Orthopaedic trends in major osteoporotic fractures

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Outlines of this presentation

• What ‘s about the outcome of patient ?
• What’re consequence from bone change ?
• What do we want to achieve ?
• What’s new for the fixation technique ?
• What’s about the orthopaedic surgeon ?
• What can we do better ?
What’s about the patient?

- Medical complexity and/or co-morbidities
- Impaired functional status
- Poly-pharmacy
- Poor mental status
- Poor compliance and resistance
- Poor outcome
Second, third .... Fracture

F/91  Aug 2008  Nov 2009  July 2010

Increase risk of future fracture after first fracture
Secondary Fracture

• After distal radius fracture
  – 12.3% had another fracture within 1 year

• After hip fracture
  – 5.13% (2,252/43,832) had another hip fracture on the contralateral side
  – >75% of second hip fracture occur within first 4 years
Fracture risk is...

• highest in the oldest population
• highest in women
• highest in those with previous fracture
• high in those with low bone density
• high in very thin people
• high in those with comorbidity
• high in those on steroid treatment
• high in those who smoke & drink
Hip fracture
Projected worldwide increase

Total no of hip Fx
1950 = 1.66 million
2050 = 6.26 million

Estimated no of hip Fx : (1000s)

Adapted from C., Melton U. *Osteoporosis Int.* 2:285-289, 1992
Outcome after hip fracture
The situation one year after fracture

- Loss of function: 50%
- Mortality: 20%
- Regained functional capacity: 30%

What’re consequence from bone change?

- More fractures
- Operative complications
- Failure of fixation
- Secondary loss of reduction
- Iatrogenic fractures
- Spontaneous peri-implant fractures
Changes cortical bone

- Decreased thickness of wall
  ➔ decreased bending stiffness

CT cross sections femur
Changes cortical bone

• Lacunisation
  ➔ Increased weakness and predisposition to low energy fractures
Changes cancellous bone

Less and thinner trabeculae with fewer, often broken interconnections

Courtesy of R. Müller Swiss Federal Institute of Technology Zurich
What are the problems for fixation?

• Low bone strength
  – Unable to resist functional load
• Brittlenessness
  – Loss of toughness
  – From tough rubber to brittle glass
• Stiffness is low (consider compatibility with implants)
Osteoporotic bone exhibits up to ten fold decrease in holding power using conventional plating and screws.

- Regular bone
- Reduced trabecula thickness
- Porotic bone
- Regular trabecula thickness
Osteopenic bone model

- 4.5 mm conventional cortex screws, bicortical
- 4.0 mm LHS, monocortical
- 4.0 mm LHS, bicortical
- 5.0 mm LHS, bicortical

Load (Newton)

600
500
400
300
200
100
0

+ 17%
+ 82%
+ 91%
What do we want to achieve?

- Early operation after pre op optimization
- Quick and successful operation
- Short and smooth anesthesia
- Minimal soft tissue dissection with less bleeding
- Minimize post op analgesic agent
- Ambulation as soon as possible
Osteoporosis fracture

• Long implant with screws both near to and far from the Fx to minimize stress concentration

• Long plate also protect from future fragility fracture along diaphysis

• More flexible fixation: bridging plate, IM nail are recommended to minimize bone implant interface stress
Absolute stability & primary bone healing often is not possible

• Principles of fixation
  – Angular stability
  – Fracture reduction by impaction
  – Enlarged surface area of implant / bone
  – Long bridging plates
  – Augmentation is an option
Advantages of MIO in the elderly

Good for fracture

- Proximal and distal femoral fracture are good indication for MIPO
- Most fracture is appropriate for indirect reduction and indirect healing
- Majority of case require bridging principle
- Application of long spanning plate is more simple with MIPO
Advantages of MIO in the elderly

Good for patient

- Reduce operative time
- Reduce anesthetic time
- Less blood loss
- Less post op pain
- Early post op recovery
Bridge plate application

Indirect reduction

Apply Percutaneous

Biological plate (MIPO)
Shortening of metaphysis by impaction
Specific implant characteristics with Angular stability

- Locking plates (internal fixator principle)
- Angular stable locking bolts for nails
How to reduce screw cut out?
Specific implant characteristics
Increased bone—implant interface

- Blades instead of screws

AO Research Institute Davos, Switzerland
Trochanteric nail with screws → Helical Blade device
Spiral Blade:
improved fixation in osteoporotic bone
+ enhanced control of rotational instability
= Rotational and Angular Stability
Spiral Blade for DHS
90 year old male fracture
Future Perspectives

Enhanced performance of fracture fixation

combination of implants with augmentation technique

Biomechanical testing

Cut-out

Survival function
to cut-out

![Biomechanical testing images]

![Survival function graph]

Group:
- uncemented
- cemented

5000 cycles per load step
Augmentation

- Physically add substance to improve the biomechanics of host bone
- Severe osteoporosis
- Large void in bone
- Tumor
- Severe comminution
- Where fixation is not obtainable
Augmentation

- Small amounts (2-3cc) already improve implant anchorage significantly
- Heat generation seems not to be a problem
- Application modes and materials need to be improved
Standardized augmentation techniques
Augmentation - Cement

- Two Types: PMMA and bioabsorbable composites
- Augmentation with cement is useful when combined with internal fixation
- Cement increases strength of fixation
- Allows early mobilization
- May reduce implant failures
Cement placement
Controlled placement of cement around the implant, through the perforated blade with the side-opening cannula.
Mechanical Bone Augmentation

- Enhancing implant purchase in osteoporotic
- PMMA cement augmentation for hip fractures; has some mechanical value
- Clinical series
  - Harrington, JBJS 75
  - Bartucci, JBJS 85
  - Aught, JOT 02
- Avoid extrusion, exothermic,
87 years old female
Household ambulator
Low energy trauma
Cement augmentation
What’s about the orthopedic surgeon?

Why are orthopedic surgeons not more engaged in the emerging problem of osteoporotic/fragility fractures?
Orthopaedics surgeons are blamed by other physicians that we has neglected patients with fragility fracture for proper management.
Multinational Survey of Osteoporotic Fracture Management

Survey of 3422 orthopaedic surgeons from 6 countries

- 90% do not routinely measure bone density following the first fracture
- 75% are lacking appropriate knowledge about osteoporosis

Dreinhöfer et al. Osteoporos Int 2005; 16:S44-S54
Conclusion from survey

• Heterogeneous practice pattern exist in different countries
• Identification & treatment of the osteoporotic patient is insufficient in many areas
• Education and Knowledge needs to be improved
• More educational opportunities need to be offered to orthopaedic surgeons
GAP

Post Fracture treatment

What orthopaedists have to do and what is actually being done?

Treatment
Making the First Fracture the Last Fracture

- High index of suspicion for secondary osteoporosis
- Adequate calcium and vitamin D supplement and anti-osteoporosis drug treatment to all patients with fragility fracture
- Early drug treatment before discharge, no need to wait for DXA result or fracture healing
- Good doctor-patient communication, education and engagement of other professionals

American Society for Bone Mineral Research 2012
Reasons that do not want to change

• Leave me alone
• I do not want to change
• Why I have to care?
• I do not believe that it will cause any serious problem
Reasons that do not want to change

• Why me, it is not my business?
• It is very complicate to work with other discipline
• I have to work harder & no incentive
• I will have less fracture to operate
• This elderly patient will not live long
Reasons to change

• There are problems & want to solve
• Inspire by other surgeons or their chief
• Painful experience within the family who suffered from osteoporosis
• Pressure from colleagues to change
• **Attitude to fight for improvement**
What happens to these elderly pts?
What are the problems?

• Delay treatment from emergency room
• No format of protocol after admission
• Different of opinion from consultants
• Prolonged time before surgery
• No multidisciplinary team approach
• Result in more complications
Models of Management

• Traditional – No Co-management
• Traditional with consultation – No Co-management
• British Orthogeriatrics model – Some Co-management
• Rochester model (GFC) – Full Co-management
Definition of Co-management

- Interdisciplinary care of the geriatric fracture patient from admission until the completion of rehabilitation
- Co-management is the essential part of any Geriatric Fracture Program (GFC)
Why Co-management?

- Medical complexity and/or co-morbidities
- Impaired functional status
- Poly-pharmacy
- Improved outcome
  - lower complication rates
  - improved quality of life
  - improved length of stay
  - lower re-admission rate

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Goal of fragility hip fracture co-management

To apply early effective co-management program by interdisciplinary care of the fragility fracture patient from admission until the completion of rehabilitation
Multidisciplinary approach

- Pre-op
  - Surgeons
  - Physicians
  - Anaes
  - Nurses
  - Physio
  - Occu
  - MSW

- Operation
  - Surgeons
  - Anaes
  - Nurses

- Post-op
  - Surgeons
  - Physicians
  - Nurses
  - Physio
  - Occu
  - MSW

- Rehab
  - Surgeons
  - Physicians
  - Nurses
  - Physio
  - Occu
  - MSW
  - Voluntary support group
10 Guidelines category

1. Pre-hospital management for transportation
2. Emergency department evaluation
3. Caring the patient in ward (nursing)
4. Preoperative assessment and care
5. Anesthetic management
10 Guidelines category

6. Surgical management
7. Early postoperative management
8. Rehabilitation
9. Discharge planning and management
10. Secondary prevention of future fracture
Clinical pathway of Fragility Fx Management

Integrated model care for patients following hip fracture

Day 0: Pre-op Multidisciplinary Approach
Day 1: Post Op ICU
Day 2-5: Multidisciplinary Care & Rehabilitation

Week 2-6: Prevention of Future Fracture
Out-patient Rehab
Home-based Rehab

Nurse Coordinator
Geriatric Hip Fracture clinical pathway can effectively shorten the pre-operative time in acute hospital and convalescence hospital stay

TW Lau, F Leung
Department of Orthopaedics and Traumatology, Queen Mary Hospital, The University of Hong Kong
Conclusions

• 4 years’ experience of Hip Fracture Clinical Pathway was proven to be effective in shortening the pre-operative waiting time.

• It also shortened the total length of stay in acute hospital and convalescence hospital.

• It results in better clinical outcome in terms of in-patient mortality and 30 days mortality.

• Other relationships with clinical outcomes need further study to explore.
Orthopaedic surgeons who treat the fragility fracture as the victim of osteoporosis. You are not responsible only for fracture care but to treat the patient for their underlying problems.
The surgeon’s responsibilities

- Identify pts with risk factors & fragility fractures
- Inform the patient about the need of an osteoporosis evaluation
- Investigate whether osteoporosis is an underlying cause of the fracture
- Ensure that appropriate intervention is initiated
- Educate the patient and family
- Coordinate the care with other physicians
Fracture Management for Osteoporotic Bone

- Special Implants
- Special Techniques
- Augmentation

- Pharmacological Treatment

- Prevention
Fall Prevention Program

• Physiotherapist, occupational therapist, dietitian, nurses
  – fall assessment and prevention
  – exercise program¹
  – home safety assessment & modification ↓ fall rate & risk of fall
  – dietary and general bone health advice – significant ↑ calcium intake after dietary counseling³

• Community care program after fragility fracture⁴
  – include also primary care physician – prescription modification ↓ fall rate²

1 Chan KM 2003, 2 Gillespie LD 2012, 3 Wong SY 2004, 4 Chan YYK 2009
GFC Team participants...

Outpatient clinic
Geriatrics
Nurse Practitioners
Rehabilitation Ward
Orthopedic Surgery
Emergency Department
DEXA / Nuclear Medicine
Orthopaedic surgeons have a unique opportunity

• Fragility fracture is often the first indication a patient has osteoporosis
• Orthopaedic surgeons are often the first and may be the only physician seen by fracture patients
• The orthopaedist can serve a pivotal role in optimizing treatment, not only of the fracture, but also of the underlying disease

1. Eastell et al. QJM 2001; 94:575-59
AOTrauma Orthogeriatrics App
Available for smartphones and tablet

Authors: Markus Gosch, Katrin Singler, Tobias Roth
Part of the curriculum of the AOTrauma Orthogeriatrics Education Taskforce
Orthogeriatrics: Mobile Apps

AOTrauma Orthogeriatrics App ("Orthogers")

Orthogers is an educational tool for healthcare professionals managing older adults with a fragility fracture. The primary audience is surgeons and surgical trainees, but the content is also appropriate for other physicians and professionals. The content is presented through a series of decision pathways but is solely for educational purposes (ie, it is NOT designed for making diagnostic or treatment decisions for any individual patient).

Available free of charge for Apple and Android smartphones and tablet devices.

Available on the Apple App Store and Android APP on Google play

Recommended to a colleague

Modules
Download A3 printable overview:
- Osteoporosis
- Delirium
- Anticoagulation
- Pain management (late 2014)

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Orthopaedic surgeons always strive for better care of patient and we can fight against this epidemic disease
Thank you for your attention