

Gait parameters associated with fall risk in glaucoma patients

Aleksandra Mihailovic, David S. Friedman, Sheila K. West, Pradeep Y. Ramulu

Purpose: Falls are the leading cause of accidental mortality in individuals over age 60, and visual field (VF) loss in glaucoma is strongly associated with falls and gait variability. Here, we examine which gait parameters are associated with falls in a glaucoma cohort, and whether severity of VF loss modifies this relationship.

Methods: The GAITRite Electronic Walkway (CIR Systems Inc) was used to characterize participants' gait. Pointwise sensitivity data measured using Humphrey 24-2 VF testing was integrated to mean sensitivity in the integrated VF (IVF). Fall data were collected prospectively over 6-22 months via a falls diary and analyzed as a rate of falls per steps taken adjusting for IVF sensitivity, comorbidities, number of medications, age, race and gender. Average daily steps were inferred from a one-week accelerometer trial.

Results: The 246 study participants had a mean age of 70.6 years (SD=7.6) and a mean IVF sensitivity of 26.1 dB (IQR=25.1 to 29.7 dB, range=1.7 to 33.9 dB). Higher fall rates were associated with a broader base of support (mean value=10.2 cm, 15% higher risk per cm, $p=0.007$), step length difference between the two feet (mean value=2.2cm, 22% higher risk per cm difference, $p<0.001$), smaller step length (mean value=56.1cm, 7% higher risk per cm shorter, $p=0.003$), and shorter single foot support time (mean value=37.2%, 17.5% higher risk per 1% of gait cycle time, $p=0.004$). Higher fall rates were also associated with increased variability in stride velocity (mean value=7.1%, 10% higher per 1% increase in variability, $p=0.001$) and stance time (mean value=5.2%, 8% higher per 1% increase in variability, $p=0.022$). Significant interactions ($p<0.05$) were observed between IVF sensitivity and step length difference between feet, variability in stride velocity, and variability in stance time, with each parameter noted to pose a higher fall risk in persons with more advanced VF loss.

Conclusions: Numerous gait parameters are associated with a higher risk of falling in glaucoma patients. Given that nearly all falls occur while walking, the identified parameters may serve as markers to identify individuals who are at a greater risk for falls and help develop targeted gait interventions to prevent falls in glaucoma patients.