A Pilot Study to Investigate the Hearing Profile of Stroke Patients

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26.5% have at least a mild hearing loss in one ear!

11.9% suffered from strokes in 2012

Why hearing and strokes?

(Division of Epidemiology & Disease control, 2010)

(C. S. Tan et al., 2015)
### Singapore Burden of Disease Study 2010

#### Table 2.1: Twenty leading specific causes of DALYs by sex, Singapore 2010

<table>
<thead>
<tr>
<th>Rank</th>
<th>Overall (DALYs = 399,675)</th>
<th>% of Total</th>
<th>Males (DALYs = 210,267)</th>
<th>% of Total</th>
<th>Females (DALYs = 189,408)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ischaemic heart disease</td>
<td>10.4</td>
<td>Ischaemic heart disease</td>
<td>12.6</td>
<td>Diabetes mellitus</td>
<td>10.6</td>
</tr>
<tr>
<td>2</td>
<td>Diabetes mellitus</td>
<td>10.4</td>
<td>Diabetes mellitus</td>
<td>10.1</td>
<td>Ischaemic heart disease</td>
<td>8.0</td>
</tr>
<tr>
<td>3</td>
<td>Stroke</td>
<td>6.8</td>
<td>Stroke</td>
<td>7.4</td>
<td>Stroke</td>
<td>6.2</td>
</tr>
<tr>
<td>4</td>
<td>Vision disorders</td>
<td>4.4</td>
<td>Lung cancer</td>
<td>4.4</td>
<td>Breast cancer</td>
<td>5.8</td>
</tr>
<tr>
<td>5</td>
<td>Alzheimer’s &amp; other dementias</td>
<td>3.9</td>
<td>Vision disorders</td>
<td>4.0</td>
<td>Vision disorders</td>
<td>4.9</td>
</tr>
<tr>
<td>6</td>
<td>Lung cancer</td>
<td>3.4</td>
<td>Chronic obstructive pulmonary disease</td>
<td>3.2</td>
<td>Alzheimer’s &amp; other dementias</td>
<td>4.9</td>
</tr>
<tr>
<td>7</td>
<td>Adult-onset hearing loss</td>
<td>3.0</td>
<td>Adult-onset hearing loss</td>
<td>2.9</td>
<td>Rheumatoid arthritis</td>
<td>3.3</td>
</tr>
<tr>
<td>8</td>
<td>Lower respiratory tract infection</td>
<td>2.8</td>
<td>Colon &amp; rectum cancer</td>
<td>2.8</td>
<td>Adult-onset hearing loss</td>
<td>3.2</td>
</tr>
<tr>
<td>9</td>
<td>Breast cancer</td>
<td>2.7</td>
<td>Adult-onset hearing loss</td>
<td>2.7</td>
<td>Lower respiratory tract infection</td>
<td>3.0</td>
</tr>
<tr>
<td>10</td>
<td>Schizophrenia</td>
<td>2.7</td>
<td>Schizophrenia</td>
<td>2.7</td>
<td>Schizophrenia</td>
<td>2.9</td>
</tr>
</tbody>
</table>
Higher prevalence of hearing loss among stroke patients
(Formby et al., 1987)

Stroke patients with hearing impairment are 1.83 times as likely to suffer from functional decline compared to controls
(Landi et al., 2006)
Yet, in Singapore…

Lack of locally relevant data on hearing and strokes

Evidence to implement hearing screening procedures for stroke patients

Identify and intervene for hearing impairment among stroke patients
Hypotheses and Aims

Primary
High prevalence of hearing loss among stroke patients

Secondary
Auditory processing ability of stroke patients with normal hearing is affected

To determine the peripheral hearing levels of stroke patients
To determine the Auditory Processing ability of stroke patients with normal hearing
Methodology

137 stroke patients (NUH Ward 57) referred

Screening (Otoscopy, tympanometry & MMSE) n=51

n=2 tested unilaterally (PTA)
n=49 tested bilaterally (PTA)

3 patients tested with RGDT

1 underwent further APD tests

Total=100 ears 50 Right ears, 50 Left ears

ENT Follow-up option for any participant with hearing loss
Participants

- Age range = 33 to 86 years old
- Mean age (SD) = 63.6 (12.0)
- 38 Males (74.5%)
  13 Females (25.5%)
Results (1)-PTA

- Severe or more hearing loss, >70 dB HL: 2.0% (1)

* Classification of hearing loss: Pure tone audiogram average of 0.5, 1, 2, and 4 kHz in better ear

- 70.6% (36) of participants with at least a mild hearing loss
- 25.5% (13) of participants with disabling hearing loss
- 2 wearing hearing aids

Figure 1. Peripheral hearing levels of stroke patients.
Comparison with general Singaporean and Elderly groups

- ANY HEARING LOSS
  - Stroke patients: 70.6%
  - General Singaporean population: 25.5%
  - Elderly population (60–69 years old): 32.9%

- DISABLING HEARING LOSS
  - Stroke patients: 25.5%
  - General Singaporean population: 2.9%
  - Elderly population (60–69 years old): 9.6%

(Epidemiology & Disease Control Division, Ministry of Health, 2010)
• RGDT: Results within normal limits for 3 patients
• 1 went for further APD tests
  • Deficits in binaural integration and separation (Right ear)

Table 1. APD test results for participant 016

<table>
<thead>
<tr>
<th>Test</th>
<th>Skill assessed</th>
<th>Results (% correct)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Dichotic Digits</td>
<td>Binaural integration</td>
<td>57.5</td>
<td>92.5</td>
</tr>
<tr>
<td>Competing Sentences</td>
<td>Binaural separation</td>
<td>20</td>
<td>97.5</td>
</tr>
<tr>
<td>Frequency patterns</td>
<td>Temporal patterning</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
• Patient complained of unclear speech on the right ear

• Dichotic speech test results suggest damage to the left auditory area
  (Niccum & Rubens, 1983; Tervaniemi & Hugdahl, 2003)

• Left Middle Cerebral Artery (MCA) stroke

• BUT, normal results bilaterally on frequency pattern test and random gap detection test:
  • Suggest that both brain hemispheres are unaffected by stroke

• Postulated that higher order auditory attention affected by stroke resulting in right spatial neglect
  (Blini et al., 2016)
Results (3) - ENT follow-up

- 23 out of 46 participants identified with any hearing loss declined ENT follow-up

- Main reason:

  “I do not find hearing loss an issue.”
Other reasons given:
- ‘Mild hearing loss.’
- ‘Would like to focus on other health problems’

Possibly due to poor awareness of hearing loss among patients and attending doctors

(Milstein and Weinstein, 2002; Chou, Dana, Bougatsos, Fleming, & Beil, 2011; Matthews, 2014)
Limitations & Future work

- Small sample size especially for APD testing
  - Cautious interpretation of results
  - **Future work**: Focus on AP in stroke patients

- Only acute stroke patients included
  - Cannot generalize results to chronic stroke patients
  - **Future work**: Study recruiting chronic stroke patients
Please remember…

Stroke patients can have hearing loss and many of them do.

Even with normal hearing, auditory processing ability may be affected.
Recommendations

- Healthcare providers need to be mindful of hearing impairment as an issue in patients
  - Can use personal sound amplifiers to ensure better communication

- Need to increase awareness of hearing impairment among patients and doctors
  - Public outreach events
  - Workshops for doctors
Acknowledgements

Supervisor: Dr Jenny Loo Hooi Yin
Collaborator: Dr Raymond Seet
Faculty members: Edmund Choo, Sebastian Ser
All my classmates 😊
The End 😊
Thank you!


Table 2. Reasons given for declining ENT referral (n=14)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not find hearing loss an issue</td>
<td>7</td>
</tr>
<tr>
<td>Mild hearing loss</td>
<td>4</td>
</tr>
<tr>
<td>Would like to focus on other medical conditions E.g. stroke rehabilitation</td>
<td>3</td>
</tr>
<tr>
<td>Already on ENT (hospital/private) follow–up for other issues</td>
<td>3</td>
</tr>
<tr>
<td>Already seen ENT previously</td>
<td>2</td>
</tr>
<tr>
<td>Inconvenient to go for ENT follow–up</td>
<td>1</td>
</tr>
<tr>
<td>No reason given</td>
<td>3</td>
</tr>
</tbody>
</table>
Figure 2. Average hearing thresholds in dB HL at each frequency for each ear.

- Downward sloping hearing configuration