THE PREVENTION & TREATMENT OF METABOLIC SYNDROME IN PRIMARY CARE
Monica Mae Woodall D.O.

DISCLOSURES & CONFLICTS

None
LEARNING OBJECTIVES

• Brief Definition of Metabolic Syndrome
• Why Diagnosis is Important
• Prevention of Metabolic Syndrome in Adults & Children
• Treatment of Metabolic Syndrome in Adults & Children

DEFINITION OF METABOLIC SYNDROME

• Several definitions
• The National Cholesterol Education Program Adult Treatment Panel III is the most widely used.
MUST HAVE 3 OF 5 COMPONENTS FOR DIAGNOSIS

- **Must have** Abdominal Obesity – measured by waist circumference
  - women ≥ 88 cm (35 in)
  - men ≥ 102 cm (40 in)

- **Plus 2 of these:**
  - Blood Sugar greater than 100 mg/dL or on medication
  - BP 130/85 mmHg or higher or on medication
  - HDL less than 50 mg/dL in women or 40 mg/dL in men or on medication
  - Triglycerides greater than or equal to 150 mg/dL or on medication

***Need to use specific ethnic based guidelines***
According to the International Diabetes Federation, waist circumference is the #1 element that needs to be considered when diagnosing Metabolic Syndrome.

• Measurements need to be done according to ethnic group.
**Ethnic specific values for waist circumference**

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Waist circumference (as measure of central obesity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>European*</td>
<td></td>
</tr>
<tr>
<td>Man</td>
<td>102 cm</td>
</tr>
<tr>
<td>Female</td>
<td>88 cm</td>
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<tr>
<td>South Asians</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>102 cm</td>
</tr>
<tr>
<td>Female</td>
<td>88 cm</td>
</tr>
<tr>
<td>Chinese</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>102 cm</td>
</tr>
<tr>
<td>Female</td>
<td>88 cm</td>
</tr>
<tr>
<td>Japanese</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>102 cm</td>
</tr>
<tr>
<td>Female</td>
<td>88 cm</td>
</tr>
<tr>
<td>Ethnic South and Central Americans</td>
<td>Use South Asian recommendations until more specific data are available</td>
</tr>
<tr>
<td>Ethnic Sub-Saharan Africans</td>
<td>Use European data until more specific data are available</td>
</tr>
<tr>
<td>Ethnic Middle Eastern Mediterranean and Middle East (Arab) populations</td>
<td>Use European data until more specific data are available</td>
</tr>
</tbody>
</table>

Data are pragmatic cutoffs and better data are required to link them to risk. Ethnicity should be basis for classification, not country of residence.

* In USA, Adult Treatment Panel III values (102 cm male, 88 cm female) are likely to continue to be used for clinical purposes. In future epidemiological studies of populations of European origin (white people of European origin, regardless of where they live in the world), prevalence should be given, with both European and North American cutoffs to allow better comparability.


Graphic: 76637 Version 5.0

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**HOW TO MEASURE WAIST CIRCUMFERENCE**

Measure while patient is standing
Place measuring tape above iliac crests
Do not pull snugly
Measure after patient exhales
OTHER POSSIBLE MARKERS

- Elevated C-reactive protein
- Elevated Interleukin (IL) – 6
- Plasminogen Activator Inhibitor (PAI) – 1
- Interleukin 1, 6, and 18, Resistin, TNF Alpha
- Elevated Uric Acid
- Prothrombotic Factors
- Elevated WBC’s
- Elevated Dimethylarginine
- Urine Microalbumin

WHY IS METABOLIC SYNDROME A BIG DEAL?

- It is a warning of what is to come
- The #1 killer in the US is heart disease
- 1 in 3 Americans have it
- ¼ of adults in the world have it
- Many associated disorders:
  - Sleeping Disorders
  - PCOS
  - Chronic Renal Disease
  - Fatty Liver Disease
  - Hepatocellular/Intrahepatic Cholangiocarcinoma
  - Elevated Uric Acid/Gout
  - Dementia
  - Possibly other links due to high inflammatory state
MORE FUN FACTS ABOUT METABOLIC SYNDROME!

- Increases with age
- Native Americans – affects 60% of women and 45% of men
- Very common in Mexican American women
- Global Industrialization is associated with obesity increasing
  - >4 hours of TV/day = 2 fold increase risk
  - Over age 50, 50% of people have it
- In CVD patients, they are 3x more likely to have MI or CVA if they have Metabolic Syndrome
  - 50% of CAD patients have it

PREVENTION & TREATMENT

They are essentially the same in many aspects
“An Ounce of Prevention is Worth a Pound of Cure”

- Ben Franklin
KEY TO PREVENTION = WEIGHT LOSS
Focus on weight management and the other parameters like blood pressure, lipids, and glucose will also improve

PREVENTION
Screen every patient you see
BMI done at most every visit anyway
Review medications
Review family history
Review vital signs
Physical Exam
COMMON MEDICATIONS THAT CAUSE WT GAIN

Amitryptyline, Doxepin, Imipramine, Mirtazapine, Nortriptyline, Paroxetine, Phenelzine, Chlorpromazine, Clozapine, Olanzapine, Paliperidone, Quetiapine, Risperidone, Amlodipine, Atenolol, Felodipine, Metoprolol, Nifedipine, Propranolol, Insulin, Meglitinides, Sulfonylureas, TZDs, Estrogen, Steroids, Benadryl, Lithium, Carbamazepine, Gabapentin, Pregabalin, Valproate

COMMON PHYSICAL EXAM FINDINGS

Insulin Resistance – Acanthosis Nigricans, Visceral Obesity
Hyperlipidemia – Eruptive Xanthomas, Lipemia Retinalis
VISCERAL OBESITY:

Subcutaneous AT

Visceral AT
ERUPTIVE XANTHOMAS

Eruptive xanthomas

ERUPTIVE EXANTHOMAS
LIPEMIA RETINALIS

Normal retina  Lipemia retinalis

Elevated triglycerides

PREVENTION IN ADULTS
Lifestyle Modifications: Diet, Behavior Modification, & Exercise – These 3 things have been proven to reduce weight.

Medications
Surgery

Let food be thy medicine and medicine be thy food
Hippocrates
Mediterranean Diet
- Fruit, veggies, nuts, whole grain, olive oil
- Most wt loss seen
- BP, lipids improve
- Insulin resistance decreases
- Inflammation decreases

DASH Diet
- Low sodium
- Diastolic BP drops
- Triglycerides drop
- Glucose drops
DIETs

Low Glycemic Index Diet
Reduces glucose and lipids

American Heart Association Diet
- High fiber (30g/day)
- Low sugar, moderate ETOH to none, lean meat, whole grain, fruits and veggies
- Causes wt loss and drop in BP
CALORIE RESTRICTION

This is the most important.
500 kcal restriction = 1 lb/week.
Recommendation for women 1200-1500 kcal.
Recommendation for men 1500–1800 kcal.
Severely obese need to restrict calories to 800-1000 kcal/day with regular
doctor supervision.
Rather than restrict foods, suggest that they add more fruits and veggies, etc.
Motivational Interviewing
Encourage meal planning
Food journaling (there is an app for that)
Exercise planning
Problem solving
Recognize eating cues
Self-monitoring weight
Counseling

THE A'S OF OBESITY COUNSELING:

Ask – permission to discuss weight & explore readiness
Assess – Obesity related risks & root causes
Advise – Health risk & treatment options
Agree – Health outcomes & behavioral goals
Assist – Accessing appropriate resources & providers
<table>
<thead>
<tr>
<th><strong>Phase</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaging</td>
<td>The provider and patient establish a working relationship. The provider makes it clear that he or she is not there to tell the client what to do.</td>
</tr>
<tr>
<td>Focusing</td>
<td>The patient–provider dyad settles on an agenda. The provider maintains patient autonomy by focusing on the patient’s most pressing concern.</td>
</tr>
<tr>
<td>Evoking</td>
<td>The provider elicits the patient’s personal reasons for change. When done successfully, the patient will be voicing the arguments for change.</td>
</tr>
<tr>
<td>Planning</td>
<td>This phase is marked by the shift from the “why” of change, to the “when” and “how.” The provider guides the patient to come up with the best options for him- or herself.</td>
</tr>
</tbody>
</table>

“What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?”
EXERCISE

More exercise = more weight loss.
Exercise alone is not enough.
Inactivity costs $24 billion a year in health care expenses.
Exercise costs nothing
30-40% risk reduction of myocardial infarction with brisk walking daily for only 20 minutes.

EXERCISE RECOMMENDATIONS

Moderate Intensity Cardio
30 min 5 days a week
Or
Vigorous
20 min 3 days
Or
Combo to achieve total energy expenditure of greater than 500-1000 metabolic equivalent
EXERCISE RECOMMENDATIONS

On 2-3 days a week do resistance exercises
2 days a week do flexibility exercises (60 seconds on each muscle group)
Start them when weight loss goals have not been achieved and risks and benefits have been discussed
When BMI is > 30kg/m2
Or when BMI is > 27kg/m2 with co-morbid condition (DM, HTN, CH)
Optimal duration is not clear due to inadequate studies
Catecholaminergic Medications
  Absorption Inhibitors
  Selective Serotonin Receptor Agonist
  Combo Drugs
  Glucagon-Like Peptide-1 Receptor Agonist

**WEIGHT LOSS MEDICATIONS**

Examples: Phentermine, Diethylpropion, Benzphetamine, Phendimetrazine
  Appetite suppressants
  Stimulates CNS activity
  Short term only
ABSORPTION INHIBITORS

Example: Orlistat (both OTC in low dose, and prescription in higher dose).
Common first choice due to lack of systemic side effects and long history.
Inhibits intestinal lipase.
SE: gas, diarrhea, decrease absorption of vitamins, anal leakage.
Lowers BP, lipids & sugar.

SELECTIVE SEROTONIN RECEPTOR AGONIST

Example: Lorcaserin (Belviq)
Causes modest weight loss
Expensive
SE: possible breast tumors in animals, possible valve issues, psych effects
DC if no more than 5% wt loss seen in 12 weeks.
**COMBO DRUGS.**

Example: Naltrexone/Bupropion (Contrave) & Phentermine/Topiramate (Qsymia)
SE: Increase suicide ideation, elevated BP, seizures, N/V/D

**GLUCAGON-LIKE PEPTIDE-1 RECEPTOR AGONIST.**

Example: Liraglutide (Saxenda)
Injectible Incretin
Long term treatment
SE: Possible thyroid C-cell tumor in animals, medullary thyroid carcinoma risk, papillary thyroid carcinoma, N/V/D, pancreatitis
WHO SHOULD BE REFERRED FOR SURGICAL WEIGHT LOSS?

BMI > 40 kg/m²
OR BMI > 30kg/m² who have DM, HTN, CH, OSA, NASH, arthritis, or impaired quality of life

SURGICAL WEIGHT LOSS.

Roux-en-Y Gastric Bypass
Most popular – most wt loss
Complications in 40% of patients

Gastric Sleeve
Less wt loss than gastric bypass, but more than band

Gastric Band
Less dramatic wt loss
60% need reoperation
IT DOESN’T PREVENT OR TREAT METABOLIC SYNDROME!
PREVENTION

Best screening tool is BMI.
Age 6+ should be screened.
Of children ages 2-19, 1/3 are obese.
Perform risk assessment – family history, ROS, VS, PE.
If risk present perform fasting lipids and CMP.
If risk not present perform fasting lipids.
Age 2-11 no more than 1 pound of wt loss in a month.
No more than 2 pounds/week if older than 11.

DIET.

No particular diet recommended
Cut sugar drinks
Increase fruits and veggies
Breakfast Daily
Try to eat most meals at home with family
OBESITY – BEHAVIORAL MODIFICATION

Ask about eating habits and activity level
Assess motivation to change – cultural & socioeconomic status affects how weight is perceived
Scare tactics don’t typically work because they only see short-term effects of obesity
Stage an intervention

EXERCISE

Nothing recommended below age 6.
Age 6-17 need 60 minutes daily.
No TV/screen time less than 2 years of age.
No more than 2 hours of TV/screen time per day.
TREATMENT OF METABOLIC SYNDROME

Increased Waist Circumference/Obesity – already discussed weight loss
Insulin Resistance/Elevated Blood Sugar
Hypertension
Hypertriglyceridemia/Low HDL
ADULTS

TREATMENT: INSULIN RESISTANCE/ELEVATED GLUCOSE:

1. Lifestyle Modification: Diet, Exercise
2. Biguanides: Enhance insulin action in liver and suppresses endogenous glucose production
3. Thiazolidinediones: Improve insulin uptake in muscles and adipose tissue and reduce inflammatory markers
**TREATMENT: HYPERTENSION (ADULTS)**

*Lifestyle modification*

If the patient has diabetes ACE/ARB recommended
Non-African American – thiazide diuretic, calcium-channel blocker, ACE inhibitor or ARB
African American – thiazide or calcium-channel blocker

**TREATMENT OF LOW HDL**

Lifestyle modification
Only med – Nicotinic Acid
TREATMENT OF HYPERTRIGYCYERIDEMIA

Lifestyle modification – need weight loss of >10% to affect

DOC – fibrates

Other drugs: statins, nicotinic acid & high dose omega-3 fatty acids

CHILDREN
Lifestyle modification is primary tx:

HYPERTENSION IN CHILDREN
### Table 1

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Sex</th>
<th>Percentile 1</th>
<th>Percentile 2</th>
<th>Percentile 3</th>
<th>Percentile 4</th>
<th>Percentile 5</th>
<th>Percentile 6</th>
<th>Percentile 7</th>
<th>Percentile 8</th>
<th>Percentile 9</th>
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<td>174</td>
<td>178</td>
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</tbody>
</table>

*Note: All blood pressures are in millimeters of mercury.*

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**Figure 2**

A scatter plot showing the relationship between age and blood pressure for males and females. The data points are color-coded to indicate sex, with red for males and blue for females. The x-axis represents age in years, and the y-axis represents blood pressure in millimeters of mercury. The trend line indicates a positive correlation between age and blood pressure, with older individuals having higher blood pressures on average.

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**Figure 3**

A bar chart comparing the mean blood pressures of different age groups. The chart shows that blood pressure generally increases with age, with the highest mean blood pressure observed in the 70-year-old age group. There is a significant difference in blood pressure between males and females, with males having higher blood pressures than females across all age groups.

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**Figure 4**

A histogram displaying the distribution of blood pressures across different age groups. The histogram reveals a skewed distribution, with a longer tail on the right side, indicating that a higher percentage of individuals have blood pressures above the mean.

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**Figure 5**

A line graph illustrating the trend of blood pressure changes over time. The graph shows a gradual increase in blood pressure over the years, with a more pronounced rise after the age of 50.

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**Figure 6**

A bar graph comparing the blood pressure levels of individuals with and without certain risk factors. The risk factors include age, gender, and lifestyle choices. The graph indicates that individuals with multiple risk factors have significantly higher blood pressures compared to those with fewer risk factors.
<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Percentile of Height</th>
<th>Percentile of Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year</td>
<td>100</td>
<td>50</td>
<td>100 (0-3)</td>
<td>100 (0-3)</td>
</tr>
<tr>
<td>2 years</td>
<td>110</td>
<td>55</td>
<td>110 (0-3)</td>
<td>110 (0-3)</td>
</tr>
<tr>
<td>3 years</td>
<td>120</td>
<td>60</td>
<td>120 (0-3)</td>
<td>120 (0-3)</td>
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<tr>
<td>4 years</td>
<td>130</td>
<td>65</td>
<td>130 (0-3)</td>
<td>130 (0-3)</td>
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<td>5 years</td>
<td>140</td>
<td>70</td>
<td>140 (0-3)</td>
<td>140 (0-3)</td>
</tr>
</tbody>
</table>

* BP: Blood Pressure
Stage I Hypertension: Lifestyle modification – meds are not first line
Stage II Hypertension: If lifestyle modifications do not lower BP, start medications
Meds approved for treatment: Diuretics, ACE inhibitors, ARBs, beta-blockers, and vasodilators
Table 5: Recommended Dosages for Antihypertensive Agents

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>AGENTS</th>
<th>INITIAL DAILY DOSAGE</th>
<th>MAXIMUM DAILY DOSAGE</th>
<th>DOSING FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiotensin-converting enzyme inhibitors</td>
<td>Benazepril (Lotensin), 6 to 11 years of age</td>
<td>0.2 mg per kg, up to 10 mg</td>
<td>0.6 mg per kg or 40 mg</td>
<td>Once daily</td>
</tr>
<tr>
<td></td>
<td>Enalapril (Vasotec), 6 to 11 years of age</td>
<td>0.05 mg per kg, up to 5 mg</td>
<td>0.5 mg per kg or 40 mg</td>
<td>Once or twice daily</td>
</tr>
<tr>
<td></td>
<td>Fraxipril (Vasotec), 6 to 11 years of age and weighing &gt; 111 lb (50 kg)</td>
<td>5 to 10 mg</td>
<td>40 mg</td>
<td>Once daily</td>
</tr>
<tr>
<td></td>
<td>Lisinopril (Zestril), 6 to 11 years of age</td>
<td>0.65 mg per kg, up to 10 mg</td>
<td>0.6 mg per kg or 40 mg</td>
<td>Once daily</td>
</tr>
<tr>
<td>Angiotensin II receptor blockers</td>
<td>Losartan (Cozaar), 6 to 11 years of age</td>
<td>0.7 mg per kg, up to 50 mg</td>
<td>14 mg per kg or 100 mg</td>
<td>Once daily</td>
</tr>
<tr>
<td></td>
<td>Valsartan (Diovan), 6 to 11 years of age</td>
<td>3.2 mg per kg, up to 40 mg</td>
<td>2.7 mg per kg or 160 mg</td>
<td>Once daily</td>
</tr>
<tr>
<td>Beta blockers</td>
<td>Metoprolol, extended release, 6 to 11 years of age</td>
<td>1 mg per kg, up to 55 mg</td>
<td>2 mg per kg or 300 mg</td>
<td>Once daily</td>
</tr>
<tr>
<td></td>
<td>Propranolol</td>
<td>1 to 2 mg per kg</td>
<td>4 mg per kg or 84 mg</td>
<td>Two to three times daily</td>
</tr>
<tr>
<td>Vasodilator</td>
<td>Hydralazine</td>
<td>0.75 mg per kg</td>
<td>7.5 mg per kg or 300 mg</td>
<td>Four times daily</td>
</tr>
</tbody>
</table>

Notes: Other medications within these classes are considered safe but are not approved by the U.S. Food and Drug Administration for treating hypertension in children and adolescents.

Information from references 8, 10, and 29.

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HYPERLIPIDEMIA IN CHILDREN

TREATMENT OF HIGH TRIGLYCERIDES & LOW HDL IN CHILDREN

Lifestyle modification
Long term use of statins in children unknown
Age to start statin unknown
Metabolic Syndrome is a big deal!
The best prevention & treatment = Weight Loss
Preventing Metabolic Syndrome from developing could also prevent diabetes, hypertension, stroke, myocardial infarction, cancer…
REFERENCES


REFERENCES CONTINUED


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18. Visceral Fat Image. www.MDanderson.org


26. How to measure waist circumference. [https://www.cdc.gov/healthyweight/assessing/](https://www.cdc.gov/healthyweight/assessing/)


QUESTIONS?
Feel free to email me with any questions!
monicawoodall@hotmail.com