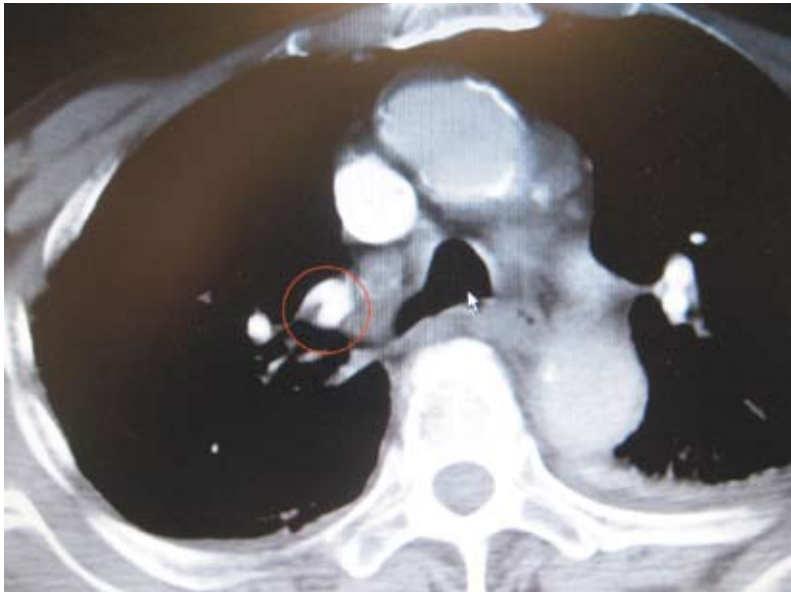
Management of Fragility Fractures at the Acute Phase

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Appendix 4A



Appendix 4B



Management of Fragility Fractures at the Acute Phase

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Appendix 5

HOSPITAL AUTHORITY Prince of Wales Hospital Occupational Therapy Department	Gum Label
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Confusion Assessment Method Instrument (CAM)		Yes	No	Uncertain	NA
Acute Onset					
1	Is there evidence of an acute change in mental status from the patient's baseline?				
Inattention					
2A	Did the patient have difficulty focusing attention (e.g. being easily distractible or having difficulty keeping track of what was being said)? ___ Not present at any time during interview ___ Present at some time during interview, but in mild form ___ Uncertain ___ Present at some time during interview, in marked form				
2B	(If present or abnormal) Did this behavior fluctuate during the interview (i.e. tend to come and go or increase and decrease in severity)?				
2C	(If present or abnormal) Please describe this behavior.				
Disorganized Thinking					
3	Was the patient's thinking disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject?				
Altered Level of Consciousness					
4	Overall, how would you rate this patient's level of consciousness? ___ Alert (normal) ___ Vigilant (hyperalert, overly sensitive to environmental stimuli, startled very easily) ___ Lethargic (drowsy, easily aroused) ___ Stupor (difficult to arouse) ___ Coma (unarousable) ___ Uncertain				
Disorientation					
5	Was the patient disoriented at any time during the interview, such as thinking that he or she was somewhere other than the hospital, using the wrong bed, or misjudging the time of day?				
Memory Impairment					
6	Did the patient demonstrate any memory problems during the interview, such as inability to remember events in the hospital or difficulty remembering instructions?				
Perceptual Disturbances					
7	Did the patient have any evidence of perceptual disturbances, such as hallucination, illusions, or misinterpretations (e.g. thinking something was moving when it was not)?				
Psychomotor Agitation					
8A	At any time during the interview, did the patient have an unusually increased level of motor activity, such as restlessness, picking up bedclothes, tapping fingers, or making frequent sudden changes in position?				
8B	At any time during the interview, did the patient have an unusually increased level of motor activity, such as sluggishness, staring into space, staying in one position for a long time, or moving very slowly?				
Altered Sleep-Wake Cycle					
9	Did the patient have evidence of disturbance of the sleep-wake cycle, such as excessive daytime sleepiness with insomnia at night?				

Scoring

To have a positive CAM result, the patient must display:

Presence of acute onset and fluctuating discourse (1) AND inattention (2) AND EITHER disorganized thinking (3) OR altered level of consciousness (4)

Delirium: Y / N

Occupational Therapist _____

Date _____

Management of Fragility Fractures at the Acute Phase

Chapter 4 Fragility fracture:- the geriatric perspectives

Appendix 6

HOSPITAL AUTHORITY Prince of Wales Hospital Occupational Therapy Department	Gum Label
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Memorial Delirium Assessment Scale (MDAS)		None (0)	Mild (1)	Moderate (2)	Severe (3)
1	Reduced Level of Consciousness (Awareness)				
2	Disorientation				
3	Short-Term Memory Impairment				
4	Impaired Digit Span				
5	Reduced Ability to Maintain & Shift Attention				
6	Disorganized Thinking				
7	Perceptual Disturbance				
8	Delusions				
9	Decreased or Increased Psychomotor Activity (a) hypoactive (b) hyperactive (c) both				
10	Sleep-Wake Cycle Disturbance (Disorder of Arousal)				
Total				/30	

Remarks:

Occupational Therapist: _____

Date: _____

Management of Fragility Fractures at the Acute Phase

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Management of Fragility Fractures at the Acute Phase

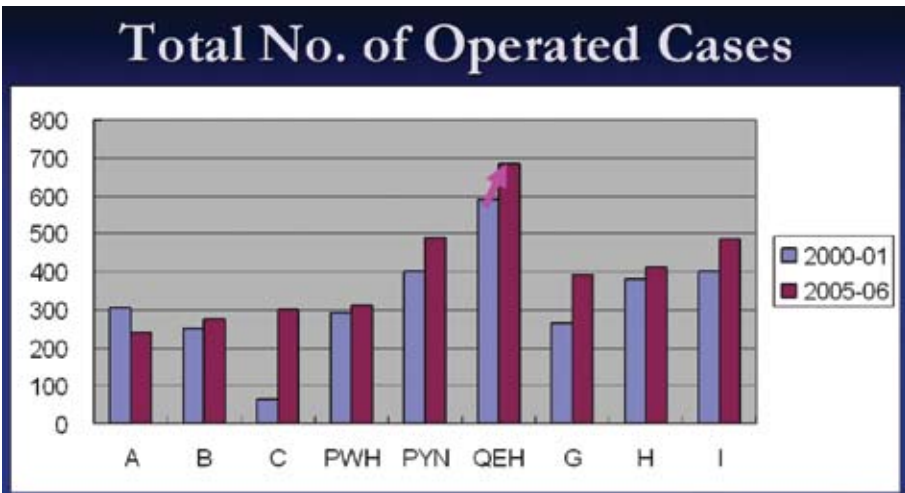
Chapter 5 Effective arrangement protocol for management of geriatric hip fractures

Chapter 5

Effective arrangement protocol for management of geriatric hip fractures

Dr. Wan-Yiu SHEN

The incidence of geriatric hip fractures (patients ≥ 65 years of age with a hip fracture) is rising due to our aging population, and represents a major portion of our work load. It reached almost 700 cases in the year 2005/06.



The **SIGN** (Scottish Intercollegiate Guidelines Network, <http://www.sign.ac.uk>) recommended that patients should be operated on as soon as possible and a management protocol incorporating this important principle was promulgated in the United Kingdom in 2002. SIGN quoted pulmonary infection as an example and emphasized that “it is not considered appropriate to delay surgery because of infective pulmonary conditions, as real improvement is unlikely in the presence of continued immobility and pain”. In other words, “one should not chase unrealistic medical goals with resulting delay” because “delays in operations have been shown to be associated with increased mortality”. In addition, “surgical treatment conducted as a night-time emergency increases mortality”. “When it is due to inadequate facilities or poor organization rather than any medical reason, the underlying problems should be addressed, and solutions should be identified by the clinicians and hospital management”. According to SIGN, “the hospital management should be responsible to make the necessary allowance and arrangements to facilitate these operations”.

Management of Fragility Fractures at the Acute Phase

Chapter 5 Effective arrangement protocol for management of geriatric hip fractures

The **BOA** (British Orthopaedic Association, <http://www.boa.ac.uk>) published a guideline on the care of patients with fragility fracture in 2007. According to BOA, “fractures associated with osteoporosis should therefore not be delegated to the inexperienced junior surgeon” and that “these fractures require timely and expert fixation with the most appropriate implant; the frailty of the patients dictates that surgery should be neither prolonged nor unduly traumatic”. In order to ensure good results, it stated eight key elements and six standards for medical care for patients with hip fractures.

The key elements of good care include:

1. prompt admission to orthopaedic care
2. rapid comprehensive assessment – medical, surgical and anaesthetic
3. minimal delay to surgery
4. accurate and well-performed surgery
5. prompt mobilization
6. early multidisciplinary rehabilitation
7. early supported discharge and ongoing community rehabilitation
8. secondary prevention, combining bone protection and falls assessment

The six standards for hip fracture care are:

1. All patients should be admitted to the acute ward within 4 hours of presentation.
2. All patients who are medically fit should have surgery within 48 hours and during normal working hours.
3. The risk of developing a pressure ulcer should be kept to a minimum.
4. acute ortho-geriatric medical support from the time of admission should be readily available.
5. Anti-resorptive therapy to prevent future osteoporotic fractures should be considered for every case.
6. All patient should be offered multidisciplinary assessment and intervention to prevent future falls.

Similar guidelines are also promulgated in the European Union. Patients are to be operated on within two days of admission, unless significant contraindication or co-morbidities are expected to be better stabilised within a few more days.

Common sense considerations have it that we should operate early to minimise suffering. Most patients are fittest on admission, and progressive dehydration, mal-nutrition, recumbency pneumonia, bed sores etc. will ensue upon prolonged bed rest.

At Queen Elizabeth Hospital, we underwent Service Re-engineering in Oct 2002. The Orthopaedic Trauma Team was established, and 9 elective sessions per week were set aside as Trauma Lists for orthopaedic trauma cases. There was no additional resources required both in forms of theatre usage and manpower deployment.

Management of Fragility Fractures at the Acute Phase

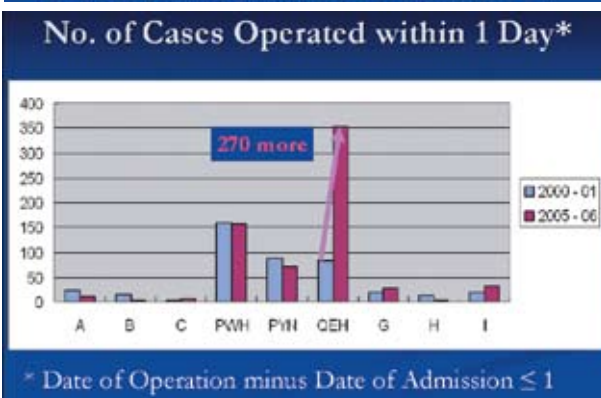
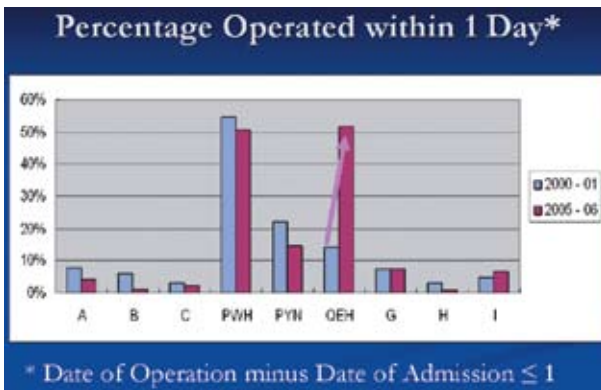
Chapter 5 Effective arrangement protocol for management of geriatric hip fractures

For the Trauma Lists, priority is given to all geriatric hip fractures, followed by cold trauma cases – implant removal and late complications. Other trauma and non-trauma cases have the lowest priority as they could be entertained in the emergency lists.

We made a review recently, comparing the situation from July 2000 to June 2001 (before the re-engineering) with that from July 2005 to June 2006 (after the re-engineering).

As indicated in the chart, percentage of patients operated within one day of admission rose from 15% to 50%. At least 35% of patients suffered one day less when compared with the situation before the re-organisation. Similarly, the percentage operated on within 2 days also improved. At the same time, the mortality rate and re-operation rate both dropped. The data across the 9 different HA hospitals are also compared.

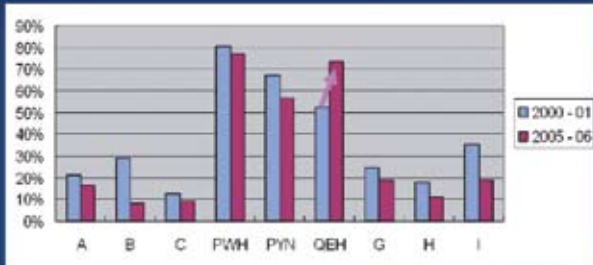
A high percentage operated within one day and two days are much better performance indicators than say, “percentage operated within 4 days” and “average waiting time”. “Average waiting time” could be severely prolonged if there are a few cases with acute myocardial syndrome requiring a delay of 6 or more weeks.



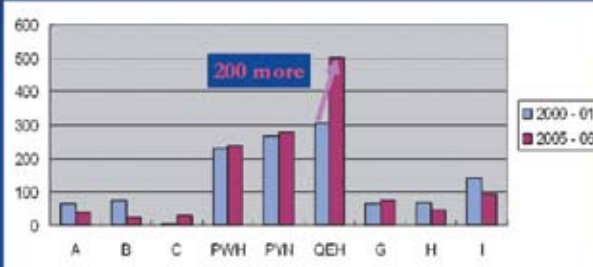
Management of Fragility Fractures at the Acute Phase

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Percentage Operated within 2 Days



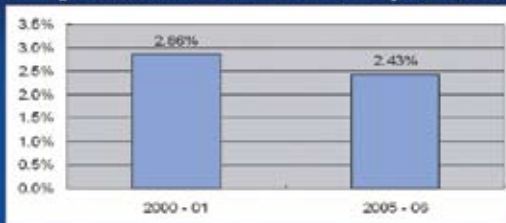
No. of Cases Operated within 2 Days



Management of Fragility Fractures at the Acute Phase

Chapter 5 Effective arrangement protocol for management of geriatric hip fractures

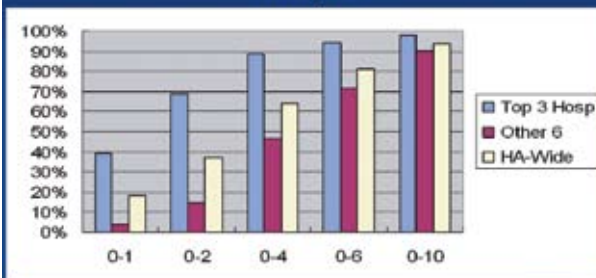
Re-operations* within 90 days, QEH



*Due to Direct Complications of the Index Operation:

- Surgical Wound Infection
- Migration / Cut-out of Implants
- Dislocation of Protheses

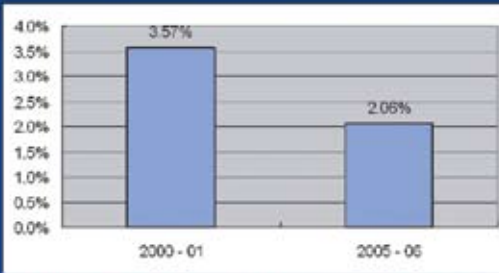
Percentage operated figures – 2005/06



Management of Fragility Fractures at the Acute Phase

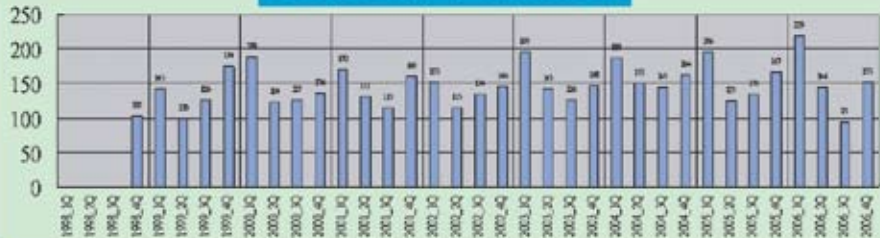
Chapter 5 Effective arrangement protocol for management of geriatric hip fractures

Same-Episode* Mortality, QEH

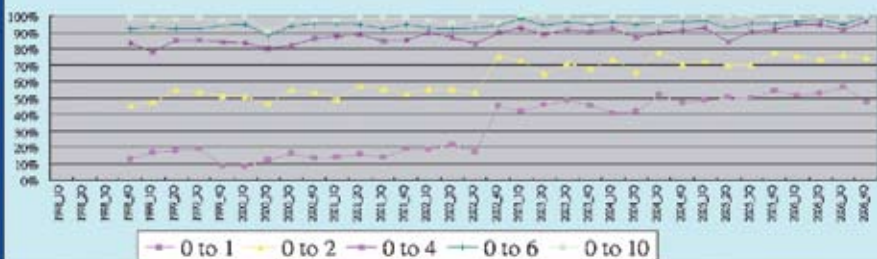


*Death before Discharge / Transfer

Seasonal Variation



Lead Time to Operation



Management of Fragility Fractures at the Acute Phase

Chapter 5 Effective arrangement protocol for management of geriatric hip fractures

Although there was a seasonal variation of workload, the waiting time had not varied much. The seasonal variation was well buffered by logistic arrangements.

The improvements included:-

- ↓ waiting time
- ↓ operative time (>90% of operations performed or supervised by designated specialists)
- ↓ Mortality Rate
- ↓ Re-operations due to direct surgical complications

We attributed these improvements to several “Human” factors:-

- Very dedicated trauma team members
- Expert team – shortened operative time and reduced complications
- Improved rapport with Anaesthetists – less cancellations, better pre-op preparation
- Uniform operative “habits” – much easier for nursing staff to support
- Very supportive nursing team – carried through lunch every day
- Improved collaboration with Cardiac Team and Pacing Team – much shortened waiting time for pre-op echocardiograms and pacing adjustments

And some logistic factors:-

- New cases are booked to electronic “queue” lists by on-call doctors so that Trauma Team members can start planning for the day early, even from home via remote access.
- Team co-ordinator screens through all “queued” cases and compile Trauma List every morning, starting 7:30 am , ready by 8:30 am !
- Trauma Lists start operating at 9:30 (end around 5:30) – ample time for anaesthetists to assess the patients before start of the list
- Pre-op meeting within Trauma Team every weekday.

The most critical factors were:-

- Dedicated Team
- Protected Trauma Lists
- Collaboration with Anaesthesia and Cardiology
- Closed responsibility loop
- Strive for Excellence

In conclusion,

- Quantum improvement achieved by management re-engineering without additional resources, except that
- Operations carried out or supervised by more senior surgeons
- Resulting in shortened operation duration and reduced intra-operative incidences;
- Leading to improved trust and co-operation with anaesthesiologists

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Chapter 6

A nursing protocol for effective in-patient management at the acute phase

Ms. Jessica CHAN & Ms. Sindy TSE

Our goal:

- to restore patients to their pre-morbid status at the earliest possible time, both physically, mentally and socially.

Commonly Seen Problems in Patient with Fragility Fracture

- Severe pain, bruise and swelling.
- Impaired mobility, muscle weakness and wasting.
- Encounter difficulties in urination and defecation.
- Potential medical problem e.g. impaired cardiac function, inadequate pulmonary ventilation, dehydration, poor nutrition.
- Complications of prolonged bed rest e.g. chest infection, pressure sore, urinary tract infection and deep vein thrombosis...etc.
- Delirium associated with risk factors e.g. infection, electrolyte imbalance, hypoxia and cerebral ischaemia...etc.
- Anxiety and worry caused by hospitalization, psychosocial problem.
- Social and family difficulties in receiving patients back home and back to the community.

Our aims:

Physical aspects:

- to relieve pain and promote comfort.
- to encourage early mobilization after operation.
- to regain early independence.
- to prevent potential complications e.g.: -wound infection
 - chest infection
 - urinary tract infection
 - pressure sore
 - deep vein thrombosis or/and pulmonary embolism

Mental aspects:

- to reduce anxiety and worry.

Social aspects:

- to streamline returning of patients back to their home and community by tackling any family and social difficulties.

Management of Fragility Fractures at the Acute Phase

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The Nursing protocol

An effective way to achieve the above aims is to keep alert of potential complication and adopt anticipatory guidance and prophylactic measures to safeguard any such potential complications from happening. In addition, formulation of the rehabilitation plan is done soon after the patient is admitted to the acute hospital (usually stay for 5-7 days) so that social and family problems are handled in a timely manner. This complicated process involves collaboration among health care professional working in a multi-disciplinary but well-orchestrated manner. Since multiple problems can be encountered with elders suffering from hip fracture, a comprehensive and standardized nursing protocol is imperative in order to make sure good results are predictably achieved for every cases. The nursing protocol is depicted as follows.

The Effective Nursing Protocol:



Hospital Authority
Prince of Wales Hospital
Fragility Fracture Care
Acute Geriatric Hip Fracture Protocol



GENERAL INFORMATION

Patient Details	Patient Label (Full Label) Address & Contact Number _____ Major Career / Contact Person _____
Orthopaedic Admission WARD 5A 5B 5C 5D	Date of Admission: dd / mm / yy Date of Planned Surgery: dd / mm / yy Date of Surgery: dd / mm / yy Date of Transfer or Discharge: dd / mm / yy
Clinical Staff In-charge	Surgeon In-charge: Geriatrician In-charge: Anaesthetist In-charge: Case Nurse /Primary Nurse Physiotherapist: Occupational Therapist: Medical Social Worker:
Primary Health Care Liaison	GOPD Clinic / CNS: Private Family Physician:

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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History of Incident **Date** _____

Diagnosis	<input type="checkbox"/> Left <input type="checkbox"/> Right <input type="checkbox"/> NOF fracture <input type="checkbox"/> TOF fracture <input type="checkbox"/> Pubic rami fracture <input type="checkbox"/> Multiple fractures <input type="checkbox"/> Others: _____
Present Complain & History	Mechanism of Fall _____ Place of Fall _____ Date and Time of Fall _____ Preceding Symptoms _____ Associated Symptoms _____
Systems Review	<input type="checkbox"/> Chest infection / <input type="checkbox"/> UTI / <input type="checkbox"/> Fever _____°C <input type="checkbox"/> Abdominal symptom <input type="checkbox"/> Uterine prolapse/ <input type="checkbox"/> BPH <input type="checkbox"/> Others: _____
Past Medical History	<input type="checkbox"/> DM (H ⁺ stix on admission _____ mmol/L) <input type="checkbox"/> HT (BP _____ mmHg P____/min on admission) <input type="checkbox"/> CVA (Haemiparesis _____side) <input type="checkbox"/> Heart disease (CHF / IHD / ACS / AF / Bradycardia /Heart Block / Pacemaker) <input type="checkbox"/> COAD (<input type="checkbox"/> need Oxygen support _____ L/min) <input type="checkbox"/> Other Lung disease _____ <input type="checkbox"/> Liver disease _____ <input type="checkbox"/> Renal disease _____ <input type="checkbox"/> Anaemia <input type="checkbox"/> History of GIB <input type="checkbox"/> DVT <input type="checkbox"/> PVD <input type="checkbox"/> Thyroid disease <input type="checkbox"/> Parkinson’s disease <input type="checkbox"/> Dementia <input type="checkbox"/> Depression <input type="checkbox"/> Malignancy <input type="checkbox"/> Others: _____

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Current Medications	Recent change of medication <input type="checkbox"/> Yes <input type="checkbox"/> No Anticoagulants <input type="checkbox"/> Yes <input type="checkbox"/> No
Drug & Food Allergies	<input type="checkbox"/> NKDA <input type="checkbox"/> Allergy : <input type="checkbox"/> Drug: _____ <input type="checkbox"/> Food: _____ <input type="checkbox"/> Others: _____
Family History	<input type="checkbox"/> Live with family _____ a=Day & Night, b= Nighttime only <input type="checkbox"/> Lives alone a=Home helper/maid b=Roommate c=Family nearby <input type="checkbox"/> OADR a=Nurse b=PT
Emergency Contact Person & Tel No	<input type="checkbox"/> As above / <input type="checkbox"/> Others: _____
Social History	Pre-morbid ambulatory status: <input type="checkbox"/> Unaided / <input type="checkbox"/> One-side aid / <input type="checkbox"/> Walking Frame <input type="checkbox"/> Chair-bound / <input type="checkbox"/> bed bound/ <input type="checkbox"/> Home bound / <input type="checkbox"/> Outdoor activities ADL: <input type="checkbox"/> Independent / <input type="checkbox"/> Partially dependent / <input type="checkbox"/> Totally dependent Education: <input type="checkbox"/> Illiterate / <input type="checkbox"/> Primary / <input type="checkbox"/> Secondary / <input type="checkbox"/> University or above Language: <input type="checkbox"/> Cantonese / <input type="checkbox"/> Mandarin / <input type="checkbox"/> English / <input type="checkbox"/> Others: _____ Religion: <input type="checkbox"/> Buddhist / <input type="checkbox"/> Christian / <input type="checkbox"/> Catholics / <input type="checkbox"/> Others: _____
Financial Assistance	<input type="checkbox"/> None <input type="checkbox"/> Old age allowance/ <input type="checkbox"/> DA / <input type="checkbox"/> HDA / <input type="checkbox"/> CSSA
Smoking & Drinking History	<input type="checkbox"/> Non-smoker/ <input type="checkbox"/> Smoker (_____ pack/day) <input type="checkbox"/> Non-drinker / <input type="checkbox"/> Drinker / <input type="checkbox"/> Social drinker

Clinical Notes:

Name & Signature

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Pre-operative Nursing Management Date _____

Nursing Assessment / Intervention	Name and Signature				
	N/AN	N	A	P	Remarks
1. Assessment - Vital signs within normal range - Neurovascular status maintained normal - Mental status: no delirium detected					
2. Pain Management - Regular pain assessment and adequate pain medication provided					
3. Positioning - Prop up in bed encouraged - Proper alignment maintained - Apply crepe bandage to affected limb					
4. Pressure sore prevention - Norton score on admission: ____/20 - Pressure areas checked and intact - Assisted turning and use of trapeze - Silicone gel pad, heel protectors in situ - Personal hygiene maintained					
5. Nutrition/hydration - Oral and fluid intake encouraged - I&O balanced					
6. Elimination - Normal voiding monitored - D/S given as necessary and bowel opened					
7. Education and treatment plan - Education on B&C, and ankle pump ex. - Relative informed about the treatment plan - Caring and placement arrangement discussed - Pre-op info leaflet provided for prevention of potential complications: wound infection, DVT, Chest infection, UTI					
8. Referral - Physiotherapist (chest PT/ROM ex) - Occupational therapist for pre-operative delirium assessment (MMSE) - Ortho-geriatric team - Medical social worker - Dietitian					

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Pre-operative Nursing Management (cont'd) Date _____

Nursing Assessment / Interventions	Name and Signature				Remarks
	N/AN	N	A	P	
9. Psychological support - Brief patient care plan introduced - Relatives are encouraged to come during visiting hours - Patient and his/her relative encouraged to ventilate their problem or query					
10. Preparation for OT - CBP, R/LFT, BS, Clotting profile, Vit. B12 - ECG, CXR - XR pelvis or/and hip and appropriate view - Urine culture / urine analysis - Obtain old records and resume usual drugs - Apply crepe bandage to affected limb - Regular and prn analgesics - Monitor I/O - Consent - Relative informed - OT booked and Anaesthetist informed - Ensure X-rays, ECG, blood test results, cross match form and other investigations are available - Keep fast for operation - IVF _____ solution 500 ml Q__H - Or DKI drip (or 1/2: 1/2 sol) for DM patients after fast - IVF prn for non-DM cases - Set 18 Gauge IV access if possible - Antibiotics on induction: Cefazolin 1g, others: _____ - Surgical site is marked - Consider DVT prophylaxis - Abduction pillow for AMA case - Pre-medication administered as prescribed					

Clinical Notes:

Name & Signature

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Post-operative Nursing Management - Day 0 Date _____

Nursing Assessment / Interventions	Name and Signature				Remarks
	N/AN	N	A	P	
1. Assessment - Vital signs within normal range (Hourly BP/P, SaO2 till stable) - Neurovascular status maintained normal - Haemodynamic, liver and renal status within normal range, check CBP and R/LFT - Mental status – no delirium detected					
2. Pain Management - Regular pain assessment & pain Rx					
3. Positioning - Prop up in bed encouraged (< 60o for AMA case) and proper alignment maintained - AMA -abduction pillow in situ - Gamma nail: (reamed→elevated on Braun’s frame, hand reamed→elevated with pillow) - Assisted in turning and use of trapeze					
4. Wound care +/- drain care - Ensure proper dressing, velband and crepe bandage applied - Dressing kept dry and intact for 72 hrs with crepe bandage in-situ - No wound oozing and pressure dressing is not required - Drain in-situ & was patent - Cephazolin 1g q8h x 3 doses or a/c to prescription for prophylactic prevention of wound infection					
5. Pressure sore prevention - Pressure areas checked and intact - Assisted turning and use of trapeze - Silicone gel pad, heel protectors in situ - Personal hygiene maintained					

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Post-operative Nursing Management - Day 0 (cont'd) Date _____

Nursing Assessment / Interventions	Name and Signature				Remarks
	N/AN	N	A	P	
6. Nutrition/hydration - DAT / DM diet when patient regained fully consciousness - IVF administrated as prescribed till diet tolerated well - Blood transfusion given as necessary - Oral & fluid intake encouraged and charted					
7. Elimination +/- urinary catheter care - Normal self voiding - Urinary catheter care, tube in-situ and patent, without s/s of UTI					
8. Patient Education - B&C, ankle pump ex. encouraged a/c to PT instruction - AMA case: keep hip flexion >90 degree, do not cross leg and do not rotate the affected hip joint internally					
9. Referral - Physiotherapist (chest PT/ROM ex) - Ortho-geriatric team - Medical social worker - Dietitian					
10. Psychological support - Brief patient care plan introduced - Relatives are encouraged to come during visiting hours - Patient and his/her relative encouraged to ventilate their problem or query					

Clinical Notes:

Name & Signature

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Post-operative Nursing Management – Day 1 to 2 Date _____

Nursing Assessment / Interventions	Name and Signature				
	N/AN	N	A	P	Remarks
1. Assessment - Vital signs within normal range (BP/P, SaO2 stable) - Neurovascular status maintained normal - Mental status – no delirium detected					
2. Pain Management - Regular pain assessment & pain treatment					
3. Positioning Day 1 - Prop up in bed encouraged (< 60° for AMA case) and proper alignment maintained - AMA – abduction pillow in situ - Gamma nail: (reamed→elevated on Braun’s frame, hand reamed→elevated with pillow) - Hip screw case- check XR & sit out - Assisted in turning and use of trapeze Day 2 - AMA case -abduction pillow in situ, pillow between lower limbs when transfer for XR, beware of hip dislocation - Gamma nail case: (reamed→elevated on Braun’s frame, hand reamed→elevated with pillow) - Sit out of bed (hip screw/ AMA /Gamma nail) after drain removed and XR of operated limb AP/Lat done) - Try walking ex.(AMA / DHS/ Gamma nail)					
4. Wound care +/- drain care - Ensure proper dressing, velband and crepe bandage maintained - Dressing was kept dry and intact for 72 hrs with crepe bandage in-situ - Ensure drain in-situ & patent - Off drain if output <30ml on Day 2					
5. Pressure sore prevention					

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Post-operative Nursing Management - Day 1 to 2(cont'd) Date _____

Nursing Assessment / Interventions	Name and Signature				Remarks
	N/AN	N	A	P	
6. Nutrition/hydration - IVF administrated as prescribed till diet tolerated well - Blood transfusion as required - Oral & fluid intake encouraged					
7. Elimination +/- urinary catheter care - Normal self voiding - Urinary catheter care, tube in-situ and patent, without s/s of UTI - Urinary catheter removed and CSU saved for C/ST on Day 2 - Reinsert urinary catheter if RU>150ml - Bowel opened pattern monitored - Laxatives provided					
8. Patient Education - B&C, ankle pump ex reinforced according to Physiotherapist's instruction - AMA case: keep hip flexion > 90 degree, do not cross leg and do not rotate the affected hip joint internally, beware of the risk of hip dislocation					
9. Referral - Ortho-geriatric team - Physiotherapist (chest PT/ROM ex) - Occupational therapist for post-operative delirium assessment (MMSE) - MSW / Dietitian					
10. Psychological support - Transfer or discharge plan discussed with patient and relative - Patient and his/her relative encouraged to ventilate their problem or query - Relatives are encouraged to come during visiting hours					

Clinical Notes:

Name & Signature

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Post-operative Nursing Management - Day 3 to 7 Date _____

Nursing Assessment / Interventions	Name and Signature				
	N/AN	N	A	P	Remarks
1. Assessment - Vital signs within normal range - Neurovascular status maintained normal					
2. Pain Management provided					
3. Positioning and mobilization - Sit out of bed - AMA case: beware of hip dislocation					
4. Wound care - Light dressing changed with cosmopor + waterproof dressing (for female and those with diaper) and crepe bandage applied					
5. Pressure sore prevention					
6. Nutrition/hydration maintained					
7. Elimination - Normal self voiding - residue urine monitored - Urinary catheter care (if any) provided - Bowel opened pattern monitored - Laxatives provided					
8. Physiotherapy a/c to order performed - Start walking exercise as prescribed					
9. Pt Education and rehabilitation plan instructed as follows: - Encourage nutritious diet - Implement preventive measures & education on signs and symptoms of hip dislocation (AMA), wound infection, deep vein thrombosis, pressure sore prevention, fall accident, chest infection & urinary tract infection					
10. Referral - Ortho-geriatric team - MSW / Dietitian					
11. Book Convalescence bed (TPH) - Transfer or discharge plan discussed with patient and relative - Patient and his/her relative encouraged to ventilate their problem or query - Informed them if TPH bed is available					

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

Hospital Authority Prince of Wales Hospital Fragility Fracture Care Acute Geriatric Hip Fracture Protocol	Patient Label
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Discharge Plan

Discharge Risk Screen Questions:		Action	
1. Does the patient lives alone?	1. N <input type="checkbox"/> Y		
2. Will the patient have problems looking after him/her self after hospital stay?	2. N <input type="checkbox"/> Y		
3. Does the patient take care of others at home?	3. N <input type="checkbox"/> Y		
4. Is the patient homeless or no fixed address?	4. N <input type="checkbox"/> Y		
5. Does the patient live in a rooming house, private hotel or hostel?	5. N <input type="checkbox"/> Y		
6. Does the patient receive community supports e.g. meals-on-wheels, home helper etc?	6. N <input type="checkbox"/> Y		
7. Is this patient likely to require planning for a complex discharge, or is he/she at risk of an unplanned readmission?	7. N <input type="checkbox"/> Y		
8. Will the patient have problems with transport home on discharge?	8. N <input type="checkbox"/> Y		
Expected Length of Stay in Hospital: Anticipated discharge date Anticipated discharge destination from ward Patient / family aware of discharge plan Relatives interviewed by case MO	DD MM YY ____/____/____ <input type="checkbox"/> Home/ OAH <input type="checkbox"/> N <input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> Y	<input type="checkbox"/> am / <input type="checkbox"/> pm <input type="checkbox"/> TPH MO : Dr. _____	
Revised Discharge Plan			
Date of revision of discharge plan	New discharge date	Reason for change of discharge plan	Signature

Management of Fragility Fractures at the Acute Phase

Chapter 6 A nursing protocol for effective in-patient management at the acute phase

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Chapter 7

Managing fragility fractures at the rehabilitation phase

Ms. Jamie LAU

1 Objectives and goals of post-operative physical rehabilitation before discharge back to community

After the fixation of fractures, the patient will be going through a period of rehabilitation. The following will use a hip fracture scenario to exemplify the key elements of rehabilitation. The objectives of the physical rehabilitation are to minimize the adverse effects of prolonged bed rest, including thromboemboli and pulmonary complications, while protecting the surgically stabilised fracture site, to regain the active use of the injured leg and participate in daily functional transfers and walking, in particular. Early mobility can help prevent the complications.

The status of weight-bearing at different phases has to be closely monitored and adjusted in close collaboration with the surgeon for every individual patient. Usually an assistive device is required for ambulation. In the early post-operative period, education for patients and caregivers is important for self care and preparation for discharge. That helps further minimize complications and enhance strength building for the injured leg.

When patients can achieve independence in ambulation using an assistive device and necessary activities in daily living, they will be discharged back to the community. In parallel, evaluation for a safe environment, with any necessary gadgets, will be sorted out before discharge. The ultimate goal of the surgical and rehabilitation intervention after hip fracture is to restore functional ability and help patient return back to his/her home environment as far as possible. Some of the very frail patients may need some facilities with nursing care services. upright activities, hence increasing demand of oxygen uptake through gaseous exchange and respiration.

2. In-patient physical rehabilitation

a. *Acute post-operative phase*

Immediately following the surgical intervention, patient suffers from inflammation, pain and swelling. In the immobilised area, there are muscle atrophy and soft tissue contracture. The overall body weakens potentially if confined in bed. It is important to monitor and check for potential complications. Any one of these complications can adversely affect the outcomes of surgery and post-operative rehabilitation. Physiotherapy interventions are designed to minimize these adverse effects.

i. *Prevent pulmonary complication*

General anaesthesia during surgery and the use of pain medication confine the patient in bed. The risk of developing pneumonia or atelectases is highest during the early post-operative period. Any increase in body temperature warrants investigation on the cause. Bronchial hygiene of deep breathing and coughing exercises are started on the day of surgery to reduce the risk and lung atelectasis. Besides, early propping up or sitting out for patients will encourage upright activities, hence increasing demand of oxygen uptake through gaseous exchange and respiration.

ii. *Prevent deep vein thrombosis*

Swelling and pain at lower limbs may indicate the development of deep vein thrombosis (DVT). It may occur proximal or distal to the popliteal artery. Proximal DVTs are larger in size and more dangerous as they more likely progress to pulmonary emboli. Patients who have undergone surgery and trauma in the hip and knee or prolonged immobilisation have increased risks for forming DVTs

When there is swelling and pain present in the lower limbs, therapists should check localised tenderness along the distribution of the deep venous system – gentle and cautious examination of the calf posteriorly, popliteal fossa and along the femoral vein of the anterior thigh. Besides, one needs to check the calf swelling whether it is > 3 cm as compared to the asymptomatic contralateral side measured at a point 10 cm below the tibial tuberosity. If it is suspicious, the signs should be documented and communicated to the surgeon.

Increasing venous return and decreasing venous stasis in the calf after hip surgery is important to prevent DVT. One minute of active ankle pumping exercises performed at regular intervals during the day has been shown to increase venous blood flow (for up to 30 minutes after exercise).^{1,2} This regime should be carried out meticulously on a regular basis until the patient resumes mobility in transfer and ambulation.

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iii Prevent subluxation and dislocation after surgery

In the early post-operative period after total hip hemiarthroplasty, there is a risk of dislocating the operated hip. The risk increases with (i)the posterior surgical approach, (ii)surgical procedure of bony positioning or soft tissue balancing and (iii)pre-operative or post-operative muscle weakness and contractures.

Subject to the surgeon's post-operative guidelines, patients usually are asked to avoid (i)hip flexion $> 80^{\circ}$ to 90° and (ii)adduction and internal rotation beyond neutral. A wedge pillow is positioned in between the two legs while the patient is lying on bed for the first and two post-operative days. A wedge high seat cushion is given to patient while sitting out. Education is important for patients to reduce undue stress on the hip. The points are summarised in the table below (table 7.1)³:

Precaution for early post-operative motion after hip hemiarthroplasty

Posterior / posterolateral approach

Hip motion

* Avoid hip flexion $> 80^{\circ}$ to 90° , adduction and internal rotation beyond neutral

Daily activities

* Transfer to the sound side from bed to chair or chair to bed

* Do not cross the legs in sitting

* Keep the knees slightly lower than the hips when sitting

* Avoid sitting in low, soft chairs

* Use a raised toilet seat

* Avoid leaning trunk forward when getting up or sitting down on a chair, dressing or undressing

* Use showers to bath, or shower chair

* Step up with the sound leg on ascending stairs and getting down with operated leg on descending

* Pivot on the sound lower limb

* Avoid standing activities that involve rotating the body toward the operated leg

* Sleep in supine position with an abduction pillow; avoid sleeping or resting in a side-lying position

iv. Maintain strength of arms and the sound lower limb

Exercises beginning on the first post-operative day is to help patients gain control of his/her body parts, engage in functional activities and prevent complications. Exercises are designed to enhance strength of the upper limbs and the normal leg. That facilitates patients to cope with transfer and ambulation with or without an assistive device. Big muscle groups involved in bed mobility, standing and walking are targeted. Progressive resisted exercises in close-chain training are selected to simulate movement patterns in these activities.

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v. *Prevent post-operative inhibitory reflex atrophy of the operated limb*

Muscles around the fracture site are traumatised by the fracture or during surgery. That results in reflex inhibition muscle weakness and pain. In the case of hip fractures, low-intensity isometric muscle exercises are performed around the hip and knee musculature of the operated leg. Education and advices are given to patients for proper positioning to avoid contractures. For comminuted sub-trochanteric fractures that require medial cortex reconstruction, contractions for abductor and adductor muscles are delayed for 4-6 weeks to avoid stresses across the fracture site.^{4,5} Besides, assisted heel slides are performed to initiate active mobility of the operated leg. That prepares the patient to start bed mobility and transfer training.

vi. *Weight-bearing consideration*

The amount of weight-bearing during transfer and ambulation is determined by surgeon for individual patient consideration. Factors affecting the decision include patient's age and bone quality, the fracture location and pattern, the type of fixation and the stability achieved. Patient will start bed transfers, sitting-out and ambulation with assistive devices.

The degree of weight-bearing recommended ranges from

- non-weight-bearing
- touch-down weight-bearing (<10 lbs)
- weight-bearing as tolerated

Similar to weight-bearing, transfer activities like moving in bed, getting up from bedside, active or resisted hip exercises all generate forces across the hip. Same approach of protective consideration is given to patients during ambulation and transfer.

b. In-patient rehabilitation phase

After the patients' acute conditions become stabilized, typically 3 to 4 days after operation, they are transferred to extended rehabilitation hospital for continuation of care. Early ambulation and ankle exercises for preventing DVT should be continued. The clinical management focuses on general conditioning, strengthening, and walking ability on different terrains and with decreasing levels of assistance.

i. *Restore active mobility and dynamic control of the operated limb*

Exercises are increased to enhance the active range of motion of the involved hip and knee as fracture healing allows. Caution is taken to provide appropriate challenges to joints and muscles yet no excessive loads are imposed on the fracture site.

Very low-intensity using low-impact exercises mark the beginning of the programme. Heel slides in supine lying are common to start with. Strengthening exercises should use very short levers or body resistance. Progression of intensity and impact can be made through changing limb position with short lever arm to longer one, or altering the effect of gravity on the limb. One example is straight leg raises (SLR) in flexion, abduction and extension in standing on sound leg, holding onto stable surface for balance before progressing to SLRs in a horizontal position.

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ii. Restore function, gait and balance

With improved bone healing and strength of the arms and legs, more practice in bed mobility transfer enables the patient to be more mobile upon movement in bed and getting up to the side of bed.

However if there are weight-bearing restrictions and pain with weight bearing, the patient may adopt a “limb shortening strategy” with increased hip flexion, knee flexion and ankle dorsiflexion. It is for reducing the leg from full contact with the floor. Besides, patients often walk with short shuffling steps because of decrease in strength and balance. Furthermore, using an assistive device may render a patient to walk with “jerky” motion because the gait is no longer bipedal. He or she advances his or her limbs following the device.

Therefore gait re-education will be done with emphasis on vertical trunk alignment, equal and not too small stride lengths, heel-contacts and toes-push-off. Longer distance of walking training will build up patient’s endurance. The ability to make turns or cope with slopes is the subsequent target to achieve.

iii Assisted devices

At any stage of rehabilitation, a physiotherapist will consider the level of stabilization the patient requires for safe mobility. Nearly all patients start to ambulate with a pick-up walking frame which allows support from both arms and a wider base of ground contact. Examples of assistive devices are illustrated in Fig. 7.1. A frame fitted with two or more wheels at the base can be rolled forward. That provides moderate stability and is suitable for use on smooth surfaces. These are especially suitable for patients with weakness in the trunk or arms.



A. Pick-up frame



B. Frame with 2 wheels



C. Push chair with 4 wheels



D. Frame with gutter support



E. One-sided walker



F. Quadripod



G. Cane



H. Wheelchair

Fig. 7.1 Different kinds of assistive devices.

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If a patient sustained a concomitant upper limb fracture at the same time, he/she can walk with a frame fitted with a gutter forearm support. Those patients who suffer from stroke and a hip fracture, they need a one-sided walker. That offers a wider base of support compared with a quadripod.

A small proportion of patients are too frail to regain ambulation. They may need a wheelchair for locomotion. During the hospital stay for rehabilitation training, some patients may improve and be able to walk with less assistance and change to use a quadripod upon discharge back to community. Upon extended training on lower limb strength and balance, some patients may further progress to using a single point cane for support.

iv. Assessment for home environment and hazards before discharge

Before discharge back home, assessment for home environment with the patient and relatives, or even through a home visit is very helpful to understand any potential hazards. Details will be covered in subsequent chapters.

3 Extended exercise programme after hip fractures

Bone healing typically takes 8 to 16 weeks. After the fracture healed completely, some studies showed that a supervised extended programme with carefully progressed resistance exercises for strength training from 6 to 19 weeks post-operatively is safe and effective. The following are the objectives for this extended exercise programme:

a. Increase flexibility of any chronically shortened muscles

Stretching exercises for calf, hamstrings and hip flexors are targeted.

b. Improve strength and muscular endurance in the lower extremities for functional activities

Body weight is used as resistance in bilateral close-chain active exercise during the partial weight-bearing period. Forward or sideways stepping exercises can be done when weight-bearing to tolerance is allowed. Open-chain resisted exercises can be started with light weight (up to 5 lbs) initially. Task specific training like stair-climbing or carrying a small load while walking can be added later.

c. Improve postural stability and standing balance

Balance activities are designed with progression appropriate to patients' needs. Walking training can be tried on various surfaces.

d. Increase aerobic capacity / cardiopulmonary capacity

The training programme is age appropriate with slow progression.

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4 Exercise for better bone health

Prevention is better than cure. Exercise plays an important part in strengthening the skeletal and appendicular bones in our body. This part will be covered in detail in subsequent chapters.

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the occupational therapist's perspectives

Chapter 8

Management of patients with fragility fractures during the rehabilitation phase:– the occupational therapist's perspectives

Ms. Barbara CHAN

This chapter covers the following topics:

- A. Cognitive / delirium screening & assessment (MMSE, CAM, MDAS)**
- B. Activities of daily living assessment & training (MBI, FIM, Lawton IADL); assistive devices prescription**
- C. Home environment & hazard assessment and home modification (Safer-Home, Westmead, Homefast)**
- D. Fall risk behavior assessment & treatment (ABC, FES, FaB)**

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A. Cognitive / Delirium Screening & Assessment

- Cognitive impairment, including dementia and delirium, occurred in 10% to 56% of hospitalized geriatric patients (Levkoff S.E. et al, 1992; Lipowski Z.J., 1994; Pompei P. et al, 1994).
- During hospitalization, patients with hip fracture were three to six times more likely in exhibiting cognitive impairment (Berggren D et al, 1987; Schor J.D. et al, 1992).
- The assessment of cognition is important for differentiating delirium from dementia.

1. Mini-Mental State Examination (MMSE) (Folstein M.F., et al, 1975)

- 11 items with 5 categories: orientation, short-term memory, attention & concentration, language and constructional ability with scores ranging from 0 to 30
- Comments: a brief cognitive evaluation, can be easily administered & scored (the test takes 5 and 10 minutes); disadvantages: insensitivity to mild cognitive dysfunction, limited memory assessment; no diagnostic value in assessing delirium

2. Confusion Assessment Method (CAM) (Inouye S.K. et al, 1990)

- 9 operationalized criteria from DSM-III-R: acute onset, inattention, disorganized thinking, altered level of consciousness, disorientation, memory impairment, perceptual disturbances, psychomotor agitation / psychomotor retardation, and disturbed sleep-wake cycle
- Comments: quick screening for delirium (requires less than 5 minutes to complete); less specific in identifying patients with delirium and underlying dementia (Trzepacz P.T., 1994); required trained raters as it relies on some subjective clinical judgment (Smith M. et al, 1995)

3. Memorial Delirium Assessment Scale (MDAS) (Breitbart W. et al, 1997)

- 10-item scale, four-point clinician-rated scale (from 0 - no impairment to 3 - severe impairment); items reflect the diagnostic criteria for delirium in the DSM-IV which includes: awareness, disorientation, short-term memory, digit span, ability to shift & maintain attention, disorganized thinking, perceptual disturbance, delusions, alternations in psychomotor behavior and disturbed sleep-wake cycles
- Comments: quantify delirium severity or measure treatment response after clinical intervention; take 10 minutes to administer and allow repeated administration within a 24-hr period

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B. Activities of Daily Living Assessment & Training

- Several studies have shown that function often declines after fracture (Mossey J.M. et al, 1989; Magainer J. et al, 1990; Narittiku R.A. et al, 1992; Wolinsky F.D. et al, 1997) and hospitalization (Hirsch C.H. et al, 1990; Landefeld C.S. et al, 1995; Sager M.A. et al, 1996).
- Functional decline leads to increased risk of illness and death, decreased quality of life, compromised autonomy and greater dependence by which institutionalization, length of stay and readmission would be increased (Creditor M.C., 1993).

1. Modified Barthel Index (MBI) (Shah S. et al, 1989)

- Widely used by occupational therapists for clinical decision-making and outcome measurement
- 10 activities of daily living, each with 5 levels of dependency; the maximum score is 100 points, representing independence in daily living
- Comments: more sensitive index for measuring physical function; but confusion with the operational definitions in some of the MBI items

2. Functional Independence Measure (FIM) (Granger C. 1990)

- Widely used by occupational therapists for clinical decision-making and outcome measurement
- 18-item questionnaire that rates independence on a scale from 1 to 7 in four categories: self-care, sphincter control, transfers, locomotion, communication and social cognition
- Comments: the easiest tool to use with the availability of clear guidelines and the mandatory need for training

3. Lawton Instrumental Activities of Daily Living (Lawton M.P. & Brody E.M., 1969) (Lawton IADL)

- Assess the performance of complicated daily living tasks. There are eight items: taking medications, meal preparation, external communication, laundry, housekeeping, community access, handling finance and grocery shopping
- Comments: an easy-to-use, validated and most widely adopted instrument currently in use by occupational therapists

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C. Assistive Devices Prescription

- Assistive device is a specially designed item, piece of equipment or set of products for people with functional limitations so as to enhance independence and safety in self-care, work and leisure. Assistive devices can be classified into high-technology and low-technology. Examples of high-tech assistive devices are sophisticated computer systems to increase communication and social integration; and smart house arrangement to increase safety and function. Low-technology assistive devices range from simple dressing aids to shower board.
- In 1985, there were over 18,000 devices to aid the functionally impaired elderly (US Office of Technology Assessment, 1985).
- The US Office of Technology Assessment (1985) reported that assistive devices can delay or prevent institutionalization, resulting in enormous personal and financial savings.



Dressing / grooming aids



Safety alarm



Shower chair

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D. Home Hazard Assessment & Treatment

- Home hazards have been recognized as contributing to falls in elderly people. Several studies have shown that 30% - 70% of falls happened in or around the home, and 40% - 60% of falls were related to environmental hazards (Nevitt M.C. et al, 1989; Tinetti M.E. et al, 1988).

Some studies have found that home hazard reduction was effective for elderly people with a history of falls and mobility limitations (Stevens M. et al, 2001; Day L. et al, 2002).

- The efficacy of home modifications in reducing falls depend on the provision of concomitant training for improving transfer abilities and other strategies for effecting behavioral changes (Cumming R.G. et al, 1999; Nikolaus T. & Bach M., 2003).
- Occupational therapy home assessment aims at increasing or maintaining functional independence, safety & quality of life of elderly people both as therapeutic and prophylactic measures.

1. The Safety Assessment of Function & the Environment for Rehabilitation

(SAFER-HOME version 3) (Chiu et al, 2004)

- Occupational therapy outcome measure
- 74 items with 12 categories: living situation; mobility; environmental hazards; kitchen; household; eating; personal care; bathroom & toilet; medication; addiction & abuse; leisure; communication & scheduling; and wandering
- Comments: comprehensive assessment with rating scale indicating the level of safety concerns; also used as outcome measures; disadvantages: pre-requisite skills (application of occupational therapy assessment skills) are required and some items are not culturally relevant



2. The Westmead Home Safety Assessment (WeHSA – Short form) (Clemson et al, 1997)

- Primarily used by occupational therapists
- 57 items with 11 categories: external trafficways; general / indoors; internal trafficways; living area; bedroom; bathroom / footwear; toilet area; kitchen; laundry; seating; and medication management / safety call system
- Comments: a comprehensive checklist with extensive coverage of outdoor activities i.e. suitable for assessing wheelchair user; but some items are not culturally relevant



3. Home Falls & Accidents Screening Tool (HOME FAST) (Mackenzie et al, 2000)

- Screening instrument for environmental and functional home safety
- 25 items with 7 categories: floors; furniture; lighting; bathroom; storage; stairways / steps; mobility
- Comments: simple and quick screening but not for detail assessment

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E. Home Modification

- Occupational therapy intervention involves major architectural alteration, minor home adaptation, on-site alteration and assistive device prescription.
- Top ten fall risk factors for elderly living at home were identified (a survey conducted by occupational therapists in 2002).

Ten Fall Risk Factors	Home Modification
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1. Improper transfer techniques used in toileting or transfer from bed to chair



Use stools and cabinet to support bed board, hold onto stool in transfer

- Educate / demonstrate / practice safe transfers & back care with clients or carers
- Assess & prescribe ADL assistive devices (e.g. chair with arms, transfer board, bedrail, overhead trapeze bar, rope ladder, toilet grab bar)

2. Slippery floor in living room, kitchen & toilet

- Remove / replace unsafe flooring tiles (e.g. distracting patterns, slippery surface, damaged / uneven flooring)
- Use non-slip tiles, non-wax flooring
- Install handrail

3. Inappropriate use of mobility aids

- Assess & prescribe mobility aids
- Emphasize the correct use of mobility aids

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Ten Fall Risk Factors

Home Modification

4. Poor stability of chairs & seating



Sit on folding stool

5. Hold onto loose or unstable furniture for support during toileting or transfer



Hold onto unstable wooden boards & clothes in transfer

6. Lack of stable support during toileting & bathing

- Educate / demonstrate / practice safe positioning / repositioning techniques & back care with clients or carers
- Alter / adjust seat or furniture height
- Remove unsafe furnitures
- Assess & secure safe furniture / prescribe ADL assistive devices / alternative methods of bathing / (e.g. commode, shower chair, bath board, handrail)



Commode



Bath board



Handrail

- Bathroom / toilet renovation for home safety & accessibility
- Use of non-slip aids / flooring / tiles

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Ten Fall Risk Factors

Home Modification

7. Overconfidence in self ability in performing ADL (e.g. use step stool / folding stool when things are out of reach; inadequate lighting)



Use step stool in reaching

- Avoid using step stool / folding chair
- Store / relocate frequently used items at accessible level
- Assess & prescribe ADL assistive devices (e.g. long-handle reacher)
- Ask for carer's help in performing ADL
- Use night lights / photo-sensitive light / timers / high wattage bulbs within specifications
- Alternative living arrangements

8. Inadequate ability in performing instrumental ADL (e.g. storage problems)

9. Unable to manage kerb at door entrance



Same pattern of flooring and kerb

- Remove kerb / construct leveled or raised platform
- Use of contrasting colored paint / tactile surface on top of kerb
- Ensure adequate lighting at door entrance



Remove kerb

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Ten Fall Risk Factors

Home Modification

10. Narrow passage way / obstacles blocking passage (e.g. clutter, scatter rug, wires or cords)



Loose wires on floor

- Educate clients / carers about safety hazards
- Remove clutter / objects no longer in use / unsafe scatter rug
- Clear pathway
- Use rug with non-slip under-padding / with rubber backing
- Re-route wires / cords away from walking area
- Secure loose wires / cords
- Problem solving related to obstacles

Other Fall Risk Factors

Home Modification

a. Inappropriate footwear



Large slippers



Inappropriate shoe wearing

- Educate clients / carers suitable footwear (e.g. enclosed heel, proper heel height, non-slip / well-tread sole)
- Avoid wearing slippers / bare foot

b. Inappropriate clothes

- Avoid wearing clothes with very long sleeves
- Repair clothes

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F. Non-compliance with Home Modification or Assistive Devices in the Elderly: Causes & Management

Causes	Management
<p>1. Personal factors</p> <ul style="list-style-type: none">• Reluctant to change habit / behavior• Lack of awareness on home hazards	<ul style="list-style-type: none">• Demonstrate / educate home safety• Empower clients to identify home hazards & solve problems• Provide more alternatives for decision making• Provide information related to home hazards (e.g. photo, newspaper from other elderly people)
<p>2. Social factors</p> <ul style="list-style-type: none">• Any home modification or ADL assistive devices prescription was restricted by other family members• Lack of social support / home alone	<ul style="list-style-type: none">• Emphasize the importance on home modification or ADL assistive devices prescription for home safety• Refer to social worker for building up community network
<p>3. Financial factors</p> <ul style="list-style-type: none">• Need extra money to purchase ADL assistive devices / conduct home renovation	<ul style="list-style-type: none">• Liaison with social worker for financial support
<p>4. Environmental factors</p> <ul style="list-style-type: none">• Limited living space	<ul style="list-style-type: none">• Liaison with Housing Authority (e.g. handrail installation, removal of kerb, building up ramp, rehousing)
<p>5. Human factors</p> <ul style="list-style-type: none">• Lack of manpower in assessing the compliance of home modification / ADL assistive devices	<ul style="list-style-type: none">• Provide regular / phone follow-up after initial home modification

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G. Fall Risk Behavior Assessment & Treatment

- The negative psychological consequences or “fear of falling” has been reported in 29% to 92% of elderly people after an incident of falls (Aoyagi K., et al, 1998; Howland J., et al, 1993).
Between 25% - 33% of reported fallers acknowledged avoidance of activities because of “fear of falling” (Tinetti M.E. et al, 1988, 1990).
- Even for those who have not experienced any fall episodes or related injuries reported “fear of falling” (Silverton R. & Tideiksaar R., 1989; Maki B.E., et al, 1991).

1. Activities-specific Balance Confidence Scale (Powell L.E. & Myers A.M., 1995) / The Chinese translated Activities-specific Balance Confidence Scale (ABC - C) (Mak M.K. et al, 2007)

- Asked how confident the elderly people is in not losing their balance or becoming unsteady in 16 specific activities, representing a range of indoor and outdoor activities on a scale of 0% (no confidence) to 100% (complete confidence)
- Comments: a wider continuum of activity difficulty and more detailed activity descriptors; the tool is culturally relevant for Chinese elderly people living in Hong Kong, also applicable to active community dwellers

2. Falls Efficacy Scale (FES) (Tinetti M.E. et al, 1990)

- Asked how concern the seniors are about the possibility of falling while performing 10 different activities of daily living (ADL) on a four-category scale from 1 (not at all concerned) to 4 (very concerned)
- Comments: previously used in more frail dependent elderly people; emphasizes mainly indoors, home-based activities; a ceiling effect for higher functioning seniors living in the community

3. Falls Behavioral Scale for the elderly Person (FaB) (Clemson L., et al, 2003)

- 30 statements describing things the elderly people do in daily lives both indoors, about lighting & eyesight, shoes, medications and outdoors activities
- Comments: a wider spectrum of falls behavioral activities; suitable for educated elderly people

Chapter 9

An overview of the primary prevention, secondary prevention and tertiary prevention program

Ms. Winnie MAK

9.1 Definition of fall

- According to Chu et al in 2005, the definition of fall is “an event which results in a person coming to rest unintentionally on the ground or other lower level, not due to any intentional movement, a major intrinsic event or extrinsic force”.¹

9.2 Epidemiology of fall

Incidence of falls in elder people

- The prevalence of fall in Chinese elderly was found to be 18%-19.3%.^{1,3}
- The incidence rate of recurrent falls was 4.75%.¹
- 24.5% of fallers experience a recurrent fall within one year.¹
- 40% of Chinese elderly were multiple fallers.¹
- There may be an underestimate of the true prevalence of fall in elderly due to recall bias.¹

9.3 Location of falls

- According to the study by Chu et al in 2005, they had interviewed 1517 Chinese elderly aged 65 or above. 46.6% and 53.4% of falls occurred indoors and outdoors respectively.¹
- 60% Hong Kong elderly falls outside as Hong Kong is an urban community. Most of the elderly live in public housing estates with small areas and hence spend more time outside. This may be the reason why more elderly falls outdoors.³
- The situation is different from that in Western countries where most of the falls occurred indoors.⁴

9.4 Consequences of fall 4-6

- Fractures of the hip, radius, ulna, humerus, pelvic and etc.
- Soft tissue injuries such as lacerations, bruises, abrasions and sprain
- Some fractures may need surgery
- Decrease in mobility, balance, gait and activities of daily living
- Hospitalization or institutionalization which may even lead to deconditioning, social isolation, pneumonia, pressure sores and etc.
- Fear of falling
- Restriction of activity
- Loss of independence
- Reduce quality of life
- Death
- Increase burden of the health care system, family members and carers

Management of Fragility Fractures at the Post-fracture Care Phase

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9.5 Risk factors of fall

9.5.1 Intrinsic Factors ^{1,7}

- Previous history of falls
- Old age
- Pathological conditions such as arthritis of knees, stroke, Parkinson's disease, postural hypotension
- Change in musculoskeletal system: Fall risk increases with decreased muscle strength of ankle, muscle atrophy, calcification of tendons and ligament, increase curvature of the spine, osteoporosis etc.
- Gait impairment: Decline in walking speed, stride length, step height and base of support increases the chance of fall.
- Poor balance especially when standing, turning, changing position or walking: Balancing ability depends on vision, proprioception, vestibular system, muscle strength and joint flexibility. Impairment in either system will lead to poor balance.
- Cognitive impairment or depressive symptoms
- Poor vision: This may be due to more time is required to adjust for the change of environmental lighting. Degeneration of the eyes may also lead to decrease in visual acuity, contrast sensitivity and depth perception. This may affect the correct interpretation of the ground surface or the surrounding.
- Medication: The use of hypnotic, anti-depressants or tranquilizers and the use of 4 or more prescribed drugs
- Psychological or emotional factors such as irritation, confidence, rush or etc.
- The greater the number of risk factors, the higher the risk of fall.

9.5.2 Extrinsic Factors ⁷

- Lighting: Insufficient amount of illumination, poor accessibility of the light switches, small size of the switch plate; glares from sunlight, glasses or floor and etc.
- Floor surface: Highly polished or wet floors, rough and uneven floor surface, carpeting that are not adhered to the floor properly etc.
- Hallways: Long hallways, untidy storage area, insufficient or inappropriate railing
- Furniture: Bed height or seat height too high or too low, sagged or slouch edges of the mattresses
- Assistive device: Improper height of the walking aids, wearing, improper use etc.

Management of Fragility Fractures at the Post-fracture Care Phase

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9.6 The three portals of fragility fracture prevention

9.6.1 Prevention of falls

9.6.2 Dissipation of forces at the moment of impact

9.6.3 Enhancement of bone strength: improving bone quality with lifestyle modification and treatment of osteoporosis



9.7 Primary prevention program

9.7.1 Definition

Primary prevention program are for elderly with no history of fragility fracture. The main aim of primary prevention program is to prevent the occurrence of fractures in this group of elderly.

9.7.2 Purposes

- To enhance the awareness of fall and fracture in public citizens
- To acquire knowledge on bone health
- To equip the staff of various organizations with professional knowledge and practical skills on organizing fall fracture prevention programs
- To train volunteers that could assist in promoting fall and fracture prevention programs
- To assist the community centers to continue fall prevention programs.

9.7.3 Educational seminars

- The target audiences of the educational seminars in primary prevention program are healthy community dwelling elderly with no history of fragility fractures.
- The seminars organized at the elderly community centre at their vicinity are more appropriate. The participants are more familiar with the environment and they can seek advice from the centers.
- The educational groups consist of multidiscipline health care professionals including orthopaedic surgeons, nurses, physiotherapists, occupational therapists, dieticians and social workers. This approach can provide a more thorough education on fall and fracture prevention.
- According to the study by Sze et al. in 2005, 52% of participants reported that their knowledge on fall and fracture prevention increased after the educational seminar.

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9.7.4 Staff training workshops

- The target participants of the staff training workshops were the staff of community centers, including both administrative staff and front line staff.
- The objective of the workshops was to equip them with professional knowledge on fall, fracture and osteoporosis and to allow them to gain the practical skills to organize fall and fracture prevention programs in their organizations.
- The training involved a team of health care and medical professionals. And the staff training workshop also act as a bridge between primary health care system, i.e. hospital, and the community.
- To ensure the efficiency of the workshops, assessment on fall and fracture knowledge, home visitation skills, fall prevention proposal writing and Tai Chi exercise were carried out after the workshop.
- It was shown that about 95% of the trained staff had planned and continued their fall prevention programs six month after the workshops.⁸

9.7.5 Train-the-trainers program

- The target participants of the train-the-trainers program are the volunteers recruited from various community centers for the elderly.
- The content of the train-the-trainers program includes an introduction to the problems of fall and fracture in Hong Kong elderly and the prevention for such, explanation on bone mineral density measurement and balance assessment, and also the practical skills in fall program promotion and home visitation.
- In the study done by Sze et al in 2005, 75% of the trained volunteers said that their knowledge on fall prevention had increased after the training and over 80% of them retained their knowledge even at 6 month after the workshop.
- Although the health care professionals in the primary health care system and the staffs in the community centers are enthusiastic in organizing programs on fall and fracture prevention, the coverage of the promotion is still limited.
- Another benefit of the workshop was that the trained volunteers act as the vectors in infiltrating the fall prevention knowledge into the community. They can share the information on fall and fracture prevention with other members in the community centers, their relatives and friends. They can also spread the fall prevention message to other elderly peers through home visitation and meeting of the interest group.
- The trained volunteers in the workshop were also committed that they would help their community centers in carrying out fall prevention activities. This also leads to success of promoting fall prevention in community.

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9.8 Secondary prevention program

9.8.1 Definition

Secondary prevention refers to prevention of recurrent fractures after having one or more fragility fractures.

9.8.2 Purpose

- To lower the risk of fall and alter the risk factors with exercise, assistive devices and home hazard modification.
- To prevent fall or fracture by using of protective devices such as hip protectors and fall prevention shoes

9.8.3 Exercise intervention

- The objectives of exercise interventions are to improve the balancing ability, gait pattern and walking endurance.
- In general, fall prevention exercise include balance training, strength and endurance training, gait training, stretching etc. One example for balance and strength training is Tai Chi exercise. It is also a low impact weight bearing exercise which is beneficial for bone strength.
- It was shown that Tai Chi exercise could reduce the risk of fall in the presence of identified risk factors.¹⁰
- Lord et al (2007) summarized the common features of effective exercise programs in fall prevention. Balance training, weight-bearing exercise, functional activity training together with some endurance and resistance training should be included in the training program. Exercise should be conducted 60 minutes per session, 3 times per week and at least for 6 weeks with a progressive increase in intensity and difficulties. Program designed and led by a trained professional, such as physiotherapists, and reminder to the participants to ensure compliance are also factors leading to success of fall prevention exercise programs.
- Some studies also showed that group based exercise programs can reduce the risk of fall and the effect remains unchanged even at one year after the exercise programs.⁹

9.8.4 Home hazards assessment and modification

- Elderly tends to fall during the daytime when they spend most of their daily activities. They are more likely to fall at places where they spend most of their time. 11 Home is one of the places that elderly spend most of their time. One third to three quarters of elderly falls in community occur at home.¹²
- Messages on home hazards and safety and home modification are commonly delivered through educational talks and workshops. However, it was shown that education and counseling were just fairly effective in reducing home hazards. Together with the provision and installation of safety devices, the effectiveness of the program could be enhanced.¹²
- More information on home hazards assessment and management can be found in Chapter 13.

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9.8.5 Medication

- Taking one or more medications is common in elderly. As poly-pharmacy is one of the predictors of fall, yearly review of medication is recommended.⁵
- Use of medications, such as psychotropics, antihypertensives or antidepressants may cause the elderly to attain a sleeping state. However, a good quality of sleep is not really achieved. As a result, inattentiveness during the waking hour may lead to fall.
- In contrast, medications that used to alter the symptoms associated with dementia, Parkinsonism, delirium and etc. had been found to reduce fall.¹³
- Review of medication is imperative in order to ensure the elderly can derive the greatest benefits from their medicines and at the same time keep the side effects to a minimum through timely adjustment of the dose and nature of the medication.

9.9 Tertiary prevention program

9.9.1 Definition

Tertiary prevention refers to minimization of ill effects of falls and fractures. Enhancement of bone strength and dissipation of energy of falls with hip protectors are examples of tertiary prevention.

9.9.2 Purpose

- The purpose of tertiary prevention is to prevent recurrent falls and fractures in the elderly who had experience a fall or fracture previously.

9.9.3 Medication

- Beside medication review mentioned previously, medications help to alter the condition of osteoporosis, such as bisphosphonate, calcium and vitamin D, are also considered. These medication are used to enhance bone strength and to prevent fragility fracture due to fall and osteoporosis.

9.9.4 Hip protector

- As hip fracture carries the worst prognosis and can occur with high probability after falls, hip protectors are recommended for elderly who had high risk of fall and fracture.
- Hip protectors are protective devices used to protect the elderly from hip fracture in the episode of fall by absorbing and transferring load from the bone to the surrounding soft tissues. The protector consists of a firm outer shell and a soft inner foam component which can be removed and fitted into a pouch of a specially designed underwear.⁵
- It is shown that hip protectors can decrease the risk of hip fracture in the elderly.¹⁴ However, the compliance is fair due to the hot and wet weather in Hong Kong. For more information, please refer to Chapter 12.

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9.9.5 Vibration therapy



(The vibration platform [red arrow])

- Vibration therapy involves a platform that produces vertical oscillations with a frequencies ranging from 15-60 Hz and vertical displacement of -1 to 1mm.
- In the review done by Dolny et al in 2008, it was shown that vibration therapy can enhance muscle strength and performance, especially in sedentary elderly subjects. And it was shown that bone mineral density can be maintained or improved, especially at the femoral neck.¹⁵
- As the mobility of the affected elderly decreased after the surgery and being disabled with a fear of fall, vibration therapy is regarded to be a safe and effective treatment modality to enhance their physical fitness and tackle osteoporosis.

9.10 Conclusion

- Falls lead to severe consequences affecting the mobility and independency of the elderly and their quality of life. Falls also increase the burden on the family, care-givers and the health care system. The importance of fall prevention should not be ignored.
- A comprehensive fall prevention program should adopt the interdisciplinary approach involving the consideration and advices from various health care professionals. The risk factors that predispose the elderly to falls and fractures, should be thoroughly assessed and the program should be planned basing on the assessment results and the characteristics of the elderly group, with the ultimate goal of reducing falls and fractures.

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Chapter 10

Post fracture care phase:- restoring bone health with updates on management for osteoporosis

Dr. Tsz-Ping LAM

This chapter covers the following areas:

- I. Clinical approaches for suspected osteoporosis
- II. Management of osteoporosis
 - A. Non-pharmacological treatment
 - B. Pharmacological treatment
- III. Treatment algorithm

1. Definition of osteoporosis

“Skeletal disorder characterized by compromised bone strength predisposing a person to an increased risk of fracture. Bone strength reflects the integration of two main features: bone density and bone quality”

2. Types of osteoporosis

- a. Primary
 - i. As part of the normal ageing process
 - ii. Two types
 - Post-menopausal
 - Senile
- b. Secondary
 - i. Drug induced: steroid, anticoagulants, GnRH antagonist, anticonvulsant
 - ii. Endocrinopathy: hyperthyroidism, hyperparathyroidism, hypogonadism, hypercalciuria, Cushing’s syndrome
 - iii. Vitamin D insufficiency
 - iv. Malabsorption: gastrectomy, inflammatory bowel disease, Coeliac disease, intestinal bypass surgery, primary biliary cirrhosis, pancreatic insufficiency
 - v. Eating disorder
 - vi. Bone marrow disorder: multiple myeloma, hemolytic anaemia, haemoglobinopathy, myelo- and lympho-proliferative disorders
 - vii. Skeletal metastases
 - viii. Syndromic disorder: Marfan’s syndrome, osteogenesis imperfecta, Ehlers-Danlos syndrome
 - ix. Others: chronic renal failure, chronic liver disease
 - x. Immobilization

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3. Risk factors for Osteoporosis

- a. For primary osteoporosis
 - i. Old age
 - ii. Caucasian race
 - iii. Menopause, especially early menopause
 - iv. Amenorrhoea > 12 mths
 - v. Personal history of fragility fracture
 - vi. Family history of hip fracture
 - vii. Height loss > 3 cm
 - viii. Smoker / alcoholics
 - ix. Body Mass Index < 18 kg/m²
 - x. Sedentary lifestyle
- b. For secondary osteoporosis
 - i. Gastrointestinal resection / inflammatory bowel disease
 - ii. long term medication (eg steroid, anti-convulsant)
 - iii. Other causes for secondary osteoporosis

4. Clinical Features of osteoporosis per se

- a. Before complication sets in
 - i. Asymptomatic!
- b. With occurrence of complications:
 - i. Fracture
 - ii. Pain
 - iii. Loss of height
 - iv. Kyphosis
 - v. Respiratory difficulty
 - vi. GI symptoms

5. The three most important independent risk factors for fragility fracture:

- a. Low bone mineral density
- b. Advancing age
- c. Prior fracture

6. Investigations for cases with suspected osteoporosis

- a. +/- x-ray for detection of fragility fracture according to individual scenario
- b. Assessment of bone density (with indications as described below)
 - i. Dual x-ray absorptiometry (DXA)
 - ii. X-ray
 - iii. Quantitative Ultrasound (QUS)
 - iv. Quantitative Computed Tomography (QCT)
 - v. Peripheral QCT (pQCT)

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- c. Investigation and workup for secondary osteoporosis
 - i. Standard screening tests
 - Complete blood picture
 - ESR
 - Biochemical tests: Serum Calcium, phosphorus, total protein, albumin, alkaline Phosphatase, liver enzymes, creatinine, electrolyte
 - ii. Other tests as indicated in selected patients
 - Protein electrophoresis
 - +/- TSH
 - In all men, serum testosterone
 - Serum PTH
 - Vit D assays
 - Urinary calcium
 - iii. Further workup for secondary osteoporosis especially indicated for
 - Men with osteoporosis
 - Unexplained fracture (eg with normal BMD)
 - Low Z-score (< -2)
 - Poor response to therapy
 - Clinical suspicion of a secondary cause

7. DXA

- a. The two important scores
 - i. Z-score: number of SD below mean compared with age-matched normal
 - ii. T-score: number of SD below mean compared with young adult mean (the group with peak bone mass)
- b. T-score
 - i. The score obtained from norms measured by same machine type
 - ii. Serial outputs should be compared using the same machine type
 - iii. Indicative of bone strength
 - iv. WHO guidelines: (based on DXA measurement of hip or spine)
 - Normal: $+1 > T \text{ score} \geq -1$
 - Low bone mass (osteopenia): $-1 > T \text{ score} > -2.5$
 - Osteoporosis: $-2.5 \geq T \text{ score}$
 - Severe osteoporosis : $-2.5 \geq T \text{ score}$ and history of osteoporotic fracture
- c. Z-score
 - i. The score obtained from norms measured by same machine type
 - ii. Indicative of how the BMD is compared with age-gender matched controls
 - iii. More an indication of secondary osteoporosis if < -1 ,
 - iv. Used for pediatric patient (T-score not appropriate for pediatric patients)

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- d. Use:
 - i. The only validated BMD measurement correlated with fracture risks
 - ii. For every SD below peak BMD, fracture risk increases by 50 to 100%
 - iii. Low radiation dose
 - 1-5 μSv per exam
 - (Natural background: 5-8 μSv per day)
 - (transatlantic return flight: 60 μSv)
 - iv. Investigation of choice
- e. The National Osteoporosis Foundation recommends that DEXA measurements be performed on the following subjects:
 - i. Postmenopausal women 65 years or older, regardless of additional risk factors. This recommendation includes women 65 years or older, who have been taking osteoporosis therapy and who have not had a BMD test.
 - ii. Postmenopausal women younger than 65 years and with 1 or more of the following additional risk factors for osteoporosis:
 - parental history of hip fracture;
 - current cigarette smoking;
 - a body weight less than 57.2 kg for Caucasians; for Asian populations, a criteria of BMI < 19 could be used;
 - use of (or plans to use) oral corticosteroids for longer than 3 months;
 - Serious long-term conditions thought to increase fracture risk, such as hyperthyroidism or malabsorption.
 - iii. Postmenopausal women who have had a fracture of any type as an adult after age 45 years.
- f. Disadvantages of DXA
 - i. 2-dimensional image, only measure areal BMD
 - ii. Areal BMD = volumetric BMD x depth of bony tissue under study
 - iii. Result affected by depth of bony object
 - iv. Affected by hyperostotic changes in degenerative disease
 - v. Results from different machine can not be directly compared
 - vi. Accepted error of measurement
 - Least significant change = 2.8 x precision error of the test
 - Precision of DXA is usually 2% at expert center
 - Changes of less than about 5.6% could be due to precision error

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8. QUS

a. Use

- i. Make use of change in speed and amplitude of sound wave when traversing bone, depending on bone density and architecture
- ii. Portable, inexpensive, quick measurement
- iii. No radiation

b. Disadvantages

- i. Only for peripheral sites eg calcaneus
- ii. Large variation between different manufacturers
- iii. Inconsistent accuracy and precision
- iv. For initial screening: if result is positive, need confirmation by DXA

9. QCT

a. Use

- i. Volumetric BMD
- ii. Can measure trabecular bone and cortical bone density
- iii. Mainly used for axial skeleton: vertebrae

b. Disadvantages

- i. Higher radiation (> 10 times than DXA)
- ii. No prospective study for fracture risk evaluation
- iii. Not for routine use

10. pQCT

a. Use

- i. Volumetric BMD of forearm or distal tibia
- ii. portable
- iii. Lower radiation dose

b. Disadvantages

- i. Limited data for fracture correlation
- ii. Not readily available
- iii. Not for routine use

11. Blood Test

- a. Bone formation and resorption markers
- b. Not useful to assess osteoporosis

12. Treatment for osteoporosis

- a. Non-pharmacological treatment
- b. Pharmacological treatment

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13. Non-pharmacological treatment for osteoporosis

- a. Lifestyle modification
- b. Dietary advice
- c. Exercise: muscle strengthening and weight bearing
- d. Weight bearing exercise: 30 minutes per day
- e. Appropriate sunlight exposure
- f. Modification of risk factors
 - i. Stop smoking, stop alcohol
 - ii. Calcium intake
 - 1000 to 1500 mg elemental calcium for post-menopausal women
 - iii. Vit D intake
 - 800 IU per day
- g. Vibration Therapy

14. Medication for treating osteoporosis

- a. Inhibiting bone resorption
 - i. Bisphosphonate
 - ii. Selective estrogen receptor modulators (SERM)
 - iii. Calcitonin
- b. Stimulating bone formation
 - i. PTH analogue
 - ii. Strontium
- c. (Hormone Replacement Therapy (HRT) – no longer used for this purpose)

15. Bisphosphonates

- a. Potent inhibitors of bone resorption
- b. Analogues of inorganic pyrophosphate
- c. Bind strongly to bone
- d. Resistant to enzymatic hydrolysis
- e. Mechanism of action
 - i. Possible effects include;
 - Disruption of osteoclast cytoskeleton
 - Inhibition of osteoclast activity
 - Stimulate apoptosis of osteoclasts
 - Inhibit proton pump of osteoclasts
 - Inhibit osteoclast recruitment
 - Inhibit secretion of matrix metalloproteinases
 - Act on osteoblasts to inhibit osteoclast activity
 - Inhibit osteoclast attachment to bone
- f. Complication:
 - i. Adynamic bone disease
 - ii. Reflux esophagitis
 - iii. Osteonecrosis of jaw
 - iv. Beware of potential drug interaction and interaction with calcium supplements

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- g. Contraindication
 - i. Swallowing problem
 - One may consider iv bisphosphonates
 - ii. Severe renal impairment
 - iii. Gastroesophageal reflux disease
- h. To be taken with empty stomach and only with water
- i. Commonly used bisphosphonates
 - i. Alendronate
 - 70 mg orally per week
 - Meta-analysis by Papapoulos *Osteoporos Int 2005*
 - i. Reduction of risk of hip fracture by 45% to 55% for subjects with osteoporosis.
 - Cummings et al *JAMA 1998*
 - i. Alendronate increased BMD at all measured sites and significantly reduced (36%) the clinical vertebral fracture rate among women with initial T-scores below -2.5.
 - ii. Risedronate
 - 5 mg per day or 35 mg per week orally
 - Harris et al *JAMA 1999*
 - i. After 3 years of treatment at 5 mg/day, risedronate reduced the incidence of vertebral fractures by 41 % and non-vertebral fractures by 39 %.
 - McClung et al *N Engl J Med 2001*
 - i. Risedronate shown to reduce hip fracture rates by 40%.
 - iii. Ibandronate
 - 2.5 mg po daily,
 - Can also be administered on a monthly dose: 150 mg po every month
 - BONE study:
 - i. New vertebral fractures at 3 years was demonstrated in patients receiving oral daily ibandronate (4.7%), relative to placebo (9.6%) (52% reduction).
 - ii. Patients with a femoral neck T score of less than 3 did show a 69% reduction in non-vertebral fractures.
 - iv. Zoledronate
 - 5 mg iv once yearly
 - HORIZON study:
 - i. At the end of 3 years, there were statistically significant decreases in the relative risk of morphometric vertebral fractures (70%), clinical vertebral fractures (77%), hip fractures (41%), and non-vertebral fractures (25%).
- j. Name of RCT for approval of use of each bisphosphonate

	Alendronate	Risedronate	Ibandronate	zoledronate
RCT supporting approval of use	FIT-1 FIT-2	VERT-MN VERT-NA	BONE	HORIZON

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16. SERM

- a. Raloxifene 60 mg per day orally
- b. Mechanism:
 - i. Anti-resorptive agent
 - ii. Mimic estrogens in some tissue (skeleton and lipids) and anti-estrogens in others (uterus and breast)
 - iii. Extra benefits: decrease serum cholesterol and CA breast
- c. Ettinger et al *JAMA* 1999
 - i. Multiple Outcomes of Raloxifene Evaluation (MORE): Risk of vertebral fracture was reduced in both study groups receiving raloxifene (for 60-mg/d group: relative risk [RR], 0.7; for 120-mg/d group: RR, 0.5).
 - ii. However, the risk of non-vertebral fracture was not significantly reduced.
- d. Adverse events
 - i. Increased incidence of thromboembolic event
 - ii. Leg cramps, hot flashes, nausea
- e. Less commonly used as compared with bisphosphonates

17. Calcitonin

- a. Nasal spray 200 iu daily, or sc injection 50 iu daily
- b. Brown et al *CMAJ* 2002
 - i. Calcitonin treatment produced modest, but reproducible increases in BMD (1–8% greater than placebo) over 1–5 years.
- c. Chestnut et al *Am J Med* 2000
 - i. (PROOF) study: a daily dose of 200 IU of nasal salmon calcitonin significantly reduced vertebral fractures by 33–36%.
- d. Used for painful episode in acute osteoporotic vertebral collapse
- e. Complication include rhinitis with nasal spray
- f. Rarely used nowadays for treating osteoporosis per se

18. PTH

- a. Teriparatide 20 μg sc daily
- b. Cranney et al *CMAJ* 2006
 - i. With 20 μg and 40 μg of hPTH, the relative risk (RR) of new vertebral fractures was 0.35 and 0.31 respectively (absolute risk reduction [ARR] 9%–10%).
 - ii. Treatment with 20 μg hPTH (1–34) resulted in a RR of 0.47 (95% CI 0.25–0.88) for non-vertebral fractures and an ARR of 3%.
- c. Side effect
 - i. ?? Osteosarcoma in animals, not in human subjects
 - ii. Transient hypercalcemia of more than 2 years not yet established.
- d. Treatment is limited to post-menopausal women with severe osteoporosis (T score < -4), or failure of response to bisphosphonate (after secondary osteoporosis is ruled out)
- e. Treatment duration should not last more than 2 years since safety with use of more than 2 years not yet established.

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19. Strontium ranelate

- a. 2 g po daily
- b. Action
 - i. Reduce bone resorption by decreasing osteoclast differentiation and activity
 - ii. Stimulate bone formation by replication of pre-osteoblast cells
- c. Seeman et al *J Bone Miner Res* 2008
 - i. In women with LS osteopenia, vertebral fracture reduced by 41% in 447 patients with no prevalent fractures, and by 38% in the 719 patients with prevalent fractures.
- d. O'Donnell et al *Cochrane Database Syst Rev* 2006
 - i. Potential risks to the vascular and neurological system associated with taking 2 g of strontium ranelate daily need to be further explored and quantified

20. Use and remarks for pharmacotherapy for osteoporosis

	Use	Remarks
Bisphosphonate	Men and postmenopausal women at risk of osteoporosis 1st line of treatment	Beware of problem with long term use Reflux esophagitis Jaw osteonecrosis
SERM	Postmenopausal women at high risk of fracture	Risk of DVT
Teriparatide	Postmenopausal women and men with severe osteoporosis	Subcutaneous injection daily
Calcitonin	Acute vertebral fractures	Nasal spray / subcutaneous injection
Strontium	Can be an option for treating osteoporosis	

21. Indication for pharmacotherapy for osteoporosis: (modified from Lau et al, Guidelines for diagnosing, prevention and treatment of osteoporosis in Asia. *APLAR Journal of Rheumatology* 2006;9:24-36 and "The Care of Patients with Fragility Fracture" by BOA 2007)

- a. Having a fragility fracture (any fracture due to falling from a standing height or lower in patient > 50 years old). DXA is not necessary for decision making regarding pharmacotherapy for osteoporosis although DXA may be useful to monitor the treatment response.
- b. Subjects > 75 years old (adopted from "The Care of Patients with Fragility Fracture by BOA 2007)
- c. According to results of BMD as indicated from NOF guidelines:
 - i. T score < -2.5: start bisphosphonate or strontium
 - ii. T between -1 to -2.5: SERM or bisphosphonate
 - iii. T above -1: observe and repeat BMD in 2 years
 - iv. For T score < -4, may consider teriparatide

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22. Fall Prevention

- a. Eradication of modifiable fall risks
 - i. Impaired eyesight
 - ii. Balance and muscle training
 - iii. Malnutrition, excessive alcohol intake
 - iv. Treatment of medical conditions: arthritis, DM, postural hypotension, cognitive impairment, peripheral neuropathy
 - v. Poly-pharmacy
 - vi. Suitable footwear
- b. Home hazard assessment and modification

23. Hip protector

- a. To be covered elsewhere in this guidebook

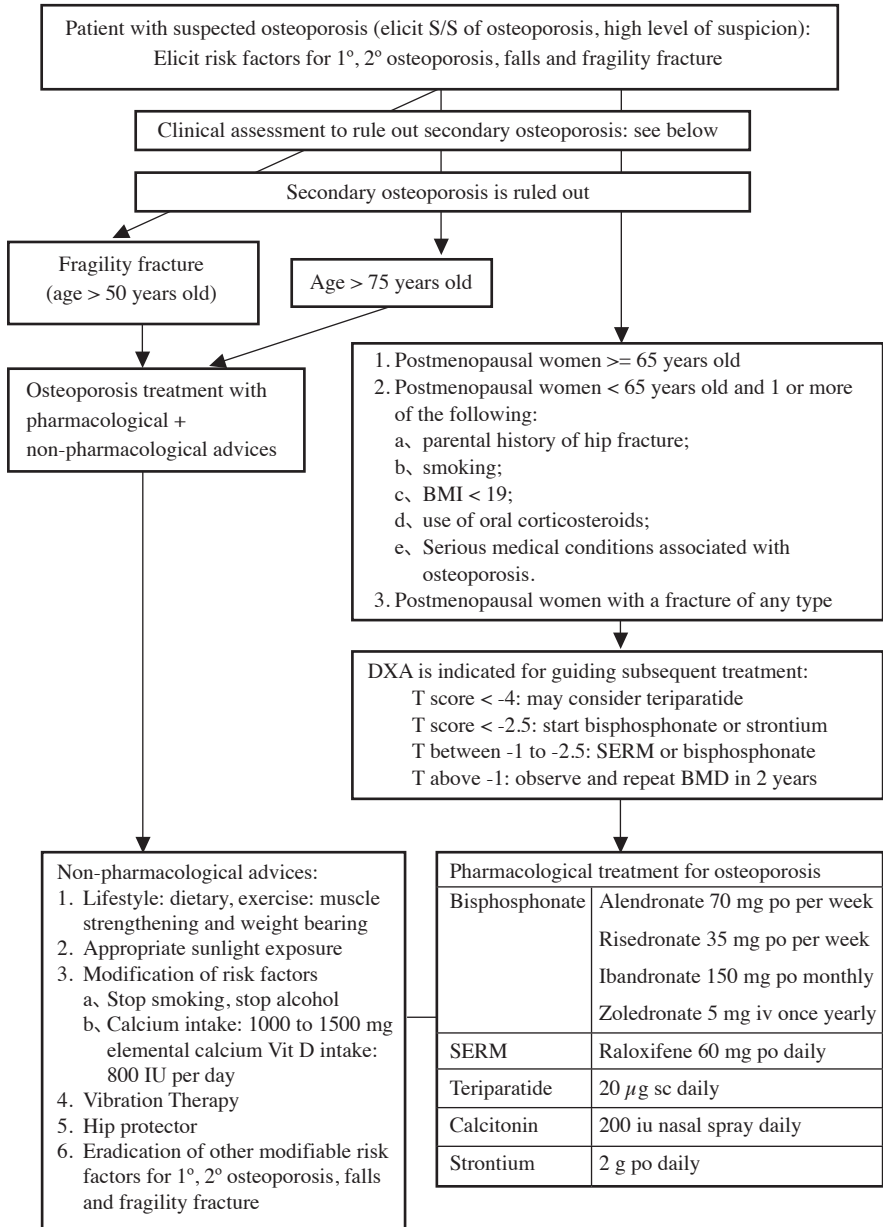
24. Conclusion

- a. Risk factors
 - i. Primary osteoporosis
 - ii. Secondary osteoporosis
- b. Risk factors for fall
- c. Risk Factors for fragility fracture
- d. Treatment for osteoporosis
 - i. Non-pharmacological
 - Lifestyle, diet, exercise, appropriate sunlight exposure, stop smoking, drinking
 - Ca and Vit D supplement
 - Vibration Therapy
 - ii. Pharmacological
 - Bisphosphonate
 - SERM
 - Calcitonin
 - Teriparatide
 - Strontium

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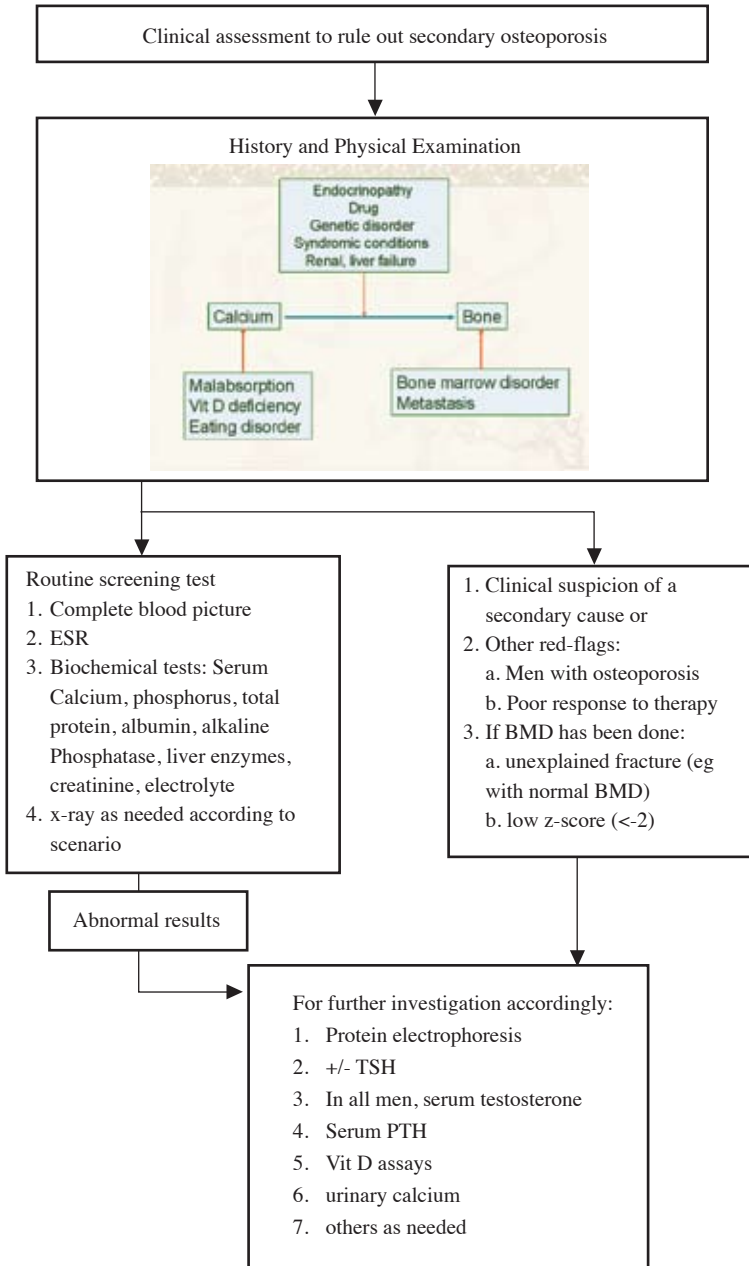
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Treatment algorithm for osteoporosis in orthopaedic practice



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Chapter 11

Medical care of fragility fracture in the community

Dr. Peter LAU

Fracture Care in the Community

Community care can be roughly divided into 3 phases:

1. Care / Rehabilitation of the current fracture
2. Prevention of another fracture
3. Detect any new onset fracture

Rehabilitation of the current fracture

By the time the patient is enrolled into the community program the rehabilitation care will have been largely completed at the convalescent hospital. The role of the community physician is mainly focused on:

1. Pain management with appropriate analgesic (both topical and oral)
2. Assess progress of rehabilitation and document improvement in functional status
3. Detect any late complication of fracture. The patient will be promptly referred back to the specialist in case of complications.

Principle of Fracture Prevention

Fracture occurs as a result of compromised bone strength and precipitated by a fall with sufficient force on impact. Thus, maintaining bone health through proper management of osteoporosis, as well as reducing the occurrence (and impact) of falls, constitute the twin pillars in protecting the elderly from fractures.

Strategy for Preventing Osteoporotic Fracture in the Elderly in Primary Care

Members of the fracture care team must be well aware of risk factors for osteoporosis (see Box 1). In addition, simple measurements such as height loss and calculation of the OSTA score (based on weight and age) allow the at risk population to be identified.

Making a diagnosis of osteoporosis / osteopenia, however, requires radiological examinations such as DEXA scan or qCT, or a confirmed presence of fracture.

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After identifying individuals with established osteoporosis, specific measures can be taken in the primary care setting to prevent osteoporotic fracture, such as:

1. Initiate and maintain specific treatment for osteoporosis
2. Initiate and maintain calcium and Vitamin D supplementation
3. Advice on and maintenance of lifestyle intervention, including diet and exercise

It is also necessary to monitor the response to intervention / treatment programs by:

1. serial BMD measurement every 2 years,
2. watching out for adverse effects of medication: esophagitis, osteonecrosis of the jaw

A fracture care program is not complete without efforts to minimize fall risk. This would include:

1. Screening for individuals at risk of fall
2. Identify and rectify fall hazards such as environment factors, medical conditions, and medications
3. Encourage participation in fall prevention programs.

Last but not the least; fracture care should be integrated into a co-ordinated, holistic plan of management for all the patient's co-morbidities.

Box 1: Osteoporosis Risk Factors危險因素:

(Non-modifiable 不可改變的)

1. early menopause 絕經期過早
2. Asians or Caucasians 亞裔或白種人
3. small stature 身材細小
4. family history of fracture 家族遺傳

(modifiable 可以改變的)

1. inadequate calcium intake 鈣質吸收不足
2. lack of exercise and outdoor exposure 足不出戶、缺乏運動
3. smoking 吸煙
4. alcoholism 酗酒
5. thyroid disorder 甲狀腺功能失調
6. long-term steroid therapy 長期服用類固醇藥物

Bone Mineral Density (BMD) Testing

BMD is the most easily measured parameter to assess bone strength. (The other parameter, bone quality/microarchitecture, is much more difficult to quantify). However it must be noted that in many guidelines / protocol, BMD testing is not mandatory

BMD measurement is useful in confirming the presence of osteoporosis / osteopenia as well as monitoring treatment response.

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Dual Energy X-Ray Absorptiometry, DEXA 雙能量放射線吸收密度儀

This is the most widely employed method of BMD measurement, and is used in large RCTs. DEXA is considered the gold standard for the diagnosis of osteoporosis.

High precision and accuracy is achieved with only modest radiation exposure. BMD is measured at the clinically relevant sites of hip and spine (although the peripheral skeleton can also be scanned). The use of 2 x-ray beams enables corrections to be made for soft tissue.

Usually only the left hip (see Box 2) and the spine are scanned. There are, however, arguments for and against scanning both hips in a screening DEXA examination. (see Box 3)

Box 2: Single Hip DEXA Scan: Left or Right?

Although it is generally suggested that the patient's "non-dominant hip" should be scanned (determined by asking the patient if he or she is right- or left- handed), there is little evidence to document the biologic relevance of such guidance.

In practice, this decision is often based on the technical ease of performing the scan, which in turn is often dependent on the technologist's personal preference and the physical location of the densitometer in the scanning room.

Box 3: DEXA Scan: One hip or both hips?

Proponents of bilateral hip scans:

- There is a small percentage of patients with statistically significant left-right differences in hip BMD, which may influence the ultimate diagnosis.
- Bilateral scans also insure having a baseline hip scan should a patient suffer a unilateral hip fracture or have a total hip replacement.

Arguments against bilateral hip scans:

- There is generally a high correlation between left-right hips and the frequency of observed left-right differences is small.
- Measurement of both hips increases the skeleton sites assessed and artificially increases the prevalence of osteoporosis.
- Bilateral hip scans exposes the patient to unnecessary radiation, and the benefit of bilateral hip scans vs. scanning only one side does not outweigh the risk of a stochastic effect of radiation.

Bone mineral density measured in a DEXA scan is translated as a T-score, which is equal to the number of standard deviations from that of a young adult reference population. The World Health Organization has established the following diagnostic guidelines:

1. T-score ≥ -1.0 or greater: "normal"
2. T-score between -1.0 and -2.5 : "low bone mass" or "osteopenia"
3. T-score ≤ -2.5 or below: osteoporosis

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Simple Osteoporosis Screening

The OSTA Score, utilizing only the weight and height, can enable a rough estimation of osteoporosis risk to be calculated very quickly. Standard charts can aid the interpretation of findings.

OSTA score = (Weight in Kg – Age) x 0.2

Note: the decimal point is truncated.

Interpretation:

< -1: high risk

> -1: low risk

Specific Treatment for Osteoporosis 骨質疏鬆: 針對性治療

To achieve success in the medical treatment of osteoporosis, the physician needs to:

1. Assess the indications for treatment
2. Convince the patient of the benefits of treatment
3. Choosing and prescribing the right medication
4. Monitoring adherence to treatment
5. Monitoring response
6. Monitoring adverse effects

Available pharmacological agents include:

1. Bisphosphonate 雙磷酸鹽
2. Selective Estrogen Receptor Modulator, SERM 選擇性雌激素受體調節劑
3. HRT 激素補充療法
4. Calcitonin 降血鈣素
5. Parathyroid Hormone 副甲狀腺激素
6. Strontium?

In the elderly population, bisphosphonates are by far the most commonly prescribed anti-osteoporotic medications.

Response to medical treatment is considered unsatisfactory when the patient has another fragility fracture despite adhering fully to treatment for 1 year, with evidence of a decline in BMD below the pre-treatment baseline. Therefore, serial BMD measurement every 1-2 years may be useful.

Patients may also develop intolerance of bisphosphonates, evidenced by oesophageal ulceration, erosion or stricture, or severe lower gastrointestinal symptoms. Osteonecrosis of the jaw is another major (but rare) complication to look out for.

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Non-pharmacological intervention 一般性的預防和支援措施

Supportive measures may be less dramatic than medications, but they are nevertheless the foundations of osteoporotic care, and are suitable to all types of patients. These would include:

1. Calcium and Vitamin D supplementation 補充鈣質及維生素D. Recommended daily intake of calcium is 1000 to 1500 mg, and Vit D is 400 to 800 iu.
2. Dietary advice to augment calcium intake 富含鈣質的日常飲食
3. Weight bearing and balance training exercise 負重運動, such as jogging or Tai Chi
4. Smoking cessation 戒煙
5. Avoid excessive drinking 節制飲酒
6. Vibration therapy 震盪治療

Fracture Prevention: Preventing Falls 避免摔倒

Fall prevention strategies include:

1. Exercising regularly 鍛鍊平衡的運動 —exercise programs like Tai Chi太極that increase strength and balance are especially good.
2. Having medicines reviewed 藥物檢討 to reduce side effects and interactions.
3. Having yearly eye exams 檢查視力.
4. Identify and rectify fall risk related to other medical conditions 辨識導致摔倒的其他醫學問題
5. Reducing fall hazards in the home 注意家居安全
6. Encourage participation in fall prevention programs and the use of hip protectors 參與社區防跌計劃

In addition, the use of hip protectors is a well-proven means to reduce the impact of falls.

Detecting New Onset Fracture

This depends on continuous, regular surveillance. Sometimes simple measurements can be a great help.

Studies have shown that height loss predicts osteoporotic fracture. For example, height loss of 5cm or more is a highly significant predictor of osteoporosis at the hip. Since loss of height may be an important clue in detecting osteoporosis, accurate measurement of height should be routine in the outpatient setting.

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Barriers to post fracture osteoporosis investigation and treatment

To achieve success in any fracture care program, obstacles to the utilization of proper medical care must be identified, and solutions to overcome such barriers must be found.

Research has shown that the following factors can deter patients from receiving proper fracture care:

1. cost of therapy
2. patient reluctance
3. time and cost of diagnosing osteoporosis
4. side effects of medications
5. perceived “unproven effectiveness” of medication
6. lack of access to BMD testing
7. lack of time to address secondary prevention

A concerted effort and dedication by all members of the healthcare team (see Box 4) are needed to bridge the care gap and implement an effective fracture care program.

Box 4: The Interdisciplinary Team 跨領域的合作團隊

- Orthopedic Specialist
- Geriatrician
- Anesthetist
- **Primary care physician / Family physician**
- Orthopedic nurse specialist
- Other nursing staff
- Dietitian
- Physiotherapist
- Occupational therapist
- Social worker
- Volunteer helper and other concerned parties

The family physician, espousing the family medicine concept of holistic, comprehensive and continuous care, is uniquely positioned to act as coordinator of the team. Support from and close liaison with the specialists and other allied health professionals is essential

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Management of co-morbidities: a holistic approach to patient care

The silent nature of osteoporosis is often the obstacle to good compliance of fracture prevention. To make a comprehensive fracture management program really successful, medical service needs to expand beyond the orthopedic concern.

By offering general medical care beyond fracture management to the recovered fracture patient, the community fracture clinic becomes a focal point for sustained surveillance where the patient returns from time to time.

In addition, a full rehabilitation program should be well integrated with regular social and recreational activities. This provides additional motivation for the patient to remain in the program and can minimize the dropout rate.

Working with the community

More efforts should be directed at promoting health education on osteoporosis and fracture prevention in the community. We need to mobilize resources by involving the stakeholders such as civic leaders and NGOs.

Into the future

It is hoped that the scope of the community fragility fracture program can be widened to encompass the primary prevention of osteoporosis targeting the at-risk population. The focus will be shifted to the prevention of the first (rather than a repeated) fracture. Even a single fracture is one too many.

Chapter 12

Post fracture care phase:- fall risk assessment and fall prevention

Ms. Winnie MAK

12.1 Background

- Fall is common in the elderly. Around 18% to 39% of elderly people fall each year.¹⁻³
- 47% of falls result in injuries including laceration, bruising, abrasion, soft tissue injuries, fracture or even death. 4 Falls affect mobility, independency and quality of life of the elderly and also increase the burden on the family members and the society as a whole.
- Elderly with an experience of fall tends to fall repeatedly. 40% of Chinese elder were multiple fallers. 1 As a result, the awareness on the importance of fall prevention should be enhanced.
- In order to organize a comprehensive and effective fall prevention program, a thorough assessment on fall risk should be performed. And the result in the assessment should be considered when designing fall prevention program.

12.2 Predictors of falls

- Functional predictors: muscle power, postural stability, balancing ability, mobility level, gait pattern etc.
- Clinical predictors: age, osteoarthritis, dementia, stroke, previous fall history etc.
- Functional predictors were stronger predictors of falls in Chinese elderly when comparing to clinical predictors.¹
- As fall is a complex and multi-factorial phenomenon, physiological mobility and balance are not the only indicator of falls in the elderly.⁵
- Home hazard assessment and individual habits should also be considered in a thorough fall risk assessment. More detail discussion can be referred to Chapter 13.

12.3 Vision and fall

- Vision also plays an important role in balance. Visual impairment may cause inappropriate foot placement or misinterpretation of the surrounding situation and leads to fall.
With visual deterioration, elderly people may use lenses to solve their visual problems. However, Lord et al reported that the use of bifocal or multifocal lenses will increase the risk of fall by impairing depth perception and edge contrast sensitivity.
- Glares from the floor surface or poor lighting can also affect vision and are risk factors of falls, especially in the elderly.

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12.4 Medical conditions, medications and fall

- Elderly people usually suffer from more than one medical diseases and taking multiple medications.
- Medical illnesses such as cardiovascular diseases, Parkinson's diseases, cerebral vascular accident, visual impairment, foot problems, incontinence, depression etc are risk factors of falls.⁶
- Medications such as anti-depressants, anti-hypertensive drugs, anti-diabetic drugs etc also predispose to fall in the elderly.^{3,6,8}

12.5 Blood pressure and fall

- Postural hypotension refers to a significant drop in blood pressure when the client changes from a supine position to an up right posture. It indicates mal-function in the auto-regulatory mechanism of the cardiovascular system. A drop of 20 mm Hg or more in systolic blood pressure or a drop of 10 mm Hg or more in diastolic blood pressure with standing is regarded as postural hypotension.⁶
- A decrease in systolic blood pressure of 20 mm Hg or more is significantly associated with fall in the elderly.⁷
- In the study done by Heitterachi (2002), faller group failed to maintain or increase the dropped blood pressure after tilting. Non-faller group also had a drop in blood pressure after tilting but the drop was not large. They can restore the condition quicker and maintain the carotid blood pressure by normal reflex.⁷
- The drop in blood pressure after standing may be due to defects in cardiovascular homeostasis or the use of drugs, such as anti-hypertensive or anti-depression drugs.

12.6 Balance and falls

- Balance is the ability to stabilize the body during standing, walking and performing various daily functional tasks.
- According to the definition quoted by Lord et al (2007), postural stability is defined as "the ability of an individual to maintain the position of the body, or more specifically, its center of mass, within specific boundaries of space, referred to as stability limits. Stability limits are boundaries in which the body can maintain its position without changing the base of support."⁶
- Muscle strength, peripheral sensation, visual acuity, vestibular function and reaction time are factors that can affect the postural stability. In normal ageing, the ability to maintain a stable posture decreases. This may be due to the deterioration of various body systems. An increase in body sway has been proven to be a useful predictor of fall in the elderly.⁶
- Gait pattern changes when age increases. Elderly tends to walk much slowly and with a shorter step length, reduced cadence and increase time in double limb support.
- Some investigators found that fallers walk with slower velocity and with narrower step width. This can reduce the base of support and can act as a predictor of fall.⁶

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- Apart from the physiological factors, such as reduced lower limb strength, slower reaction time, increased postural sway and impaired peripheral sensation, cognitive status and psychological factors, such as anxiety and fear of falling, may also alter the gait pattern and increase the risk of falling.⁶
- When overcoming obstacles, elderly tends to step on the obstacle rather than step over it and this increases the risk of falling.
- During stair negotiation, difficulties were reported in elderly. The risk of fall is much greater when the elderly is descending the stair rather than ascending it.⁶

12.7 Fall risk assessment

12.7.1 Visual assessment

- Visual assessment includes visual acuity, contrast sensitivity and stereoacuity. Visual assessment should be included as part of the fall risk assessment.
- Visual acuity is how clear the elderly can see. It can be assessed with the setting shown in Fig. 1. The elderly is asked to point out the direction of the “E” shown in the light box. The more the correct answer the elderly can give, the better is his/her vision.



Fig. 1 shows the setting of visual acuity assessment. The more the number of “E” that the elderly can correctly see, the higher the marks in the visual acuity assessment.

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- Contrast sensitivity refers to the ability to discriminate an object from its background. Contrast sensitivity will be affected in elderly with cataract or diabetic retinopathy. It can be assessed as in Fig. 2 and 3.

The elderly is asked to point out which circle had grey lines in row A, B, C and D. Elderly who can correctly point out the circles up to column 4 in row A and B, column 3 in row C and column 2 in row D is said to pass the contrast sensitivity test.



Fig. 2 shows the setting of the assessment of contrast sensitivity.

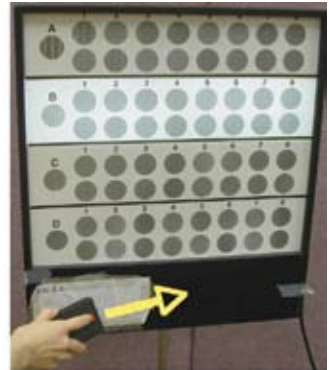


Fig. 3 shows the figure of the light box.

- Stereoacuity refers to the ability to discern distance or depth of an object. The test is carried out as in Fig. 4. The testing cues consist of 3 pieces of glasses with different thickness. The elderly is asked to point out the image with a “protruded/depressed” circle from the 4 images on the testing cues.

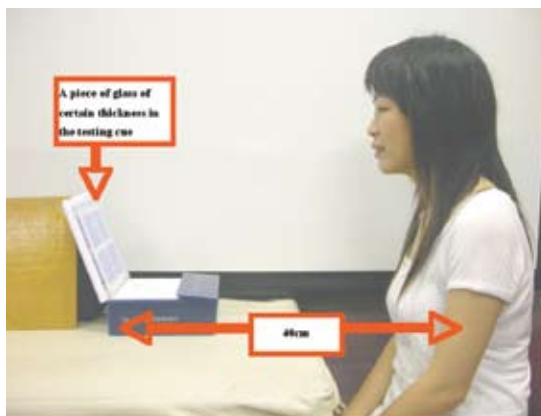


Fig. 4 shows the setting for assessing the stereoacuity.

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12.7.2 Assessment of postural hypotension

- As postural hypotension is associated with falls. It should be assessed during fall risk assessment.
- Blood pressure should be measured twice. The first measurement should be taken in the sitting position and the second reading is done in standing position after standing quietly for 3 minutes.
- The elderly is said to have postural hypotension and prone to have a higher risk of fall when there is a 20 mm Hg or more drop of his/her systolic blood pressure or when there is a 10 mm Hg or more drop of his/her diastolic blood pressure upon standing.

12.7.3 Balance and mobility assessment

12.7.3.1 Timed-up-and-go test (TUG)

- Tools: a stop watch, a stable chair with a seatback and armrest
- Setting: The chair is placed stably on the floor. A distance of 3 meters is measured from the chair and the point is marked on the floor.
- Procedures: The elderly is asked to get up from the chair, walks for 3 meters, turns back at the marked point, walks back to the chair and sits down. The elderly is asked to complete the whole task safely but as fast as she could. The time taken to complete the task is recorded.
- Result interpretation: Normal independent adults usually take 10 seconds or less to complete the task. 9 TUG is a valid predictor of fall. In some studies, TUG of 13-16 seconds can be used as a cutoff point to discriminate fallers from non-fallers. For patients who have undergone surgery for hip fracture, the cutoff point is a bit greater. If the patient takes 24 seconds or more to complete the test, the risk of recurrent fall increases.¹⁰
- Other comments: TUG test is easy and convenient to carry out. It can test the ability of sitting to standing, standing to sitting, turning and walking. TUG test can be used as a predictor of fall in community dwelling elderly. But the test may not be useful in inpatient or acute setting the elderly just can not complete the test for other physical reasons.¹¹

12.7.3.2 Berg Balance Scale (BBS)

- BBS is commonly used to assess balance in the elderly by assessing their ability to perform various functional tasks. It can also be used to evaluate the effectiveness of an intervention.
- There are 14 functional tasks in BBS including sitting, standing, standing with eyes closed, standing with feet together, sitting to standing, standing to sitting, transfer, reaching forward, picking up objects, turning, turning 360°, stepping, tandem stand and single leg standing.
- For each task item, the scale range from “0” to “4”. A higher score represents better performance of the task. As physical mobility and balancing ability are predictors of falls, BBS is also commonly used to assess the fall risk of an elderly. A score of 45 is usually used as a cutoff point.¹² Elderly who scores 45 or above is considered to have a low fall risk while those score less than 45 possesses a high risk of fall. However, in a recent study by Muir et al (2008), BBS is sensitive in identifying recurrent falls or multiple falls but it may not be so effective to act as a dichotomous scale to differentiate the fall risk of the elderly.¹³

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- BBS consists of daily tasks that an elderly need to handle. It is a detail balance assessing tool but it may be a bit time consuming if used as a screening test for fall risk. Besides, as the tasks mainly concern the lower limb performance, the balancing ability may be biased. It may be overestimated if the elderly suffered from upper limb problems or, in vice versa, it may be underestimated if the elderly can ambulate independent with a wheelchair although their lower limbs are impaired.

12.7.3.3 Elderly Mobility Scale (EMS)

- EMS is useful to classify the independent level and the residential placement of the elderly.¹⁴
- It consists of 7 daily functional tasks: lying to sitting, sitting to lying, sitting to standing, standing, gait, 6 meters timed walk and functional reach. It consists of the tasks similar to those in BBS but are less complicated.
- The items are rated by a 3-point scale or a 4-point scale. The total score is 20. According to Yu's study in 2007, elderly individuals with a score 14 or above are more independent and with good mobility and balancing skills. Those who score 6 or lower may have poor mobility and may need assistant in daily activities.¹⁴
- It can be used in frail elderly who are discharged from inpatient shortly or who suffers from fractures recently. EMS is suitable in rehabilitation state.

12.7.4 Assistive devices

- Assistive devices include footwear, walking aids, spectacles and etc. Wear and tear of these devices may also increase the risk of falling in the elderly.
- Footwear should be slip resistant, be appropriate size and have proper fixation. More detail information on footwear assessment can be found in Chapter 15.
- Cane, quadripods and walking frame are the most commonly seen walking aids used in elderly. The elderly in need of external support should be assessed by physiotherapists on their balancing ability and their mobility before walking aids are prescribed. The aids should be of appropriate height. The height is appropriate if the elbow of the elderly is in 30° flexion when he/she placed his/her hand on the handle of the aid and the aid is placed by his/her side.
- The visual problem should be assessed and spectacles should be prescribed by optometrists. Improper spectacles may increase the risk of fall.

12.8 Rationale for test selection

- There are many tests or assessments that need to be considered when deciding the fall risk of the elderly. A thorough assessment provides the hints to design appropriate and effective fall prevention programs.
- When choosing tests for fall risk assessment, the time for administrating the tests, the feasibility of the tests for both the elderly and the assessors, availability and suitability of the assessing environment and whether the test can be quantified or not should be considered.⁶

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12.9 Recommendation for fall prevention

- The fall prevention program should be tailor-made according to the fall risk of the target group elderly.
- Education and training can be considered for those who are in the low risk group. It is shown that these programs can enhance the knowledge and the awareness on fall and fracture prevention.¹⁵
- Exercise intervention, medication and assistive devices prescription should also be considered for elderly with high fall and fracture risk.
- More detail information on fall prevention program can be found in Chapter 8.

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Chapter 13

Hip protector:- biomechanics, design, enhancement of compliance, evidence of benefits

Mr. Patrick SZE

I) Definition and mechanism

The use of hip protectors for prevention of hip fracture has been widely researched in the past decade. Hip protectors are external protective device to protect the hip from fracture in the occasion of fall. The mechanism of protection provided by hip protectors is to attenuate the impact force to the hip when fall occurs. Thus even when a fall occurs, hip protectors will be able to provide instant protection to the hip so that the chance of hip fracture will be lower for people who wear hip protectors than those who do not.



II) Evidence on effectiveness of hip protector

Effectiveness of hip protector has been proven in the following areas

i) Mechanical studies

There are studies done in laboratory either under simulated or real fall situation. These studies show that most of the hip protector is effective in reducing the force during falling. Some of them can even reduce over 90% of the impact force while the remaining impact is well-below the fracture threshold of proximal femur of the elderly.

ii) Clinical effectiveness

There are many clinical studies demonstrating the effectiveness of hip protectors in preventing hip fracture. It is shown that up to 60% of hip fracture can be prevented through wearing of hip protectors. Hip fractures seldom occur when hip protector is being worn.

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iii) Cost-effectiveness

Studies demonstrated that hip protector is more cost-effective than other strategies for hip fracture prevention such as exercise and pharmaceutical approaches. Studies also showed that use of hip protectors is more beneficial in terms of the cost when comparing the cost of hip protector and the medical cost of treating hip fracture which may have been prevented with the use of hip protectors. Use of hip protectors is also beneficial in terms of quality adjusted life year gain.

III) Key factors for the effectiveness of hip protector

i) Types of hip protector and force attenuation power:

The force attenuation power varies between different types of hip protectors, which determines its ability in reducing the amount of impact force to the hip during fall.

Hip protectors are divided into two types:

Energy absorption hip protector:

Major action is to absorb the impact energy generated during fall. It is usually made of foams or other energy absorption materials, which absorb part of the impact energy. Amount of energy being absorbed depends on types and thickness of materials.

Pros: more comfortable to wear.

Cons: more bulky and less effective in force attenuation

Energy shunting hip protector

Major action is to shunt away the impact energy to surrounding soft tissues. Energy shunting pads are usually made of harder materials like plastics. They are usually in oval shapes with a convex area at the middle of the pads so that the trochanteric area is free from contact with the pads, and energy will be shunted to the surrounding parts to avoid direct transmission of energy to the weaker trochanteric region.

Pros: more effective in force attenuation, less bulky

Cons: more discomfort to wear, the impact shunt away to the surrounding tissues which may be bruised or injured.

ii) Compliance of users

No matter how effective the hip protector can attenuate the impact force, it becomes in vain if the users refuse to wear it.

Compliance is defined as the wearing of hip protectors in accordance with the recommendations of the study protocol and can be measured in the following ways: (1) the amount of time the hip protector is worn or (2) percentage of fall where hip protector was being worn.

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iii) Selection of users

Identification of users at high risk of fall and hip fracture is also crucial in determining the effectiveness of hip protectors. Application of hip protectors to the high risk users implies better chance in protecting the users from hip fracture as a result of fall. This also has implication in cost-effectiveness.

IV) Concerns of users in wearing hip protector

i) Concerns of users that may hinder the use of hip protector

- Need to wear additional pants
- Not necessary as self perceived risk of fall or fractures was low
- do not like the fabric materials or the design of the pants
- do not like the appearance after wearing or let others know they are wearing hip protectors
- Laundry problems
- tightness of the pants
- Hot
- Forgetfulness
- Urinary incontinence or frequent toilet user
- Clumsy in positioning the pads, the wearing and removing of the pants
- Discomfort caused by pressing from pads while dressing
- Extra effort or time is needed for dressing and removing the pants, hinder activities of daily living like toileting or dressing
- Bulkiness: bulkiness of the hip protector adds further difficulties in dressing additional outer pants or trousers (especially when the weather is cold and subjects need to dress additional trousers)
- Heavy: the hip protector is heavy and some subjects need to pull up the pants regularly
- Skin irritation: skin irritations like itchiness after wearing hip protector

ii) Concerns of users that may facilitate the acceptance and use of hip protector

- Like the texture of the garment
- Gaining of confidence against fall after wearing hip protectors
- No difference in appearance after wearing
- Regarding the hip protector as normal under-garment
- Getting warmer after wearing in winter

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V) Recommendations

i) *Choose/design a hip protector:*

- Recommend to use energy shunting design
- With cushioning materials around the pad to ameliorate user-comfort
- Detachable pads
- Size of pads should be minimal but effective in covering the trochanteric region
- Convexity of the pads should be minimal to avoid bulkiness
- Should pass mechanical test on force attenuation
- The design of pants should be in reference to anthropometry of the user group
- The fabric materials should be elastic for providing force to hold the pads in place
- For use in places with hot and humid climate, the fabric materials should have good function in air-permeability, moisture absorbency and resisting dimensional change after laundry.
- The components of fabric materials should be in high percent of natural fibre such as cotton for comfort and with a few percent of synthetic fibre such as lycra for improvement of function)

ii) *Implementation of hip protector programs for your client*

- It is important to implement education program to your client before providing them the hip protectors
- The education program should include the following: cause and consequence of hip fracture; mechanism of hip protector and its effectiveness; method of wearing, laundry and wearing regime
- In general, at least three pairs of pants should be provided to each client for change
- Provide training session to your client in wearing hip protectors
- Provide individual fall risk counseling if necessary to increase the acceptance of hip protectors
- Provide assistance to clients with special needs that may hinder their use of hip protectors, such as low hand function and physical difficulties.
- Provide counseling to clients with psychological barriers such as self-perceived barriers in wearing hip protectors and poor self-rated health.
- Include the client's carers / family members in the education program as they can provide good source of reinforcement to the client in wearing hip protector
- For programs in old age home, provide in service training to the staff to let them appreciate how the hip protectors can help the clients.
- Provide clear instruction to the staff on the wearing regime, laundry method, compliance checking and any recordation required

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iii) *Client selection and special consideration*

Clients with high risk of fall and fracture should be the prioritized users. Risk factors include:

- With repeated fall history in the previous year
- With history of fracture since the age of 50
- With osteoporosis
- Poor in balance and gait
- With fall risk behavior
- Have more than three prescription
- Need walking aids in daily life
- Diseases that may increase fall risk such as stroke and Parkinsonism

Special consideration

- For clients with implantation done on hip as the result of hip fracture, the pad is not required to apply to the corresponding side.
- For users who require napkins, hip protector pants of a larger size should be selected
- For frequent toilet users, toileting aids such as commode should be provided. Also extra pants (at least 5) should be provided for frequent changing
- For clients with dementia or problems in cognitive functioning, visual cues or memory aids should be provided to remind the client in wearing hip protectors. Special attention is required for clients with more severe level of dementia to make sure they wear the hip protector properly to avoid accidents.

Conclusion

Hip protector can be effective in preventing hip fracture. However, problems on acceptance and compliance are the major challenges on its application. A holistic approach with multidisciplinary inputs from hip protector design, client selection and facilitation programs should be adopted in order to improve its effectiveness.

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Chapter 14

Nutritional problems in the elderly

Mr. Terry TING

Physiology Changes in Elderly Affecting Dietary Intake

Physiological changes with aging can be categorized as changes in body composition, in the senses and in major organ system. These changes may affect the elderly from consuming adequate nutrients, thus resulting in malnutrition.

The physiological changes in the elderly result in decreased interest in food and dietary intake:

1. Sensory changes with aging

- Decreased number of papillae
- Decreased number of taste buds
- Changes in the central nervous system resulting in decreased sense of taste and smell
- Decline in visual acuity
- Decline in hearing acuity

2. Inadequate Dentition

- One third of persons over age 75 have no teeth and at least 10 pairs of tooth are required to chew food properly
- Improper used of dentures causing pain with eating
- Poor dentition affects how much food are ingested, absorbed, and digested

3. Swallowing problems and dysphagia

- Modified texture foods (minced or pureed) contain low density of nutrient
- May cause under-feeding and malnutrition in long term if no dietary intervention is taken

4. Decline Gastrointestinal function

- Increased gastric emptying from 50 to 120 min in elderly
- Digestive enzymes are reduced (i.e. salivary amylase, HCL, intrinsic factor, pepsin, pancreatic enzyme and lipase)
- Constipation discourage food intake
- Lactase deficiency

5. Decline in Renal, liver, and cardiopulmonary functions - play an important role in decreased food consumption in elderly

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Risk Factors Associated with Poor Nutritional Status

Malnutrition is common in the elderly and may lead to serious medical conditions. The following are the consequences of malnutrition.

- Loss of muscle mass
- Impaired immune response
- Poor response to medication
- Death
- Decline in nutrition status
- Impaired organ function
- Poor adaptation

Nutritional risks of the elderly are multi-factorial and problems are often difficult to resolve (White, 1994)

1. Inappropriate food intake

- Diminished desire to eat reduced hunger, slowing of gastric emptying and autonomic nerve dysfunction. Clarkston, et al., (1997)
- Half of the older women had olfactory dysfunction resulting in reduced interests in food-related activities. Duffy, et al., (1995)

2. Poverty

- Food consumption survey showed low income elderly have consistently lower intakes of nutrients (decreased protein rich food, iron rich food, calcium rich food, high fiber food etc..)

3. Social Isolation

- The emotions associated with losses of family members and friends, independence, self-esteem and income can negatively affect nutritional status (ADA, 1998)

4. Depression

- Changes in appetite, changes in weight and lack of interests in food are leading causes of unexplained weight loss in elderly. Morley (1996)
- Drugs for depression can cause decreased appetite, dry mouth, nausea and constipation.

5. Impaired Functional status

- Physical inactivity leads to difficulties related to eating, food purchasing & preparation.

6. Acute or Chronic diseases

- DM, CHF, HT, CVD, decline in immune system, Dementia, COPD, Cancer, Pneumonia, Pressure Sores, Infection etc...

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Nutritional Assessments for Elderly

The purposes of nutritional assessment are to determine if the body is capable of converting food into usable body components and to determine if the elderly will benefit from the medical nutrition therapy (MNT).

Assessments should include:

- Anthropometric measurements
 - Weight, height/knee height and BMI
 - Triceps Skinfold – indicator of subcutaneous fat
 - Mid-arm circumference – indicators of both protein and subcutaneous fat status
 - Mid-arm muscle circumference – more sensitive indicator of somatic protein
 - Bio-impedance Analysis & DEXA – lean muscle mass, body fat and hydration status
- Biochemical data
 - Nutrition Status - Pre-albumin, albumin and C-reactive protein
 - Anemia - Hematocrit, TIBC and Hemoglobin
 - Hydration status - Serum sodium, Blood Urea Nitrogen, Serum Osmolarity
 - Blood Pressure
- Clinical History
 - Acute or chronic diseases and their medications
- Dietary intake assessments
 - Diet History
 - Food Frequency Questionnaire
 - 3 or 7 days food record
- Social and economic status
 - Education level
 - Economic status
 - Family support
 - Functionality

Common Nutrition Screening Tools

- Mini Nutrition Assessment
- Subjective Global Assessment
- Malnutrition Universal Screening Tool

Interpretation of the degree of weight Loss

Time	Significant weight loss	Sever weight loss
6 month	10%	>10%
3 months	7.5%	>7.5%
1 month	5%	>5%
1 week	2%	>2%

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Eating Problems of Hong Kong Elderly

- High salt intake – Tea House, salted fish/egg, preserved vegetable & meat
- High fat intake – eat out, high fat cooking methods
- Low nutrition value food – Chinese soup, congee, plain bread, oatmeal
- Low High Biology Value protein intake – reduce meat or meat substitute intake
- Inadequate iron intake – reduced red meat, consume more fish
- Inadequate calcium intake – lactose intolerance
- Low fiber intake – only 40% elderly in HK met recommended dietary fiber intake (20-30g/d)

Nutrients Requirement for the Elderly

Nutrients	Requirements
Energy	Individualized, 25 to 30 Cal/kgBW
Protein	0.8 to 1g/kgBW
Carbohydrate	45 to 65% of total energy intake
Fat	30% of total energy intake (<10% from saturated fat)
Dietary fiber	20 to 30g/d
Calcium	800 to 1000mg/d
Iron	15mg/d
Vitamin C	60 to 100mg/d



長者健康飲食金字塔

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Chapter 15

Footwear assessment for the Elderly

Ms. Claudia CHAN

1. Introduction

- Falls are common occurrences in older population
- Fall related injuries account for considerable morbidity and mortality among elderly people¹
- Therefore, investigation on the biomechanics of fall becomes the important issue on fall prevention among the elderly

1.1 Balance control of the elderly

- It is defined as the ability of an individual on how to walk safely and preserve balance by maintaining the position of the center of mass (COM) over his/her base of support²

1.1.1 Biomechanics of fall

- An individual able to maintain balance when his/ her body's centre of mass is maintained dynamically over its base of support³
- If there is an abnormal displacement of the centre of mass beyond the base of support together with the fact that the body's postural control systems fail to detect such displacement and do not reposition the centre of mass over the base of support in time, an individual fail to maintain balance and initiate fall
- Elderly have failure in detection and reposition more frequent than the younger adults due to a variety of causes from many intrinsic factors⁴
- Thus elderly people are prone to fall

1.1.1.1 Intrinsic factors affecting the balance control in the elderly

- Elderly people face body changes due to aging, diseases and inactivity
- Include:
 - i. Improper functioning of the various senses⁵
 - Deterioration in visual function
 - Deterioration in lower extremity sensory function
 - ii. Slowing in central nervous system^{6,7}
 - Slow reaction time
 - Reduce the speed of postural reflexes
 - iii. Weakening in neuromuscular system and musculoskeletal system^{6,7}
 - Impairment in proprioception
 - Lowering in muscle strength
 - Lowering in joint range of motion
- Elderly with such kind of changes have difficulties to detect displacement of the centre of mass and fail to reposition the centre of mass over the base of support in time
- Therefore, balance control is lost among the elderly

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1.1.2 Gait changes in the elderly

- Apart from balance control, changes in normal gait pattern among the elderly also contributes to falls⁸
- Normal gait pattern in an individual includes six phases:
 - i. Initial contact
 - The instant when the heel of the reference limb touches the floor
 - ii. Mid stance
 - The supporting time when both heel and toe of the foot touch the ground
 - iii. Heel off
 - The instant during stance when the heel leaves the ground
 - iv. Toe off
 - The instant when the toe of the foot or shoe leaves the ground
 - v. Mid swing
 - The instant when the leg swings in the mid point of time between toe off and initial contact of next gait cycle
 - vi. Terminal swing
 - Complete the whole gait cycle when the heel of reference limb touches the ground
- Initial contact is the key for maintaining stability, as the forward momentum maintains the body weight on the leading foot causing a forward slide of foot⁸
- Any factor which prevent the heel from contacting the ground initiates fall⁸
- Elderly people change their gait pattern due to aging and diseases
- There are obvious changes in the gait pattern between elderly and young adults⁸, including:
 - i. Reduced velocity
 - ii. Have a shorter step length
 - iii. Have a broader walking base
 - iv. Result in a gait cycle with a longer stance or support time
- It is believed that such kind of changes in gait pattern can minimize energy expenditure and results in a stable gait
- Many elderly people can ambulate independently with the gait pattern when conditions are ideal
- However, elderly with such gait changes perform inadequately in tasks requiring great speed, strength or agility. Such tasks include the rescue responses that are necessary to prevent or cushion a fall

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1.1.3 Foot changes in elderly

- Elderly have drastic changes in feet⁹ due to aging, diseases and long term wearing of inappropriate footwear¹⁰, including
 - i. Foot structure, deformity or malalignment
 - Flat foot
 - Hallux valgus
 - Hammer toes
 - ii. Limit of joint motion, muscle strength and flexibility in feet
- These foot changes cause foot pain and alter gait pattern among the elderly⁹
- Compensatory gait pattern such as weight shifting and limping increases stress on other parts and also affect the balance by shifting and displacing the centre of mass over the base of support
- Moreover, foot changes result in poor shoe wearing habit among the elderly¹⁰
- They prefer to wear shoes with soft material, without any support or without any fixation to compensate their foot changes¹⁰
- These inappropriate footwear have poor stability and further affect foot biomechanics which may eventually lead to fall¹¹
- In addition, foot changes cause problems in shoe fitting, such as pinching on bunion, pressure on hammer toe. These further affect comfort and balance maintenance among the elderly
- Illness (e.g. Diabetes mellitus) can lead to decreases in the sensation and proprioception which is another factor for easy fall among elderly⁹

1.2 Foot and footwear

- The foot provides the only source of direct contact with the ground during walking
- It is reasonable to expect that footwear plays a significant role in controlling the postural stability, gait pattern, and even balance
- Therefore, footwear is believed to be one of the aids on fall and fracture prevention
- The tips on choosing appropriate footwear and fitting of footwear are necessary

2. Shoes

2.1 Components of shoes

Shoes consists of

- An upper
- A sole
- A heel

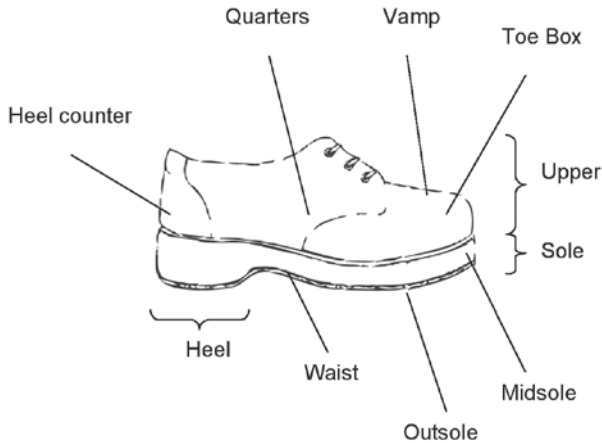


Fig.1 Structure of shoes

2.1.1 An upper

An upper consists of

- The vamp
- The two quarters
- The heel counter

2.1.1.1 The vamp

- Extends from the toe box to the two quarters
- Covers the forefoot and toes with upper material

2.1.1.2 The two quarters

- Extend posterior from the vamp around each side of the heel
- Provide medial-lateral stability by the provision stiffeners built inside their construction

2.1.1.3 The heel counter

- Locate at the back side of the heel
- Provide control of heel movement by the provision heel stiffeners built inside their construction

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2.1.2 The Sole

The sole consists of

- Insole
- Midsole
- Outsole

2.1.2.1 The insole

- Insert inside shoes which connects between the upper and the shoe bottom
- Usually made of material which have moisture and shock absorbing abilities
- Provide comfort, foot accommodation and biomechanics control during gait

2.1.2.2 The midsole

- Defines as the material filled in the space between the inner sole and the outer sole
- Acts as a shock absorber primarily
- Affect proprioception by altering its thickness and hardness of material

2.1.2.3 The waist

- Defines as the area of the shoe between the anterior edge of the heel, and the area of widest sole contact at the metatarsal heads

2.1.2.4 The outsole

- Defines as the part of the shoe in contact with the ground
- Curves upwards from the sole contact at the metatarsal heads to the toe end for easy toe off during gait
- Has certain pattern at the bottom for the provision of some slip resistance

2.1.3 The heel

- Defines as the area of the shoe which contacts the ground first during the stance phase
- Act against the ground reaction force during heel contact
- Varies in height and shape according to individual needs

3. Fall prevention: footwear and shoe fitting

3.1 Desirable features of footwear for fall prevention

As mentioned before, choosing appropriate footwear is necessary for fall prevention. There are a number of features of shoe design implicated as having impact on postural stability and balance:

- Heel height
- Heel counter and heel collar height
- Heel and midsole geometry
- Sole hardness
- Slip resistance of outsole
- Pattern of outsole
- Fixation

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3.1.1 Heel height

- Heel height depend on shoe style, for example, high heeled shoes
- Heel height corresponds to the contact area acting against the ground
- High heeled footwear usually have higher and narrower heels
- Higher and narrower heels reduce the contact area with the ground during gait
- These increase the wobbling of foot and indicate that the high heeled footwear are associated with foot instability¹¹
- Moreover, wearing high heeled footwear may produce changes in posture, which may be responsible for falling in elderly adults¹²
- Recent researches suggested that footwear with heel height between 1-2.5 cm can enhance most of the foot stability and distribute the bodyweight evenly over the entire feet¹³

3.1.2 Heel counter and heel collar height

- Heel counter should have heel stiffeners built inside their construction
- Researchers suggested that firm and stiff heel counter can grip the heel of foot strongly and provide better control of heel movement¹⁴
- Thus, provide higher postural stability
- Literature reviewers also suggested that high heel collar height increased postural stability and enhanced balance in elderly adults¹⁵
- It is believed that the mere presence of the material surrounding the ankle region can provide mechanical stability to the ankle and subtalar joints of foot. Therefore, prevent eversion or inversion and even ankle sprain
- Footwear with raised heel collar height can also increases the proprioceptive feedback and thus improves proprioception among elderly people

3.1.3 Heel and midsole geometry

- Footwear experts found that a beveled heel perform better than the square heel against the surface of ground on slip resistance¹⁶
- They suggested that 10° bevel of heel geometry can increase the surface area contacting with the ground at heel strike and provide certain slip resistance for prevention of slip-related accidents
- On the other hand, midsole geometry should have flare on both the medial and lateral sides¹⁷
- As increasing the medial or lateral flare on a shoe may increase foot stability by increasing the contact area during heel strike

3.1.4 Sole hardness

- Shoes with thin and hard sole are supposed to improve elderly proprioception, and enhance both stability and balance during walking¹⁸
- Midsole thickness around 6.5 mm under the forefoot and 13 mm under the heel was proven to enhance proprioception among elderly people¹⁸
- Ethyl vinyl acetate foam (EVA) is commonly used as the midsole material. EVA with hardness Shore A50 is recommended for footwear among the elderly¹⁹

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3.1.5 Slip resistance of outsole

- Outsole of shoes should have material with medium coefficient of friction²⁰
- Because shoes without adequate slip resistance may be too slippery for the elderly while shoes with excessive slip resistance may be difficult for elderly to step and walk
- The best sole material recommended is a double density, soft microcellular polyurethane which provides medium coefficient of friction for shoe wearer

3.1.6 Pattern of outsole

- Footwear experts recommended that shoes having trend pattern with linear groove on outsole act to disperse fluid from under the shoe²¹
- This provides certain slip resistance for elderly shoe wearer

3.1.7 Fixation

- The feet have a tendency to slide forwards inside shoes
- Therefore, proper shoes need a good system of fixation so that it can counteract the sliding force and apply an oblique and downward force into the posterior-inferior angle of the heel
- Good fixation systems which are suitable for the elderly include:
 - i. Velcro
 - ii. Lace

3.2 Desirable style of footwear for the elderly on fall prevention

According to the above desirable features of shoe design on fall prevention, the following recommendation on shoe styles can be prescribed for the elderly²²

Do wear:

- Walking shoes
- Running shoes
- Sport shoes
- Leather shoes

Don't wear:

- Slippers
- Sandals
- Clothes shoes

3.3 Fitting of shoes

Apart from choosing appropriate footwear, fitting of footwear among the elderly is also important.

- There are two primary components of achieving proper shoes
 - i. Shoe shape
 - ii. Shoe size

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3.3.1 Shoe shape

- Shoe shape refers to the shape of both the sole and the upper
- Proper fit is achieved when shoe shapes match foot shapes

3.3.2 Shoe size

There are several factors that govern the proper fit of shoe size:

- Length
- Width
- Arch and instep

3.3.2.1 Length

- Basically, there should be sufficient free space of about 1.5 cm between the longest toe and the front end of the shoe
- This can stop the toes from hitting the front of the toe box
- At the top back of the heel, there should be no gap at the heel seat if a shoe is fitting properly

3.3.2.2 Width

- The width of the shoe should be adequate, such that the head of the first metatarsal should be free on the medial border, and the head of the fifth metatarsal should be free on the lateral border
- Therefore, there is no compression of the toes at the sides or the top and the forefoot is prevented from sliding apart

3.3.2.3 Arch and instep

- There should be proper support for the arch
- However, people have different arch shape and length even they have the same foot length
- Arch support inside shoes should match the arch shape and length in each individual
- To determine the arch length is correct, the first metatarso - phalangeal joint should be accommodated in the widest part of the shoes
- Apart from the arch, the height over the instep should be sufficient enough to prevent impingement or irritation at or near the apex of the first metatarsocuneiform joint
- There is a danger that the medial longitudinal arch can be pushed down if the upper is not sufficiently high, leading to potential foot strain and elongation

4. Conclusion

- Elderly people face changes in the balance control, gait pattern and foot anatomy
- Such changes alter postural stability and balance of the elderly
- Therefore, falls are frequent among the elderly
- Fall and its related injuries can be prevented
- Choosing an appropriate and well-fitted footwear are instrumental in preventing fall among the elderly people

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Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 16 Back to community:- a service model for fracture prevention and good quality of life
(Community Healthcare and Fall Prevention Scheme)

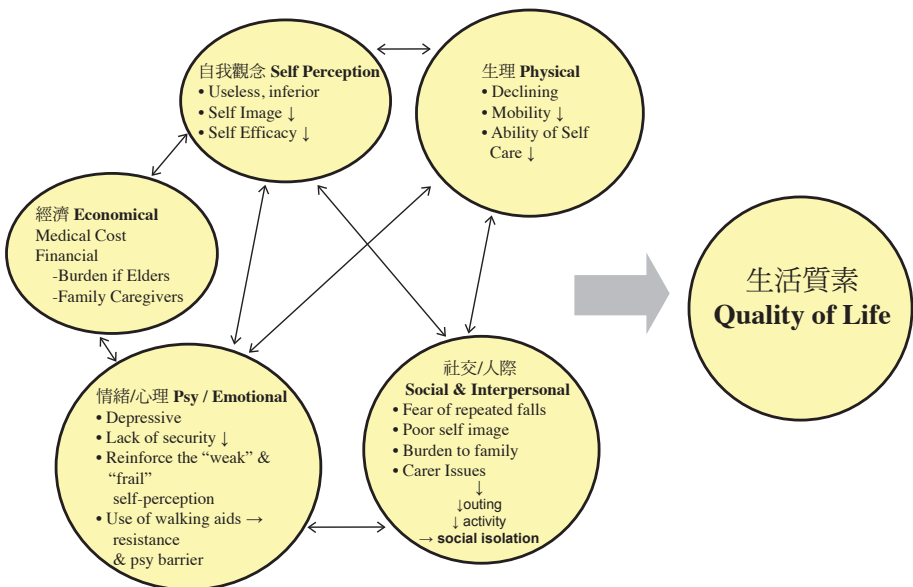
Chapter 16

Back to community:- a service model for fracture prevention and good quality of life (Community Healthcare and Fall Prevention Scheme)

Ms. Kam-Lee LAM

WHY

- Fall is not merely a physical problem for elders
- It may affect all aspects of the elders, ranging from social and interpersonal, psychological and emotional, financial, physical aspects to self perception
- It is a heavy blow that brings global influence to the elders and affect their quality of life in general
- It can bring stress to family caregivers
- It is a meaningful joint venture to work together among professionals to strive for the best interest and holistic care for the elders



Fall may Affect All Aspects of the Elders

Management of Fragility Fractures at the Post-fracture Care Phase

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CHARACTERISTICS

- A trans-system collaboration of hospital, university, private health sector and NGO providing elderly service
- A close collaboration among professionals, orthopedic consultant, geriatricians, nurse, physiotherapist and social workers, involving both private and public sectors
- Community based and centre-based, in the neighborhood of elders
- One-stop service and elders friendly
- A holistic and enhanced care program
- Integrated with centre service
- Volunteers are mobilized to assist
- Fee charging, though still at minimal level
- A funded health project tailored made for elders having fall history
- Data shared and computer system linked
- Research built in



**4 Elderly Centres under
Evangelical Lutheran Church
of Hong Kong**

**Shatin Multi-Service
Centre for the Elderly**

**Ma On Shan District Elderly
Community Centre**



Fall Prevention for Frail Elders at Community Level

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Staff / Volunteer Training (Manpower Investment)

Community Fall & Fracture Prevention Centre (started 2002)

- Exercise Class
- Tai Chi Practice
- Volunteer Group
- PT Exercise Class
- Walking Aids
- Structured and Regular Programme (package)
- Home Visit
- Home Modification
- Educational Talk



Community Healthcare & Fall Prevention Scheme (started 2007)



From Prevention Program to a More Holistic and Enhanced Scheme

Management of Fragility Fractures at the Post-fracture Care Phase

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COMPONENTS

i. Community Healthcare and Fall Prevention Clinic

- A tailor-made package of service provided
- Package of service :
 1. Treatment with Vibration Platform, 3 times a week and each time for 15-20 minutes recommended
 2. Rehabilitative exercise group, once a week in centre
 3. Educational health talks organized regularly
 4. Regular medical consultation by visiting medical officer from private health institute, each elder will see the doctor 4 times a year to monitor progress. Necessary follow up will be prescribed as needed. Efficient referral to specialist in PWH will be made when necessary.
 5. Centre membership automatically effective, newsletter will reach them and the elders are welcome to join other centre services or use facilities

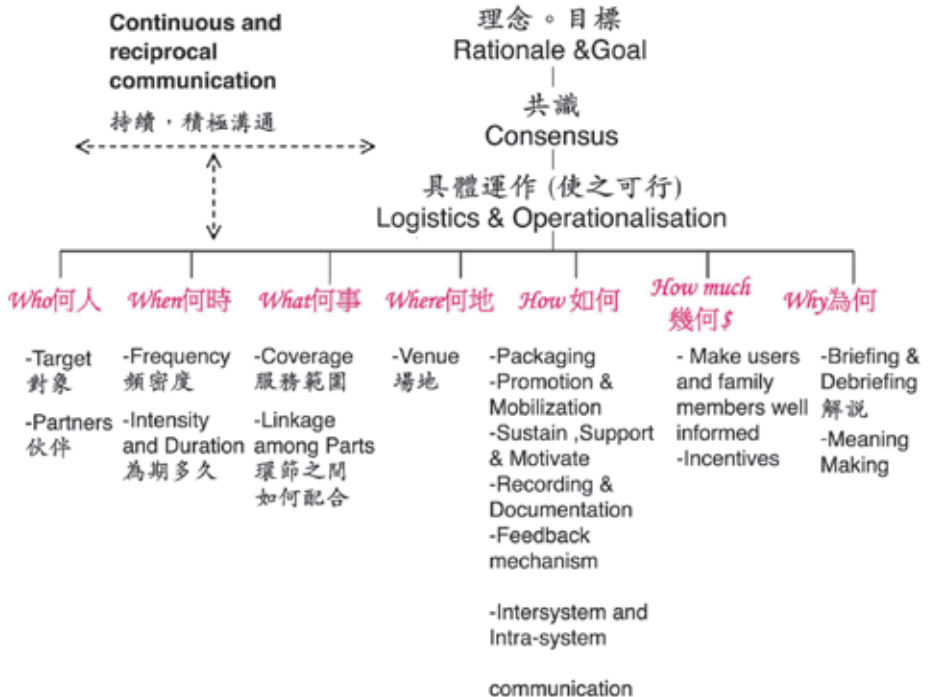


Trial Run of Community Healthcare and Fall Prevention Clinic
(社區防跌診所測試日)

Management of Fragility Fractures at the Post-fracture Care Phase

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From Rationale to Operationalisation (從理念、目標到實務安排)



Management of Fragility Fractures at the Post-fracture Care Phase

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ii. Educational Talks

Contents and Topics

- Health talks relating to fall can be a main theme while wider coverage of health related topics will equally benefit the elders, caregivers and volunteers. For instance, early identification and intervention of depressive symptoms is recommended.
- The concept of total health is more beneficial, physical-psycho-social perspective should be adopted when addressing the topic on fall or others. Elders can be educated for both physical and psychological hygiene.

Targets

- Elders with fall history, fall risks as well as all community dwelling elders
- Younger elders, to-be-retirees are welcome, primary prevention is recommended
- Family caregivers, including the elders' children, spouse or domestic helpers
- Formal caregivers (personal care workers of the service units concerned)
- Volunteers

Tips

- Apart from the elders themselves, involve caregivers whenever possible, both formal and family caregivers
- Experiential programs / interactive games / simple quiz will help
- Live examples and pictures are helpful to draw interest and attention
- Illustrate the importance and essence of the message via interview with real case(s), videoed or live on the show will be impressive
- Keep the educational talk 30 minutes and no longer than 45 minutes. It is preferred to add an easy-to-try practice session or Q & A rather than dragging the talk.

iii. Exercise Program

Who, When, What

- Different exercise groups can be tailor made for elders of varied level of fall risk (history), mobility or level of support required
- Options available, for time slots and intensity
- For long-term exercise group, it will be good to arrange it by stages. Organizers may consider giving some recognition or reward to encourage active and continuous participation
- When the exercise group / program is started to mature, trained volunteers or lay-leaders can be mobilized to take up the role as trainers
- Effective maintenance and sustaining the program is no less important than getting started
- Human touch, empathy, support and adequate facilitation along the process is important

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Rehabilitative Exercise for High Risk Group (高危運動班)

iv. Peer Support

- Some peer support can be more visible (verbal, behavioral and explicit) while some can be subtle, but effective. For instance, a quiet and persistent group member can be a good modeling for the other elders.
- Peer learning often exists among elders. To facilitate beneficial peer learning rather than destructive learning is important. Yet, natural grievances can be accepted as elders may share empathy among themselves.
- While learning from a well-behaved peer can help, downward comparison can also help. For instance, when an elder find a peer in a poorer condition but still strives for maintaining good health, the elder may feel better herself /himself.

Management of Fragility Fractures at the Post-fracture Care Phase

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**A Volunteer is Assisting
an Elder to Use the
Vibration Platform**

v. Family Support

- Apart from the elders themselves, family support is often a determining factor for successful intervention of the health program
- Whenever possible, involve the adult children or spouse of the elders along the process
- If family members do care but are too busy, a call, a note or an email can help to engage better support and understanding. The principle is keeping adequate communication and allowing family members to be well-informed.

Management of Fragility Fractures at the Post-fracture Care Phase

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Fall Prevention in Elderly Community Centre

Strength

優勢

- De-Labeling 去標籤，有助增加長者的動機
- Integration with existing services, as a total package 可融合原有服務
 - 延伸Extension
 - 增值Enhancement
 - 可提供的服務/不局限於防跌
 - 有適合長者的服務配套
 - 有利於對有需要的個案提供較全面的關顧
- User Friendly 方便長者與家人
- Build on accumulated experience 善用過去在防跌工作已有經驗和人力資源
- Good at mobilization 有動員能力：義工網絡、專業人員與相關機構
- Good experience in collaborations 有豐富協作經驗

Limitation & Challenge

限制・挑戰

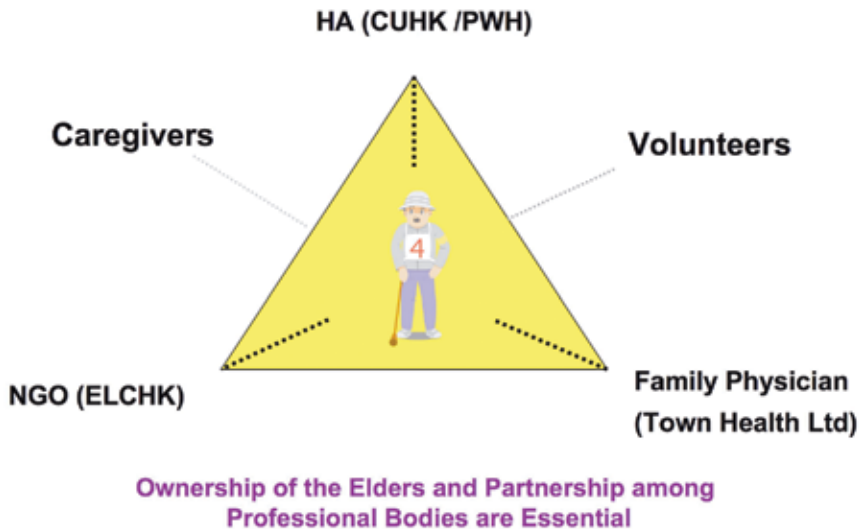
- Balance among competing demands and stringent resources 面向社區對服務質與量的龐大需求，人手、場地與資源的平衡
- Large volume of work on volunteer mobilization and support 計劃需要強大的義工支援，服務單位需加強動員和培訓
- One-Stop and Seamless? 能做到一站式與無縫服務？
- To make it truly Sustainable 令計劃能持續而有效地推展，當中需要有良好的維繫和支援，包括支援同工、義工、長者和家人
- Welfare Mode VS Fee Charging 福利模式 VS 用者自付/收費模式？
- Harmonization and synchronization among systems and professions, both internal and cross systems 系統間能有效協調、磨合

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 16 Back to community:- a service model for fracture prevention and good quality of life
(Community Healthcare and Fall Prevention Scheme)

KEY ELEMENTS FOR EFFECTIVENESS AND SUSTAINABILITY

- Continuity of service
Short term or one-shock campaign may not help much. It requires continuous and long-term commitment to promote holistic well-being of elders suffered from fall problems or risks
- Full support from top management needed
- Effective downstream training, orientation and meaning making (why the project is a worthwhile one that deserves commitment and full support of the whole team)
- Shared mission and values among collaborators and team members
- Open, reciprocal and continuous communication for internal members and among systems
- Solution focused rather than defect focused
- System and intersystem perspective required
- Learning teams
- Ownership of elders and caregivers / well-being for their health is very important



Chapter 17

Helping elderly with fragility fractures to get on with daily activities:– guideline and recommendation for care-takers

Ms. Winnie MAK

17.1 Roles of care-takers

- Fall and fractures are common among the elderly. The common sites for fractures are hip, distal radius and spine. As mentioned in the previous chapters, the consequences of falls and fractures include a decrease in mobility and independency.
- Hip fractures lead to severe consequences and may even lead to death. According to Rosell et al in 2003, the mortality of hip fracture in 1 year is 33%. The mobility of the survivors from hip fracture decreased significantly ($p < 0.0001$). The percentage of patient being home bound changed from 50% before the hip fracture to 64% after the hip fracture. Besides walking ability, other functional activities such as negotiating stairs, dressing, preparing meals etc were also affected.¹
- With the increase in the dependency of the affected elderly, family members and the maids at home may need to take care of the elderly in both physical and emotional aspects. The care takers may help the elderly to handle their daily activities and help them to face the change in their physical conditions, fears of falls and the fear of re-fractures.
- The burdens on the family members and care takers are multi-faceted, namely in the economic, physical and emotional areas.

17.2 Common fractures and operation

- One of the common consequences of fall is fracture. During fall, it is a reflex action to seek support from the environment. Elderly may fall with an out-stretched arm, together with osteoporosis, he/she may suffered from fracture distal radius. If the elderly fell on his/her buttock, fracture proximal femur will result.

17.2.1 Fracture distal radius

- Fracture distal radius is common. It mainly affects the upper limbs functions but it is also an indicator for recurrent fall or fractures.
- Fracture distal radius is usually treated by casting and, occasionally, by surgery. During this immobilizing period, elderly may need help from the care takers in most of the activities of daily living. Continuous rehabilitation exercise is needed and the function of the affected upper limb may not be restored immediately after the removal of the casting.

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 17 Helping elderly with fragility fractures to get on with daily activities:-
guideline and recommendation for care-takers

17.2.2 Hip fracture

- Old fallers commonly experience a previous fall or fracture. It is not uncommon for an elderly to suffer from fracture distal radius of bilateral hands to be followed by fracture of the hip.
- Hip fracture is commonly treated by surgery. The choice of surgery depends on the severity and the site of the fracture. Dynamic Hip Screw (DHS), Gamma-nail, screw fixation and Austin Moore Arthroplasty (AMA) are commonly performed procedures to treat hip fracture.
- AMA: It is a commonly performed procedure for fracture neck of femur. The whole pieces of femoral head and neck are replaced by a metal implant. As the surgery is performed with the postero-lateral approach, elderly after this surgery should not flex the affected hip for more than 90°, rotate the affected hip internally nor adduct the affected hip.
- Family members or care takers should prevent the elderly from making motion with excessive hip flexion such as sitting on a low chair or stool or bending their trunk to pick up objects fallen on the floor. This may lead to dislocation of the implant and may lead to further surgery and pain. The seats for the elderly should be high enough for them to keep the hip from flexion more than 60° and the cushion should not be too soft.
- For safety and convenience, the toilet seat can be raised in order to fit the need of the elderly. As the mobility of the elderly decreases after the hip fracture and surgery, a commode with adjustable height is recommended, especially for toileting at night.
- During sleeping, the placement of the affected hip in internal rotation and adduction should be avoided.

17.3 Transferring skills

- With the increase in dependency and decrease in mobility, elderly suffering from fracture may need the help from care takers while transferring from one place to another place. The following are transferring skills that worth consideration.

17.3.1 Shifting

- Shifting is one of the bed mobility. On the bed, the elderly may need to shift upward, downward or sideways to get into proper position.
- There are some assistive devices, such as Monkey pull, for the elderly with hip fracture to shift in the bed. It is a hook like handle for the elderly to pull up their upper body. Ask the elderly to move by his/herself if possible.
- However, If the elderly can only provide limited support for the movement, the care taker should ask the elderly to hold and pull the Monkey pull and bending his/her unaffected leg. The care taker should hold the scapular of the elderly and move with the effort of the elderly.
- If the elderly is too dependent, effort from 2 care takers may be necessary.

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 17 Helping elderly with fragility fractures to get on with daily activities:-
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17.3.2 Rolling

- Before rolling the elderly, the care taker should consider carefully to ensure enough space for the elderly to roll. If the space is not enough, the elderly may fall from the edge of the bed.
- To roll the elderly, the elderly should bend his/her unaffected leg. A pillow should be placed between the two legs of the elderly to prevent excessive hip adduction while rolling. The care taker should help the elderly to roll by placing his/her hands one on the scapular and the other one on the buttock.
- When rolling the elderly, the care taker should not pull by his/her arms. He/she should stand firmly and stably and rolls the elderly by leaning the trunk slightly backward. The care taker should keep his/her back straight to avoid getting hurt.



Fig. 1 shows the posture for the care taker to help the elderly in rolling.

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 17 Helping elderly with fragility fractures to get on with daily activities:-
guideline and recommendation for care-takers

17.3.3 Lying to sitting

- The elderly should roll to one side first before getting up. Main points for rolling an elderly is described in previous paragraphs.
- The care takers should stand firmly by the side of the elderly with a wider step width. One hand should be placed under the scapular of the elderly and the forearm supporting his/her head. The other hand should be gently pressed down on the thigh. The care takers should move the elderly by using the force of leaning the trunk sideways in the getting up direction. Both legs should be moved outside the bed while getting up.
- When helping the elderly to get up from lying, the care taker should also note his/her posture. The trunk should be straight and the care taker should ask someone for help if the elderly is too heavy, in order to avoid getting hurt.
- In order to allow the elderly to be trained through daily activities, the care taker should allow the elderly to perform as much as he/she can and give help when necessary.



Fig. 2 shows the posture for the care taker to help the elderly from lying to sitting.

17.3.4 Sitting to lying

- When getting back on the bed, the elderly should firstly sit by the side of the bed. The height of the bed should not be too low or too high. The appropriate height of the bed should be about the length of the calf so that the elderly can place his/her feet stably on the floor when sitting on the bed.
- The elderly should lie down his/her trunk by the side of the bed and then slowly put their legs on the bed. Care taker can help by supporting the shoulder, head and neck of the elderly when lowering down the body and by supporting the legs when placing the lower limbs on the bed.

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 17 Helping elderly with fragility fractures to get on with daily activities:-
guideline and recommendation for care-takers

17.3.5 Sitting to standing

- The seat height should not be too low. Otherwise, it will be difficult for the elderly to get up from the chair.
- When getting up, the elderly should shift his/her body to the edge of the chair first. One hand can be placed on the armrest of the chair and the other can be placed on the walking aid to get support for standing up. While standing up, the elderly should slightly lean his/her body forward.
- If the elderly do not have enough strength for standing up, the care taker can help on the weaker side of the elderly by giving support to his/her arm and pelvis.
- Similar to other transferring skill, allow the elderly to do as much as he/she can and give help when necessary.



Fig. 3 shows the posture for the elderly to standing up from sitting.

17.3.6 Standing to sitting

- Before sitting on the chair, the elderly should turn around with his/her back facing the chair. The elderly should put one of his/her hand on the armrest of the chair and the other one still on his/her walking aid to gain support when sitting down.
- Like standing up, the elderly should lean his/her trunk slightly forward when sitting down.
- Care taker can help by giving support to the weaker side or pelvis of the elderly.

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 17 Helping elderly with fragility fractures to get on with daily activities:- guideline and recommendation for care-takers

17.3.7 Ambulation

- When the elderly need to walk with the help of walking aid, the walking aid should be hold by the hand of the stronger side and the care taker should walk by the weaker side, usually the fractured side, of the elderly to give support when necessary.
- The walking aid should be stepped out first followed by the weaker leg and then the good leg. The care taker should remind the elderly not to step further than the walking aid.

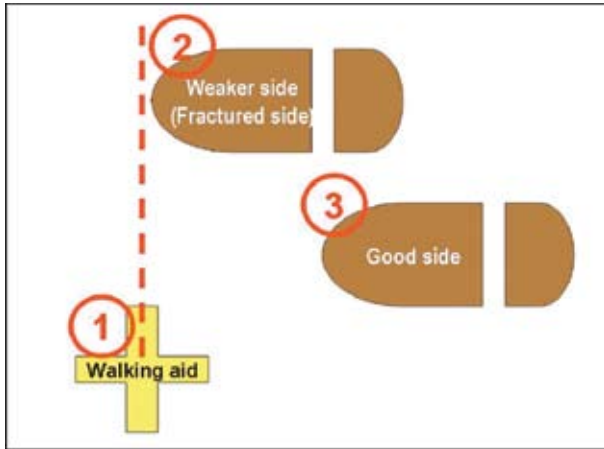


Fig.4 showing the proper sequence of stepping and the feet should not step further than the aids.

- The care taker can give support by holding the arm or the pelvis of the elderly when necessary.

Management of Fragility Fractures at the Post-fracture Care Phase

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17.4 Walking aids

- When getting unstable, elderly may need to get support from walking aids for ambulation. The commonly use walking aids are cane, quadripod and walking frame.
- Proper height of the walking aid is important. When the aid is held by the side of the elderly, the elbow of the elderly should be at 30° flexion. If the walking aid is too short, the elderly may walk with a kyphotic posture. If it is too long, the elderly may not gain much assistant from the aid.



Fig. 5 showing the proper height of the walking aids.

- The rubber crutch tips should be checked regularly to ensure there is no wearing and able to provide slip resistant.

Management of Fragility Fractures at the Post-fracture Care Phase

Chapter 17 Helping elderly with fragility fractures to get on with daily activities:-
guideline and recommendation for care-takers

17.5 Exercise

17.5.1 Mobilization exercise

- The purposes of mobilization exercise are to mobilize the joint and soft tissues and to attain a full range of motion or functional range of motion.
- Some examples are passive or active mobilization, stretching, cycling exercise, pulley exercise and etc.

17.5.2 Strengthening exercise

- The purpose of strengthening exercise is to increase the strength of the muscles and limbs.
- Some assistive devices such as calf weights, thera band, putty and etc. can be used for strengthening purposes.

17.5.3 Weight bearing exercise

- The purpose of weight bearing exercise is to enhance the bone quality and lower the risk of repeat fracture.
- Some simple weight bearing exercises are walking, Tai Chi exercise and vibration therapy.

17.5.4 Balance training exercise

- The purpose of balance training is to improve the balance of the elderly and prevent recurrent falls. Tai Chi exercise is a good example for balance training.
- Proper balance training should be prescribed and instructed by physiotherapists.

17.5.5 Gait training

- The purpose of gait training is to improve walking ability, gait pattern, stability and endurance. Proper gait training should be prescribed and instructed by physiotherapists.

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Community Fall Prevention Campaign

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