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A COMPARISON OF GAIT ASSESSMENT METHODS: TINETTI AND GAITRITE ELECTRONIC WALKWAY

To the Editor: Gait and self-selected walking speed have been shown to be reliably responsive to a variety of disorders[1–3] as well as an indicator of overall health and well-being of individuals.[4,5] Numerous scales have been developed to assess gait. One frequently used measure, the Tinetti scale,[5] requires subjects to walk twice, once at the "usual" pace and once at a "rapid but safe" pace while aspects of gait such as step symmetry, step continuity, and path are observed. Scores range from 0 to 12, based on the reviewer's subjective assessment. Although the Tinetti scale has been shown to be reliable in normal populations,[6] and one study found fair to good interrater reliability of the Tinetti balance portion across raters with differing degrees of experience,[7] there appear to be no studies that have investigated inter- or intrarater reliability of the gait portion or reliability as a measure of change over time in populations with gait disorders. As with other subjective measurements, it may be less sensitive when used for detection of small but clinically relevant changes. Indeed, sensitivity was found to be inadequate for detecting change in patients with Parkinson's disease.[8]

In an institutional review board–approved protocol, 19 subjects recruited for evaluation of possible normal pressure hydrocephalus (NPH) were studied at baseline (n = 19) and after shunt surgery (n = 9). Gait disturbance is part of a triad of symptoms of NPH that includes urinary incontinence and dementia. Each subject was assessed by a single physician using the Tinetti scoring system, and then by the GAITRite Portable Walkway System (CIR Systems, Inc., Havertown, PA), which automates the acquisition, analysis, and reporting of the objective parameters of gait as the subject walks down the 1-by-5 meter walkway with embedded sensors.

The Tinetti scoring system was compared with the automated system. The GAITRite variables analyzed for this report were self-selected walking speed (velocity) and functional ambulatory performance (FAP). Linear regression analyses were performed using SPSS version 12.0 (SPSS Inc., Chicago, IL).

For all subjects at baseline (n = 19), the Pearson correlation coefficient (r) was 0.78 ($P < .001$) for Tinetti gait score and FAP and 0.72 ($P = .001$) for Tinetti gait score and velocity. For the subgroup that later had a shunt (n = 9), at baseline, r was 0.82 ($P = .004$) for Tinetti gait score and FAP and 0.68 ($P = .03$) for Tinetti gait score and velocity. Correlation between Tinetti gait score and FAP remained significant after shunt surgery ($r = 0.67$, $P = .03$), but correlation between Tinetti and velocity did not ($r = 0.59$, $P = .07$). Correlation between change in Tinetti gait score and change in FAP was 0.82 ($P = .007$), and correlation between change in Tinetti gait score and change in velocity was 0.67 ($P = .047$).

The effect size of the correlations at baseline (R^2) suggests that the Tinetti scores can explain approximately two-thirds of the variance in GAITRite FAP scores and approximately half the variance in self-selected walking speed. This provides evidence of a strong relationship between a subjective measure of gait and a quantitative one, and supports the use of the Tinetti scoring system for initial assessment of gait in the evaluation of NPH. However the reduction of the effect size of the correlations after shunt surgery suggests that the Tinetti gait score may not be as sensitive as the GAITRite in detecting change or that there may be a ceiling effect with the Tinetti score (Table 1). For example, subject 17 received the maximum score of 12 on the Tinetti gait test at baseline and at postshunt evaluation. When scored electronically, baseline FAP score was 81 out of a possible 100. After shunting, GAITRite showed a 36.4% increase in velocity and a 22.2% increase in FAP. Other subjects also showed significant discrepancies in the percentage of change in scores between Tinetti and GAITRite. The ability to identify and quantify such changes may be useful to clinicians, especially when such changes are used to assess response to therapy or to make therapeutic decisions, as with NPH.

Table 1. Baseline and Postshunt Scores

Subject ID	Tinetti Gait Baseline (Range 0–12)	GAITRite FAP Baseline (Range 0–100)	GAITRite Velocity* Baseline	Tinetti Gait Postshunt	GAITRite FAP Postshunt	GAITRite Velocity* Postshunt
3	5	63	45	10	88	56.7
4	9	51	30.1	11	83	45.9
6	6	45	12.9	12	99	76.9
7	9	78	40.3	12	99	58.3
8	10	65	34.4	12	86	47.1
16	7	55	12.5	11	93	50.1
17	12	81	46.1	12	99	62.9
18	4	47	20.9	12	86	53.1
20	12	87	51.2	10	88	51.5

*Velocity in meters per minute, not adjusted for height.
FAP = functional ambulatory performance.

These data support the use of the Tinetti system as a screening tool for gait impairment in NPH. They also suggest that it may be acceptable as a "rough" system to identify changes in gait, especially if gait was significantly impaired at the outset. The small sample size limits the conclusion; more studies are needed before any final determination can be made. Nevertheless, although the Tinetti system was useful to identify some changes in overall gait, it appears that the GAITRite system more finely discriminates alterations in gait.

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