Fragility Fractures

Transcript

[#] corresponding slide

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**[2] Introduction and Outline**

According to the AO Foundation, fragility fractures are defined as “...low-energy fractures that occur from a fall from standing height or less. The most common locations are vertebrae, hip, and wrist.” (AOT p. 1)

[3] In this video we will introduce the:

-Anatomy of common fracture sites

-Pathophysiology

-Pertinent history

-Physical findings

-Investigation

-Management

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**[4] Case Study**

Mrs. Jones, a petite 80yo woman, is brought to the Emergency Department after she tripped and fell in her home. She is unable to move her left wrist, or her left shoulder. Her left hip is also painful, and she is unable to walk.

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**Anatomy**

[5] 1.Hip: Shown in the image below is the basic anatomy of the femur. Femoral head or neck fractures define intracapsular fractures, while extracapsular fractures are defined as fractures of the trochanteric, intertrochanteric or subtrochanteric regions (<http://emedicine.medscape.com/article/87043-overview>). When a fracture occurs and the involved bone fragments stay together, this is called an undisplaced fracture. When the bone fragments are migrated away from each other, this is called a displaced fracture (<http://www.aofas.org/footcaremd/treatments/Pages/Foot-Fracture-Surgery.aspx>).

[6] 2.Wrist: A ‘broken wrist’ is most often a fracture of the distal radius, with the break frequently occurring about 1 inch from the distal end of the bone. Fractures of the distal radius may be extra-articular, intra-articular, displaced, or non-displaced. A Colles fracture is a common type of extra-articular fracture of the distal radius, where the distal bone fragment is dorsally displaced (<http://orthoinfo.aaos.org/topic.cfm?topic=a00412>). The American Society of Internal Fixation classification of distal forearm fractures is shown in Figure XYZ.

3.Proximal humerus: The Neer system is widely used to classify proximal humeral fractures. This system divides the humerus into four parts: humeral head, greater tuberosity, lesser tuberosity, and the diaphysis. Classification is based on the extent of displacement, as shown in Figure XYZ (Pietri and Lucarini, 2007).

[7] 4.Spine:The vertebral column can be organized into 3 structural columns; the anterior, middle and posterior columns:

1) The anterior column consists of the anterior longitudinal ligament, the anterior ⅔ of the body of the vertebrae and the anterior ⅔ of IV discs.

2) The middle column is comprised of the posterior ⅓ of the body of the vertebrae, the posterior ⅓ of the IV discs and the posterior longitudinal ligament.

3) The posterior column consists of the pedicles, facet joints, articular processes, ligamentum flavum, neural arch and interconnecting ligaments between such structures. Basically, this column is comprised of everything posterior to the posterior longitudinal ligament.

(<http://radiopaedia.org/articles/three-column-concept-of-spinal-fractures>).

**[types of breaks]** There are 4 types of intracapsular fractures according to the Garden Classification: Type I is an incomplete fracture, Type 2 is a complete nondisplaced fracture, Type 3 is a complete partially displaced fracture, and Type 4 is a complete fully displaced fracture. Displacement here is only measured in the AP plane of x-rays (<http://www.orthobullets.com/trauma/1037/femoral-neck-fractures>). A complete fracture is one that breaks the bone into multiple pieces, going fully along the length of its cross section (<http://medical-dictionary.thefreedictionary.com/complete+fracture>). An incomplete fracture does not fully cross the cross section of the bone (<http://www.medilexicon.com/medicaldictionary.php?t=35336>). According to Boyd and Griffin, there are 4 types of extracapsular fractures. Type 1 is a fracture from greater to lesser trochanter, this is called the intertrochanteric line. Type 2 is also a fracture of this line, but also has a degree of comminution and multiple cortical fractures. Type 3 is a comminuted subtrochanteric fracture that extends to or past the lesser trochanter. Type 4 is defined by fractures in 2 or more planes localized in the proximal diaphyseal and trochanteric regions (<http://www.orthofracs.com/adult/trauma/hip/fracture-nof-intertrochanteric.html>). An unstable fracture is one that has a propensity to displace post-reduction (<http://www.medilexicon.com/medicaldictionary.php?t=35393>). Post-reduction, a stable fracture will not displace (http://www.medilexicon.com/medicaldictionary.php?t=35376).

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**Pathophysiology**

[8] Osteoporosis:Osteoporosis is a metabolic disease of bone, which involves progressive loss of cortical and trabecular bone, and ultimately increased skeletal frailty. Occurrence of a fragility fracture implies that the patient has osteoporosis. It is important to recognize that the forces which cause fragility fractures would not be powerful enough to cause fractures in healthy bone - this is what distinguishes fragility fractures from traumatic fractures.

(<http://www.merckmanuals.com/professional/musculoskeletal-and-connective-tissue-disorders/osteoporosis/osteoporosis>; AOT p. 1)

[9] 1.Hip: Hip fragility fractures commonly result after a fall from standing height while conducting activities of daily living (Pisani et al. 2016).

2.Wrist: Fragility fractures of the distal radius often occur after a fall from standing height onto an extended arm. (<http://orthoinfo.aaos.org/topic.cfm?topic=a00412>).

3.Proximal humerus: Similarly, fractures of the proximal humerus may also occur after a fall from standing height onto an extended arm. They may also result after a fall from standing height onto an elbow, or from low-energy shoulder trauma (Pietri and Lucarini, 2007).

[10] 4.Spine:The mechanism by which the fractures happen is axial compression from a fall, lateral flexion or lifting weight. Usually the fractures occur in the anterior column and can occur in many different patterns. Two notable fracture patterns are 1) compression fractures and 2) burst fractures (Pietri). A compression fracture has occurred when the anterior aspect of the vertebra is fractured in such a way that its height is decreased, while the height of the posterior aspect of the vertebra remains normal, creating a wedge shaped vertebral body. (<http://orthoinfo.aaos.org/topic.cfm?topic=a00368>). A burst fracture is characterized by a decrease in the height of both the anterior and the posterior aspects of the vertebral body.

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**[11] History**

If a patient has several of the risk factors, shown in Table 1, a fragility fracture should be suspected. The history should include queries about any recent falls from a standing or sitting position, and the cause of the fall. A full social history, and an assessment of the patient’s cognitive status should also be performed (BOS, 2007).

1.Hip: Patients with a hip fracture may report pain that worsens with weight-bearing. Specifically, they may report pain in the groin, posterior buttock, anterior thigh, medial thigh, and/or medial knee.(<http://emedicine.medscape.com/article/330598-clinical?pa=rAmDgtH6fDYH1wnXJokGQy9iYaSNKCF64Jt%2Bbxa2yrLX%2FgWmyOoeCw55uGwLn7Fw43mU9jD%2B1DtnxY47OmyybA%3D%3D>)

2/3.Wrist/Proximal Humerus: Patients with distal radius fractures and patients with proximal humerus fractures will report pain and loss of function on history. (http://emedicine.medscape.com/article/1245884-clinical)

4.Spine: Back pain localized to the fracture site. Movement, sneezing or coughing can make the pain worse and rest/lying down relieves it. (http://orthoinfo.aaos.org/topic.cfm?topic=A00538) . Neurological symptoms such as weakness, tingling and numbness could also be present if the fracture has implicated the neighbouring spinal cord or spinal nerves. Pain is nonradiating, aching or sharp. Note that compression fractures can also be pain free. (http://emedicine.medscape.com/article/309615-clinical#b1)

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**[12] Physical Findings**

1.Hip: Diminished range of motion (ROM), particularly on internal rotation and flexion may be observed on physical exam. The affected hip may be externally rotated when the patient is sitting. (http://emedicine.medscape.com/article/330598-clinical?pa=rAmDgtH6fDYH1wnXJokGQy9iYaSNKCF64Jt%2Bbxa2yrLX%2FgWmyOoeCw55uGwLn7Fw43mU9jD%2B1DtnxY47OmyybA%3D%3D)

[13] 2/3.Wrist/Proximal humerus: Patients with fractures of the distal radius and fractures of the proximal humerus may present with ecchymoses, swelling, noticeable deformity, and/or loss of function of the affected limb. The ‘dinner fork’ deformity is characteristic of a Colles fracture of the distal radius. When a fracture of the distal radius is suspected, median nerve function should always be assessed. (<http://emedicine.medscape.com/article/1245884-clinical>; http://emedicine.medscape.com/article/1261320-overview#a10).

[14] 4.Spine: Point tenderness at the suspected location of the fracture upon palpation usually produces moderate pain. A detailed neurological exam and rectal exam should also be performed to evaluate the impact of the fracture on the spinal cord and the spinal nerves (http://emedicine.medscape.com/article/309615-clinical#b4). Patients can also present with a shorter and rounder spine producing what’s called Dowager’s hump. (<http://orthoinfo.aaos.org/topic.cfm?topic=A00538>). With this finding, patients have a very accentuated and uncorrectable kyphotic curve to their spine. This results from the fracture giving the vertebra a wedge shape as its anterior aspect collapses. Contractures of the hip flexor muscles are also common(http://emedicine.medscape.com/article/309615-clinical#b4)

A common physical presentation in the elderly is progressive scoliosis (<http://emedicine.medscape.com/article/309615-clinical>). The test for this deformity is Adam’s Forward Bend test.

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**[15] Investigations**

Plain radiographs are the first-line investigation for fragility fractures. CT and MRI scans may be ordered to assist with pre-operative planning, or to examine damage to surrounding soft tissues and ligaments.

[16] 1.Hip: Fractures of the proximal femur are commonly evaluated by AP radiograph. However, spiral fractures and comminuted fractures may not be visible on AP view. If a femoral neck fracture is suspected, the patient should subsequently be evaluated by CT.

(http://emedicine.medscape.com/article/390598-overview#a2)

[17] 2.Wrist: AP, lateral, and oblique films are used in the assessment of distal radius fractures. Images of the uninjured wrist may also be ordered for comparison, especially in pediatric populations. The PA is view is used for assessment of radial height, which is measured by drawing two parallel lines—one on the radial articular surface and the second in tangent with the tip of the radial styloid—and measuring the distance between them. The normal distance between these two lies in adults is 9.9-17.3 mm. If the distance is < 9mm a comminuted or impacted fracture should be suspected. The oblique views may elucidate intra-articular fractures that are not visible on the other views.

(http://emedicine.medscape.com/article/398406-overview)

[18] 3.Proximal humerus: A series of 3 radiographs—AP, scapular plane, and axillary—are ordered for evaluating suspected proximal humerus fractures. (1) The AP projection is useful for assessing varus or valgus displacements of the surgical neck, superior displacements of the greater tuberosity, and medial displacements of the lesser tuberosity. The glenohumeral joint should be apparent in this view, if it is not readily visible there may be a dislocation. (2) The lateral view in the scapular plane is used to image flexion or extension displacements of the surgical neck, and posterior displacements of the greater tuberosity. (3) The axillary view is useful for delineating dislocations of the humeral head. This view is also used to assess displacements of the greater and lesser tuberosity fragments. (http://emedicine.medscape.com/article/1261320-workup#c7)

[19] 4.Spine: a) X-ray AP and lateral views are standard studies for vertebral fractures. b) CT scanning is also used to elucidate the details of the fractures and uncover any spinal cord or nerve injury. For evaluation of fractures of the laminae and the neural arch, a CT scan is the recommended test. c) When there is the presence of motor and sensory losses in the lower limbs, radicular pain or spinal cord involvement, an MRI is performed. d) DRA, or Dual energy radiographic absorptiometry scanning can be used to evaluate BMD, which is much lower in those with osteoporosis, which is a major cause of these fractures. e) PET scans can be used to rule out malignant compression fractures. (http://emedicine.medscape.com/article/309615-workup#c6)

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**Management:**

[20]1.Hip: The management of hip fractures depends on if the fracture is intracapsular or extracapsular. In the case of intracapsular fractures, Type 1 fractures only require conservative treatment. Type 2 or 3 fractures can be managed by osteosynthesis with 3 cannulated screws (Pietri). Osteosynthesis is defined as the use of materials such as pins, screws, rods or plates to achieve internal fixation of a fracture (http://www.medilexicon.com/medicaldictionary.php?t=63874). Type 4 fractures require replacement with a prosthetic hip. In the case of extracapsular fractures intertrochanteric fractures are often managed with by devices called screw-plates, one of which is the Dynamic Hip Screw (Pietri). This mechanical device promotes the healing process via a plate on the lateral side of the femur that’s connected to a screw inserted into the femoral neck which can slide along the femoral neck’s longitudinal axis, which puts pressure on the fracture (<http://radiopaedia.org/articles/dynamic-hip-screw>). Use of a locked nail, one of which is called a Gamma Nail, which provides intramedullary fixation (Anil) is a possible management when the fracture is intertrochanteric and unstable, reverse oblique or subtrochanteric (Pietri). In a reverse oblique fracture, the fracture is localized through the intertrochanteric and subtrochanteric areas, specifically it traverses from a proximal-medial location and ends at a distal-lateral location in such areas (http://www.wheelessonline.com/ortho/reversed\_obliquity\_intertroch\_frx).

[21]2.Wrist: Closed reduction followed by placement into a cast is a common strategy for fractures that are evaluated as stable. There is a risk of the reduction failing in the cast, so routine x-rays can be used to monitor the healing process. Devices called Kirschner-wires can be used to surgically fixate the fracture into correct alignment before the cast is applied. External fixation is another possible strategy (Kalia, p.114). By virtue of the larger pins used in this fixation technique, it can be more effective at holding osteoporotic bone together (Ring ,p.S82). Finally, in the treatment of unstable fractures of the distal radius in those with osteoporosis, open reduction with internal fixation using devices called locking plates on the volar aspect has been shown to result in outcomes (Kalia, p.114)

[22] 3.Proximal humerus: For undisplaced fractures, conservative management is indicated (Pesce, p.133). Options here include Desault bandages or arm holders. Surgical intervention is indicated for unstable or displaced fractures (Pietri, p.112). The surgical strategy to be followed depends on the type of fracture. Possible surgical techniques to choose from are: 1) closed reduction followed by percutaneous screw fixation, 2) open reduction with internal fixation (ORIF), or 3) arthroplasty, namely hemiarthroplasty or reverse total shoulder arthroplasty (<http://orthoportal.aaos.org/oko/article.aspx?article=OKO_TRA050&section=3&#article>). A reverse total shoulder arthroplasty is named as such since the prosthesis has a concave proximal humerus aspect and a convex distal scapula aspect, which is opposite the normal anatomy of the humeral head and the glenoid cavity (ref and good photo … http://orthoinfo.aaos.org/topic.cfm?topic=A00504)

[23]4.Spine:The management vertebral fragility fractures can be surgical or non-surgical depending on the severity (Pietri). Nonsurgical treatment is often used for vertebral compression fractures and can help resolve the fracture within 3 months. This includes bed rest and pain medications. Braces can also be used during this period to minimize movement of the fracture area as it heals. (<http://orthoinfo.aaos.org/topic.cfm?topic=A00538>).

The decision to treat vertebral fragility fractures surgically varies with age, the presence of other co-morbidities, the type of fracture, the stability of the fracture, the time since the fracture, whether the spinal canal is involved and the quality of the bone tissue (Pietri). The surgical options include kyphoplasty and vertebroplasty, which are both Percutaneous Vertebral Augmentation procedures. (http://www.knowyourback.org/Pages/Treatments/SurgicalOptions/PercutaneousVertebralAugmentation.aspx). A kyphoplasty is performed via the x-ray guided placement of a needle into the centre of the fractured vertebra with the patient in the prone position. Next, the needle is used to guide the insertion of a balloon into the vertebra. Inflation of the balloon pushes the compressed and fractured bone back to its initial position and height; leaving a hollow core in the vertebra. This core is then filled with bone cement. A vertebroplasty is the same procedure, however the step with the balloon is skipped. Instead, the bone cement is simply injected directly into the fractured vertebra. (<http://orthoinfo.aaos.org/topic.cfm?topic=A00538>). Vertebral stabilization is indicated when the fracture is more unstable. This involves the use of bars, plates and/or screws (Pietri).

[24] 5. Manage the low BMD (ie the osteoporosis) concurrently with the management of each fracture:

Osteoporosis is a chronic disease, and proper management is important in the prevention of future fragility fractures. An in-depth discussion of the management of osteoporosis is beyond the scope of this video, but patients should be taking a vitamin D supplement, and they should be on medication to slow the resorption of bone. Medications used in the treatment of osteoporosis include: bisphosphonates, teriparatide, selective estrogen receptor modulators (SERMs), denosumab, and strontium ranelate. Long-term monitoring is another important component of disease management in osteoporosis. Patients should receive a DEXA scan every two years, and their serum calcium and 25-hydroxy vitamin D levels should be monitored. (AOT\_Orthogeriatrics).

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Credits

Content prepared by Ryan Gotfrit and Amanda Shelley. Edited by Nikhile Mookerji

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Bibliography

Citations in text.

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