Key Learning Objectives:
1. Describe the relationship between diabetes, osteoporosis and fracture.
2. Perform and interpret tests and measures to evaluate the risk of falls and fractures in a person with diabetes.
3. Propose interventions to decrease the risk of fracture in a person with diabetes and determine appropriate referrals to promote comprehensive care.

Case study: Sarah
- 34 y.o. female, Caucasian
- T1D since 14 yrs old, no complications
- Diabulemia 16-19 yrs old
- BMI 20.4 kg/m²
- Insulin pump
- A1c=6.7% (normal 4.4-6.4%, goal <7%)
- No falls past yr
- Multiple stress fxs as teenager when a X-C runner (metatarsals, tibial plateau, pelvis), none since
- No regular exercise since high school
- Married, no children, smoked 1 ppd x 10 yrs, quit 4 yrs ago, social alcohol intake ~4/month
- DXA T-scores: LS -3.0, total hip -2.8, neck -2.9
- Takes alendronate (since 3 yrs ago)
- No pain

Case study: Martina
- 64 y.o. female, Hispanic
- T2D since 44 yrs old
- Peripheral neuropathy, retinopathy, microalbuminuria
- CAD, s/p MI, HTN, dyslipidemia, cataracts, depression, OA bil knees with pain 6-7/10, Lx stenosis
- BMI 44.8 kg/m²
- Multiple daily injections, basal/bolus insulin
- A1c=10.4% (normal 4.4-6.4%, goal <7%)
- 4 falls past yr
- s/p R wrist fracture 4 yrs ago and L patellar fx 2 yrs ago, both following a fall
- Lives with husband, no exercise, minimal house activities, attends appointments, runs some errands, inactive otherwise, never smoked, 1-2 drinks/month
- Ambulates with a rolling walker for knee pain and balance
- DXA T-scores: LS -0.8, total hip -2.0, neck -2.2; no OP meds

Case study: James
- 84 y.o. male, African-American
- T2D since 68 yrs old
- Peripheral neuropathy, retinopathy
- CAD, s/p MI, HTN, dyslipidemia, OA R hip with pain 2/10
- BMI 34.6 kg/m²
- Multiple daily injections, basal/bolus insulin
- A1c=6.0% (normal 4.4-6.4%, goal <7%)
- 2 falls past yr
- No fractures
- Lives alone, does house and yard chores, volunteer at church, active with children/grandchildren, no regular exercise, never smoked, 2-4 drinks/month
- Ambulates with a straight cane outdoors for balance
- DXA T-scores: LS -2.3, total hip -2.5, neck -2.6; no OP meds

Osteoporosis, Diabetes, and Risk of Fracture
- Diabetes and Osteoporosis
  • Definition
  • Incidence/Prevalence
  • Pathophysiology
  • Risk factors
  • Diagnosis
- Fractures in diabetes
Diabetes

Definition

Incidence/Prevalence

Pathophysiology

Risk factors

Diagnosis

Definition: Diabetes

- Chronic disease, insulin deficiency and/or resistance
- Insulin: hormone secreted by β cells in the pancreas
  - Cells to utilize glucose from bloodstream for energy
- Hyperglycemia: blood glucose above normal
  - Can cause damage to blood vessels, nerves, kidneys, eyes and heart
- HTN and hyperlipidemia accelerate damage to blood vessels; important targets for control

Types of Diabetes

- Type 1
  - 5% to 10% of Canadians with diabetes
- Type 2
  - 90% to 95% of Canadians with diabetes
- Gestational diabetes
  - Diagnosed during pregnancy
- Pre-diabetes
  - Increased risk of type 2 diabetes
  - Changes in lifestyle (primarily diet, physical activity and weight management) can delay or halt the progression from pre-diabetes → type 2 diabetes

Prevalence/Incidence of Diabetes

- Grown to epidemic levels
- Estimated 3.4 million Canadians (9.3%) have diabetes; 5.7 million (22.1%) have prediabetes, putting them at risk for diabetes
- From 1998/99 to 2008/09, the prevalence of diagnosed diabetes ↑ 70%
- Just under half of new cases in those aged 45 - 64 yrs
  - 47.5% with diabetes were obese
  - 19.1% without diabetes obese
  - Obesity likely a major contributor to diabetes in this age group
- Greatest ↑ 35 - 39 and 40 - 44 year age groups (doubled)
- If incidence and mortality rates continue, Canadians with diabetes will reach 3.7 million by 2018/19

Prevalence of Diabetes by Age

Prevalence of Diabetes

<table>
<thead>
<tr>
<th>Province</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nova Scotia</td>
<td>6.5</td>
</tr>
<tr>
<td>New Brunswick</td>
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<tr>
<td>Newfoundland &amp; Labrador</td>
<td>5.5</td>
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<td>5.3</td>
</tr>
<tr>
<td>Nunavut</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Health Impact of Diabetes
- Increased rates of hospitalization
  - >3 x with CVD
  - 12 x with ESRD
  - 20 x with non-traumatic lower limb amputations
- 36.5% Canadian adults with DM have ≥ 2 other serious chronic conditions (HTN, CHD, COPD, mood disorder, and/or arthritis); 12.5% with ≥ 3 chronic conditions
- Only 3.1% of all deaths attributed to DM, but 29.9% of those who died had DM (2008/09)
- Complications often associated with death

Diabetes in Youth
- Diabetes is one of the most common chronic diseases among children and youth
  - Type 1 diabetes remains the main form of the disease
  - Type 2 diabetes on the rise
  - In 2008/09, > 3,000 new cases of diabetes (type 1 and type 2) were reported among Canadian children and youth aged; prevalent cases to just under 26,000

Risk Factors for T1D
- Still being researched
- Family member with type 1 diabetes ↑ risk
- Immediate relative (parent, brother, sister, son or daughter) has T1D, ↑ risk by 10 to 20X (or more)
- Caucasians have a higher risk; Northern Europeans > Southern Europeans
- Environmental factors
- Exposure to viral infections

Pathophysiology of T1D
- Autoimmunity: lymphocytic infiltration and destruction of insulin-secreting β-cells of the islets of Langerhans in the pancreas
- β-cell mass declines, ↓ insulin secretion
- When 80-90% β-cells are destroyed → hyperglycemia
- Genetically susceptible, viral infection may stimulate the production of antibodies
- Increased prevalence T1D with other autoimmune diseases (i.e., Graves disease, Hashimoto thyroiditis, and Addison disease)

Pathophysiology of T2D

Risk Factors for T2D
- Genetic history of type 2 diabetes
- Increased body weight
- Physical inactivity


Risk Factors for T2D:
Non-modifiable and Modifiable
• Family history of diabetes
• Overweight
• Unhealthy diet
• Physical inactivity
• Increasing age
• High blood pressure
• Ethnicity
• Impaired glucose tolerance (IGT)
• History of gestational diabetes
• Poor nutrition during pregnancy


Physical Inactivity in Canada (2009-2010)
45.2% of Canadians aged ≥12 yrs reported being inactive


Screening & Diagnosis of Diabetes

Definition: Osteoporosis
• Low bone mass, deterioration of bone tissue and disruption of bone architecture, compromised bone strength, and an increase in the risk of fracture
• WHO diagnostic classification, BMD at the hip or lumbar spine ≤ 2.5 SD below mean BMD of a young-adult reference population


Incidence of Osteoporotic Fractures

Pathophysiology of Osteoporosis

- Bone remodeling: osteoclasts and osteoblasts
- Bone mass peaks 3rd decade, slowly decreases, increased rate during menopause
- Nutrition/PA for optimal growth and development
- Hereditary factors; genetics account for up to 80% variance in peak bone mass
- Aging and loss of gonadal function (estrogen deficiency)
- Calcium and vitamin D deficiency
- Secondary causes affecting bone loss/quality (i.e., corticosteroids, type 1 diabetes, RA)


Risk Factors for Osteoporosis and Fracture

Modifiable risks

- Alcohol
- Smoking
- Low body mass index
- Poor nutrition
- Low dietary calcium intake
- Vitamin D deficiency
- Eating disorders
- Insufficient exercise
- Frequent falls

International Osteoporosis Foundation at http://www.iofbonehealth.org/whos-risk

Risk Factors for Osteoporosis and Fracture

Non-modifiable and ‘secondary risk factors’

- Age
- Female gender
- Family history of osteoporosis
- Previous fracture
- Ethnicity
- Menopause/hysterectomy
- Long term glucocorticoid therapy
- Rheumatoid arthritis
- Primary/secondary hypogonadism in men
- Gastric bypass

International Osteoporosis Foundation at http://www.iofbonehealth.org/whos-risk

Diagnosis of Osteoporosis

Fragility of bone or decreased density

1. Density: DXA to compare the person’s density to young adult reference mean (~30 y.o.)
2. Fragility of bone: non-traumatic fx
   - Non-traumatic or low trauma fracture
     - From fall of standing height or less
     - Loss of >4 cm from max height, confirm with x-ray

Diagnosis of Osteoporosis

Dual x-ray absorptiometry (DXA)

- The gold standard
- Measures bone density of hip, spine and wrist
- Painless, noninvasive, safe, low dose x-ray requiring no protective shields
- Measure the amount of mineral (calcium) in a specific area of bone

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DXA Interpretation

T-score:
- Compares bone density to average density of young healthy adults of same gender
- Expressed in standard deviations above and below the average

Osteoporosis | Low Bone Mass/Osteopenia | Normal Bone Mass
---|---|---
(-2.5 and lower) | (Between -1.0 and -2.5) | (-1.0 and above)
... -3.5 ... -3.0 ... -2.5 ... -2.4 ... -2.0 ... -1.5 ... -1.1 ... -1.0 ... 0.0 ... +1.5 ... +2.0 ...

DXA: Clinical Problems

Degenerative Changes in the Lumbar Spine

Diagnostic Evaluation
- Bone mineral density
- Measure height annually, wall-mounted stadiometer
- Vertebral imaging
- Assess for secondary causes of osteoporosis

Laboratory Testing for Osteoporosis
- Blood calcium levels
- 25-OH vitamin D
- Thyroid tests (T4 and TSH)
- Parathyroid hormone (PTH)
- Follicle-stimulating hormone (FSH)
- 24 hour urine calcium/creatinine
- Testosterone
- Serum protein electrophoresis
- Alkaline phosphatase (ALP)
- Bone markers

Tests measuring bone loss
- C-telopeptide (CTX)
- Urinary collagen type 1 cross-linked N-telopeptide (NTX)
- Deoxypyridinoline (DPD)
- Pyridinium Crosslinks
- Urinary hydroxyproline
- Tartrate-resistant acid phosphatase (TRAP) 5b
- Bone sialoprotein (BSP)

Tests measuring bone formation
- Bone-specific alkaline phosphatase (ALP)
- Osteocalcin (bone gla protein)
- P1NP (Procollagen Type 1 N-Terminal Propeptide) and C-terminal (C1NP)

Lab tests online. Osteoporosis. Available at: https://labtestsonline.org/understanding/conditions/osteoporosis/start/1/
FRAX® Tool
- Developed by WHO to evaluate fracture risk
- Integrates risks associated with clinical risk factors and femoral neck bone mineral density (BMD)
- From population-based cohorts from Europe, North America, Asia and Australia
- 10-year probability of fracture (hip fracture and major osteoporotic fracture [clinical spine, forearm, hip or shoulder fracture])
- Model relevant only for untreated patients
- Can be done with/without bone density test

FRAX® Tool
- Consider medical treatment in postmenopausal women and men ≥ 50 yrs:
  - A hip or vertebral (clinical or morphometric) fracture
  - T-score ≤ -2.5 at the femoral neck or spine
  - Low bone mass (T-score between -1.0 and -2.5 at the femoral neck or spine) and 10-year probability of a hip fracture ≥ 3% or for major osteoporosis-related fracture ≥ 20%
- Clinicians judgment and/or patient preferences may indicate treatment for people with 10-year fracture probabilities above or below these levels

FRAX Underestimates Fracture Risk in Patients with Diabetes


Fractures in Diabetes

Incidence of Fractures in Diabetes
- Prospective cohort (32,089), postmenopausal women
- 306,900 person-years of follow-up, 490 hip fractures
- Adjustment for age, smoking status, estrogen use, BMI, and waist-to-hip ratio
- Compared to women without DM
  - T1D (n = 47) ↑12.25-fold (95% CI 5.05–29.73)
  - T2D (n = 1,682) ↑ 1.70-fold (95% CI 1.21–2.38)
  - Increased risk with longer duration T2D and use of insulin or oral diabetes medications
  - “Strategies to prevent osteoporosis and/or falling may be especially warranted in women with diabetes.”


Incidence of Fractures in Diabetes
- Systematic review, association between DM and hip fracture
  - MEDLINE through June 2006 and reference lists of pertinent articles
  - 16 studies (2 case-control studies, 14 cohort studies)
  - 836,941 participants; 139,531 incident cases of fracture
  - Risk of hip fracture ↑T1D (RR = 6.3) and ↑T2D (RR = 1.7)
  - Risk of hip fracture T2D ↑ men (RR = 2.8) and T2D women (RR = 2.1)


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Incidence of Fractures in Diabetes

- Meta-analysis, association between DM and hip fracture
- Cohort and case-control studies, 21 studies; 6,995,272 participants; 82,293 hip fracture events
- DM associated with an ↑ risk hip fractures (RR 2.07; 95% CI 1.83–2.33)
  - T1D RR 5.76 (95% CI 3.66–9.07)
  - T2D RR 1.34 (95% CI 1.19–1.51)


- ACCORD BONE ancillary study (77 sites US & Canada)
- Compared intensive glycemia therapy to standard strategy on occurrence of fractures and falls
- Falls:
  - ≥ 1 fall in any year= 20.8% (intensive) and 20.9% (standard)
  - ≥ 2 falls in any year= 7.9% (intensive) and 7.7% (standard)
- Those aged ≥ 65 years, the average proportion reporting ≥ 1 falls was 19.4% and 18.5% among men and 24.1% and 25.5% among women in the intensive and standard control group, respectively


Falls in Diabetes

- Health ABC (a prospective study of 3,075 men and women 70–79 years, avg follow up of 4.9 yrs, Pittsburgh, PA and Memphis, TN)
  - “In the past 12 months, have you fallen and landed on the floor or ground?”
  - Diabetes-related complications associated with risk of falls include reduced peripheral nerve function, poorer vision, and decreased renal function


Sarah

- 34 y.o. female, Caucasian
- T1D since 14 yrs old
- No complications
- Diabulemia
- BMI 20.4 kg/m²
- Insulin pump
- A1c=6.7% (normal 4.4–6.4%, goal <7%)
- No falls past yr; no height loss
- Multiple stress fxs as teenager when a X-C runner (metatarsals, tibial plateau, pelvis), none since
- No regular exercise since high school
- Married, no children, smoked 1 ppd x 10 yrs, quit 4 yrs ago, social alcohol intake ~4/month
- DXA T-scores: LS -3.0, total hip -2.8, neck -2.9
- Takes alendronate (since 3 yrs ago)
- No pain

Martina

- 64 y.o. female, Hispanic
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- Peripheral neuropathy, retinopathy, microalbuminuria
- CAD, s/p MI, HTN, dyslipidemia, cataracts, depression, OA bil knees with pain 6–7/10, Lx stenosis
- BMI 44.8 kg/m²
- Multiple daily injections, basal/bolus insulin
- A1c=10.4% (normal 4.4–6.4%, goal <7%)
- 4 falls past yr; 3 inch height loss
- s/p R wrist fracture 4 yrs ago and L patellar fx 2 yrs ago, both following a fall
- Lives with husband, no exercise, minimal house activities, attends appointments, runs some errands, inactive otherwise, never smoked, 1-2 drinks/month
- Ambulates with a rolling walker for knee pain and balance
- DXA T-scores: LS -0.8, total hip -2.0, neck -2.2; no OP meds

James

- 84 y.o. male, African-American
- T2D since 68 yrs old
- Peripheral neuropathy, retinopathy
- CAD, s/p MI, HTN, dyslipidemia, OA R hip with pain 2/10
- BMI 34.6 kg/m²
- Multiple daily injections, basal/bolus insulin
- A1c=6.0% (normal 4.4–6.4%, goal <7%)
- 2 falls past yr; 1 inch height loss
- No fractures
- Lives alone, does house and yard chores, volunteer at church, active with children/grandchildren, no regular exercise, never smoked, 2-4 drinks/month
- Ambulates with a straight cane outdoors for balance
- DXA T-scores: LS -2.3, total hip -2.5, neck -2.6; no OP meds

Sarah

• Concerns?
• Risk of OP/fracture
• FRAX?

Martina

• Concerns?
• Risk of OP/fracture
• FRAX?

James

• Concerns?
• Risk of OP/fracture
• FRAX?

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Tests and Measures for Risk of Fractures and Falls

- Historical height loss
- Rib-pelvis distance test
- Wall-occiput distance test
- Gait speed
- Single-limb stance test
- Tandem gait
- Four-square step test
- Berg Balance Scale
- Semmes-Weinstein monofilament test

Historical Height Loss

- To detect clinically the likelihood of the prevalence of a vertebral fracture(s)

Historical Height Loss

- Historical height loss (HHL) = tallest recalled height - current measured height
- HHL of >4 cm (1.6 in) suggests incident vertebral fracture
- HHL of 6.1-8.0 cm (2.4-3.1 in) LR+ 2.8 of vertebral fracture
- HHL > 8.0 cm (3.1 in) LR+ 9.8 of vertebral fracture
- Patients/clients with HHL >6.0 cm should have VFA or spine radiograph

Rib-pelvis Distance

- To determine if rib/pelvis distance may be indicative of suspected osteoporosis related to vertebral compression fractures
- Have individual raise arms parallel to the floor
- Measure the distance from the inferior margin of the ribs to the superior surface of the pelvis in the midaxillary line

Wall-occiput Distance

- To test for occult thoracic vertebral fracture(s)

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### Wall-Occiput Distance

- Stand straight with back against a wall with heels touching wall
- While keeping back flat against the wall, try to put head against the wall
- Keeping head against the wall, try to straighten up as much as possible so that the back of neck is as close to the wall as possible
- Measure the distance between the occipital prominence and the wall


### The Wall-Occiput Distance

- The inability to touch the wall with the back of the head is + finding
- WOD increases 1.2 cm (.47 in) for every vertebral fracture
- A wall-occiput distance (WOD) of 0 cm reduces the chance of thoracic fracture, does not reliably rule it out
- WOD 4.1-6.0 cm (1.6-2.36 in) odds ratio 8.2, LR+ 3.2 for prevalent fracture
- WOD > 6 cm (> 2.36 in) odds ratio 17.8, LR+ 6.9 for prevalent vertebral fracture
- Consider spine radiograph > 4 cm (1.57 in) WOD


### Case Study: Sarah

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- Takes alendronate (since 3 yrs ago)
- No pain

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- BMI 44.8 kg/m²
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- A1c=10.4% (normal 4.4-6.4%, goal <7%)
- 4 falls past yr; 3 ½ inch height loss; hyperkyphosis
- s/p R wrist fracture 4 yrs ago and L patellar fx 2 yrs ago, both following a fall
- Lives with husband, no exercise, minimal house activities, volunteer at church, inactive otherwise, never smoked, 1-2 drinks/month
- Ambulates with a rolling walker for knee pain and balance
- DXA T-scores: LS -0.8, total hip -2.0, neck -2.2; no OP meds
- FRAX: hip 0.5%, other sites 5%

### Case Study: James

- 84 y.o. male, African-American; T2D since 68 yrs old
- Peripheral neuropathy, retinopathy
- CAD, s/p MI, HTN, dyslipidemia, OA R hip with pain 2/10
- BMI 34.6 kg/m²
- Multiple daily injections, basal/bolus insulin
- A1c=6.0% (normal 4.4-6.4%, goal <7%)
- 2 falls past yr; 1 inch height loss; forward head
- No fractures
- Lives alone, does house and yard chores, volunteer at church, active with children/grandchildren, no regular exercise, never smoked, 2-4 drinks/month
- Ambulates with a straight cane outdoors for balance
- DXA T-scores: LS -2.3, total hip -2.5, neck -2.6; no OP meds
- FRAX: hip 2.0%, other sites 4.2%

### Interventions to Decrease the Risk of Fracture

- Exercise recommendations
- Nutritional considerations
- Blood glucose management
- Medications
- Smoking
- Alcohol intake

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Exercise Recommendations

Exercise Recommendations for Children
Ages 5-17 yrs:
• ≥ 1 hr moderate to vigorous-intensity physical activity daily
• Vigorous-intensity ≥ 3 days/wk to strengthen muscle and bone


Exercise Recommendations for Adults
• ≥ 150 mins/wk, over at least three separate days
• Build up to 4 hrs/wk
• Start with bouts of 10 mins, a couple of times/day
• Moderate intensity aerobic activities:
  • Brisk walking
  • Dancing
  • Raking leaves
  • Cycling
  • Water aerobics
  • Swimming


Exercise Recommendations for Adults
• In the absence of contraindications, adults with T2D should be encouraged to perform resistance training at least 2 x/wk
• Consult a health professional if you are unsure about the types and amounts of physical activity most appropriate for you.


Care of Older Adults with Diabetes
• ≥ 2.5 hours of moderate- to vigorous-intensity aerobic activity/wk
• Sessions of ≥ 10 mins
• Muscle and bone strengthening activities, major muscle groups, ≥ 2 x/wk (help posture and balance)1
• Screening for diabetes complications should be individualized in older adults, but particular attention should be paid to complications that would lead to functional impairment2


Osteoporosis
Exercise to Increase/Maintain Bone Density
Posture and Body Mechanics
Balance Exercises/Fall Prevention

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Exercise Recommendations for Osteoporosis

Osteoporosis or at risk for osteoporosis:
- Resistance training and/or
- Weight-bearing aerobic exercises
- Exercises to enhance core stability for individuals who have had vertebral fractures
- Balance, such as tai chi, or on balance & gait training should be considered for those at risk of falls

Exercise to Increase/Maintain Bone Density

- Examples of high-impact weight-bearing exercises
  - Dancing
  - Doing high-impact aerobics
  - Hiking
  - Jogging/running
  - Jumping Rope
  - Stair climbing
  - Tennis

Posture and Body Mechanics

- Individualized by pt presentation
- Focus on:
  - Strengthening of spine and hip extensors, scapular stabilizers, abdominals, extremities
  - Lengthening cervical muscles, anterior thorax/shoulder girdle, hips, knees, calf/Achilles complex

Balance Exercises/Fall Prevention


National Osteoporosis Foundation at [http://nof.org/exercise](http://nof.org/exercise)
Exercise Strategies for Balance/Fall Prevention

- Fall prevention requires multi-factorial intervention, including exercise
- Consider assistive devices when appropriate
- Exercise program to decrease falls and fractures:
  - Balance-challenging/agility activities
  - LE strength/power exercises (hip and ankle)
  - Primarily done in standing
  - Should include static and dynamic activities
  - Individually prescribed and monitored
  - High-intensity to provide benefit

Nutritional Considerations for Bone Health

- Total calcium intake
  - Men 50–70: 1000 mg/day
  - Women ≥ 51 and men ≥ 71 yrs: 1200 mg/day
  - Supplement if needed
- Vitamin D
  - ≥ 50 yrs: 800–1000 IU/day
  - Supplement if needed

Nutritional Considerations for DM

- Total calcium intake
  - Men 50–70: 1000 mg/day
  - Women ≥ 51 and men ≥ 71 yrs: 1200 mg/day
  - Supplement if needed
- Vitamin D
  - ≥ 50 yrs: 800–1000 IU/day
  - Supplement if needed

Oral Agents, Insulin and Hypoglycemia Risk

- Sulfonylureas
  - Stimulate insulin release
- Risk of hypoglycemia
  - Glyburide/glibenclamide
  - Glipizide
  - Gliclazide
  - Glimepiride
- Meglitinides
  - Stimulate insulin release
- Risk of hypoglycemia
  - Repaglinide and nateglinide
- Insulin
- Risk of hypoglycemia

BMD and Fracture Risk in T2D: TZDs

- Long-term use of TZDs (rosiglitazone and pioglitazone) and fractures in type 2 diabetes
- Meta-analysis: MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, other trial registries and product information sheets through June 2008
  - 10 RCTs (n=13,715) and 2 obs studies (n=31,679)
  - ↑ fx risk: 10 RCTs OR=1.45; 5 RCTs with women OR=2.23, men OR=1.00
  - 2 obs studies ↑ risk of fractures associated with TZDs
  - RCTs: Bone mineral density in women reduced at the lumbar spine (-1.11%) and hip (-1.24%)

Universal Recommendations

- Cessation of tobacco smoking

- Limit alcohol intake

Possible Referrals

Promote comprehensive care for a person with diabetes who is at risk of fracture

- Endocrinologist
- Diabetes educator (DSME/S)
- Dietitian
- Podiatrist
- Dentist
- Eye care professional
- Mental health professional
- Others?

Case study: Sarah

- 34 y.o. female, Caucasian; T1D since 14 yrs old
- No complications; Diabulemia 16-19 yrs old; BMI 20.4 kg/m²
- Insulin pump; A1c=6.7% (normal 4.4-6.4%, goal <7%)
- No falls past yr: no height loss
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- DXA T-scores: LS -3.0, total hip -2.8, neck -2.9
- Takes alendronate (since 3 yrs ago)
- No pain
  - Rib-pelvis distance test=3 fingers
  - Wall-occiput distance test=0
  - Gait speed=1.4 m/sec (goal 1.2-1.3 m/sec)
  - Single-limb stance test=>30 seconds bil (goal)
  - Tandem gait=20 steps (goal)

Interventions?

Other care?

Case study: Martina

- 64 y.o. female, Hispanic; T2D since 44 yrs old
- Microvascular complications; CAD, s/p MI, HTN, dyslipidemia, cataracts, depression, OA bil knees with pain 6-7/10, Lx stenosis
- Multiple daily injections, basal/bolus insulin; A1c=10.4%
- 4 falls past yr; 3 ½ inch height loss; hyperkyphosis
- s/p R fractures following a fall
- Lives with husband, no exercise, minimal house activities, attends appointments, runs some errands, inactive otherwise, never smoked, 1-2 drinks/month; ambulates with a rolling walker for knee pain and balance
- DXA T-scores: LS -0.8, total hip -2.0, neck -2.2; no OP meds
- FRAX: hip 0.5%, other sites 5%
  - Rib-pelvis distance test=1 fingerbreadth
  - Wall-occiput distance test=12 cm
  - Gait speed=0.7 m/sec (1.2-1.3 m/sec)
  - Single-limb stance test=unable; Tandem gait=0 steps

Interventions?

Other care?

Case study: James

- 84 y.o. male, African-American; T2D since 68 yrs old; neuropathy, retinopathy
- CVD, OA R hip with pain 2/10; BMI 34.6 kg/m²
- MDI insulin; A1c=6.0% with hypoglycemia 1/wk
- 2 falls past yr; 1 inch height loss; forward head; no fractures
- Lives alone, does house and yard chores, volunteer at church, active with children/grandchildren, no regular exercise
- Ambulates with a straight cane outdoors for balance
- DXA T-scores: LS -2.3, total hip -2.5, neck -2.6; no OP meds; FRAX: hip 2.0%, other sites 4.2%
  - Rib-pelvis distance test=2 fingerbreadths
  - Wall-occiput distance test=6 cm
  - Gait speed=0.8 m/sec (1.2-1.3 m/sec)
  - Single-limb stance test=0 seconds bil (30)
  - Tandem gait=2 steps (20)
  - Four-square step test=24 sec (<15 sec)

Interventions?

Other care?

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