Update on Falls Prevention Research

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NSW Falls Prevention Network Rural Forum
8
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Acknowledgments: Prof Stephen Lord

www.NeuRA.edu.au
Recent falls risk factor studies
Vascular disease

- 38.6% of all deaths in 2000 (Australian Institute of Health and Welfare; 2005)

- Leading cause of morbidity (stroke, heart attack, heart failure...)

- Many fall risk factors: manifestation of systemic vascular disease or result of pharmacological interventions
High Arterial Pulse Wave Velocity Is a Risk Factor for Falls in Community-Dwelling Older People

Alfred K. W. Wong, MD, a Stephen R. Lord, DSc, a,b Julian N. Trollor, MD, c,d Daina L. Sturnieks, PhD, a,e Kim Delbaere, PhD, a,b Jasmine Menant, PhD, a,b Henry Brodaty, MD, DSc, c Perminder S. Sachdev, MD, PhD, c,f and Jacqueline C. T. Close, MD a,g


- 481 community-dwellers ≥70 years
- Carotid-femoral pulse wave velocity ~ arterial stiffness
- 45% fallers - monthly calendars for 12 months

Increased arterial stiffness associated with:
  - high systolic BP and HR, diabetes, low physical activity (p<0.05)
  - **37% increased risk of falls** (RR: 1.37, 95%CI: 1.06-1.78) (after adjusting for psychotropic & CV meds, age, sex, BMI, seated SBP, HR and diabetes)

- Possible mediating factors: structural brain changes (through white matter lesions) and at the peripheral level (peripheral vascular disease).
- **Vascular risk reduction to prevent falls**: pharmacotherapy and exercise.
Unexplained falls

Menant et al., JAGS, 2015

- N= 529 community-dwellers (80±4 years, 52% female).
- Multidisciplinary comprehensive assessment
Prospective falls follow-up for 12 months
Unexplained falls

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- N= 529 community-dwellers (80±4 years, 52% female).
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- Unexplained fallers (n=35, 15% of all fallers (n=238)): participants who fell due to a blackout, dizziness, feeling faint or “found themselves suddenly on the ground”.
- ≠ Balance-related fallers (n=203)
<table>
<thead>
<tr>
<th></th>
<th>Non-Fallers</th>
<th>Unexplained Fallers</th>
<th>Balance Fallers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>291</td>
<td>35</td>
<td>203</td>
</tr>
<tr>
<td><strong>Cognitive function</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digit symbol</td>
<td>47.9 ± 12.8</td>
<td>50.0 ± 12.7</td>
<td>48.8 ± 12.2</td>
</tr>
<tr>
<td>Trail Making Test–B-A (s)</td>
<td>75.1 ± 51.2</td>
<td>84.9 ± 70.3</td>
<td>70.3 ± 41.3</td>
</tr>
<tr>
<td><strong>Sensorimotor function</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite fall risk score</td>
<td>0.86 ± 0.93</td>
<td>1.16 ± 0.97</td>
<td>1.00 ± 0.93</td>
</tr>
<tr>
<td>Coordinated stability</td>
<td>13.2 ± 12.7</td>
<td>14.9 ± 11.1</td>
<td>14.6 ± 13.6</td>
</tr>
<tr>
<td><strong>Health and Medications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfactory sitting BP 77%</td>
<td>(223)</td>
<td>83% (29)</td>
<td>82% (166)</td>
</tr>
<tr>
<td>Orthostatic hypotension 22%</td>
<td>(64)</td>
<td>39% (13)</td>
<td>21% (40)</td>
</tr>
<tr>
<td>Heart disease 18%</td>
<td>(50)</td>
<td>6% (2)</td>
<td>19% (39)</td>
</tr>
<tr>
<td>Cardiovascular medication 73%</td>
<td>(212)</td>
<td>63% (22)</td>
<td>66% (133)</td>
</tr>
<tr>
<td>Psychotropic medications 19%</td>
<td>(54)</td>
<td>34% (12)</td>
<td>27% (54)</td>
</tr>
<tr>
<td>Antidepressants 8%</td>
<td>(22)</td>
<td>23% (8)</td>
<td>11% (23)</td>
</tr>
<tr>
<td>Benzodiazepines 8%</td>
<td>(22)</td>
<td>11% (4)</td>
<td>15% (31)</td>
</tr>
<tr>
<td>Depressive symptoms 8%</td>
<td>(22)</td>
<td>24% (8)</td>
<td>10% (20)</td>
</tr>
<tr>
<td><strong>Falls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple fallers 0%</td>
<td>(0)</td>
<td>66% (23)</td>
<td>40% (82)</td>
</tr>
<tr>
<td>Injurious fallers 0%</td>
<td>(0)</td>
<td>89% (31)</td>
<td>71% (144)</td>
</tr>
</tbody>
</table>
Unexplained falls

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- N= 529 community-dwellers (80±4 years, 52% female).
- Multidisciplinary comprehensive assessment

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- Balance-related fallers (n=203)

- Depressive symptoms and orthostatic hypotension increased the risk of unexplained falls
- To reduce the risk of unexplained falls: psychotherapies and physical exercise to raise mood & medication reviews and non-pharmacological therapies to treat orthostatic hypotension
Depressive symptoms increase fall risk in older people, independent of antidepressant use, and reduced executive and physical functioning.

488 people aged 70+ years

Depressive symptoms were defined by a GDS (15-item) score ≥ 5

Depressive symptomatology and antidepressant use were independent of each other, and independent of a high physiological fall risk and poorer executive functioning in predicting falls.

Fall risk increased with the number of risk factors present: i.e. by 55% in participants with any two risk factors (RR = 1.55; 95% CI = 1.17–2.04) and by 144% in participants with three or four risk factors (RR = 2.44; 95% CI = 1.75–3.43)

Higher depressive symptoms and antidepressant use predicted falls over 12-months, independent of reduced executive and physical functioning.
Poor nutritional status is associated with a higher risk of falling and fracture in elderly people living at home in France: the Three-City cohort study

M. J. Torres1,2,3 · C. Féart1,2 · C. Samieri1,2 · B. Dornigny3 · Y. Luiking4 · C. Berr5,6 · P. Barberge-Gateau1,2 · L. Letenneur1,2

Osteoporosis International, 2015

- Baseline nutritional status of participants was assessed using the Mini Nutritional Assessment (MNA)
- After a follow-up of 12 years, 6040 individuals with available data for falls and 6839 for fracture were included.
- Poor nutritional status (MNA ≤ 23.5) at baseline was 12.0 % in the fall study sample and 12.8 % in the fracture study sample
- Incident fall and fracture over 12 years were reported in 55.8% and 18.5 % of the respective samples, respectively

- In multivariate models, poor nutritional status was significantly associated with a higher risk of falling (hazard ratio (HR) = 1.66, (95 % CI) 1.35-2.04 in men and HR = 1.20, 95 % CI 1.07-1.34 in women) and with a higher risk of fracture (HR = 1.28, 95 % CI 1.09-1.49)
Recent interventions
Two year balance training

El-Khoury et al., BMJ, 2015

- RCT of 706 community-dwelling women aged 75-85 years- with gait or balance impairments
  - Control (n=354)- usual care
  - Intervention (n=352): 1hr/week group supervised + home exercises
- 16% of women never started the program

- **Intervention group vs. controls**
  - **19% reduction in injurious falls** (bruising, sprains, fractures, etc) (305 vs. 397)
  - significant **improvements in gait & balance**
  - Less reduction in quality of life and less increase in fear of falling over time

- **Potential for pragmatic intervention to be effective**
- **Need to improve participation in such programs**
Two year exercise and vitamin D program

Uusi-Rasi et al., JAMA Internal Medicine, 2015

- RCT of 409 community-dwelling women aged 70-80 years- with ≥1 fall in past year
  - Placebo no exercise (n=102)
  - Vitamin D only: (800IU/d) (n=102)
  - Placebo & Exercise (group sessions+ home exercises) (n=103)
  - Vitamin D & Exercise (n=102)

Rate of falls per 100 person-years

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Placebo Without Exercise</th>
<th>Vitamin D Without Exercise</th>
<th>Placebo and Exercise</th>
<th>Vitamin D and Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>All falls</td>
<td>118.2</td>
<td>132.1</td>
<td>120.7</td>
<td>113.1</td>
</tr>
<tr>
<td>Injurious falls</td>
<td>13.2</td>
<td>12.9</td>
<td>6.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

IRR (95% CI)

- All falls
  - 1 [Reference] 1.08 (0.78-1.52) 1.07 (0.77-1.45) 0.99 (0.72-1.39)
- Injurious falls
  - 1 [Reference] 0.84 (0.45-1.57) 0.46 (0.22-0.95) 0.38 (0.17-0.81)
- All multiple falls
  - 1 [Reference] 1.05 (0.60-1.86) 1.11 (0.63-1.94) 1.14 (0.65-1.99)
- Multiple injurious falls
  - 1 [Reference] 1.04 (0.56-1.96) 1.10 (0.59-2.05) 1.54 (0.84-2.81)

- Vit D may not improve neuromuscular function when vit D intake is sufficient
- Evidence that good physical function may help prevent injuries during a fall
Perturbation training: trips & slips

- Slip training transfers to real-life (vinyl floor), to other types of perturbations (trips) and has long-term motor retention (up to 12 months) in older people (Pai et al., 2009-2014)
Perturbation training: trips

Rosenblatt et al., JAGS, 2013

- 162 women community-dwellers >55 years - 12-months falls follow-up
- Intervention (n=82): 4 x 1hr trip training on treadmill

- **Reduction in trip-related falls rate**: Intervention: 0.21 pp/year vs. Controls: 0.39 pp/year (IRR=0.54, 95%CI=0.30-0.97, p=0.04)
- No difference in trip-related stumbles or non-trip-related avoidable falls
- Motor skill of trip-related falls avoidance improved with specific short-term training
Perturbation training: slips


- 212 community-dwellers ≥ 65 years - 12-months falls follow-up
  - Control (n=103): 10 walking trials + 1 slip
  - Intervention (n=109): 10 walking trials + 24 repeated slips in 3 blocks

- **Reduction in fall risk**: Intervention: 13% fallers vs. control: 25% fallers
Does Perturbation-Based Balance Training Prevent Falls? Systematic Review and Meta-Analysis of Preliminary Randomized Controlled Trials

Avril Mansfield, Jennifer S. Wong, Jessica Bryce, Svetlana Knorr, Kara K. Patterson

- 8 studies, n=404 participants; high heterogeneity
- 29% reduction in risk of falls & 46% reduction in number of falls
- Perturbation-based balance training appears to reduce fall risk among older adults and individuals with Parkinson disease.

- Potential of such low dose perturbation training intervention to be as effective in reducing falls as multifactorial long-term interventions
- Potential to use as an adjunct to conventional balance training
Post-hospital home exercise program

Sherrington et al., PLOS One, 2014

- RCT of 340 people aged 60+ years recruited as inpatients
- Control (n=169): falls prevention education booklet
- Intervention group (n=171): tailored home exercise program (15-20 min 3-6/week)
  - Improved performance-based mobility
  - **Increased falls** (177 vs. 123 falls in controls, IRR=1.43, 95% CI= 1.07-1.93, p=0.017)

- Hypotheses re increase in falls
  - Sub-optimal adherence
  - Harmful effect of exercise
  - Increased exposure / confidence
  - Different time course of improvement in mobility vs falls

- **Single home exercise training not appropriate to prevent falls in frail population**
Cognitive-motor training

Schoene et al., Plos One, 2013

- 37 community-dwellers ≥70 years –cognitively intact
- 8 weeks of home-based step training – 15/20min x3/wk
- Intervention group:
  - Faster choice-stepping reaction time
  - Reduced falls risk score
  - Improved dual-task ability

- RCT in 90 people ≥70 years: 16 weeks of cognitive-motor training: significant improvements in processing speed and visuo-spatial abilities (Schoene et al., submitted)

- Cognitive-motor training with computerised step mat: safe home-based training to improve physical and cognitive fall risk factors
Cognitive-motor training – future work

Sturnieks et al., NeuRA, 2015-2019

Multidisciplinary assessment to uncover mechanisms of action
- Sensorimotor & balance function
- Executive function
- Brain structure (MRIs, n=105)
Falls prevention – what works

- Highest level of evidence given by meta-analyses of RCTs

- Gillespie LD et al. Interventions for preventing falls in older people living in the community. Cochrane Database Syst Rev. 2012 Sep 12;9

- Cameron ID et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database Syst Rev. 2012 Dec 12;12:
Gold bar evidence scale

- One good quality RCT
- At least two good quality RCTs – little inconsistency
- Multiple RCTs and/or systematic reviews – little inconsistency
Falls prevention – what works

- High level balance exercise in group or home settings (functional balance exercises, Otago, Tai Chi)
- Occupational therapy interventions (home safety modifications in association with transfer training and education) in high risk populations
- Expedited first eye cataract surgery
- Restriction of multifocal glasses use in older people who take part in regular outdoor activity
- Pharmacist-led education and GP medication review
- Podiatry intervention in people with disabling foot pain
Falls prevention – what works

- Withdrawal of psychoactive medications
- Intensive multidisciplinary assessment of high risk populations
- Intensive interventions in hospitals
- Comprehensive geriatric assessment in residential aged care
- Vitamin D supplementation in residential aged care
- Medication review in residential aged care
Thank you!

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