The Association of Metabolic Syndrome With Premature Out-of-Hospital Sudden Death
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Purpose

• Metabolic Syndrome (MetS) is defined by the presence of at least three established cardiovascular risk factors: increased waist circumference (WC), elevated triglycerides (TG), low-density lipoprotein cholesterol (HDL-C), elevated blood pressure (BP) or on an antihypertensive, and elevated fasting glucose (FG) or on glucose-lowering treatment.
• This cluster of risk factors multiplies the risk of sudden death beyond each risk factors’ individual contribution.

We hypothesize that there is a higher prevalence of MetS and the individual components, and a greater association of out-of-hospital sudden death (OHSD) compared to a national sample of the US population.

Methods

• From March 1, 2013 to February 28, 2015 all out-of-hospital deaths reported by emergency medical services (EMS) aged 18-64 were adjudicated using EMS narratives, medical records, medical examiner reports and/or post-mortem examinations in Wake County (pop. ~ 950,000), North Carolina (NC), United States (Figure 1).
• A comparison group was formed of NHANES 2009-10 participants (Figure 2).
• MetS was defined as presence of ≥3 of the pre-established criteria as outlined by the National Cholesterol Education Program Adult Treatment Panel III (2005) guidelines.

Figure 1. Ascertainment process for OHSUD Victims

Wake County, NC, out of hospital deaths attended by EMS (n=1,632)
Cases reviewed by adjudication committee (n=590)
All 2013-2015 OHSUD victims (n=408)
OHSD victims with medical records (n=278)
OHSD victims with lipid panels (n=146)
OHSD victims with values for all 5 MetS criteria (n=141)

Primary Exclusions: Age <18 or >64, non NC residents, unnatural/violent deaths, and non-free living (hostpice, skilled nursing, correctional facilities)
Secondary Exclusions: Review of post-mortem and medical records by adjudication committee to determine sudden and unexpected nature of event
Excluded: Victims with no available healthcare provider based medical record
Excluded: Victims without at least one lipid panel, containing both TG and HDL within 5 years of death.
Excluded: Victims without information on all five criteria for the diagnosis of MetS

Figure 2. Ascertainment process for NHANES participants

NHANES 2009-10 cycle participants (n=10,537)
Primary Exclusions: Age <18 or >64, not listed as Non-Hispanic black or Non-Hispanic White and deceased at 1 year follow-up
Secondary Exclusions: Did not undergo blood testing for lipids available but null value for TG or HDL listed. Did not have a value for all 5 MetS Criteria
Excluded: Victims with no available healthcare provider based medical record

Results

• OHSD cases had a higher overall prevalence of MetS than NHANES participants, elevated TG, low HDL-C, elevated BP, and elevated FG (Table 1).

Table 1: Baseline characteristics and overall prevalence of individual components of MetS in OHSUD victims and NHANES participants

<table>
<thead>
<tr>
<th></th>
<th>OHSUD (n=1,141)</th>
<th>NHANES (n=1,330)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥35 years old (%)</td>
<td>97.2% (137)</td>
<td>65.1% (866)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male (%)</td>
<td>68.5% (97)</td>
<td>47.7% (635)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>White (%)</td>
<td>62.4% (88)</td>
<td>70.2% (933)</td>
<td>0.013</td>
</tr>
<tr>
<td>MetS Criteria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased WC (%)</td>
<td>61.7%</td>
<td>30.8%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Elevated Triglycerides (%)</td>
<td>38.3%</td>
<td>22.6%</td>
<td>0.001</td>
</tr>
<tr>
<td>Low HDL-C (%)</td>
<td>45.4%</td>
<td>31.4%</td>
<td>0.001</td>
</tr>
<tr>
<td>Elevated BP (%)</td>
<td>86.5%</td>
<td>31.4%</td>
<td>0.001</td>
</tr>
<tr>
<td>Glucose lowering treatment (%)</td>
<td>60.3%</td>
<td>42.5%</td>
<td>0.001</td>
</tr>
</tbody>
</table>

• Data on MetS criteria were available an average of 1.2 years prior to OHSD

Secondary Exclusions:

Table 2: Unadjusted and adjusted odds ratio of OHSD

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted OR</th>
<th>p value</th>
<th>Adjusted OR</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic Syndrome</td>
<td>3.13</td>
<td>&lt;0.001</td>
<td>1.94</td>
<td>0.001</td>
</tr>
</tbody>
</table>

• Logistic regression models were used to assess the odds of OHSD associated with MetS, adjusted for age, race and sex (Table 2).
• Chi-square test was used to assess differences in prevalence of MetS and its individual components in OHSUD and NHANES groups.

• Our limitations include requiring OHSD victims to have available values for all 5 MetS criteria to be included in the analysis, and using NHANES participants for comparison as opposed to an appropriately matched control group from the same population.

Conclusions

• Metabolic syndrome prevalence is twice as high among premature out-of-hospital sudden death victims compared to a sample of free living adult US population.
• Targeting metabolic syndrome risk factors have the potential to reduce the overall incidence of premature death.