Clinical Effectiveness of Physiotherapy-led Vestibular Service in tertiary hospital

Vicky Stewart (nee Woodhead), BPhty
Senior Physiotherapist, TPCH; PhD student, ACU

Vicky_stewart@hotmail.com.au

PhD Supervisors: Prof. Nancy Low Choy & Dr. Dilani Mendis
Why look at clinical effectiveness?

- Dizziness/ Vertigo are common reasons for ED presentations \((\text{Kroenke & Hoffman, 2000})\)

- Vestibular Disorders in Emergency Department (ED): not optimally managed \((\text{Newman-Toker, 2009})\)

- Referral to Physiotherapy Vestibular Rehab from ED: not routine practice (to assess and manage vestibular disorders) \((\text{Polsenek, 2008})\)

- Vestibular disorders not managed optimally may cause:
  - Ongoing symptoms of dizziness/ vertigo \((\text{Herdman, 2000})\)
  - Medical consultations/ referrals, re-presentation to hospital
  - Medication use \((\text{Buchman, 2010})\)
  - Interference with daily activities \((\text{Whitney, 2000})\)
  - Loss of balance, falls and fall related injuries \((\text{Hall, 2004})\)
  - Increased healthcare costs \((\text{Lo & Harada, 2013})\)
Current Vestibular Service

1 FTE Vestibular Physiotherapist
- 0.4 FTE permanent since Jan 2014
- 0.6 temporary since Jan 2015 (Awaiting business case)

Receive referrals from MOs in ED / wards (630 bed hospital)
- Assess patients whilst in ED/ wards
- Run daily out-patient Vestibular Rehab Physiotherapy Clinics
Vestibular Rehabilitation (VR)

VR incorporates:

- Physical manoeuvres to remove particles from the canals (BPPV) *(Bhattachayya, 2008)*
- Education of the patient *(Herdman, 2000)*
- Exercise regimes that aim to maximise vestibular adaptation, thus reducing vertigo, dizziness and nausea *(McDonnell, 2015)*
- Habituate patients to motion sensitivity *(Clendaniel, 2010)*
- Improve balance and gait *(Hillier & McDonnell, 2011)*
- Introduce substitution strategies as required *(Herdman, 2000)*
Aims of the Study

• To investigate clinical effectiveness of a physiotherapy-led, hospital-based vestibular service by:

  1. Determining initial and longer-term outcomes

Methods of study

Design:
Prospective, observational study, reporting baseline, discharge and follow-up outcomes

Settings:
Emergency/ acute hospital setting/ hospital-based vestibular clinic

Participants:
Adults presenting to hospital with non-emergent dizziness

Exclusion criteria:
- Known cardiac/ stroke diagnosed;
- Unable to provide informed consent (intoxication, mental disability, language barrier);
- Fracture/ injury limiting assessment
Patients presenting to hospital with non-emergent dizziness, screened (VST) & referred to Physio Vestibular Service

Physiotherapy Assessment & VR Treatment

Discharge Assessment completed – Short term effectiveness?

3/12 Follow-up Assessment completed – Longer term effectiveness?

Aim 1: Determine clinical effectiveness of Physio-led, hospital based vestibular service
Patient presenting to hospital with non-emergent dizziness, screened (VST) & referred to Physio Vestibular Service

**Immediate Intervention pathway**
- Treatment commenced whilst in hospital / immediate post-discharge period (48 hours)

**Delayed Intervention Pathway**
- Discharged home from hospital
- Placed on wait-list for vestibular assessment & management

Follow-up Physiotherapy Treatment

Discharged: assessment completed

3/12 Follow-up assessment completed

Determined by availability and timing of the referral

Aim 2: Determine clinical outcomes for immediate & delayed referral pathways
Clinical diagnostic tests on Initial Assessment

Video Frenzel and Video HIT utilized for assessment
- Comprehensive subjective examination
- Nystagmus: Spontaneous, Gaze-evoked
- Smooth Pursuit and Saccadic Eye Movement
- Test of Skew Deviation
- VOR Cancellation Test
- Head Impulse Test (HIT)
- Head-Shaking Nystagmus (HSN)
- Positional Tests including Hallpike-Dix and Head Roll Test
- Pressure/ Fistula testing when indicated
- DVA static vs. dynamic

Vestibular diagnostic clinical tests used to categorise patients:
- Vestibular impairment
- Non-vestibular impairment
## Vestibular Disorder Diagnosis

<table>
<thead>
<tr>
<th>Test</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Hallpike Dix, Head Roll Test <em>(Bhattachayya, 2008)</em></td>
<td>BPPV</td>
</tr>
<tr>
<td>Positive head impulse test / video head impulse test + Acute vestibular crisis history (nil central features) <em>(Luxon, 2007)</em></td>
<td>Acute vestibular neuritis, unilateral/ bilateral vestibular hypofunction</td>
</tr>
<tr>
<td>Episodic symptoms of fluctuant hearing loss, vertigo, tinnitus or ear blockage confirmed by a specialist <em>(Luxon, 2007)</em></td>
<td>Meniere’s Disease</td>
</tr>
<tr>
<td>Migraine headaches as per international headache criteria and vestibular symptoms of imbalance, vertigo/dizziness/unsteadiness <em>(Lempert, 2013)</em></td>
<td>Migraine Vertigo</td>
</tr>
<tr>
<td>Direction-changing gaze-evoked nystagmus or pure down-beating/up-beating/torsional nystagmus <em>(Herdman, 2000)</em></td>
<td>Indicative of central pathology</td>
</tr>
</tbody>
</table>

If unclear and symptoms of vestibular dysfunction presented, the patient was categorised as ‘other vestibular’ and referred for further specialist assessment.
Outcome Measures

Initial/ Discharge/ Follow-up assessment

• **Subjective improvement in dizziness** (McDonnell, 2015)
  - Patient report improved/ same/ worse

• **Vestibular Screening Tool (VST)** (Stewart, 2015)
  – Scores of ≥4/8 indicate vestibular disorder
  – Demonstrates concurrent validity with DHI
  – 2 point change demonstrates clinically meaningful change

• **Dizziness Handicap Inventory (DHI)** (Jacobson, 1990)
  – Scores >60 = severe vestibular dysfunction, greater functional impairment (Whitney, 2004)

• **Functional Gait Assessment (FGA)** (Wrisley, 2004; Wrisley, 2010)
  – ≤22/30 predict prospective older fallers

• **Activities Balance Confidence Scale – Short form** (Schepens, 2010)
  - Balance confidence measure 0-100%.
## Results - Demographics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total Group (n=193)</th>
<th>Immediate Intervention (n=112)</th>
<th>Delayed Intervention (n=81)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age ± SD (y)</td>
<td>64 ± 15 (19–94)</td>
<td>63 ± 16 (30–94)</td>
<td>65 ± 14 (19–91)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>115 (59.6)</td>
<td>63 (56.3)</td>
<td>52 (64.2)</td>
</tr>
<tr>
<td>Falls past 12-months, n (%)</td>
<td>57 (29.5)</td>
<td>28 (25.5)</td>
<td>29 (36.7)</td>
</tr>
<tr>
<td>Independent Gait, n (%)</td>
<td>152 (78.8)</td>
<td>77 (77.8)</td>
<td>75 (93.8)</td>
</tr>
<tr>
<td>Non-vestibular, n (%)</td>
<td>37 (19.2)</td>
<td>22 (19.6)</td>
<td>15 (18.5)</td>
</tr>
<tr>
<td>Vestibular, n (%)</td>
<td>156 (80.8)</td>
<td>90 (80.4)</td>
<td>66 (81.5)</td>
</tr>
</tbody>
</table>
Clinical Vestibular Diagnosis

- BPPV (42.5%)
- Vestibular neuritis (14.5%)
- Unilateral hypofunction (6.7%)
- Unspecified vestibular (6.7%)
- Migraine vertigo (3.6%)
- Central (2.1%)
- Bilateral hypofunction (1.6%)
- Meniere’s Disease (1.6%)
- Motion sensitivity (1.6%)
Intervention Groups
Clinical Vestibular Diagnosis

- Motion sensitivity
- Meniere’s Disease
- Bilateral hypofunction
- Central
- Migraine vertigo
- Unspecified vestibular
- Unilateral hypofunction
- Vestibular neuritis
- BPPV

Number

Delayed Intervention
Immediate Intervention
## Results

<table>
<thead>
<tr>
<th></th>
<th>Total Group (n=193)</th>
<th>Immediate (n=112)</th>
<th>Delayed (n=81)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosed as vestibular</td>
<td>156 (80.8%)</td>
<td>90 (80.3%)</td>
<td>66 (81.5%)</td>
</tr>
<tr>
<td>Completed discharge Ax</td>
<td>105 (67.3%)</td>
<td>67 (74.4%)</td>
<td>38 (57.6%)</td>
</tr>
<tr>
<td>Completed Follow-up Ax</td>
<td>73 (69.5%)</td>
<td>44 (65.7%)</td>
<td>29 (76.3%)</td>
</tr>
</tbody>
</table>

- Immediate and delayed groups completed similar No. of Physiotherapy sessions: 3.24 – 3.28
- Immediate group assessed within 48hrs of presenting to hospital
- Delayed group waited an average 22 days (3-77 days) for initial Ax
Subjective Improvement

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
<th>Immediate group</th>
<th>Delayed group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discharge</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved since Initial</td>
<td>97.8</td>
<td>97.1</td>
<td></td>
</tr>
<tr>
<td>No change/ Worse since initial</td>
<td>2.2</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td><strong>3/12 Follow-up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved/ same since discharge</td>
<td>91.4</td>
<td>83.6</td>
<td></td>
</tr>
<tr>
<td>Worse since discharge</td>
<td>8.6</td>
<td>16.4</td>
<td></td>
</tr>
</tbody>
</table>

No significant difference in subjective rating scale between immediate and delayed groups (p>.05)
Vestibular Screening Tool (VST)

- Significant difference between immediate and delayed group on initial Ax

### VST Score

<table>
<thead>
<tr>
<th></th>
<th>Immediate Group</th>
<th>Delayed Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Vestibular Screening Tool (VST)

- Significant difference between immediate and delayed group on initial Ax

- Both groups’ scores were abnormal (ie. ≥4/8) on initial Ax
Vestibular Screening Tool (VST)

- Significant difference between immediate and delayed group on initial Ax
- Both groups’ scores were abnormal (ie. ≥4/8) on initial Ax
- Significant improvements between initial–discharge, initial–follow-up, for both groups
• Mild significant difference between immediate and delayed groups on initial assessment
Dizziness Handicap Inventory (DHI)

- Mild significant difference between immediate and delayed groups on initial assessment
- Immediate and Delayed groups were approaching the ‘severe’ DHI level
Dizziness Handicap Inventory (DHI)

- No significant difference between immediate and delayed groups on initial assessment
- Immediate and Delayed groups were approaching the ‘severe’ DHI level
- Significant improvements between initial and discharge, initial and follow-up, for both groups
Functional Gait Assessment (FGA)

- Significant difference between immediate and delayed groups on initial assessment
Functional Gait Assessment (FGA)

- Significant difference between immediate and delayed groups on initial assessment
- Both groups scored below 22/30 on initial Ax = predictive of falls
Functional Gait Assessment (FGA)

- Significant difference between immediate and delayed groups on initial assessment
- Both groups scored below 22/30 on initial Ax = predictive of falls
- Significant improvements between initial and discharge, initial and follow-up, for both groups
Activities Balance Confidence: Short Form 6

- Significant difference between groups at initial assessment
- Both groups scored below 60/100 on initial – low balance confidence
- Significant improvements by discharge and follow-up assessment
Summary

• People who present to hospital with a vestibular dysfunction have:
  • Moderate - severe dizziness impairment
  • Significant functional limitations
  • Increased risk of falling
  • Poor community ambulation
  • Low balance confidence

• Resultant symptoms and functional impact of a vestibular disorder do not always spontaneously resolve, even 3 weeks after hospital.

• Physio VR intervention produced significant improvements in:
  • Dizziness impairment
  • Balance confidence
  • Functional gait

• Results were maintained 3 months post discharge
Summary

- Delayed group had persistent symptoms until management commenced (> 3 weeks after ED presentation) ie did not spontaneously improve
- Both immediate and delayed physiotherapy intervention groups responded to VR & achieved similar results by D/C
- Significant improvements maintained three-months after discharge
- A physiotherapy-led vestibular service demonstrated clinical effectiveness in Mx of dizzy patients presenting to hospital
- Patients presenting to hospital with a suspected vestibular disorder should be considered for referral to a physiotherapy-led vestibular service in the hospital setting.
Limitations/ further Research

Limitations:
• Differences in patient profile in the immediate & delayed groups whilst in ED is unknown
• Costs to patients & healthcare service for delayed group not calculated

Further Research:
• Psycho-social impact on patients during wait-list period requires FU
• Rate of falls, representations/ re-admissions to hospital requires FU
• Proportion referred to Audiology/ Neurology/ ENT/ Psychology for FU
• Longer-term (>3/12) follow-up required
• Burden of Care to be established
References


References


Acknowledgements & Funding

• Acknowledgements: Sue Lewandowski (Physiotherapist)
  Dr Jeff Rowland (Specialist)

• Funding: HP Research Grant ($20,000.00)
  QRPN Research Grant ($2,000.00)
Questions?

Thank-you

vicky_stewart@hotmail.com.au
<table>
<thead>
<tr>
<th>Clinical Diagnosis</th>
<th>Total (n = 193)</th>
<th>Immediate (n = 112)</th>
<th>Delayed (n = 81)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Non-vestibular, n (%)</td>
<td>37 (19.2)</td>
<td>22 (19.6)</td>
<td>15 (18.5)</td>
</tr>
<tr>
<td>- Vestibular: n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPPV</td>
<td>82 (42.5)</td>
<td>46 (41.1)</td>
<td>36 (44.4)</td>
</tr>
<tr>
<td>Vestibular neuritis</td>
<td>28 (14.5)</td>
<td>20 (17.9)</td>
<td>8 (9.9)</td>
</tr>
<tr>
<td>Unilateral hypofunction</td>
<td>13 (6.7)</td>
<td>7 (6.3)</td>
<td>6 (7.4)</td>
</tr>
<tr>
<td>Bilateral hypofunction</td>
<td>3 (1.6)</td>
<td>3 (2.7)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Migraine vertigo</td>
<td>7 (3.6)</td>
<td>3 (2.7)</td>
<td>4 (4.9)</td>
</tr>
<tr>
<td>Meniere’s Disease</td>
<td>3 (1.6)</td>
<td>2 (1.8)</td>
<td>1 (1.2)</td>
</tr>
<tr>
<td>Central</td>
<td>4 (2.1)</td>
<td>4 (3.6)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Motion sensitivity</td>
<td>3 (1.6)</td>
<td>1 (0.9)</td>
<td>2 (2.5)</td>
</tr>
<tr>
<td>Unspecified vestibular</td>
<td>13 (6.7)</td>
<td>4 (3.6)</td>
<td>9 (11.1)</td>
</tr>
</tbody>
</table>
## Results - Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total group (n = 193)</th>
<th>Immediate Intervention (n = 112)</th>
<th>Delayed Intervention (n = 81)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age ± SD (y)</td>
<td>64 ± 15 (19–94)</td>
<td>63 ± 16 (30–94)</td>
<td>65 ± 14 (19–91)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>115 (59.6)</td>
<td>63 (56.3)</td>
<td>52 (64.2)</td>
</tr>
<tr>
<td>Falls past 12 months, n (%)</td>
<td>57 (29.5)</td>
<td>28 (25.5)</td>
<td>29 (36.7)</td>
</tr>
<tr>
<td>Independent gait, n (%)</td>
<td>152 (78.8)</td>
<td>77 (77.8)</td>
<td>75 (93.8)</td>
</tr>
</tbody>
</table>
**VST: Vestibular Screening Tool** *(Stewart et al, 2015)*


- VST is Valid & Reliable tool for use in hospital setting

- High Sensitivity (83%) & Specificity (84%) for identifying a likely vestibular disorder when patients present to hospital with non-emergent dizziness

- Uni-dimensional internal construct validity

- High inter-rater reliability (0.988 ICC)

- High intra-rater reliability (0.878 ICC)
VST Validation Results Study #1

VST Scores $\geq 4/8$:
- Predict vestibular dysfunction as cause to non-emergent dizziness

VST Scores $\leq 3/8$:
- Non-vestibular cause to dizziness more likely
VST – Vestibular Screening Tool

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>Sometimes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you have a feeling that things are spinning or moving around?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Does bending over and/or looking up at the sky make you feel dizzy?</td>
<td>Yes</td>
<td>= 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>= 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>= 0</td>
<td></td>
</tr>
<tr>
<td>3. Does lying down and/or turning over in bed make you feel dizzy?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Does moving your head quickly from side to side make you feel dizzy?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL / 8**
Statistics

• Means / SD outcome measures determined for initial, discharge & follow-up assessment

• Linear mixed Models
  – Determined significance of the mean difference of measures across continuum of care
  – Compared differences in mean scores between immediate & delayed intervention groups