Welcomes You To
THE CONVERGENCE OF
TYPE 2 DIABETES &
CARDIOVASCULAR DISEASE
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Program Overview
Cardiovascular disease and diabetes are closely related and as a result, the ACC is conducting a large initiative over the next two years to increase this awareness and to provide further education to medical professionals.

Learner Objectives
Enhance competence by providing the most up-to-date information on the correlation of type 2 diabetes and cardiovascular disease.

Upon completion of this program, attendees should be able to:
- Describe the prevalence of CV disease in patients with diabetes
- Identify patients with known diabetes and those at risk for diabetes, who are at significantly increased risk for CV disease based on the most current screening and treatment guidelines
- Apply modifiable and controllable risk factor strategies in the daily management of patients with diabetes and/or CV disease, to achieve evidence-based optimal outcomes

Abdominal Adiposity Is Associated With Increased Risk of Diabetes

Relative Risk of Diabetes

Waist Circumference (in)

Obesity Trends* Among U.S. Adults:
BRFSS - 1985
(*BMI ≥30, or ≥30 lbs overweight for 5’4” woman)

Obesity Trends* Among U.S. Adults:
BRFSS - 2008
(*BMI ≥30, or ≥30 lbs overweight for 5’4” woman)
Abdominal Adiposity Is Associated With Increased Risk of CV Events

Diabetes: A Growing Challenge
Prevalence in the United States

Diagnosed Diabetes in the US: 2008
CDC BRFSS: Self-Reported Diabetes: 8.2% Nationwide

Age-Adjusted Prevalence of Physician-Diagnosed Diabetes in Adults Age 18 and Older by Race/Ethnicity and Sex

Patient Beliefs About Diabetes Risks
ACC/ADA Diabetes Knowledge Survey (n=2008)

Diabetes and CVD
- Atherosclerotic complications responsible for
  - 80% of mortality among patients with diabetes
  - 75% of cases due to coronary artery disease (CAD)
  - Results in >75% of all hospitalizations for diabetic complications
- 50% of patients with type 2 diabetes have preexisting CAD. (This number may be less now that more younger people are diagnosed with diabetes.)
- 1/3 of patients presenting with myocardial infarction have undiagnosed diabetes mellitus
The Continuum of CV Risk in Type 2 Diabetes

Diabetes Mellitus: A Cardiovascular Disease

United Kingdom Prospective Diabetes Study (n=3867)

Age-Adjusted CVD Death Rates (MRFIT)

Type 2 Diabetes and CHD 7-Year Incidence of Fatal/Nonfatal MI (East West Study)

Cardiovascular Disease (CVD) and Total Mortality: U.S. Men and Women Ages 30-74

Type 2 Diabetes and CHD 7-Year Incidence of Fatal/Nonfatal MI (East West Study)

CVD=cardiovascular disease
MRFIT=multiple risk factor intervention trial

CHD=multiple risk factor intervention trial
MRFIT=Multiple Risk Factor Intervention Trial


CVD=coronary heart disease; MI=myocardial infarction; DM=diabetes mellitus


Summary

- Prevalence of obesity is increasing
- The number of patients with diabetes is increasing
- There is increased mortality and morbidity associated with diabetes
  - Primarily attributable to cardiovascular disease
- Patients with diabetes underestimate the risk of the disease

Summary of Care: ABC’s for Providers

<table>
<thead>
<tr>
<th>A</th>
<th>A1c Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Blood Pressure Control</td>
</tr>
<tr>
<td>C</td>
<td>Cholesterol Management</td>
</tr>
<tr>
<td>D</td>
<td>Cigarette Smoking Cessation</td>
</tr>
<tr>
<td>E</td>
<td>Diabetes and Pre-Diabetes Management</td>
</tr>
<tr>
<td>F</td>
<td>Exercise</td>
</tr>
<tr>
<td>G</td>
<td>Food Choices</td>
</tr>
</tbody>
</table>

A1c Target

- A1c Target: Glucose lowering to achieve normal to near normal plasma glucose, as defined by the HbA1c <7%
- Aspirin Daily: Secondary prevention or primary prevention in higher risk patients with diabetes

CAD Event Risk vs. Fasting Glucose (CARE)

CV Mortality vs. FBG:
22-Year Follow-Up

FBG=fasting blood glucose
FBG=fasting blood glucose

Adapted with permission from Bjornholt JV et al. Diabetes Care. 1999;22:45-49.
**Type 2 Diabetes: A1C Predicts CHD**

<table>
<thead>
<tr>
<th>CHD Mortality Incidence (%) in 3.5 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;6%)</td>
</tr>
<tr>
<td>Medium (6.7-8.9)</td>
</tr>
<tr>
<td>High (&gt;7.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>All CHD Events Incidence (%) in 3.5 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;6%)</td>
</tr>
<tr>
<td>Medium (6.7-8.9)</td>
</tr>
<tr>
<td>High (&gt;7.9%)</td>
</tr>
</tbody>
</table>

A1C = hemoglobin A1C

* P < 0.01 vs lowest tertile
** P < 0.05 vs lowest tertile

Adapted with permission from Kuusisto J et al. Diabetes. 1994;43:960-967.

**Impact of Glycemic Control on Clinical Outcomes**

- Proven efficacy for microvascular complications
- Uncertain effects on cardiovascular outcomes
  - Most trials to date not designed nor powered to assess CVD effects

**UKPDS Relative Risk Reduction for Intensive vs. Less Intensive Glucose Control**

Over 10 years, HbA1c was 7.0% (6.2-8.2) in the intensive group (n=2,729) compared with 7.9% (6.9-8.8) in the conventional group (n=1,138).

**UKPDS Metformin Sub-Study: CHD Events**

- Myocardial Infarction
- Coronary Deaths

**2009 ADA/AHA/ACC Statement Recommendations**

- Goal of A1c<7% For uncomplicated patients and for those with macrovascular disease
- Incremental microvascular benefit may be obtained from even lower goals
- Less stringent goals may be appropriate for those with labile glucose control or with advanced micro- or macrovascular disease
**A1c Target**

- **A1c Target**: Glucose lowering to achieve normal to near normal plasma glucose, as defined by the HbA1c < 7%.

- **Aspirin Daily**: Secondary prevention or primary prevention in higher risk patients with diabetes.

**Aspirin Therapy**

- Aspirin therapy 75-162 mg for secondary prevention in patients with diabetes with CVD.
- Aspirin therapy 75-162 mg for type 1 or type 2 at increased CV risk (10 year risk > 10%):
  - Men > 50 or women > 60 and
  - Family History
  - Hypertension
  - Smoker
  - Dyslipidemia
  - Albuminuria

**Therapeutic Efficacy in Diabetes: ASA**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>No ASA</th>
<th>ASA</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 yr MI</td>
<td>26 vs 11</td>
<td>20 vs 22</td>
</tr>
<tr>
<td>4 yr MCE</td>
<td>117 vs 116</td>
<td>86 vs 68</td>
</tr>
<tr>
<td>7 yr MCE</td>
<td>283 vs 241</td>
<td>241 vs 183</td>
</tr>
<tr>
<td>1 yr MCE</td>
<td>426 vs 403</td>
<td>403 vs 375</td>
</tr>
<tr>
<td>7 yr MI</td>
<td>2368 vs 2368</td>
<td>1336 vs 1592</td>
</tr>
<tr>
<td>Syn CVDeath</td>
<td>3711 vs 3711</td>
<td>2368 vs 2368</td>
</tr>
</tbody>
</table>

**Summary of Care: ABC's for Providers**

- **A**: A1c Target
- **B**: Blood Pressure Control
- **C**: Cholesterol Management
- **D**: Diabetes and Pre-Diabetes Management
- **E**: Exercise
- **F**: Food Choices

**Prevalence of Hypertension* in Adults with Diabetes: NHANES III 1988-1994**

- **Men**: 72%
- **Women**: 66%
- **Total**: 75%

*BP ≥130/85 or therapy for hypertension

**UKPDS: Effects of Tight vs. Less-Tight Blood Pressure Control**

- **Any Diabetes**: Statin
- **Diabetes-Related**: Diabetic Nephropathy
- **Diabetes-Mediated**: Insulin Resistance
- **Progression**: Dravet Syndrome
- **Total**: Statin
- **Heart Failure**: Statin
**HOT Trial:**

**Effect of BP Control on CV Event Rate**

**Overall Study Cohorts**

**Patients with Diabetes**

<table>
<thead>
<tr>
<th>Diastolic Blood Pressure Goal</th>
<th>Major CV Events Per 1000 Person-Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;90</td>
<td>0</td>
</tr>
<tr>
<td>90-95</td>
<td>1</td>
</tr>
<tr>
<td>96-100</td>
<td>2</td>
</tr>
<tr>
<td>101-105</td>
<td>3</td>
</tr>
<tr>
<td>&gt;105</td>
<td>4</td>
</tr>
</tbody>
</table>

**Scientific Statements: Diabetes, CV Disease and Hypertension**

- JNC VII Report on Diabetic Hypertension
  - BP goal (<130/80 mm Hg)
  - Commonly requiring combinations of ≥2 drugs
  - ACEIs, CCBs, Thiazide-diuretics, β-blockers, and ARBs shown to reduce CVD/CVA risk
  - ACEIs/ARBs reduce progression of diabetic nephropathy and reduce albuminuria
  - ARBs reduce progression of macroalbuminuria

**ADA Standards of Medical Care in Diabetes – 2010**

- Treatment of hypertension
  - Target SBP<130 and DBP<80 mmHg
  - In patients with BP 130-139/80-89 may try three months of diet, weight management and exercise
  - ACEI or ARB for initial drug therapy
  - Especially with micro or macroalbuminuria, given benefit in both type 1 diabetes and type 2 diabetes
  - Multiple drug therapy is generally required to achieve BP control

**Summary of Care: ABC’s for Providers**

- **A** Atc Target
  - Aspirin Daily
- **B** Blood Pressure Control
- **C** Cholesterol Management
  - Cigarette Smoking Cessation
- **D** Diabetes and Pre-Diabetes Management
- **E** Exercise
- **F** Food Choices

**LDL-C as a Predictor of CAD in Patients with Diabetes**

<table>
<thead>
<tr>
<th>LDL-C Quartile Mean</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 mg/dl</td>
<td>1</td>
</tr>
<tr>
<td>90 mg/dl</td>
<td>1.2</td>
</tr>
<tr>
<td>110 mg/dl</td>
<td>2</td>
</tr>
<tr>
<td>151 mg/dl</td>
<td>3</td>
</tr>
</tbody>
</table>

LDL-C=low density lipoprotein cholesterol; CAD=coronary artery disease.
Lipid Treatment Goals for Patients with Type 2 Diabetes

<table>
<thead>
<tr>
<th>Lipid</th>
<th>ADA 2010</th>
<th>ATP III</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL (mg/dL)</td>
<td>&lt;100</td>
<td>&lt;100</td>
</tr>
<tr>
<td>TG (mg/dL)</td>
<td>&lt;150</td>
<td>&lt;150</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>&gt;50</td>
<td>*</td>
</tr>
<tr>
<td>Non HDL (mg/dL)</td>
<td>&lt;130</td>
<td>&lt;130</td>
</tr>
</tbody>
</table>

HPS Substudy: First Major Vascular Event by LDL-C and Prior Diabetes Status

<table>
<thead>
<tr>
<th>LDL-C and diabetes status</th>
<th>Simvastatin (10,289)</th>
<th>Placebo (10,277)</th>
<th>Rate ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>With diabetes</td>
<td>191 (16.7%)</td>
<td>252 (20.9%)</td>
<td>Statis better</td>
</tr>
<tr>
<td>No diabetes</td>
<td>407 (18.4%)</td>
<td>504 (22.9%)</td>
<td>Placebo better</td>
</tr>
<tr>
<td>≥15% triglycerides</td>
<td>410 (23.7%)</td>
<td>498 (27.9%)</td>
<td></td>
</tr>
<tr>
<td>No diabetes</td>
<td>1,831 (20.8%)</td>
<td>1,541 (20.3%)</td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>2,313 (19.8%)</td>
<td>2,345 (23.5%)</td>
<td>24% reduction (90% CI)</td>
</tr>
</tbody>
</table>

CARDS: Primary Endpoint

Relative Risk Reduction 37% (95% CI: 17-52)
P = 0.001

ADA 2010 Guidelines

- Statin therapy should be added to lifestyle therapy, regardless of baseline lipid levels, for diabetic patients:
  - With overt CAD
  - Without CVD >40 and have ≥ 1 CVD risk factor

Specific Dyslipidemias: Elevated Triglycerides

Non-HDL: Secondary Target

- Non-HDL = TC – HDL
- Non-HDL: secondary target of therapy when serum triglycerides are ≥200 mg/dL (esp. 200-499 mg/dl)
- Non-HDL goal: LDL goal + 30 mg/dL

CARDS: Treatment Effect on the Primary Endpoint

<table>
<thead>
<tr>
<th>Event</th>
<th>Placebo*</th>
<th>Atorvastatin</th>
<th>Hazard Ratio</th>
<th>Risk Reduction (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary endpoint</td>
<td>127 (9.8%)</td>
<td>83 (6.9%)</td>
<td>37% (17-52)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Acute coronary events</td>
<td>77 (5.3%)</td>
<td>51 (3.6%)</td>
<td>39% (5-59)</td>
<td></td>
</tr>
<tr>
<td>Coronary revascularization</td>
<td>54 (4.1%)</td>
<td>24 (1.7%)</td>
<td>33% (9-59)</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>29 (2.8%)</td>
<td>21 (1.9%)</td>
<td>30% (4-40)</td>
<td></td>
</tr>
</tbody>
</table>

* N (% randomized)
Management of Low HDL

- LDL is primary target of therapy
- Weight reduction and increased physical activity (if the metabolic syndrome is present)
- Non-HDL is secondary target of therapy (if triglycerides ≥ 200 mg/dL)
- Consider nicotinic acid or fibrates (for patients with CHD or CHD risk equivalents)

Effectiveness of Smoking Cessation Interventions for CVD Admissions

- Smoking cessation intervention
  - MI = “teachable moment”
  - JCAHO/CMS core measure for MI care
- Meta-analysis of 18 RCTs in CVD, by intensity of intervention
- Only extended support programs significantly improved abstinence

Summary OR     1.14                   1.07                   1.81
95% CI             0.90-1.4               0.71-1.6               1.52-2.2


The 5 “A’s” for Effective Smoking Intervention

1. **ASK** about smoking
2. **ADVISE** to quit
3. **ASSESS** willingness to make a quit attempt
4. **ASSIST** if ready - offer therapy and consultation for quit plan and if not, then offer help when ready
5. **ARRANGE** follow up visits

Summary of Care:
**ABC's for Providers**

| A | A1c Target Aspirin Daily |
| B | Blood Pressure Control |
| C | Cholesterol Management Cigarette Smoking Cessation |
| D | Diabetes and Pre-Diabetes Management |
| E | Exercise |
| F | Food Choices |

Most Cardiovascular Patients Have Abnormal Glucose Metabolism

- GAMI n = 194
- EHS n = 1920
- CHS n = 2263

- 38% Normoglycemia
- 34% Prediabetes
- 18% Type 2 Diabetes

GAMI = Glucose Tolerance in Patients with Acute Myocardial Infarction Study
EHS = Euro Heart Survey
CHS = China Heart Survey

Diagnostic Criteria for Metabolic Syndrome:
Modified NCEP ATP III

≥3 Components Required for Diagnosis

<table>
<thead>
<tr>
<th>Components</th>
<th>Defining Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased waist circumference</td>
<td>≥40 in</td>
</tr>
<tr>
<td>Men</td>
<td>≥35 in</td>
</tr>
<tr>
<td>Elevated triglycerides</td>
<td>≥150 mg/dL</td>
</tr>
<tr>
<td>Reduced HDL-C</td>
<td>&lt;40 mg/dL</td>
</tr>
<tr>
<td>Men</td>
<td>&lt;60 mg/dL (or Medical Rx)</td>
</tr>
<tr>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>Elevated blood pressure</td>
<td>≥130/85 mm Hg</td>
</tr>
<tr>
<td>(or Medical Rx)</td>
<td></td>
</tr>
<tr>
<td>Elevated fasting glucose</td>
<td>≥100 mg/dL</td>
</tr>
<tr>
<td>(or Medical Rx)</td>
<td></td>
</tr>
</tbody>
</table>

IDF Criteria: Abdominal Obesity and Waist Circumference Thresholds

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europid</td>
<td>≥94 cm (37.0 in)</td>
<td>≥80 cm (31.5 in)</td>
</tr>
<tr>
<td>South Asian</td>
<td>≥90 cm (35.4 in)</td>
<td>≥80 cm (31.5 in)</td>
</tr>
<tr>
<td>Chinese</td>
<td>≥90 cm (35.4 in)</td>
<td>≥80 cm (31.5 in)</td>
</tr>
<tr>
<td>Japanese</td>
<td>≥85 cm (33.5 in)</td>
<td>≥90 cm (35.4 in)</td>
</tr>
</tbody>
</table>

Year CVD Risk Estimates Associated with Metabolic Syndrome

<table>
<thead>
<tr>
<th>Study</th>
<th>10-Year CVD Risk Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botnia</td>
<td>23%</td>
</tr>
<tr>
<td>TARFS</td>
<td>12%</td>
</tr>
<tr>
<td>Kuopio</td>
<td>10%</td>
</tr>
<tr>
<td>WHS</td>
<td>8%</td>
</tr>
</tbody>
</table>

Management Opportunity: Prevent Diabetes

- Placebo (n=1082)
- Metformin (n=1073, p<0.001 vs. Placebo)
- Lifestyle (n=1079, p<0.001 vs. Metformin, p<0.001 vs. Placebo)

Benefit of Comprehensive, Intensive Management: STENO 2 Study

- Treatment Goals:
  - Intensive TLC
  - HgbA1c <6.5%
  - Cholesterol <175
  - Triglycerides <150
  - BP <130/80
**Summary of Care: ABC's for Providers**

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**Physical Inactivity: A Call to Arms**

- 10,000 Steps Daily  
- 30 minutes most days

**Take an Exercise History and Encourage Increased Physical Activity**

- Brisk walking is an ideal physical activity for those without orthopedic issues  
- Walking uses the patient's increased body weight to increase energy expenditure  
- Pedometers provide daily feedback - 10,000 Steps Per Day

**RCT Trial Assessment of Pedometer Interventions**

N=277; 8 Trials  
Pedometer increased steps by 2500/day

**National Weight Control Registry**

- Successful Losers: >10% Body weight for 1 year  
- 3000 Registrants, 80% Women  
- Average Loss = 30 kg; Time = 5.5 yrs  
- How?  
  ~Low Fat Diet  
  ~Self-monitoring  
  ~Physical Activity  
- 81% Reported More Physical Activity

**Lifestyle Activity as an Alternative to "Working Out"**

- Weight Change (kg)  
  Programmed activity  
  Lifestyle activity  
  p=0.96  

**Graphs and Figures**

- Bar graph showing difference in changes in steps/day (mean ± SD)  
- Line graph showing weight change over weeks  
- Table showing weight change in kg over weeks  
- Diagram illustrating exercise history and encouragement of increased physical activity  
- Diagram illustrating pedometer trial assessment and increased steps  
- Graph illustrating national weight control registry results  
- Graph illustrating lifestyle activity as an alternative to working out  

**References**

- Bravata, DM et al. JAMA 2007; 298:2296-2304  
- National Weight Control Registry  
- Andersen RE et al. JAMA 1999;281:335-340  
Physical Activity Recommendations

<table>
<thead>
<tr>
<th>Mode of exercise</th>
<th>Frequency</th>
<th>Intensity</th>
<th>Duration</th>
<th>Class and level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio-respiratory (large muscle)</td>
<td>3-7 d/week</td>
<td>Moderate intensity OR</td>
<td>150 min/week</td>
<td>1 (A)</td>
</tr>
<tr>
<td>Cardio-respiratory (large muscle)</td>
<td>3 d/week</td>
<td>Vigorous intensity</td>
<td>90 min/week</td>
<td>1 (A)</td>
</tr>
<tr>
<td>Resistance</td>
<td>3 d/week</td>
<td>2-4 sets of 8-10 reps</td>
<td></td>
<td>1 (A)</td>
</tr>
</tbody>
</table>

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ADA Nutritional Guidelines

- Patients with pre-diabetes should receive individualized Medical Nutrition Therapy (MNT)
- Weight loss recommended for all overweight or obese individuals who have or are at risk for diabetes
- Physical activity and behavior modification effective for weight loss and maintenance
- Fiber 14 g/1000 kcal intake
- Saturated fat 7% with minimal trans fat

Effect of Mediterranean-Style Diet in the Metabolic Syndrome

- 180 pts with metabolic syndrome randomized to Mediterranean-style vs. prudent diet for 2 years
- Those in intervention group lost more weight (-4kg) than those in the control group (+0.6kg) (p<0.01), and significant reductions in CRP and IL-6

Patient Education

- Educational Objectives
  - Ensure patients realize the link between metabolic syndrome and risk of heart disease
  - Reinforce the patient’s role and control in disease management
    - Focus on significant impact even modest exercise and weight losses will have
  - Verify patients understand how to implement healthy changes to diet and physical activity level

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CASE STUDY

52 Year-Old Man with ACS

- JN is a 52-year-old man who has gained 20 pounds over the past 10 years
- Many of the men in his family are overweight and have hypertension
- CAD at age 62 in his father and early 60’s in his paternal grandfather. Both were diabetic

52 Year-Old Man with ACS

- “Borderline” HTN over the past 3-4 years
- No history of hyperlipidemia or diabetes
- Lifelong non-smoker
- He was advised to lose weight and start an exercise plan, but did not follow through
- He has a sedentary job and does minimal walking as a part of his daily routine

52 Year-Old Man with ACS

- At 5:30 a.m. he awoke with chest heaviness that worsened over the next 30 min when he called 911
- Exam on arrival to the Emergency Room:
  - Diaphoretic. BP 190/90, HR 78, Ht. 5’10”, Wt 220 (BMI 32kg/m²)
  - CV and lung exams were normal
  - His abdomen was obese
  - no edema and his pulses were 2+
- Given aspirin and SL NTG with relief of his symptoms

52 Year-Old Man with ACS

- The 12 Lead EKG showed ST depressions in leads II, III, aVf and V6
- Labs on Admission:
  - Blood glucose 248 mg/dL
  - TG 252 mg/dL
  - LDL-C 153 mg/dL
  - HDL-C 35 mg/dL
  - Initial Troponin I 2.3 ng/ml
  - HgbA1C was 7.2 %

High Risk of Diabetes Independent of ST-Segment Status

1994-1995
Effect of Primary Invasive Strategy of ACS by Diabetes Status at 6 Months

Case

- Patient underwent catheterization with successfully PCI of his LCx artery
- He was placed on
  - Aspirin 325 mg
  - Plavix 75 mg
  - Lisinopril 20 mg
  - Carvedilol 12.5 mg bid
  - Atorvastatin 20 mg

Diabetes and NSTEMI: Help from the Guidelines

- Treatment and diagnostics for NSTEMI patients with diabetes should be similar to those without (I; A)
- Diabetes-specific recommendations
  - Gp IIb/IIIa inhibitor for all (I; A)
  - ACE Inhibitors for all (I; A)
  - Eplerenone with EF ≤ 40; Cr≤ 2.5; K+ ≤ 5.0 (I; A)
  - CABG preferred over PCI for multi-vessel dz (IIa; B)
  - Glucose: target <150mg/dL X 1st 72 hours; 80-110 thereafter (IIa; B)

Process of Care and Outcomes by Diabetes Status: Observations from CRUSADE

Glucose in ACS: Help From the Guidelines

- AACE
  - Target BG 80 - 110 mg/dL
- ADA
  - As close to 110 mg/dL as possible and generally <180 mg/dL
- ACC/AHA Guidelines
  - 2000 USA/NSTEMI
    - Attention should be directed toward tight glucose control. (Level of evidence: A)
  - 2004 STEMI
    - Insulin infusion to normalize BG for patients with STEMI and complicated courses (I; B)
    - Insulin infusion during 1st 24-48 hrs, ...to normalize BG even in patients with an uncomplicated course (IIa; B)

Glucose in ACS: Help From the Guidelines (cont.)

- 2007 NSTEMI
  - Aggressive insulin use for the first 72 hours with a target of <150 mg/dl, 80-110 mg/dl thereafter (IIa; B)
- 2008 AHA position paper
  - Glucose target of < 180 mg/dl is reasonable (B)
  - Glucose target of 90-140 mg/dl is reasonable if hypoglycemia is avoided (C)
Association Between Glucose Therapy and Outcomes after MI

N=8872 w/ AMI and DM, mean age 76.4 years

- No insulin sensitizer (n = 6641)
- Thiazolidinediones (n = 1273)
- Metformin (n = 819)
- TZD + MET (n = 139)

Proportion of Patients Surviving

Days from Discharge

Adjusted RR

Conclusions

- Diabetes is increasingly prevalent in ACS/AMI populations
  - Associated with especially adverse clinical outcomes

- Diabetes and hyperglycemia associated with adverse outcomes
  - Role of glucose modulation remains to be defined
  - Concerning safety signals from intensive control trials

Conclusions (cont.)

- Most recent recommendations endorse more conservative glucose targets
  - <180 mg/dl is a reasonable target
  - Target 90-140 mg/dl only if hypoglycemia can be systematically avoided
    - Diabetes is increasingly prevalent in ACS/AMI populations
    - Associated with especially adverse clinical outcomes
  - Cornerstone remains prevention of ACS/MI
  - Continued efforts to apply chronic preventive therapies according to evidence base and guidelines

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