Diabetes Complications Assessment, Recognition, Prevention and Treatment
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Learning Objectives
1. Conduct appropriate screenings for comorbidities and complications in patients who have diabetes, including provisions of clinical practice guidelines and performance measures (when appropriate).
3. Devise appropriate treatment strategies to address microvascular and macrovascular complications.
4. Use office registries and empowered office teams - to become a “participatory office.”

Associated Session
• Diabetes Complications: PBL
Audience Engagement System

Diabetes is the most difficult of all chronic diseases for both the patient and the physician!!

For the patient—Multiple medications, finger sticks, injections, frequent visits to your physician, exercise is no longer optional, food is now a potential enemy, counting carbs; fear of (complications) heart attacks, strokes and premature death, the unknown??—Diabetes Distress

For the physician—Multiple responsibilities, concern about complications, conflicting guidelines, new medications, metabolic defects, pathophysiology, not enough time, confusing goals, various levels of patient literacy, coding, compensation

Agenda

• Prevention—earlier treatment
• Microvascular complications—Retinopathy, Neuropathy, Nephropathy
• Macrovascular complications—including NAFLD
• Registries and participatory office teams to help overcome Physician-Patient and Office Staff inertia

AES Polling Question

Natural progression of T2 diabetes is associated with which of the following?

A. Increased glucagon
B. Decreased glucagon
C. Decreased insulin levels
D. B & C
E. A & C

Natural Progression of Type 2 Diabetes

Glucagon Secretion Upregulated in Diabetes

- Glucagon normally a counter regulatory hormone—stimulates hepatic glucose production to avert hypoglycemia
- Bi-hormonal cause of diabetes—glucagon excess and insulin deficiency
- Mechanism not clear—alpha cell dysfunction vs beta cell dysfunction - or both?
- Paradox—post meal increase in glucagon - not decreased


Foundation of All Therapy is Lifestyle Optimization

- Start at the same time as medications
- Set lifestyle goals that are measured at each visit - exercise aerobic, resistance and stretching - motion is lotion and a tight muscle is a weak muscle
- 6-9 hours of sleep per night—sleep deprivation increases insulin resistance, B/P, lipids and inflammatory cytokines
- Weight loss or at least no weight gain
- A1C goal usually less than 6.5-7% but depends on several factors


Metformin and Pre-diabetes

- The American Diabetes Association’s 2017 guideline recommendations for metformin use in prediabetes have evolved
- 2017 recommendations suggest lifestyle changes plus metformin in patients with prediabetes and additional risk factors (BMI ≥ 35 kg/m², age < 60 years, prior gestational diabetes mellitus) or rising hemoglobin A1c (HbA1c)
- Pre-diabetes (HbA1c 5.7-6.4%, fasting glucose 100-125 mg/dL, 2-h post-stimulated glucose 140-199 mg/dL)

American Diabetes Association Standards of Medical Care in Diabetes. Prevention or delay of type 2 diabetes. Diabetes Care 2017; 40 (Suppl. 1): S44-S47

Lifestyle Intervention More Effectively Prevents Diabetes as Populations Age vs Metformin

- 15-year Follow-up Diabetes Prevention Program (DPP)
  - 15-year follow-up of the DPP demonstrated that metformin reduced the incidence of diabetes significantly compared with placebo
  - Lifestyle intervention reduced diabetes incidence by 27% and metformin reduced diabetes incidence by 18%


Medicare Payment for DPP in Prediabetes

- Seniors in a DPP clinical trial reduced their diabetes risk by more than 70 percent
- Medicare Diabetes Prevention Act was born. Act would require Medicare to cover participation in a national DPP program. CMS said that Medicare coverage would begin in January 2018.
- “Fifty percent of Medicare beneficiaries have prediabetes, and one out of three Medicare dollars is spent caring for somebody with diabetes. Seniors will soon have access to evidence-based prevention programs that will improve their health, and bring down Medicare costs as well.”

Brenda Montgomery, RN, BSN, CDE, ADA President, Health Care & Education. Annual Address San Diego June 11, 2017
Cause of Complications

- An increase of 1% in A1c is associated with an increased risk of 18% in CVD.
- However, the risk of microvascular disease is much stronger than that for macrovascular disease, with a 37% increase in the risk of retinopathy or renal failure associated with a 1% increase in A1c.
- Control of blood pressure and lipids account for the majority of the increased risk of CVD.

Agenda

- Microvascular complications—Retinopathy, Neuropathy, Nephropathy

AES Polling Question

Which of the following statements about Diabetic Retinopathy is true?

A. Recent guidelines recommend fenofibrates for retinopathy treatment
B. 30% newly diagnosed T2DM may have some evidence of retinopathy
C. Omega 3 Fatty Acids may decrease incidence of Retinopathy
D. All of the above
E. None of the above

Diabetic Retinopathy (DR)

- Leading cause of blindness in adults in the United States
- 30% newly diagnosed T2DM have some evidence of retinopathy
- Yearly exam to detect early retinopathy and other conditions more common with diabetes—cataracts, glaucoma, and macular degeneration
- Disease prevalence depends on diabetes duration and glycemic control
  - Puberty and Pregnancy two high-risk times
- May delay dilated eye exam to every 2 years if no abnormalities found

DR - Primary Care Prevention/RX

1. Treat Hyperglycemia and ↑ HBA1c
2. Treat Hypertension
3. Prevent Nephropathy
4. ↑ Triglycerides—Rx with fenofibrates—Two large randomized trials FIELD and ACCORD eye study demonstrate benefit
5. Omega 3-Fatty Acids—two weekly servings of oily fish associated with decreased risk of Diabetic Retinopathy
DR Treatment Recommendations

- Any suspicion of Retinopathy, refer patient to an Ophthalmologist that is experienced in the RX of DR
- Laser photocoagulation reduces vision loss in high risk proliferative retinopathy
- Intravitreous injections of vascular endothelial growth factor for central involved diabetic macular edema


Agenda

- Microvascular complications—Neuropathy

AES Polling Question

Which of the following statements about Diabetic Neuropathy is true?

A. Distal Symmetric Polyneuropathy (DSPN) is the most common type of diabetic neuropathy
B. 10-15% newly diagnosed T2DM - some evidence of DSPN
C. DSPN is a unilateral disease
D. A & B
E. B & C

Screening Questions for Peripheral Neuropathy

- Are your feet numb • Burning pain • Feet sensitive to the touch • Able to sense feet when walking • Can you tell hot from cold water • Symptoms worse at night • Do legs hurt when you walk • Prickling feeling • Muscle cramps • Bed covers hurt your skin • Does skin crack open • Unsteady gait

Accessed on line May 24 2016

Distal Symmetric Polyneuropathy (DSPN)

- Occurs in 20% type 1 diabetes - 20 years of disease duration
- DSPN present in at least 10%-15% of newly diagnosed type 2 diabetes, rates increasing to 50% after 10 years’ duration
- Most common neuropathy - 75% of diabetic neuropathy
- Signs - loss of sensory, proprioception, temperature and pain discrimination, bilateral
- Leads to unsteadiness, risk of falls


Distal Symmetric Polyneuropathy (DSPN)

- 50% have no symptoms - just positive exam
- Some just have unpleasant feeling
- Others—pain is burning, lancinating, tingling, or shooting (electric shock–like); triggered by bed cover
- Various combinations and worse at night

Treatment DSPN

- Stretching and resistance exercises decrease risk of falls (motion is lotion; tight muscle is a weak muscle)
- The most effective drugs for treating diabetic peripheral neuropathy (DPN) are duloxetine, venlafaxine, pregabalin (Lyrica), oxcarbazepine (Trileptal), tricyclic antidepressants (e.g., amitriptyline [Elavil]) and atypical opioids (e.g., tapentadol [Nucynta])
- Results are disappointing—some relief, but not consistent, and chance of addition with opioids is high


Diabetic Foot Ulcers

- Annual incidence: 5-6%
- Risk of death at 5 years is 2.5 times higher if patient has a diabetic foot ulcer
- 50% become infected
- 20% lead to an amputation

Armstrong DG et al Diabetic Foot Ulcers and Their Resurgence NEJM 2017;376:2367-75

Diabetic Foot Ulcers/Infection ↑ costs through ↑ admissions and referrals

- Between 2007-2013, 784.8 million visits for diabetes and 6.7 million for Diabetic Foot Ulcers (DFU) and Infection
- 3.4 times higher odds of admission and 2.1 times higher odds of referral to another physician
- Prevention saves time, money and limbs

Skrepnek GH et al, Diabetes Care 2017, 40:162189; DOI: 10.2337/dc16-2189

Loss of Protective Sensation in Feet

- Loss of protective sensation (LOPS) renders patients unable to sense pain; "lost gift of pain"
- 50% of patients with diabetes have LOPS
- Data suggest that diabetic foot adequately evaluated only 20% of the time in primary care
- Reasons for not doing the exam include time, and monofilaments not available - not properly used


10-g Monofilament Test

To perform the 10-g monofilament test, place the device perpendicular to the skin; apply pressure until monofilament buckles.

Hold in place for 1 second & release.

The monofilament test should be performed at the highlighted sites while the patient's eyes are closed.


Ipswich Touch Test

MA or clinician instructs patient to close eyes while lightly resting finger on each of the patient’s first, third, and fifth toes for 1 to 2 seconds. Asks patient if they felt something.

Head-to-head trial was as good as monofilament and vibratory tests.

Agenda

- Microvascular complications—Nephropathy

Assessment of Diabetic Nephropathy

- Annual assessments
  - Serum creatinine to determine eGFR
  - Urinary albumin-to-creatinine ratio (UACR)
- Begin annual screening
  - 5 years after diagnosis of T1D if diagnosed before age 30 years
  - At diagnosis of T2D or T1D in patients diagnosed after age 30 years


Cardiovascular Outcomes Worsen With CKD Progression


Risk for CVD, Morbidity and Progression to ESRD by GFR and Albuminuria


Colors represent risk of progression, mortality and morbidity
- Green Low Risk
- Yellow Moderate Risk
- Pink High Risk
- Red Very High Risk

CKD

For more on CKD, come to my presentation on CKD as a lecture and/or PBL

AES Polling Question


What A1C goal would you recommend for him?

A. <8
B. <9
C. <7
D. <6.5
Guide for Determining HbA1c Goal for Individual Patients

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<thead>
<tr>
<th>Most Intensive</th>
<th>Less Intensive</th>
<th>Least Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Psychological</td>
<td>Less depression and distress, good support</td>
<td>Depression, chores, few resources, not confident, poor support</td>
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<tr>
<td>Hypoglycemia Risk</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Frail/Life Expectancy</td>
<td>Longer life expectancy, active</td>
<td>Less active, needs help with ADL</td>
</tr>
<tr>
<td>Comorbidities/CV complications</td>
<td>None</td>
<td>Multiples</td>
</tr>
</tbody>
</table>

Agenda
- Macrovascular complications—including NAFLD

Agenda
- Macrovascular complications (and associated comorbidities - Hypertension and Hyperlipidemia)

Hypertension and Diabetes
- In T2D, blood pressure lowering has the greatest and most immediate effect on morbidity and mortality
- The recommended BP target for patients with diabetes is 140/90 - 130/80 mmHg
- Multiple agents are usually required to achieve target BP
- BP treatment must be continued for benefits to be maintained
- An ACE inhibitor or ARB should be included in the BP-control regimens of patients with diabetes and hypertension

Prevalence of Hyperlipidemia in Type 2 Diabetes

**LDL Treatment Goal Diabetes**

- Goal of <100 mg/dl if HDL, triglycerides and B/P normal
- Goal of <70 to 40 mg/dl if HDL, triglycerides and B/P abnormal
- LDL particles smaller and more of them when LDL accompanied by other abnormalities


**Rx Patients With the >> Risk the Most Aggressively**


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**AES Polling Question**

Which of the following statements about Non-Alcoholic Fatty Liver Disease (NAFLD) is true?

A. Type 2 diabetes does not increase chances of developing NAFLD  
B. Atorvastatin decreases biochemical markers of NAFLD  
C. NAFLD patients have increased triglycerides and decreased HDL  
D. A & B  
E. B & C


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**NAFLD and CVD**

- These patients have worse atherogenic dyslipidemia  
- Hypertriglyceridemia  
- Low levels of HDL  
- Small dense LDL particles  
- Significant increased risk for CVD


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**NAFLD and Diabetes**

- T2D worsens NAFLD  
- T2D and metabolic syndrome promotes development of NASH and increases risk of cirrhosis and hepatocellular carcinoma  
- NASH soon to be main cause of liver transplant  
- Plasma ALT not sensitive enough for Dx  
- Ultrasound, Liver biopsy and MRI Spectroscope (R)


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**Dyslipidemic NAFLD patients using statins improved biochemical as well as histological markers**

Statins in general and atorvastatin in particular are emerging as a potential treatment for condition. In this paper, the authors compared the effect of atorvastatin 20 mg.

All patients were diagnosed with histological confirmed NAFLD and followed for ± 8 months. In the atorvastatin group, significant reductions of ALT, AST, GGT, TC, AP and TG levels (P<0.0001) were achieved, as well as the extent of steatosis.

Agenda

- Registries and participatory office teams to help overcome Physician-Patient and Office Staff Inertia

Planned Visit

- Develop a Diabetes Plan (list) with your team and seek patient agreement—allow patient to change goals to what they think they can achieve
- Goals for A1C, LDL, B/P and all other quality indicators
- Place all goals in writing and give patient a copy—tell them all future visits will be to review goals—achievement and changes
- Medical Assistant/Nurse first one to see them and review the goals at each visit—protocol developed for MA to initiate some of the plans for goal achievement

Diabetes Related Activities

Empowered Teams

- Delegate tasks that do not require a Physician
- Certain tasks should belong to the Nurse or Medical Assistant—Immunizations, urine albumin to creatinine ratio—Empower them to be more than a medical waitress
- Empower patients with key words and useful patient handouts—planned visit sheets and patient portals
**Diabetes Population Based Activities**

**Empowered Teams**
- Review as a team—data from the registry that identifies high-risk patients (those not at evidence-based goals for A1C, LDL, BP)
- Develop team solutions for gaps identified in the Population Reports
- Clinician facilitates the team and assures that all team members provide suggestions—anticipate that staff have more valuable solutions than the clinicians

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**Impact of Team Care, 8-Month Period in 140 Patients**

1. Sat down as a team and discussed gap reports; created team decisions
2. Emails, phone calls (4 a day)
3. Improved use of patient report cards
4. Protocols developed for MA to use for foot exam, microalbumin and immunizations

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**Practice Recommendations**

- Be more aggressive with early treatment with lifestyle and metformin
- Prevent and treat microvascular complications—Retinopathy, Neuropathy, Nephropathy
- Be aware of the significant relationship of macrovascular complications—including NAFLD—and diabetes mortality and morbidity
- Develop Diabetes Registries and Participatory Office Teams to help overcome Physician-Patient and Office Staff inertia

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**Questions**
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