The impact of bladder sensation on gait in continent and incontinent community-dwelling women fallers

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Does strong desire to void (SDV) alter gait parameters and increase risk of falling?

AIMS OF STUDY

Primary objective:
Investigate the effect of a strong desire to void on gait parameters in urgency/mixed incontinent and continent community-dwelling women who are at risk of falls.

Secondary objective:
Determine the relationship between urinary incontinence severity and gait parameters in the group of incontinent women.

METHOD

- 3 hour gait laboratory assessment
- Gait assessment on GAITRite mat

Before laboratory assessment
- 7 day bladder diary
- 24 hour pad test

Walk on GAITRite® (practice)

Intervention: Drink water

Empty bladder

Strong desire to void (SDV)

SDV was determined by a score of 3 on Urinary Scale Sensation (USS): Enough urgency discomfort. Need to stop usual activity and task, and go right to the bathroom.

- Walk on GAITRite®

Continent group
- No urine leakage in last year
- ICIQ-UI SF=0 (International Consultation on Incontinence Questionnaire on UI Short Form)
- No urine leakage in 7 day bladder diary

Incontinent group
- Moderate to severe MUI or UUI
- ICIQ-UI SF > 6
- 3 urine leakage a week (1 and + related to urgency) in 7 day bladder diary

Inclusion/exclusion (for all)
- BMI<35
- No medical condition or medication affecting gait or continence
- No surgery or treatment for UI or gait in last year

Fall rate in urgency UI (UUI) (urine leakage related to urgent desire to void) and mixed UI (MUI) (urine leakage related to effort and urgent desire to void) in elderly women is higher than continent.

29% vs 20%

OUTCOMES

Continence status/severity
ICIQ-UI SF:
- Evaluates 4 domains in the form of 4 questions:
  - Frequency of UI (0 to 5)
  - The perceived quantity of leakage (0 to 6)
  - Impact of UI in everyday life (VAS 0 to 10)
  - Causes of leakage

7 day bladder diary:
- Measurement tool to assess the number of urine leakage (symptom severity) and type of urinary leakage in 7 days.

24 hour pad test:
- Measures the amount of urinary leakage in a pre-weighted protective pad for 24 hours, during which, participants continue usual activities. Positive if weight >4g in 24 hr.

Gait parameters
(GAITRite® results)
- Velocity (cm/sec)
- Stride width (cm)
- Stride length (cm)
- Stance time (sec)
- Variability of each parameter (%)
  - Standard deviation/mean X100
  - According to literature review, those gait parameters are determinant of falls.

Demographics
- Age
- Body mass index (BMI)
- Montreal Cognitive assessment test (MOCA)

Primary objective:
We analysed and compared gait parameters for the two groups (continent/incontinent) for the two conditions (SDV/NDV) using:
- ANOVA (parametric gait parameters outcomes)
- Kruskall-Wallis (non-parametric gait parameters outcomes)

Secondary objective:
- Spearman correlation (r_s) between ICIQ-UI SF and gait parameters

RESULTS: Demographics & continence status/severity

<table>
<thead>
<tr>
<th></th>
<th>Continent (n=17)</th>
<th>Incontinent (n=15)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)^b</td>
<td>74.6 (4.1)</td>
<td>73.5 (5.9)</td>
<td>0.53</td>
</tr>
<tr>
<td>BMI (kg/m^2)^b</td>
<td>24.6 (3.0)</td>
<td>28.3 (4.8)</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>MOCA (/30)^b</td>
<td>27 (3)</td>
<td>28 (2)</td>
<td>1.00</td>
</tr>
<tr>
<td>Nb. Falls in the last year (%)^c:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>70.6</td>
<td>33.3</td>
<td>0.03*</td>
</tr>
<tr>
<td>2</td>
<td>29.4</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>3 and +</td>
<td>0</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td>ICIQ-SF UI (/21)^d</td>
<td>0 (0)</td>
<td>12 (3)</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Pad test 24 hour (g)^d</td>
<td>0.6 (0.5)</td>
<td>9.3 (10.8)</td>
<td>0.04*</td>
</tr>
<tr>
<td>Nb. Urine leakage/day (mean)^d</td>
<td>0 (0)</td>
<td>11 (8)</td>
<td>&lt;0.01*</td>
</tr>
</tbody>
</table>

*: significant p<0.05, b: t-test, c: Chi-square, d: Mann-Whitney

STATISTICAL ANALYSIS

Primary objective:
We analysed and compared gait parameters for the two groups (continent/incontinent) for the two conditions (SDV/NDV) using:
- ANOVA (parametric gait parameters outcomes)
- Kruskall-Wallis (non-parametric gait parameters outcomes)

Secondary objective:
- Spearman correlation (r_s) between ICIQ-UI SF and gait parameters

p<0.05 was considered significant

ANOVA (parametric outcomes):
BMI (>25/<25) included as a covariate

Kruskall-Wallis (non-parametric outcomes):
4 groups:
- Incontinent BMI>25
- Incontinent BMI<25
- Continent BMI>25
- Continent BMI<25

BMI was different between groups it was included in analysis as:
RESULTS primary objective: GAIT parameters

ANOVA Gait parameters results

<table>
<thead>
<tr>
<th></th>
<th>Continent</th>
<th>Incontinent</th>
<th>Interaction effect F; p</th>
<th>Group effect F; p</th>
<th>Condition effect F; p</th>
<th>Effect size ($\eta^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity (cm/sec)</td>
<td>NDV n=16</td>
<td>SDV n=17</td>
<td>120 (17)</td>
<td>118 (18)</td>
<td>107 (20)</td>
<td>106 (17)</td>
</tr>
<tr>
<td>Stride width (cm)</td>
<td>NDV n=15</td>
<td>SDV n=15</td>
<td>10.5 (2.0)</td>
<td>9.9 (2.5)</td>
<td>10.9 (2.5)</td>
<td>10.8 (2.6)</td>
</tr>
<tr>
<td>Stride length (cm)</td>
<td>NDV n=15</td>
<td>SDV n=15</td>
<td>127.4 (12.9)</td>
<td>126.3 (12.7)</td>
<td>114.5 (16.9)</td>
<td>114.2 (15.0)</td>
</tr>
<tr>
<td>Stance time (sec)</td>
<td>NDV n=15</td>
<td>SDV n=15</td>
<td>0.67 (0.07)</td>
<td>0.69 (0.10)</td>
<td>0.69 (0.06)</td>
<td>0.69 (0.06)</td>
</tr>
</tbody>
</table>

1- Clinically slower walking velocity in incontinent (<100 cm/sec = increased risk of falls)

2- Reduced velocity in both groups when experiencing SDV

3- Reduced stride width in both groups when experiencing SDV

Difference between NDV & SDV (both groups)

Gait variability (Kruskall-Wallis results): no difference between groups and conditions

- : significant $p<0.05$: $\eta^2$: 0.06$<\eta^2<0.13$=moderate, $\eta^2>0.13$=large

1-Mortaza 2014

SDV: Strong desire to void NDV: No desire to void
RESULTS secondary objective: Correlations ICIQ-UI SF & GAIT parameters

More severe urinary incontinence (UI) was strongly correlated:

- Reduced velocity ($r_s$: -0.63; $p=0.01$)
- Increased stance time ($r_s$: 0.65; $p=0.01$)
- Increased stance time variability ($r_s$: 0.65; $p=0.01$)

In no desire to void (NDV):

- Reduced velocity ($r_s$: -0.56; $p=0.03$)
- Increased stride length variability ($r_s$: 0.54; $p=0.04$)

In strong desire to void (SDV):

CONCLUSION

Primary objective:
- No group & interaction effect
- Clinically slower velocity in incontinent group

In SDV we observed in both groups:
- Reduced velocity
- Reduced stride width

Secondary objective:

- Slower gait parameters
- Increased gait variability

When you add those results together, incontinent women, when experiencing a SDV reduce their already slower gait when going to the bathroom.

As increased variability and slower velocity are known to be related to an higher risk of falls\(^1\), women with severe incontinence could be even more at risk of falls.

Women with severe incontinence could be even more at risk of falls

It could be relevant in clinic to question about fall history, especially women suffering from moderate to severe urgency or mixed UI.

More studies are needed to confirm these results and to further understand falls in an incontinent population.

\(^1\) Mortaza 2014