

Should we consider a collective interpretation of clinical balance tests results to best predict falls in people with Parkinson's disease?

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OBJECTIVES

- To identify the most accurate cutoff scores for falls risk of four balance measures;
- To determine which measure has the greatest overall predictive ability for falls;
- To explore the collective interpretation of the balance tests results in people with Parkinson's disease (PD).

BACKGROUND

Postural instability and falls are common in PD. Recurrent falls, especially, can be considered a disabling feature of the disorder. Early identification of individuals at risk of falling may be important for providing effective interventions such as falls prevention programs and specialized rehabilitation to reduce these risks. Some clinical balance measures are useful for predicting the falls risk in the elderly population, but they need to be investigated further for their potential to accurately predict falls in individuals with PD.¹⁻³

METHODS

Study sample

- Consecutive participants with idiopathic PD and independent walking ability.
- Movement Disorders Clinic – AMMI, Bahia State Health Attention Center for the Elderly– CREASI/SESAB, Salvador, Bahia, Brazil.

Exclusion criteria

- Dementia
- Neurological conditions other than PD
- Visual disturbance or vestibular dysfunction
- Musculoskeletal disorders limiting locomotion or balance

Assessments

- Demographic and clinical data
- UPDRS- ADL and motor
- Modified Hoehn and Yahr scale (H&Y)
- Berg Balance Scale (BBS)
- Dynamic Gait Index (DGI)
- Functional Reach Test (FRT)
- Timed Up and Go Test (TUG)
- Patients were tested during the “on” phase of the medication cycle.
- Fallers: history of two or more falls in the previous 12 months.

Statistical Analysis

- Descriptive statistics for demographic and clinical variables.
- Mann-Whitney and Pearson Chi-Square tests for comparison between fallers and nonfallers.
- Receiver operating characteristic (ROC) curves were constructed and the area under the curve (AUC) and validity indices were determined.

RESULTS

Study sample

- 171 PD patients
- Age: median of 70 years (Q1=66; Q3=77)
- Gender: 89 (52%) female
- Fallers: 52 (30.4%) subjects - **pretest probability of being a faller**

There were no differences between fallers and nonfallers in these demographic characteristics. Fallers had longer disease duration and increased disease severity than nonfallers, as well as higher degree of functional impairment and reduced performance on all balance measures ($p < 0.001$).

The AUC and the corresponding cutoff scores are shown in Table 1. Figure 1 shows the ROC curves for all balance tests.

The combination of one or more positive tests provided the highest level of sensitivity and the lowest level of specificity, the opposite relation obtained when considering four positive tests. The collective interpretation of balance tests reached higher posttest probabilities of being a faller, with a positive test, than a single balance measure (Table 2). Validity indices for the combination of two and three balance tests can be seen in Tables 3 and 4, respectively.

Table 1. Cutoff scores, area under the curve, sensitivity, specificity, and posttest probabilities for the BBS, DGI, FRT and TUG.

Balance Test	AUC (95% CI)	Cutoff scores	Sensitivity	Specificity	PPV	NPV
BBS	0.86 (0.80-0.91)	≤ 48 points	0.81	0.73	0.57	0.10
		< 45 points ^a	0.56	0.90	0.70	0.18
DGI	0.84 (0.77-0.89)	≤ 18 points	0.79	0.74	0.57	0.11
		≤ 19 points ^a	0.83	0.66	0.52	0.10
FRT	0.79 (0.72-0.85)	≤ 17 cm	0.75	0.76	0.58	0.12
		≤ 25 cm ^a	0.96	0.32	0.38	0.05
TUG	0.76 (0.69-0.82)	> 16,61 sec	0.69	0.76	0.56	0.15
		> 14 sec ^a	0.77	0.49	0.40	0.17

^aBased on original research.

PPV, positive predictive value; NPV, negative predictive value.

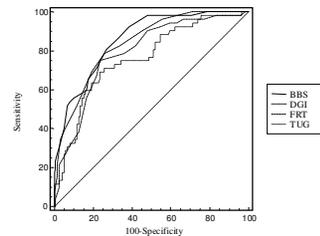


Figure 1. ROC curves for the BBS, DGI, FRT and TUG.

Table 2. Validity indices for the collective balance tests.

Balance Tests (n) ^a	Sensitivity	Specificity	PPV	NPV
≥ 1 positive tests (96) ^a	0.92 (0.82-0.97)	0.60 (0.51-0.68)	0.50	0.05
≥ 2 positive tests (81) ^a	0.85 (0.72-0.92)	0.70 (0.61-0.77)	0.55	0.09
≥ 3 positive tests (62) ^a	0.71 (0.58-0.82)	0.79 (0.71-0.85)	0.60	0.14
4 positive tests (40) ^a	0.56 (0.42-0.68)	0.91 (0.84-0.95)	0.72	0.18

Table 3. Validity indices for two balance tests.

Balance Tests (n) ^a	Sensitivity	Specificity	PPV	NPV
BBS + DGI (61) ^a	0.71 (0.58-0.82)	0.80 (0.72-0.86)	0.61	0.14
BBS + FRT (57) ^a	0.69 (0.56-0.80)	0.82 (0.74-0.88)	0.63	0.14
FRT + DGI (52) ^a	0.67 (0.54-0.79)	0.86 (0.78-0.91)	0.67	0.14
TUG + DGI (56) ^a	0.65 (0.52-0.77)	0.82 (0.74-0.87)	0.61	0.16
BBS + TUG (51) ^a	0.61 (0.48-0.73)	0.84 (0.76-0.89)	0.63	0.17
FRT + TUG (44) ^a	0.60 (0.46-0.72)	0.89 (0.82-0.93)	0.70	0.16

Table 4. Validity indices for three balance tests.

Balance Tests (n) ^a	Sensitivity	Specificity	PPV	NPV
BBS + FRT + DGI (48) ^a	0.63 (0.50-0.75)	0.87 (0.80-0.92)	0.69	0.15
BBS + TUG + DGI (49) ^a	0.61 (0.48-0.73)	0.86 (0.78-0.91)	0.65	0.16
FRT + TUG + DGI (41) ^a	0.58 (0.44-0.70)	0.91 (0.84-0.95)	0.73	0.17
BBS + FRT + TUG (41) ^a	0.56 (0.42-0.68)	0.90 (0.83-0.94)	0.71	0.18

^aNumber of individuals with positive test in each condition. PPV, positive predictive value; NPV, negative predictive value.

CONCLUSIONS

Our results suggest that the adoption of the proposed cutoff scores and the utilization of combined balance tests results may be considered in order to improve the identification of fall risk in people with PD. The BBS and DGI had the greatest overall predictive ability to discriminate fallers and nonfallers.

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