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Smartphone monitoring of multidomain gait parameters to facilitate remote monitoring of gait in Normal Pressure Hydrocephalus

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INTRODUCTION: Gait dysfunction is a classic symptom of Normal Pressure Hydrocephalus (NPH). While current instrumented measures have focused on gait speed, we aimed to establish the reliability of smartphone monitoring of gait in NPH patients in three domains of gait using CDC recommended measures of gait function.

METHODS: We recruited 15 (mean age 73.5 ± 7.1) probable NPH patients undergoing large volume lumbar puncture (LVLP) or extended lumbar drainage (ELD) at Johns Hopkins to determine their eligibility for ventriculoperitoneal shunt surgery. We recorded their gait tests before and after the procedure using Mon4t application concurrent to the physiotherapists' (PT) assessments. The gait tests covered all three domains: Speed (Timed-Up-Go), balance (30-second sit-to-stand and 4-stage-balance test), and endurance (2-Minute-Walk Test). We used Pearson correlation and ANOVA tests for data analysis.

RESULTS: Results obtained with Mon4t app showed a significantly positive correlation with the PT results both in the absolute measures and the magnitude of change before and after procedure in each patient. Correlation coefficient for different gait tests included: Timed-Up-Go = 0.96, change in Timed-Up-Go = 0.87, 30-second sit-to-stand = 0.97, change in 30-second sit-to-stand = 0.73, 2-Minute-Walk test = 0.99 in ELD and 0.96 in LVLP settings, change in 2-Minute-Walk test = 0.8 (P-value < 0.05).

CONCLUSIONS: The results of this pilot study suggest that smartphone monitoring of gait using the Mon4t Clinic application is a reliable and valid tool for assessing gait in NPH. The strong correlation between the results indicates that the app can be used as an adjunct to clinical assessment in the management of NPH if validated in an ongoing larger cohort.