Acute and Chronic Complications of Diabetes

By

Kathy Magee, BSN, RN, CDE
DISCLOSURES

I have no disclosures to report.
Your patients’ blood glucose is 55 mg/dl before lunch. It was 60 mg/dl yesterday at this time. What is your assessment?

1. Get juice fast!
2. No, problem, this is in target range
3. Have him eat his lunch soon.
4. Need to look at the insulin dose at breakfast
Hypoglycemia

Hypoglycemia in patients with diabetes is any episode of an abnormally low plasma glucose that exposes the individual to potential harm.

Hypoglycemia and Diabetes: A Report of a Workgroup of the ADA and The Endocrine Society; Diabetes Care; May 2013, Vol 36, No 5, 1384-1395
Hypoglycemia

Problematic with optimal control

- Factors increasing risk for hypoglycemia:
  - Advanced age
  - Decreased oral intake
  - Mismanagement by self or practitioner
  - Chronic renal failure
  - Liver disease

- Beta blockers—block symptoms
Sign and Symptoms of Hypoglycemia

Minor

- Weakness or Fatigue
- Dizzy
- Sweating
- Hungry
- Shaky
- Fast Heartbeat
- Irritable
Sign and Symptoms of Hypoglycemia

Major (requires assistance of someone else)

- Slurred Speech
- Impaired Cognition
- Combativeness
- Loss of consciousness
- Seizure
Hypoglycemia
Causes

• Delay or skip a meal
  Fasting tests or procedures when in hospital
• Unusual exercise
• Medication
Treatment-Rule of 15

- 15-20 Gm fast acting CHO (4oz fruit juice, or regular soda, 8oz low fat milk, 1 tbsp sugar, honey or syrup).
- Recheck in 15 minutes
- If blood glucose has not returned to normal, repeat treatment and retest in 15 minutes.
- When blood glucose is normal and next meal is longer than one hour away give a snack that contains a protein and carbohydrate.
Glucagon
Hypoglycemia unawareness

• “Hazard” of optimal control
• Deficient counter-regulatory hormone release
• Diminished autonomic response
Recommendations:

• Ask patient about hypo at every visit
• Glucose is preferred treatment
• Glucagon should be prescribed for all individuals that are at risk for severe hypo and someone needs to be trained on how to use it
• Hypoglycemia unawareness or one or more episodes of severe hypo should trigger reevaluation of treatment

• ADA Standards of Medical Care in Diabetes-2015
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent can you tell by your symptoms that your blood glucose is LOW?</td>
<td>Never, Rarely, Sometimes, Often, Always</td>
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<tr>
<td>2. In a typical week, how many times will your blood glucose go below 70 mg/dL?</td>
<td>___ a week</td>
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<tr>
<td>3. When your blood glucose goes below 70 mg/dL, what is the usual reason for this?</td>
<td></td>
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<tr>
<td>4. How many times have you had a severe hypoglycemic episode (where you needed someone's help and were unable to treat yourself)?</td>
<td>Since the last visit ___ times, In the last year ___ times</td>
</tr>
<tr>
<td>5. How many times have you had a moderate hypoglycemic episode (where you could not think clearly, properly control your body, had to stop what you were doing, but you were still able to treat yourself)?</td>
<td>Since the last visit ___ times, In the last year ___ times</td>
</tr>
<tr>
<td>6. How often do you carry a snack or glucose tablets (or gel) with you to treat low blood glucose?</td>
<td>Check one of the following: Never, Rarely, Sometimes, Often, Almost always</td>
</tr>
<tr>
<td>7. How LOW does your blood glucose need to go before you think you should treat it?</td>
<td>Less than ___ mg/dL</td>
</tr>
<tr>
<td>8. What and how much food or drink do you usually treat low blood glucose with?</td>
<td></td>
</tr>
<tr>
<td>9. Do you check your blood glucose before driving? Check one of the following:</td>
<td>Yes, always, Yes, sometimes, No</td>
</tr>
<tr>
<td>10. How LOW does your blood glucose need to go before you think you should not drive?</td>
<td>___ mg/dL</td>
</tr>
<tr>
<td>11. How many times have you had your blood glucose below 70 mg/dL while driving?</td>
<td>Since the last visit ___ times, In the last year ___ times</td>
</tr>
<tr>
<td>12. If you take insulin, do you have a glucagon emergency kit?</td>
<td>Yes/ No</td>
</tr>
<tr>
<td>13. Does a spouse, relative, or other person close to you know how to administer glucagon?</td>
<td>Yes/ No</td>
</tr>
</tbody>
</table>
Table 3—Hypoglycemia Provider Checklist

<table>
<thead>
<tr>
<th>Name</th>
<th>First</th>
<th>Middle</th>
<th>Last</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>
| Today’s date __________

1. __ Reviewed the Hypoglycemia Patient Questionnaire
2. __ Questioned the patient about circumstances surrounding severe or moderate hypoglycemia
3. __ Discussed strategies to avoid hypoglycemia with the patient
4. __ Made medication changes where clinically appropriate
5. __ Recommended carrying snack and/or glucose tablets where appropriate and provided instructions for how to use them (take 15 g glucose, wait 15 min, and remeasure blood glucose; repeat if hypoglycemia persists). A 1-page patient handout on treating hypoglycemia is available at http://clinical.diabetesjournals.org/content/30/1/38
6. __ Prescribed glucagon if appropriate
Patient teaching:

- Wear diabetes identification
- Carry low blood glucose treatment with you at all times
- Know your glucose value before driving
- Tell family and friends you have diabetes. Instruct them in your signs and treatment of hypoglycemia.
Hyperglycemia

A condition in which an excessive amount of glucose circulates in the blood plasma.

Can be caused by:
Diabetes
Drugs-glucocorticoids, atypical antipsychotics
Critical illness-stress hyperglycemia
Hyperglycemia Signs/Symptoms

- Thirst
- Frequent urination
Hyperglycemia Signs/Symptoms

- Fatigue
- Hunger
Hyperglycemia Signs/Symptoms

• Blurred vision

• Cuts or sores that don’t heal
What to tell your patients?

• Try to figure out why it is high
• Check blood sugar again in 3-4 hours
• Increase intake of sugar free liquids
• Check for ketones
• Consider calling healthcare provider
How to prevent hyperglycemia

• Optimal nutrition
• Regular exercise
• Taking medications as directed
• Healthcare visits as recommended by care provider
“Sick days”

Any condition that can cause an acute deterioration of glycemic control:

Silent MI
Inappropriate stopping of diabetes medications
Surgery
Flu
Upper respiratory infection
Stress event
Sick-day Care

• Eat as usual if able
• Choose more soft or liquid foods
• Keep hydrated
• Call healthcare provider:
  If vomiting or have diarrhea most of day
  If a fever greater than 101
  Blood sugars stay higher than usual for several checks
  Moderate or large urine ketones.
Ketones

• Ketones appear in the blood and urine when there is extreme insulin lack/resistance and cells don’t have enough glucose for energy
• The body burns fat for energy as a substitute for glucose and ketones are a byproduct of that metabolism
• Ketones are primarily eliminated from the body through the kidney
Ketones

• Call healthcare provider if ketones are moderate or large
• Call healthcare provider if: nausea, vomiting, abdominal pain, faster and deeper breathing or breath smells fruity
TROUBLE!
Diabetic Ketoacidosis (DKA)

Hyperglycemia occurs, because insulin is unavailable or ineffective to transport sugar into cells. The body shifts from its normal metabolism (using carbohydrates for fuel) to a starvation state (using fat for fuel). As the body burns fat a byproduct (ketones) are formed. Ketones are an weak acid and as they accumulate you develop acidosis. Ketones are readily cleared by the kidney and show up in the urine. As blood sugar levels rise, there is a diuresis and dehydration occurs.
Causes

- Missed or inadequate insulin
- Newly diagnosed or previously unknown diabetes.
- Infection (particularly with nausea, vomiting, diarrhea, fever)
- Various other causes may include a heart attack, stroke, trauma, stress, alcohol abuse, drug abuse, and surgery. A low percentage of cases have no identifiable cause
Symptoms

- Excessive thirst (polydipsia)
- Frequent urination (polyuria)
- General weakness
- Vomiting
- Confusion
- Abdominal pain
- A generally ill appearance
- Dry mouth,
- Tachycardia
- Hypotension
- Tachypnea
- Fruity breath odor
Treatment

• Fluid
• Insulin
• Treat underlying cause
Hyperosmolar Hyperglycemic State (HHS)

A relative insulin deficiency leads to hyperglycemia (usually > 600 mg/dl) and a resulting serum osmolarity that is greater than 320 mOsm. This leads to an osmotic diuresis/excessive urination and volume depletion. Ketosis is absent because the presence of some insulin inhibits fat tissue breakdown. HHS is usually precipitated by an infection, myocardial infarction, stroke or another acute illness.
Treatment

• Fluids
• Correct underlying cause
• May or may not need modest insulin replacement
• Supportive care
Chronic Complications of Diabetes

- Hyperglycemia
  - Macrovascular Disease
    - Damage to medium and large blood vessels
      - Coronary Artery Disease
      - Cerebrovascular Disease
      - Peripheral vascular disease
  - Microvascular Disease
    - Damage to small blood vessels
      - Retinopathy
      - Nephropathy
      - Neuropathy
A1C levels and the risk of complications in type 1 diabetes

Adapted from DCCT. Diabetes 1995;44:968-43.
### Complication Reductions

#### Lower A1C Reduces Incidence of Complications

<table>
<thead>
<tr>
<th>A1C</th>
<th>DCCT 9 → 7%</th>
<th>Kumamoto 9 → 7%</th>
<th>UKPDS 8 → 7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retinopathy</td>
<td>63%</td>
<td>69%</td>
<td>17-21%</td>
</tr>
<tr>
<td>Nephropathy</td>
<td>54%</td>
<td>70%</td>
<td>24-33%</td>
</tr>
<tr>
<td>Neuropathy</td>
<td>60%</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Macrovascular disease</td>
<td>41%*</td>
<td>–</td>
<td>16%*</td>
</tr>
</tbody>
</table>

* Not statistically significant.

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Microvascular Disease

Retinopathy

Nephropathy

Neuropathy
Retinopathy

- Occurs in both type 1 and type 2 diabetes
- Prevalence strongly related to duration of DM
- Most frequent cause of new cases of blindness in adults aged 20-74
- Glaucoma, cataracts and other disorders of the eye occur earlier and more frequently in people with diabetes
Normal vision

Vision with retinopathy
Recommendations

• Optimize glycemic control
• Optimize blood pressure control
• Screen adults with type 1 diabetes within 5 years of onset and then yearly
• People with type 2 should have comprehensive eye exam shortly after diagnosis and then yearly
• Exam should be DILATED exam
Nephropathy

• Occurs in 20-40% of patients with diabetes
• Leading cause of end-stage renal disease
Nephropathy – Screening

- Urine albumin/serum creatinine ratio

**Albuminuria**
- A measure of a urine protein called (albumin)
- Done annually

**Serum Creatinine**
- Created from routine muscle breakdown and filtered through the kidneys
- Used as an indicator of kidney function
Recommendations

• Optimize blood glucose control
• Optimize blood pressure control
• Screen once a year—urine albumin-to-creatinine ratio and estimated glomerular filtration rate (T1 over 5yr duration, all T2)
• ACE or ARB NOT recommended for primary prevention in patients with normal BP and normal UACR
• ACE or ARB suggested for modestly elevated urinary albumin excretion (30-299 mg/dl) and recommended with urinary albumin excretion greater than 300 mg/dl
Neuropathy

- Autonomic neuropathy
  Damage to the nerves that send signals to your heart, stomach, bladder, or sex organs, skin

- Peripheral neuropathy
  - Affects the nerves that reach the farthest parts of your body: the hands and feet
Affects of Autonomic Neuropathy:

- Hypoglycemia unawareness
- Sexual dysfunction
- Indigestion, nausea, vomiting, or abdominal pain, chronic diarrhea or constipation
- Problems with urination or frequent urinary tract infections
- Faintness or dizziness when you stand up
- Changes in sweating, trouble with temperature regulation
Symptoms of Peripheral Neuropathy

• Tingling, burning, or prickling, which often starts in your toes or the balls of the feet and spread upward
• Numbness or loss of sensation, so you don’t feel cold, heat, or pain
• Sharp or jabbing pain
• Muscle weakness and difficulty walking
• Loss of coordination or balance
• Extreme sensitivity even to light touch
• Resultant: increased foot ulcers, infections, amputation
Foot Care by Care Giver

• Annual comprehensive foot examination
• People with insensate feet-examine at each visit
• Foot care education to all with diabetes
• Multidisciplinary approach with foot ulcers and high-risk feet
• Refer to specialist those who smoke or have loss of protective sensation, structural abnormalities or hx of prior lower extremity complication
• Screening should include assessment of pedal pulses
Foot Care by Patient

- Check top & bottom of feet daily
- Check for cuts, sores, blisters, redness, hot areas, calluses, swelling,
- Ingrown toenails
- Use mirror if needed
- Lotion- no alcohol or perfume
Wash Feet Daily

- Use warm water
- Do not soak feet
- Pat dry, especially between toes
- Corn, calluses—file using emery board, pumice stone
- Wear good shoes
- Do not try to treat foot problems yourself!
Chronic Complications of Diabetes

Hyperglycemia

Macrovascular Disease
- Damage to medium and large blood vessels
  - Coronary Artery Disease
  - Cerebrovascular Disease
  - Peripheral vascular disease

Microvascular Disease
- Damage to small blood vessels
  - Retinopathy
  - Nephropathy
  - Neuropathy
Macrovascular Disease

- Cardiac
- Cerebral vascular
- Peripheral vascular
Cardiovascular Disease

• People with diabetes are twice as likely to have heart disease or coronary artery disease (CAD), a heart attack, or a stroke.
  – People with diabetes also tend to develop heart disease or have strokes at an earlier age than other people.
  – Women of all ages with diabetes have an increased risk of heart disease because diabetes cancels out the protective effects of being a woman in her child-bearing years.
Diabetes increases MI

Incidence of Myocardial Infarction in People With Type 2 Diabetes

- Nondiabetes (n=1373)
- Type 2 diabetes (n=1059)

7-Year Incidence (%)

Managing Macrovascular Risk

• Blood pressure- check at each visit
  Blood pressure goal:
    systolic BP <140 (130 in some)
    diastolic BP <90 (80 in some)

• Cholesterol-screen at diagnosis, at age 40 and periodically (every 1-2 years)
  Treat with statin unless age is less than 40 AND has no other CAD risk factors
Aspirin Usage for Primary Prevention

• Consider with type 1 or type 2 at increased CVD risk (CVD, hypertension, smoking, dyslipidemia or albuminuria) men over 50 and woman over 60.

• Not recommended for those at low risk for CVD
Other Entities Associated with DIABETES

- DEPRESSION
- OSA
- FATTY LIVER
- CANCER: INCREASE IN LIVER, PANCREAS, ENDOMETRIAL, COLON/RECTAL, BREAST, BLADDER
- FRACTURES: TYPE 1 DM 6.3 RR, TYPE 2 DM 1.7
- COGNITIVE IMPAIRMENT
- PERIODONTAL DISEASE
- HEARING IMPAIRMENT: 2 X MORE COMMON
Dental Care

- Gum infections more common
- Brush teeth at least twice a day
- Use floss
- Have regular dental exams
Certified Diabetes Educator

• AADE  American Association of Diabetes Educators
• WADE  Washington Association of Diabetes Educators
• NCBDE  National Certification Board for Diabetes Educators
• www.ncbde.org
Criteria

• Discipline:

1. Clinical psychologist, Registered nurse, Occupational therapist, Optometrist, Pharmacist, Physical therapist, Physician, Podiatrist

2. Dietitian, Dietitian nutritionist, Physician assistant, Exercise specialist, Exercise physiologist, Health Educator

3. Health professional with master’s degree or higher in social work
Criteria

• Professional Practice Experience
  1. Minimum of 2 years of professional practice experience in discipline
     AND
  2. Minimum of 1000 hours of DSME (Diabetes Self Management Education) experience with a minimum of 40% of those hours accrued in the most recent year preceding application.
Criteria

• Continuing Education
  Minimum of 15 clock hours of continuing education activities applicable to diabetes within the two years prior to applying for certification.
Criteria

- Fee
  $350.00
Thank you!