Syncope and Cardiovascular Causes of Falls in Older People

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Faller 1

- 75 male, smoker, moderate alcohol intake
- Retired driving instructor
- At least 3 falls in 5 months
- One episode of falls with loss of consciousness
- No warning signs
- No palpitations/ chest pain
Faller 1

Investigations

- FBC/ U&ES/ LFTS/blood sugar – normal
- ECG- sinus rhythm, rate = 86/mt, normal
- CXR - no abnormality
- 24-hour tape normal
Faller 1

Tilt test

- Right Carotid sinus massage 5 second pause (symptomatic)
- No orthostatic hypotension
- No delayed vasodepressor effects
Faller 1

**Carotid sinus syndrome – (cardio-inhibitory type)**

Treatment: Dual chamber pacemaker

F/u at one year – no further falls
Mr. N 65 male Asian

- Collapse preceded by dizziness and loss of consciousness
- No chest pain/ palpitations
- Light-headedness and feeling of ‘about to pass out’ during prayer on most occasions
Faller 2

O/E

- Sinus rhythm
- BP 132/74 mm Hg
- No postural hypotension
- No murmurs
- No carotid bruits
- Evidence of peripheral neuropathy
Faller 2

Tilt test response

- CSM >50 mm Hg systolic drop in BP (symptoms)
- Certain neck movements precipitated presyncope
- No orthostatic hypotension
- No delayed vasodepressor response
Faller 2

Carotid sinus syndrome – (Vasodepressor Type)

Management: Life style modifications
Faller 3

- EW 75 yrs. Female
- Falls at least 4 times in 12 months
- Mainly outdoors – twice while shopping in the supermarket
- Dizzy, sweaty, looses consciousness for a few seconds
- Witness account – pale and sweaty
Faller 3

- Haematological & biochemical investigations – normal
- 24 hour Holter monitoring X 2 - NAD
- ECG – Sinus rhythm

What next?
Faller 3

- CSM – no response
- Prolonged head-up tilt
## Results

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Blood Pressure</th>
<th>Heart rate</th>
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</thead>
<tbody>
<tr>
<td>0 (Supine)</td>
<td>151/74</td>
<td>79</td>
</tr>
<tr>
<td>1 (Upright)</td>
<td>138/72</td>
<td>94</td>
</tr>
<tr>
<td>3</td>
<td>150/102</td>
<td>106</td>
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<tr>
<td>5</td>
<td>117/75</td>
<td>82</td>
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<tr>
<td>10</td>
<td>122/79</td>
<td>84</td>
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<tr>
<td>15</td>
<td>114/79</td>
<td>74</td>
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<td>20</td>
<td>112/69</td>
<td>62</td>
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<tr>
<td>25</td>
<td>54/46</td>
<td>48</td>
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<tr>
<td>30</td>
<td>unrecordable</td>
<td>48</td>
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</table>
Neurocardiogenic (vasovagal) syncope

Management

- General advice
- TED Stockings
- Fludrocortisone
- Follow up at 3 & 6 months – no syncope
The overlap between falls, dizziness and syncope
Overlap of Falls and Syncope in Older People

- 30% of cognitively intact older people are unable to recall documented falls 3 months after the event.
- Eye witness accounts of falls are often unavailable.
- Amnesia for a loss of consciousness is present in up to 50% of patients with syncope.
Definition of Syncope

A transient loss of consciousness, due to a temporary impairment of cerebral perfusion, characterised by unresponsiveness and loss of postural tone with spontaneous recovery.
Syncope: Reported Frequency

- Individuals <18 yrs: 15%
- Military Population 17-46 yrs: 20-25%
- Individuals 40-59 yrs*: 16-19%
- Individuals >70 yrs*: 23%

*during a 10-year period
Causes of Syncope (CORN)

- **Cardiac**
  - Arrhythmia (e.g. sinus node disease)
  - Outflow obstruction (e.g. Aortic stenosis, HOCM)
  - Circulatory failure (e.g. pulmonary embolism)

- **Orthostatic Hypotension** (including postprandial)

- **Reflex syncope**
  - Vasovagal (neurocardiogenic, neurally mediated, vasodepressor)
  - Carotid sinus syndrome (cardioinhibitory, vasodepressor, mixed)
  - Glossopharyngeal syncope (associated with glossopharyngeal neuralgia)
  - Post-prandial hypotension

- **Neurological Disease**
  - Vertebrobasilar TIA (other neuro signs/symptoms usually present)
  - Subclavian steal syndrome
  - Basilar migraine (rare)

Conditions Mimicking Syncope

( but no reduction in cerebral perfusion)

- **Epilepsy**

- **Metabolic disorders** (e.g. hypoglycaemia)

- **Psychiatric** (less common in elderly than younger syncope patients)
The Commoner Cardiovascular Causes of Falls in the elderly

(same causes for Syncope)

- Orthostatic Hypotension (OH)
- Arrhythmias (eg AV block, sick sinus)
- Structural Heart Disease (eg aortic stenosis)
- Carotid Sinus Syndrome
- Neurocardiogenic Syncope
- Postprandial Hypotension
Orthostatic Hypotension

- Defined as >20 mmHg fall in systolic blood pressure and/or a >10 mmHg fall in diastolic blood pressure within 3 minutes of standing WITH symptoms
Orthostatic Hypotension - Symptoms

- Dizziness
- Syncope/pre-syncope
- Circadian pattern
- Occipital or ‘Coat Hanger’ Headache
Orthostatic Hypotension - Prevalence

Varies on the population studied

- Community dwelling
- Institutionalised
- Acute in-patients
- Hypertension trials
<table>
<thead>
<tr>
<th>Investigator</th>
<th>Number</th>
<th>Type of patients</th>
<th>Prevalence</th>
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<tbody>
<tr>
<td>Rodstein et Zeman</td>
<td>250</td>
<td>Nursing Home</td>
<td>8%</td>
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<tr>
<td>(1957)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Johnson et al (1965)</td>
<td>100</td>
<td>In patients</td>
<td>17%</td>
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<tr>
<td>Lennox et Williams</td>
<td>272</td>
<td>In patients</td>
<td>10%</td>
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<tr>
<td>(1980)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robinson et al (1994)</td>
<td>106</td>
<td>Clinic</td>
<td>27.4%</td>
</tr>
<tr>
<td>Alli et al (1992)</td>
<td>858</td>
<td>G.P.clinic</td>
<td>13.8%</td>
</tr>
<tr>
<td>Mader et al (1987)</td>
<td>300</td>
<td>Health screening</td>
<td>13.7%</td>
</tr>
<tr>
<td>Caird et al (1973)</td>
<td>294</td>
<td>Community dwelling</td>
<td>24%</td>
</tr>
<tr>
<td>Rutan et al (1992)</td>
<td>5,201</td>
<td>Community dwelling</td>
<td>16.2%</td>
</tr>
</tbody>
</table>
Orthostatic Hypotension - Aetiology

- Circulatory Volume loss /Dehydration
- Medication
- Autonomic Failure (e.g. Diabetes)
- Parkinson’s Disease / MSA (Shy-Drager)
- Hypertension
Orthostatic Hypotension - Diagnosis

- Fulfil diagnostic criteria
- Monitor BP changes at different times of the day
- Consider Ambulatory BP Monitoring
Orthostatic Hypotension - Treatment

- Treat any acute conditions
- Review medication
- Postural training
- Head of bed raised
- Compression hosiery  (careful of PVD)
- Fludrocortisone  (can worsen heart failure)
- Midodrine  - alpha 1 receptor agonist (careful of IHD)  
  - causes peripheral vasoconstriction  
  - can cause supine hypertension & piloerection
Carotid Sinus Syndrome (CSS)

• A cause of falls, dizziness and syncope in the elderly
• Not uncommon but rarely diagnosed
• Exaggerated baroreflex activity → episodic bradycardia ± hypotension
• Disorder of the elderly (virtually unknown < 50yrs)
• Males > Females
• Associated with IHD and hypertension
• Associated with neurocardiogenic syncope and orthostatic hypotension
• Appreciable morbidity (injuries 50%). Low mortality
Carotid Sinus Syndrome (CSS)

- occurs in 0.5%-9.9% of patients with recurrent syncope
- in up to 14% of older people in nursing homes
- in up to 30% of older people with unexplained syncope and “drop attacks”
- associated with digoxin, b blockers, methyldopa
- association described with Alzheimers, Parkinsonism, Lewy Body disease
Carotid Sinus Syndrome (CSS)

Precipitants:
- Head turning (tight neckwear)
- Looking up
- Vagal manoeuvres
- Micturition
- Defecation
- Coughing
- Swallowing
- Prolonged standing
- Exertion
- Meals
How to perform Carotid Sinus Massage

- Exclude carotid bruits
- Longitudinal massage repeated both sides: 5-10 s
- Supine and at 70° head-upright tilt
- Resuscitation equipment
- C/I if CVA, TIA, MI within 3 months
- Relative C/I s- h/o VT, VF, carotid bruit (consider US)

Positive response:
- \( \geq 3 \) s asystole (cardioinhibitory CSS)
- \( \geq 50\)mmHg systolic drop (vasodepressor CSS)
- Mixed response
Carotid Sinus Syndrome (CSS)

Management

• Treat only if symptomatic (2 syncopal episodes)
• General advice (avoid tight collars, sudden neck turning)

Cardioinhibitory type
• Dual chamber pacing
• Anticholinergics

Vasodepressor type
• Increase salt & fluids
• Fludrocortisone
• Midodrine
The Carotid Sinus

- Dilated portion of ICA
- Thin tunica media
- Abundant elastic tissue
- Rich sensory supply
- Nerve of Herring
- Glossopharyngeal Nerve
Carotid Sinus Syndrome (CSS)

Proposed mechanism

Central processing
Alpha 2, 5HT receptors

Aortic arch & Heart
Baroreceptors

Afferent Pathways

Sympathetic Outflow + Vagus

Efferent Pathways

IX → nucleus tractus solitarius
X → Paramedian nucleus

Brainstem - medulla + pons

Heart rate
Contractility
Arteriolar tone
Neurocardiogenic syncope (NCS)
(Vasovagal, delayed vasopressor, neurally mediated)

**Features**
- Upright posture
- Prodrome, LOC
- Post-syncopal nausea, headache, malaise
  (often no warning in the elderly + amnesia)

**Witness**
- pallor, ashen colour, cold and clammy
- dilated pupils
- convulsive syncope
- rapid recovery in mental state
Neurocardiogenic syncope (NCS)

**Triggers**

- Prolonged standing
- Emotional stress, anxiety
- Pain, pain anticipation, venepuncture
- Accident, sight of blood
- Situational e.g. - defecation, micturition, cough
- Food, alcohol (esp. in the elderly)
Neurocardiogenic syncope (NCS)-one proposed mechanism

- Upright posture
  - Downward displacement of blood
    - Increased venous pooling
      - Decreased ventricular filling
        - Mechanoreceptor stimulation
          - Increased afferent flow to brain stem
            - Overstimulation of hypersensitive baroreceptors in LV wall

- Hypotension
- Vasodilatation
- Bradycardia

SYNCOPE
Neurocardiogenic syncope (NCS)

**Diagnosis**

- History
- Prolonged head-upright tilt with symptom reproduction
- Provocative tests:  
  - GTN (s/l or i/v)
  - Isoprenaline
  - Venous cannulation
How to perform Head-up Tilt test

- Tilt table 70° head up for 40 mins
- After 20 mins give GTN spray 400mcg
- Continuous BP and ECG monitoring

Diagnoses
- Neurocardiogenic (vasovagal) syndrome
- Orthostatic hypotension
- Hyperventilation
- Central dizziness (symptoms only)
Cardiovascular Causes of Falls
Neurocardiogenic syncope (NCS)

Management: (difficult)

- General advice (avoid prolonged standing, heat, dehydration, large meals, alcohol; increase water intake)
- Compression Stockings
- Fludrocortisone
- Midodrine (pre-synaptic alpha 1 agonist [sympathomimetic])
- SSRIs
- (β Blockers)
- (Disopyramide)
- (Dual chamber pacing – consider only if prolonged asystole - controversial especially in the young)
Post Prandial Hypotension
Postprandial Hypotension

- Definition:
- A fall of $> 20$ mmHg in Systolic blood pressure after the ingestion of a meal
- Can have effect for up to 90 minutes
Postprandial Hypotension

• Symptoms

• Similar to those of orthostatic hypotension though related temporally to meal times
Postprandial Hypotension

- Increased incidence of postprandial hypotension in patients with falls and syncope
- Worse after breakfast
- Associated with diabetes and number of prescribed drugs
Postprandial Hypotension

- Advise to eat smaller meals more frequently
- Rest after meals
- Water drinking
- Avoid alcohol
Overlap of Vasodepressor syndromes

- Orthostatic Hypotension
- Postprandial Hypotension
- Neurocardiogenic Syndrome
- Carotid Sinus Syndrome
Cardiovascular Causes and Falls

Basic medical assessment of falls

1. Careful history
2. Thorough examination (inc. postural BP)
3. FBC, U&Es, LFTs, TFTs, glucose
4. Urinalysis
5. Specific tests as directed by 1 & 2
6. ECG
7. CXR
Further investigations to consider if appropriate:

- Holter monitoring (24 hour- 7day tapes)
- Echocardiography
- Carotid Sinus Massage
- Head-up Tilt Testing
- Ambulatory BP monitoring
- Implantable loop recorder
- Electrophysiological studies
- CT, EEG, Carotid Ultrasound
Suggested Protocol for the investigation of Syncope

History
Examination (including Lying/Standing Blood Pressure and 12 lead ECG)

Orthostatic Hypotension
Normal ECG

Review medication
Consider 24 hour ABPM
TED stockings/lifestyle advice

If symptoms persist
consider referral

No Orthostatic Hypotension
Normal ECG

Referral for Tilt Table Testing
with carotid sinus massage

No Orthostatic Hypotension
Abnormal ECG

24 hour monitor/Echocardiogram

If normal

Referral for Tilt Table Testing
with carotid sinus massage
Testing
(combines Carotid Sinus Massage and Prolonged Head Up Tilt Test)

Carotid sinus massage R/L
Supine and Tilted

Supine Rest for 10 mins

Head-Up tilt to 70 degrees for 20-30 mins
Terminate if symptomatic or systolic blood pressure < 80 mmHg

GTN Provocation
Terminate if symptomatic or systolic blood pressure < 80 mmHg

Supine rest for 10-15 mins
Important Messages

- Always consider a cardiovascular aetiology if the cause of recurrent falls remains unexplained.

- Carotid sinus syndrome and neurocardiogenic causes of unexplained syncope and unexplained falls are not uncommon.

- Tilt Testing (including carotid sinus massage) can be a useful diagnostic aid in these patients.
Tilt Tests: Diagnoses Made in 95 Patients (32 male 63 Female)

- CSS: Male 15, Female 10
- VD CSS: Male 11, Female 9
- CI CSS: Male 6, Female 3
- NCS: Male 2, Female 1
- OH: Male 6, Female 6
- Dizzy: Male 6, Female 1
- Any: Male 42, Female 18
Fitting syncope investigations into a Falls Service

- Uncertainty over who to target
- High risk patients (such as those who have presented to A&E with an injury after falling)
- Patients with a clear syncope history
- History of “drop attacks”
- Recurrent or unexplained fallers
Who not to investigate for underlying syncope

- Dementia (Folstein MMSE<20)
- One off fallers
- Patients with obvious mechanical source for falls, e.g. impaired vision, aortic stenosis