Is Parkinson's Kinetigraph useful in frail patients with Parkinson's disease?

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The use of accelerometer device technology in Parkinson's disease allows a period of continuous monitoring giving insight into disease pattern and aiding the optimisation of medication regimens. This service evaluation explores the use of such technology in a geriatrician-led movement disorder clinic. The authors describe successful use of the Parkinson's Kinetigraph (PKG) in frail older people and discuss how frailty may have implications on the interpretation of the PKG results.

Parkinson's disease (PD) is a neurodegenerative disease that causes motor symptoms, including bradykinesia, rigidity, postural instability and tremor. At present, there is no curative or disease modifying treatment for PD. Gold standard treatment involves motor symptom control with drugs such as levodopa, monoamine oxidase B (MAO-B) inhibitors and dopamine agonists. These drugs are introduced and titrated with aim of achieving good motor symptom control while minimising side-effects (including dyskinesia and impulse control disorder).[1] Achieving this balance requires the input of specialist clinicians with expertise in caring for patients with PD. In the UK, these clinicians are specialist neurologists or geriatricians with an interest in movement disorders.

In recent years advances in health technology have been applied to help inform treatment decision making. One example – the Parkinson's Kinetigraph (PKG) system – was developed by Global Kinetics Corporation (GKC) and has been available in Europe since 2016.[2] The PKG system involves a wrist-worn accelerometer device, like a smart watch in appearance, that collects data on parameters, including bradykinesia, dyskinesia and tremor, for the duration of the period worn; the usual recommendation is 7 to 10 days. It also gives medication dose reminders. After using the watch data-logger for the assessment period, the patient mails it back to GKC for the data to be uploaded. A PKG report is generated using algorithms comparing the patient's data with healthy controls. The report includes numerical scores, one such is the bradykinesia score (BKS), for which a score above 18.6 suggests high levels of bradykinesia and thus an uptitration of medication may be indicated. Graphs show the data in more detail, for example bradykinesia score on the Y axis against time of day on the X axis, with vertical lines to show medication dose acknowledgements. This gives insight into dose-related fluctuations and wearing off.[3] Use of the PKG system and a 'treat to target' approach have been shown to be beneficial.[4]

Similarly to Parkinson's, incidence of frailty increases with advancing age, but it is not an inevitable part of aging. Frailty, described in terms of the phenotype model, is a distinct health state characterised by low energy, slow gait speed, reduced grip strength and sarcopenia.[5] It is a state of vulnerability where relatively minor insults, such as mild infection or a medication adverse effect, could cause a disproportionate increase in functional dependence.[6] It can be associated with the presence of multiple disease conditions and disabilities. In addition to the phenotype model, the cumulative deficit model describes a frailty index in which an increasing number of symptoms, signs, disease conditions and disabilities correlate with adverse outcome.[7]

At our university teaching health board in South Wales, the majority of patients with PD are reviewed in a movement disorder specialist geriatrician-led clinic. In our experience locally, patients seen in neurologist-led clinics tend to be younger at diagnosis, some with familial disease or a considerable diagnostic uncertainty. Our geriatrician-led movement disorder clinic has over 18 months experience in using the PKG. Our clinic cohort has a higher prevalence of frailty and multimorbidity than neurologist-led clinics that have been presented in the literature.[1,4] This service evaluation aims to review our use of the PKG, specifically in older people with PD, looking at the impact of frailty on clinical management.

Methods

We selected 60 patients with PD who had had the most recent PKGs as part of routine clinical care. Data from that PKG report was collected from the GKC online portal, which is general data protection regulation compliant. Demographics and data were sought by matching hospital numbers on a clinical portal and then recorded anonymously in Microsoft Excel on a secure hospital computer. The data included the Rockwood clinical frailty scale (CFS),[8] Charlson comorbidity index (CCI),[9] level of mobility and if any package of care was in place. The *p* values for the comparison of BKS in the frail and non-frail groups were calculated using an unpaired t-test, a *p* value of <0.05 was considered significant.

The primary marker of frailty we have used is the CFS, a nine-point scale with higher scores equating to more severe frailty. The CFS is a validated tool and a score of 5 or above would deem a person frail. Other markers used that are suggestive of frailty are CCI, requirement of a formal care package and impaired mobility. CCI is an index that includes 19 different health conditions with hazard weightings and is used to predict 10-year survival. A CCI score of 0 predicts a 98% 10-year survival, compared with 53% for a CCI score of 4. We use CCI as a surrogate marker for cumulative comorbidity, and have opted for a cut-off of 4 or greater to define a frail group. Those with formal packages of care are compared with those without and those who use walking aids or have walking distance less than 500m are compared with those with unlimited mobility.

Results

Table 1 shows the demographics of the cohort of 60 patients with PD. The mean age of this group was 71 years, which compares to a mean age of 77 years on our clinic database of patients with PD. A mean Hoehn & Yahr score (H&Y) of 2 and time since diagnosis of 4.7 years indicate mild-to-moderate disease.[10] On average, CFS was 3, with 91.7% of patients falling into the non-frail categories of CFS 1 to 4. There is some impairment of mobility in 13/60 or 21.6%; reduced walking distance or requiring a walking aid, as illustrated in Table 2. Most patients, 56/60 or 93.3%, do not have formal care packages (Table 3).

A comparison of bradykinesia scores between frail versus non-frail groups defined by the parameters above is shown in Figure 1. Mean age was similar in the frail and non-frail groups – 72 years and 71 years, respectively – when defined by CFS. The range of BKS in the CFS frail group was 26.5 to 50.2 compared with 19.7 to 47.1 in the non-frail group. Mean BKS was higher in the frail groups by each of the four definitions, with statistically significant results in the CCI, care requirement and impaired mobility groups. All bradykinesia scores are higher than the threshold at which medication up-titration should be considered.

Table 1. Cohort demographics

	Mean	Range	Standard deviation
Age	71 years	56–89 years	6.9
H&Y	2	1–5	
Time since diagnosis	1726 days (4.7 years)	125–5739 days	1423
CFS	3	2.0–7.0	1.1
CCI	3	1.0–6.0	1.2

Table 2. Level of mobility

	n	%
Walks unaided >500m	47	78.3
Walks unaided <500m	8	13.3
Uses walking stick	2	3.3
Uses walking frame or wheeled walker	3	5

Table 3. Formal package of care (POC) requirement

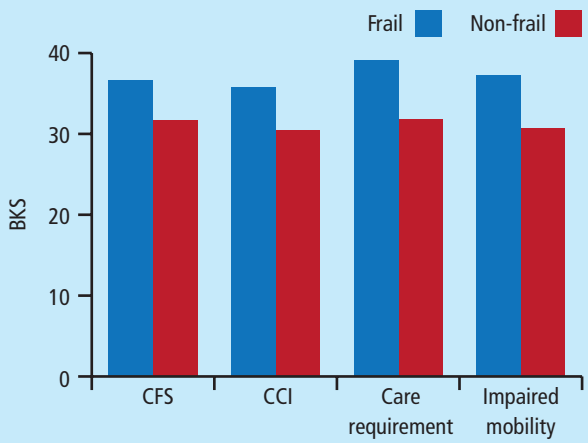
	n	%
Lives alone, no POC	24	40.0
Lives alone, has POC	1	1.7
Lives with spouse, no POC	32	53.3
Lives with spouse, has POC	3	5.0

Discussion

We have shown that PKGs are acceptable to patients with PD across a wide range of ages. This included patients up to age 89 years and with severe frailty up to CFS 7. There may therefore be scope to use the PKG in those previously deemed too frail to benefit. However, the mean age of those in the PKG group is lower than that of the clinic database and none lived in care homes. While there were no exclusion criteria for age alone it is possible that there was unconscious bias. The discrepancy could be due to the fact that those who are older are more likely to have a higher incidence of functional disability or cognitive problems, which clinicians may perceive makes obtaining meaningful PKG data unlikely, and therefore decide that a PKG is unsuitable for them. With regards to residents of care homes, the continuous monitoring aspect of the PKG may also be less useful if a patient has 24-hour nursing care and detailed care records to inform treatment choices.

There is a suggestion that patients who are frail have higher bradykinesia scores. This finding would not be unexpected. The cumulative deficit model of frailty describes the accumulation of deficits that can occur with aging, including disease comorbidities as well as symptoms and sensory impairments.[8] The Charlson comorbidity index is a validated tool for prognosticating cumulative comorbidities. It is a useful substitute marker for frailty based on the cumulative deficit model, but does not include impairments not caused by a distinct disease. Using the CCI we have shown that those with a higher burden of comorbidities have higher bradykinesia

Figure 1. Bradykinesia score (BKS) in frail and non-frail patients



	Mean BKS		
	Frail	Non frail	
CFS *(frail n=5, non frail n=55)*	36.7	31.7	p=0.329
CCI *(frail n=19, non frail n =41)*	35.8	30.5	p=0.016
Care requirement *(frail n=4, non frail n =56)*	39.1	31.6	p=0.035
Impaired mobility *(frail n=13, non frail n =47)*	37.3	30.7	p=0.002

Abbreviations: CFS: clinical frailty scale; CCI: Charlson comorbidity index

scores. The phenotype model of frailty describes characteristics such as slowed gait speed, reduced strength and sarcopenia.[9] These features could present similarly to bradykinesia in terms of the accelerometry data. From this and other available data, it is not possible to determine whether bradykinesia as a result of PD is a contributor to frailty, or if frailty can mimic bradykinesia giving a high BKS, even in the absence of PD. If being frail in itself can increase the BKS independently of PD motor symptom control, then the 'treat to target' method may not be as beneficial to people with frailty as those who are non-frail, especially given those older and with frailty are also more likely to experience drug side-effects from more intensive PD medication regimens.[11] In summary, we have shown that patients with frailty can use the PKG system successfully. However, we believe that clinical acumen is important in interpreting the reports and tailoring a treatment plan.

There are some limitations in our evaluation. The sample size of 60 is small. A control group would have been useful to compare patients with PD who had not had PKGs, but our database is incomplete. The main indicator of frailty we have used is the validated Rockwood clinical frailty scale. Other markers used include Charlson comorbidity index, mobility or care status, which may give good insight but are not validated measures of frailty.

Conclusions

Age or frailty is not a barrier to patients being offered a PKG, with some patients in our cohort classified as severely frail. A clinical decision is made on a patient-by-patient basis as to whether PKG is deemed a suitable intervention. Features such as advanced disease or frailty may have a bearing on this. Further research is needed to show if using PKGs has a beneficial effect on symptoms or quality of life in older and frail patients. We have shown that patients with frailty have higher bradykinesia scores, which could be a sign of suboptimal PD control or a marker of the generalised slowing associated with frailty. Therefore we employ a more cautious approach than the 'treat to target' method for those who are frail.

Dr Evans is a Specialist Registrar in Geriatric Medicine and Dr Mohamed and Dr Thomas are Consultant Geriatricians who run the Movement Disorder Service at Cardiff and Vale University Health Board.

Declaration of interests

No conflicts of interest were declared.

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