Healthy Heart, Healthy Brain:
The association between cardiovascular disease and Alzheimer’s disease

Meharvan Singh, Ph.D.
Associate Professor of Pharmacology & Neuroscience
UNT Health Science Center at Fort Worth
A brief introduction about Alzheimer’s disease
The “first” face of Alzheimer’s disease: Auguste D.
Alzheimer’s disease (AD) – a neurodegenerative disease

Taken from: http://hubpages.com/hub/My-Simple-Theory-on-Alzheimers
The AD brain is functionally impaired

NORMAL

Alzheimer’s disease

Source: Alzheimer’s disease Education and Referral Center - NIA
Hallmarks of Alzheimer’s brains?

Taken from the Alzheimer’s Association-www.alz.org)
Hallmarks of AD: Neurofibrillary tangles

Taken from the Alzheimer's Association-www.alz.org
Exploring the link between heart disease and Alzheimer’s disease
The brain is very sensitive to changes in blood/oxygen supply

- The brain receives approximately 15% of cardiac output
  - Implies that compromised cardiovascular function would reduce supply of blood (and thus oxygen) to the brain
- The brain is responsible for 20% of the body’s total oxygen consumption
  - The brain is very sensitive to loss of oxygen
- The brain is responsible for about 25% of total body glucose utilization
Common risk factors for heart disease and Alzheimer’s disease

• Advancing age
• Hypertension
• ApoE4 allele
• Elevated cholesterol (LDL)
• Diabetes
• Elevated homocysteine
Age is the greatest risk factor in Alzheimer’s disease

- About 5 million Americans currently have Alzheimer's disease. The risk of getting Alzheimer's disease goes up with age after 65.

- By 2050, it is estimated that in the US alone 13.5 million people will have Alzheimer’s Disease
The Graying of America
Hypertension and Alzheimer’s disease

- Kaiser Permanente study – those with hypertension at mid-life had a 24% greater risk for Alzheimer’s disease (Whitmer et al., 2005)
- Honolulu-Asia Aging study – those with borderline high blood pressure had more than three-fold increase in risk for Alzheimer’s disease (Launer et al., 2000)
Cholesterol and Alzheimer’s disease

• Higher cholesterol and higher LDL levels are associated with increased risk for cognitive dysfunction (Yaffe et al., 2002)

• The French Three-City Study of 9294 subjects, higher total cholesterol levels was associated with increased risk for dementia (Dufouil, et al., 2005, Whitmer et al., 2005; Kivipelto et al., 2002)
  – Note, however, that not all studies that have examined this relationship show a convincing effect of increased cholesterol and Alzheimer’s disease. May be due to parameter being measured
ApoE4 allele and Alzheimer’s disease

- ApoE4 regulates lipid transport
- Increases the risk for not only cardiovascular disease but also Alzheimer’s disease.
- Subjects with an e4 allele had impaired cognitive function (Kang et al., 2005).
- In a meta-analysis of caucasians, one e4 allele conferred a nearly 3-fold increase risk for Alzheimer’s disease, while having both e4 alleles increased risk by 14.9 fold (Farrer et al., 1997)
Diabetes/obesity and Alzheimer’s disease

• Diabetes/obesity predisposes people to heart disease

• Type 2 diabetes is associated with increased risk of cognitive impairment (Cukierman et al., 2005; Coker and Shumaker, 2003)
Patients who have had a stroke are at increased risk for dementia

- Epidemiological data describing the incidence of dementia following a stroke:
  - Cross sectional analysis:
    - 1 yr: 6.7% demented
    - 3 yrs: 21.3% demented
    - 4 yrs: 21.5 to 23.2% demented
    - 5 yrs: 32% demented
  - Longitudinal studies:
    - Kokmen et al: retrospective review of 971 stroke patients
      - 7, 10, 15, and 23% at 1, 3, 5, and 10 yrs, respectively.
    - Samuelsson et al: 81 lacunar infarction patients
      - 4.9 and 9.9% demented at 1 and 3, respectively.
    - Desmond et al: 334 ischemic stroke and 241 stroke-free control
      - Incidence rate: 8.94 per 100 person-yr for stroke patients
      - 1.37 per 100 person-yr for control
Treatments for heart disease have been proposed/shown to be of potential benefit in the treatment/prevention of Alzheimer’s disease

- **Statins**
  - Lower cholesterol
- **IDE (Insulin degrading enzyme)**
  - Can degrade amyloid-beta
- **Anti-hypertensives**
  - Can reduce the risk for Alzheimer’s disease
Strategies to prevent the occurrence of brain aging and Alzheimer’s disease?

- Choose Good Parents (genetics)
- Physical Exercise
- Mental Exercise
- Cardiovascular fitness
- Dietary lowering of cholesterol
- Protect the brain from injury and inflammation
- Use Antioxidants
The moral of the story……

Keep your heart healthy and you will reduce your risk for Alzheimer’s disease and other dementia
Alzheimer’s disease is 6th leading cause of death in the United States

## Percentage Changes in Selected Causes of Death, 2000 and 2006

<table>
<thead>
<tr>
<th>Cause</th>
<th>2000</th>
<th>2006</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart disease</td>
<td>710,760a</td>
<td>629,191c</td>
<td>-11.5</td>
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<tr>
<td>Breast cancer</td>
<td>41,200b</td>
<td>40,970d</td>
<td>-0.6</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td>31,900b</td>
<td>27,350d</td>
<td>-14.3</td>
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<tr>
<td>Stroke</td>
<td>167,661a</td>
<td>137,265c</td>
<td>-18.1</td>
</tr>
<tr>
<td>Alzheimer’s disease</td>
<td>49,558a</td>
<td>72,914c</td>
<td>+47.1</td>
</tr>
</tbody>
</table>

* b American Cancer Society. *Cancer Facts and Figures 2000.*
* c Heron et al.*
Alzheimer’s disease is multi-faceted

We must understand all the risk factors

We must work together to enable more work to be done and subsequently ensure the dissemination of the resulting information.