Treating Metabolic Syndrome: Interventions for Success

BC Nephrology Days 2007

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Metabolic Syndrome Program
Healthy Heart Program
St. Paul’s Hospital
Learning Objectives:

• Understand the central role of abdominal obesity

• Identify Metabolic Syndrome criteria

• Understand current management of cardiometabolic risk factors

• Improve ability to adopt a comprehensive lifestyle modification program for individualized therapy
The new ‘vital sign’ for human health: waist size

BY SHARON KIRKEY
Abdominal Obesity Predicts the Metabolic Syndrome

Hans TS et al. Obes Res. 10(9):923-31; 2002
Relationship Between BMI and Risk of Type 2 Diabetes Mellitus

Body Mass Index (kg/m²)

Age-Adjusted Relative Risk

Men
Women

10-year Risk of Developing Chronic Diseases by BMI Level

From AE Field et al. Arch Intern Med 2001; 161:1581-1586
**Fig. 2:** Temporal trends in the prevalence of measured obesity in Canada and the United States. Sources: US National Health and Nutrition Examination Surveys, 13, 17 1972 Canada Nutrition Survey, 11 Canada Health Survey, 1978–1979, 14 Canadian Heart Health Survey, 1986–1992 15 and Canadian Community Health Surveys. 6, 17 The estimates for Canada are age-standardized to the 2004 Canadian Community Health Survey, 6 and the estimates for the United States are age-standardized to the 2000 population census. 16
Prognosis of Metabolic Syndrome

Data from the Third National Health and Nutrition Examination Survey (NHANES III),
How Prevalent is Metabolic Syndrome?

• Numbers are alarming
• Prevalence is increasing in the age 50 plus population, it reaches one third of men and one quarter of women in Canada.
• Prevalence culminates particularly in the First Nations ethnic groups
Challenges in Canada

• 20% of population will be $\geq 65$ y/o by 2011
• 31% of adults are overweight or obese (BMI $>27$)
• 60,000 “new cases” of diabetes a year
• Prevalence of diabetes may increase to 3 million in 2010
• Extremely high frequency of obesity and diabetes in the First Nation populations
Challenges in British Columbia:

- 450,000 people have the metabolic syndrome
- 57% of men and 35% of women are overweight
Metabolic Syndrome is a constellation of metabolic abnormalities as a result of poor lifestyle habits interacting with underlying genetic susceptibility factors.
Metabolic Syndrome

Clustering of Risk Factors:

- Abdominal obesity
- Insulin resistance
- Atherogenic dyslipidemia
- Increased blood pressure
Metabolic Syndrome

- Increases risk for both cardiovascular disease and diabetes
- Metabolic syndrome has become the most important target of preventive strategies in the developed world
Intra-abdominal (visceral) fat: The dangerous inner fat!

AT: adipose tissue
Subcutaneous obesity
‘Healthy’ adipose tissue

- NO ECTOPIC FAT
  - Low muscle fat
  - Low epicardial fat
  - Low liver fat and normal function

Visceral obesity
Dysfunctional adipose tissue

- LIPID OVERFLOW—ECTOPIC FAT
  - Altered FFA metabolism
  - Altered release of adipokines
  - ↑ Muscle fat (↑ intracellular lipid)
  - ↑ Epicardial fat
  - ↑ Liver fat and altered function
Medical Complications of Obesity

- **Pulmonary Disease**
  - abnormal function
  - obstructive sleep apnea
  - hypoventilation syndrome

- **Non-alcoholic Fatty Liver Disease**
  - statuses
  - steatohypatitidis
  - cirrhosis

- **Gall Bladder Disease**

- **Gynecologic Abnormalities**
  - abnormal menses
  - infertility
  - polycystic ovarian syndrome

- **Osteoarthritis**

- **Skin**

- **Gout**

- **Idiopathic Intracranial Hypertension**

- **Stroke**

- **Cataracts**

- **Accelerated Atherosclerosis**

- **Coronary Heart Disease**

- **Diabetes**

- **Dyslipidemia**

- **Hypertension**

- **Severe Pancreatitis**

- **Cancer**
  - breast, uterus, cervix, colon, esophagus, pancreas, kidney, prostate

- **Phlebitis**
  - venous stasis
How do you diagnose Metabolic Syndrome?
Required For Diagnosing the Metabolic Syndrome

**IDF criteria of the metabolic syndrome**

- High waist circumference, plus any two of:
  - ↑ Triglycerides (≥ 1.7 mmol/L)
  - ↓ HDL cholesterol
    - Men < 1.0 mmol/L
    - Women < 1.3 mmol/L
  - ↑ Blood pressure ≥ 130 / > 85 mm Hg
  - ↑ FPG (≥ 5.6 mmol/L), or diabetes

‡or specific treatment for these conditions

International Diabetes Federation (2005)
### NCEP ATP III Criteria: 3 or more criteria

<table>
<thead>
<tr>
<th>Abdominal obesity</th>
<th>Waist Circumference</th>
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<tbody>
<tr>
<td>Men</td>
<td>&gt; 102 (40”)</td>
</tr>
<tr>
<td>Women</td>
<td>&gt; 88 (35”)</td>
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<table>
<thead>
<tr>
<th>Blood pressure</th>
<th>&gt; 130/85 mmHg</th>
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<tbody>
<tr>
<td>Triglycerides</td>
<td>≥1.7 mmol/L</td>
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<table>
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<tr>
<th>High Density Lipoprotein Cholesterol</th>
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<td>Men</td>
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<td>Women</td>
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<tr>
<th>Fasting glucose</th>
<th>5.7-7.0 mmol/L</th>
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Abdominal Obesity and Waist Circumference Thresholds

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
<td>Europid</td>
<td>&gt;94 cm (37.0 in)</td>
<td>&gt;80 cm (31.5 in)</td>
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<tr>
<td>South Asian</td>
<td>&gt;90 cm (35.4 in)</td>
<td>&gt;80 cm (31.5 in)</td>
</tr>
<tr>
<td>Chinese</td>
<td>&gt;90 cm (35.4 in)</td>
<td>&gt;80 cm (31.5 in)</td>
</tr>
<tr>
<td>Japanese</td>
<td>&gt;90 cm (33.5 in)</td>
<td>&gt;80 cm (35.4 in)</td>
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Current NCEP ATP-III criteria:

- > 102 cm (>40 in) in men
- > 88 cm (>35 in) in women

NCEP 2002; International Diabetes Federation (2005)
How do you identify high-risk patients?
Global Risk Score and Metabolic Syndrome

- Framingham Risk Score used in assessment
- Metabolic syndrome individuals often at higher risk than predicted by FRS
- Double the total percentage score
Assess Other Contributing Factors of Hypertriglycerideremia:

- Obesity/Overweight
- Decreased physical activity
- Increased in alcohol intake
- High carbohydrate diet
- Underlying diabetes
- Renal failure
- Genetic disorders
- Medications (BB, estrogens, oral contraceptives, diuretics)
Assess Associated Conditions of Insulin Resistance:

- Skin (acanthosis nigricans)
- PCOS (polycystic ovarian syndrome)
- Pediatric risk factors
- Sleep disturbances (sleep apnea, daytime sleepiness and fatigue)
- Dysregulation of insulin increases risk for cognitive impairment, Alzheimer’s disease
- Liver – nonalcoholic fatty liver disease
  – Screen ALT
Metabolic Syndrome: Treatment
## Comparative Effects of Interventions

<table>
<thead>
<tr>
<th></th>
<th>Exercise</th>
<th>Diet</th>
<th>Meds</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>-7/-3 mmHg</td>
<td>-7 to -11 mmHg</td>
<td>-15/-9 mmHg</td>
</tr>
<tr>
<td>Lipids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDL</td>
<td>-5%</td>
<td>-5%</td>
<td>-30%</td>
</tr>
<tr>
<td>HDL</td>
<td>+5%</td>
<td>--</td>
<td>+5%</td>
</tr>
<tr>
<td>TG</td>
<td>-4%</td>
<td></td>
<td>-20%</td>
</tr>
<tr>
<td>TC</td>
<td></td>
<td>-3%</td>
<td></td>
</tr>
<tr>
<td>A1C</td>
<td>-10%</td>
<td>Reduced</td>
<td>&gt; -20%</td>
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<tr>
<td>Hs-CRP</td>
<td>Reduced</td>
<td>Reduced</td>
<td>Reduced</td>
</tr>
<tr>
<td>Cytokines</td>
<td>Reduced</td>
<td>Reduced</td>
<td>Reduced</td>
</tr>
<tr>
<td>Total body weight</td>
<td>~8%</td>
<td>~8%</td>
<td>+/-</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>Reduced</td>
<td>Reduced</td>
<td>Reduced</td>
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<tr>
<td>Abdominal fat</td>
<td>Reduced</td>
<td>Reduced</td>
<td>Reduced</td>
</tr>
<tr>
<td>Intra-abdominal fat</td>
<td>Reduced</td>
<td>Reduced</td>
<td>Reduced</td>
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Therapeutic Objectives:

- **To reduce underlying causes**
  - Overweight and obesity
  - Physical inactivity

- **To treat associated lipid and non-lipid risk factors**
  - Atherogenic dyslipidemia (lipid triad)
  - Hypertension
  - Dysglycemia
  - Prothrombotic state
  - Proinflammatory state
Treatment of the Metabolic Syndrome Assessment:

- Recognize and identify cardiometabolic risk factors
- BP, HR
- Medical history
- Medications
- Anthropometrics: WT, HT, WC, BMI, WHR
  - Measure waist circumference
  - Make waist circumference a new vital sign!
The waist circumference is measured by locating the upper hip bone and the top of the right iliac crest and placing a measuring tape in a horizontal plane around the abdomen at the level of the iliac crest.

Before reading the tape measure, the tape should be snug but not compressing the skin and should be parallel to the floor.

The measurement is made at the end of normal expiration.
Assessment of Current Lifestyle Factors:

- Nutrition history
  - eating disorders, obesity, yo-yo dieting
- Weight history
  - Range of weight and usual weight (past programs)
- Exercise and physical activity patterns
- Tobacco use
- Alcohol use/other drugs
- Psychosocial variables (stress, anxiety, depression, anger, social support)

Other:
- Psychiatric comorbidities
- Family history
Lifestyle Interventions: Nutrition and Weight Management
The Most Important Goal in Treatment:
Focus on making *healthy lifestyle changes*.

- Physical activity and diet changes that lead to weight loss can reduce or reverse the metabolic syndrome.
- Balance calorie intake and physical activity to reach or keep up a healthy body weight.
• Reduce body weight by 7-10% during the first year of therapy

• Anti-atherogenic diet
  – Saturated fat <7% of total calories
  – Reduce trans fat
  – Dietary cholesterol <200mg/day
  – Total fat 25-35% of total calories
  – Simple sugars should be limited
Dietary Principles:

Diet and Lifestyle Recommendations Revision 2006 A Scientific Statement From the American Heart Association Nutrition Committee Circulation 2006;114:82-96

AHA 2006 Diet and Lifestyle Recommendations for Cardiovascular Disease Risk Reduction

• Balance calorie intake and physical activity to achieve or maintain a healthy body weight.
• Consume a diet rich in vegetables and fruits.
• Choose whole-grain, high-fiber foods.
Dietary Principles:

• Consume fish, especially oily fish, at least twice a week.

• Limit your intake of saturated fat to <7% of energy, *trans* fat to <1% of energy, and cholesterol to <300 mg per day
Dietary Principles:

• Minimize your intake of beverages and foods with added sugars.
• Choose and prepare foods with little or no salt.
• If you consume alcohol, do so in moderation.
• When you eat food that is prepared outside of the home, follow the AHA Diet and Lifestyle Recommendations.
Adult Weight Management Evidence-Based Nutrition Practice Guideline (American Dietetic Association – ADA evidence library.com)

- An individualized reduced calorie diet is the basis of the dietary component of a comprehensive weight management program. Reducing dietary fat and/or carbohydrates is a practical way to create a caloric deficit of 500-1000kcal below estimated energy needs and should result in a weight loss of 1-2lbs per week.

- Total caloric intake should be distributed throughout the day, with the consumption of 4 to 5 meals/snacks per day including breakfast. Consumption of greater energy intake during the day may be preferable to evening consumption.
2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children

This complete set of guidelines consists of an executive summary and 12 chapters on specific aspects of obesity generation and management. It is available online as a PDF at www.cmaj.ca/cgi/content/full/176/8/e117.

CMAJ 2007;176(8 suppl):Online-1–117
• Dietary intervention for the treatment of obesity in adults
  – Reduced energy intake (by about 500kcal/day) will promote gradual weight loss over time at the expected rate of 1-2kg per month
  – Currently insufficient evidence to conclude that manipulation of the macronutrient distribution to achieve either a low carbohydrate intake or a low fat intake offers any significant advantages
Dietary Interventions:

• Low-carbohydrate diets
  – The use of long-term (>6 months) is not recommended

• Low-fat diets
  – <10% fat diet without energy restriction resulted in an average weight loss of 3.2 kg after 1 year
Dietary Interventions:

- **High Protein Diets**
  - Higher protein diets (25% vs 12%) – no change in weight but a greater decrease in waist circumference, waist–to-hip ratio and abdominal fat mass at 1 year
  - Evidence to suggest that higher protein intake increases satiety compared with diets of lower protein content
Dietary Interventions:

- Low glycemic index, high-fiber diets
  - Review of dietary interventions on appetite and energy balance comparing low glycemic vs high glycemic showed no differences in 14 trials
  - 22 studies on impact of fiber on appetite suppression and weight loss concluded that the addition of 10-14g of fiber may promote a weight loss of 1.3-1.9kg over 3 months
Nutrition Education in SPH Metabolic Syndrome Program:

- Food Trackers
- Nutrition Lifestyle Questionnaire
- Portion Distortion – portions and fiber
- Grocery Shopping Tour
- Mood and Food
- Facts about Fat
- Potluck
- Holiday/Vacation Scenarios
What are the Key Fundamentals for Initiating Behavior Change:

- Exercise and nutrition goals should be SMART:
  - S pecific
  - M easurable
  - A ttainable
  - R ealistic
  - T ime-defined
Common Barriers:

- Irregular eating patterns
- Lack of balanced meals
- Night-time eating
- Low intake of fruits and vegetables
- Low intake of fiber
- Restaurant Dining
- Psychological issues
Weight Loss Prevents Diabetes!

Lifestyle Interventions: Exercise and Physical Activity
Lifestyle Interventions: Physical Activity

- Physical activity is an important component of successful weight loss and weight loss maintenance programs.
- Has independent beneficial effects on cardiometabolic risk factors and overall CVD risk.
SMART Principles and Exercise Prescription:

- Exercise prescriptions should be SMART:
  - **S**pecific
    - Concise, clear exercise instructions
  - **M**easurable
    - Use pedometers
    - Exercise equipment
    - Defined distances
  - **A**ttainable
    - Patient-specific goals
  - **R**ealistic
    - Use your common sense
  - **T**ime-defined
    - Expect improvements in 6–12 weeks
What are the Key Fundamentals of an Exercise Prescription?

- Exercise prescriptions should follow FITT
  - F requency
  - I ntensity
  - T ime (duration)
  - T ype
Cardio

- Frequency: most days
- Intensity: “moderate” 50-70% of max HR, or use the “talk test”
- Time: 10 minutes or more at a time
- Type: what you like! (preferably low impact exercise)

Strength

- 2-3 times per week (non-consecutive days)
- 8-20 repetitions against a resistance that causes fatigue.
- 1-2 sets
- One exercise for every major muscle group (largest muscle groups take priority)
**Physical Activity and Weight Management**

- **30 minutes cardio most days for health, 60 minutes or MORE for weight-loss**
- **National Weight Control Registry**
  - “Physical activity has remained the same at roughly 2600 calories per week”
  - That is approximately equal to a 235 pound person walking for an hour every day on level ground

<table>
<thead>
<tr>
<th>Exercise Calorie Estimator (Walking, up to 4 mph)</th>
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<tbody>
<tr>
<td>Weight (lbs)</td>
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<tr>
<td>Walking Speed (mph)</td>
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<tr>
<td>Walking Grade (%)</td>
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<thead>
<tr>
<th>Exercise Calorie Estimator (Running, as low as 3 mph if truly jogging)</th>
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<table>
<thead>
<tr>
<th>How fast will I lose weight?</th>
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<tbody>
<tr>
<td>walking</td>
</tr>
<tr>
<td>Days exercise/week</td>
</tr>
<tr>
<td>Duration of exercise</td>
</tr>
<tr>
<td>Intensity of exercise</td>
</tr>
<tr>
<td>kcals/week</td>
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<tr>
<td>pounds of fat per week</td>
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Strength Training to Improve Metabolic Control: an Underutilized Tool

“Swimming isn’t enough. Our veterinarian says we also have to pump iron three times a week!”
Strength Training to Improve Metabolic Control: an Underutilized Tool

• Particularly useful for:
  – Improving glucose metabolism
    • Improvement in HbA1C levels and insulin sensitivity in T2DM
  – Increasing basal metabolic rate
    • In theory 1kg lean muscle mass increases BMR by 21 kcal/day\(^1\)
    • May potentially offset age relate weight gain.

1) Circulation. 2007 Jul 16
Strength Training...

- Despite misconceptions, strength training is safe even with high workloads
  - Hemodynamically less demanding than aerobic exercise

- Supervised, centre-based training most effective; however, home based exercise may still have some efficacy, especially in the elderly\(^2\).

Fitness versus Fatness

- Fitness (time on Bruce treadmill) independently predicts risk of total mortality, CV mortality and CV events.
  - 1 Met decrease on the treadmill = +1.20 RR for CV mortality in asymptomatic women
- Exercise, even without significant decrease in weight (or waist) should reduce risk

“...low cardiorespiratory fitness was a strong and independent predictor of CVD and all-cause mortality and of comparable importance with that of diabetes mellitus and other CVD risk factors.”

Safety considerations

• An appropriately designed strength and conditioning program is very safe for asymptomatic people with metabolic syndrome.
• If Framingham 10 year risk score exceeds 10%, graded exercise stress testing may be considered, particularly if patient is new to exercise.
• Supervised exercise is not a necessity; however, patients may find benefit from the structure and expert staff associated with cardiac rehabilitation programs.
• Referral to a qualified exercise professional (ACSM Exercise Specialist or equivalent)

*American College of Sports Medicine: Guidelines for Exercise Testing and Prescription*
Measuring Physical Activity: the SPH experience

- Measuring free living physical activity patterns continues to be a challenge:
  1) Self report questionnaires
     - Over reporting
     - IPAQ (www.ipaq.ki.se)
  2) Pedometers / step counters
     - No indication of exercise intensity
  3) Continuous heart rate monitoring
     - Tremendous inter-individual variation
  4) Accelerometers
     - Better than pedometers, but only capture dynamic activity
  5) Indirect calorimetry
     - More accurate
     - $$$ and not realistic to wear for the whole day
  6) Doubly labeled water
     - $$, not practical
Physical Activity and Exercise Therapy

Summary

• Obesity and overweight
  – Is related to physical inactivity
  – Is improved by regular exercise

• Physical activity and exercise
  – Significant health benefits in obesity
    • Preserves lean body mass
    • Vascular benefits
  – For weight management
    • Time much more important than intensity
    • Use pedometers as motivators
      – 10 000 Steps program
    • Be SMART and be FITT
Lifestyle Intervention Strategies:

• Self-monitoring
• Problem solving around barriers
• Cognitive restructuring – moderating unrealistic goals, reduce self-defeating thoughts and feelings
• Prevent relapse – Anticipate lapses in lifestyle change and practice coping strategies to get back on track
• Social support – involve family and friends
• Contracting – may increase commitment
Pharmacotherapy:

• May be needed after trial of intensive lifestyle intervention (6-12 months)
• Lipid lowering therapy
• Hypoglycemic agents
• Antihypertensive agents
• Weight loss agents
• Smoking cessation
• Mental health agents
Psychosocial Interventions:

- Assessment
- Acknowledgement!
- Letter to referring physician/family physician
- Education materials to patient
- Self-management workbook on depression
  - [www.carmha.ca/publications](http://www.carmha.ca/publications)
- Referral to community resources
  - Support programs, Psychology, Psychiatry
Summary: Lifestyle Therapy

• Lifestyle modification – including weight loss, increased physical activity and an anti-atherogenic diet – is the primary therapeutic goal for the treatment of metabolic syndrome

• Prescribing lifestyle changes are underutilized in routine clinical practice!
Summary: Lifestyle Therapy...

- Drug therapy alone does not completely eliminate the cardiovascular disease risk; lifestyle therapies provide a multifaceted approach to reduce this residual risk.
- Once metabolic syndrome is diagnosed, lifestyle therapies need to be introduced, reinforced, and monitored.
Summary

• Multidisciplinary team members are able to effectively and confidently support the identification and treatment plans of individuals with the metabolic syndrome both at the bedside and in the outpatient setting.

• Patient risk reduction is a team effort – share with the primary or referring doctor plan of action and recommendations. Refer to other health care professionals or programs for additional patient support.
1st Annual Western Cardiometabolic Summit

- St. Paul’s Hospital
- 1081 Burrard Street, Vancouver, BC
- New Lecture Theatre – Providence Building

- Sponsored by St. Paul Hospital

- Unrestricted grants-in-aid of continuing medical education have been provided
Questions and Discussion