Erythrocytic Proteins as Biomarkers for Dementia

Paul Khoo Li Zhi*, Dr. Elizabeta Mukaetova Ladinska (l.z.khoo@newcastle.edu.my)

INTRODUCTION
Currently, diagnosing dementia in the elderly requires both specialist memory consultations, mental state examinations, and various brain imaging investigations. (1) This timely protocol will delay diagnosis and initiation of treatment in early stages when available drugs are most effective.

It is therefore essential to establish a swift blood test that can be incorporated in routine medical examination for the screening and rapid diagnosis of various dementia.

AIMS
- Identify biomarkers for dementia based on previous proteomic studies in erythrocyte (ERC)
- Detect any differences in these biomarkers between various dementia and healthy control subjects.

METHOD
- We used Scopus to identify potential dementia biomarkers from erythrocytic proteins:
  - Ubiquitin (Ubi)
  - IgG
  - Ferritin
- We prepared 69 ERC at pH5.7, 29 control, 20 vascular dementia (VaD), 13 Alzheimer’s disease (AD) and 7 dementia with Lewy bodies (DLB)
- We used ELISA to detect levels of Ubi, IgG, and Ferritin in the bloods above

RESULT AND DISCUSSION

1) Ubiquitin

<table>
<thead>
<tr>
<th></th>
<th>AD</th>
<th>VaD</th>
<th>DLB</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.1</td>
<td>4.9</td>
<td>4.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Std Err</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Based on Figure 1, high levels of Ubi were found in AD, while lower levels were seen in VaD and DLB, as compared to the control.

- Statistical analysis of T-test (p<0.05) shows significant difference between: AD and control, DLB and control, VaD and control.
- It was suggested that Tau/Amyloid aggregates in an AD brain is due to an overload of cerebral Ubi (2). This excessive cerebral ubiquitin might be derived from AD ERC which contains high levels of Ubi.
- The primary pathology of DLB is the accumulation of Ubi (Lewy bodies) in the brain (3). This excessive U utilization might lead to a drop in its systemic levels, i.e. the levels in ERC.
- Following cerebral hypoxia (VaD), large amount of Ubi could be utilized to remove products of cell injury, leading to a decline in its ERC level.

2) IgG

<table>
<thead>
<tr>
<th></th>
<th>AD</th>
<th>VaD</th>
<th>DLB</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.1</td>
<td>4.9</td>
<td>4.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Std Err</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Based on Figure 2, high levels of IgG were found in VaD as compared to the control.

- Statistical analysis of T-test (p<0.05) shows significant difference between: DLB and control but no significant difference between: AD and control, VaD and control.

3) Ferritin

<table>
<thead>
<tr>
<th></th>
<th>AD</th>
<th>VaD</th>
<th>DLB</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.1</td>
<td>4.9</td>
<td>4.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Std Err</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Based on Figure 3, high level of Ferritin was found in VaD and AD, as compared to the control.

- Statistical analysis of T-test (p<0.05) shows no significant difference between: AD and control, DLB and control, VaD and control.

CONCLUSION
- The data suggest the potential use of Ubiquitin, IgG, Ferritin as erythrocytic biomarkers in screening and diagnosing dementia.
- Further work should be carried out to integrate the mental state examinations and brain imaging with these novel biomarkers in refining the detection of dementia.

ACKNOWLEDGEMENT
I would like to thank Dr. Elizabeta Mukaetova Ladinska (supervisor), Dianne Marquez Lopez and Charlotte Graham for their supervision, guidance, and support throughout this research.

Reference: