Aeromedical Decision Making in Parkinson’s Disease

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Abstract 085
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Disclaimer

I receive a salary from the Commonwealth of Australia
I have no financial relationships to disclose
I will not be discussing drugs and off label use
I will try to fairly represent the Policy and Practice of the Civil Aviation Safety Authority (Australia), and to clearly indicate where I am straying into personal / professional opinion for which I and I alone am responsible.
Policy review of aeromedical decision making in Parkinson’s disease (PD)

- Literature review
- Audit of CASA cases
- Review of current policy
- Proposed new policy
Aero-medical Significance of PD
Aero-medical significance of PD

- No mandatory retirement age
- By 2020 10% of professional pilots in Australia will be aged over 60
- Prevalence of PD 1% 60, 4% 80
Visual dysfunction in PD

- Dopaminergic cells in retina of rats (Malmfors 1963)
- Dopaminergic cells in human retina (Frederick et al 1982)
- Impaired Contrast sensitivity in PD (Regan and Neima 1984)
- Contrast sensitivity improves with L-Dopa (Bullens et al 1987)
- Impaired V/A in PD (Jones et al 1992)
- Impaired motion perception in PD (Trick et al 1994)
Fitness to Drive

• more than half would not have passed a state based driving test. (Wood et al 2005)
• significantly worse on cognitive, visual and motor tests on a route following task. (Uc et al 2007)
• under low-contrast conditions - drivers had poorer vehicle control and were at higher risk of crashes (Uc et al 2009)
• driving cessation 17.6% for PD and 3.1% for aged matched controls (Uc et al 2011)
Pre-Review CASA Policy

- PD Dx not disqualifying in itself
- Case by case assessment
- Careful assessment and record of neurological deficits
- Flight test
Audit

- 22 case, 6 active, 5 refused, 11 drop out
- What is mild disease? - Neurological Specialist Vs Aeromedical Specialist
- Motor Vs Non-motor
- High drop out (11/22)
- Progressive disease Vs Static assessments
- Little use of neuropsychology or flight test
- Results of flying tests (100% pass) Vs driving tests (<50% pass) (Wood et al 2005)
Unified PD Rating Scale

I. Mentation, behaviour and mood
II. Activities of daily living
III. Motor examination
IV. Complications of therapy
V. Modified Hoehn and Yahr Staging
VI. Schwab and England activities of daily living scale

Identify aviation red flags
Flight Test

- ‘g’ tolerance
- in-flight problem solving
- reaction time + motor function
- visual function
- a collision avoidance steep turn,
- a short navigation exercise with an unplanned diversion,
- an emergency go-round on short finals,
- an assessment of traffic, ground feature and signal light identification
Proposed policy

- Diagnosis PD
  - Neurol UPDRS
    - Tremor Dominant Nil Rx
  - Neuro Psych
    - No red flags UPDRS Acceptable Rx Stable Response
  - Optho
    - Red Flags UPDRS Cog Impaired Vis impaired Unacceptable Rx

MC C1
Clean C2
MC C1 and C2
Refuse
Conclusion – recommendations provide

1. Practical implementation of the intent of existing policy
2. Incorporates findings of recent literature into assessment
3. Objective assessment
4. Interval comparison
5. Targeted functional assessment
The End.

Thank you for the opportunity to present today.

I’m pleased to answer questions or receive comment?
Additional conditions and review period

- Reduced contrast sensitivity – condition – Day VFR
- Review at 6 months - Class 1, and Class 2
- Pilot or controller to ground themselves and be reviewed by DAME if any significant change in condition or **any** change to medications
Audit

- 22 cases in 20 years
- 16 no longer certificate holders
- 11 time expired and 5 refused or cancelled
- 6 current certificate holders
  - 1 Professional Pilot and 5 Private Pilots
- Average age at diagnosis 58 yrs
- Average time from diagnosis to loss of certificate 3.75 years
Audit

- Comprehensive use of specialist opinion and review
- Only partial use of Ops test & MC
- Very little use of Neuropsych
- 3, (possibly 4) cases evidence of efforts to conceal diagnosis
- One case using Modafinil to counter effects of Pramipexole
Review of the literature - highlights

• Increased diagnostic accuracy provided by Spec in Movt Dis
  
  *Ref Hughes AJ. The accuracy of diagnosis of parkinsonian syndromes in a specialist movement disorder service. Brain. 2002*

• Multi-system disorder - variety of motor and non-motor features – including vision
  

• MOCA superior to MMSE for detection of Mild Cog Impairment in PD
  

• PD Sub-types prognostically significant
  
Review of the literature - highlights

- Mild to Moderate PD associated with impaired driving performance
- No conclusive evidence that treatment can delay progression
  - Ref Silburn P. Management of Parkinson’s Disease. Australian Prescriber 2012
- Dopamine agonists associated with hypersomnolence and impulse control disorders
- Surgical treatments - medication refractory tremor / treatment related motor complications
Driving under low-contrast visibility conditions in Parkinson disease

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ABSTRACT

Objective: To assess driving performance in Parkinson disease (PD) under low-contrast visibility conditions.

Methods: Licensed, active drivers with mild to moderate PD (n = 67, aged 66.2 ± 9.0 years, median Hoehn-Yahr stage = 2) and controls (n = 51, aged 64.0 ± 7.2 years) drove in a driving simulator under high- (clear sky) and low-contrast visibility (fog) conditions, leading up to an intersection where an incurring vehicle posed a crash risk in fog.

Results: Drivers with PD had higher SD of lateral position (SDLP) and lane violation counts (LVC) than controls during fog (p < 0.001). Transition from high- to low-contrast visibility condition increased SDLP and LVC more in PD than in controls (p < 0.01). A larger proportion of drivers with PD crashed at the intersection in fog (76.1% vs 37.3%, p < 0.0001). The time to first reaction in response to incursion was longer in drivers with PD compared with controls (median 2.5 vs 2.0 seconds, p < 0.0001). Within the PD group, the strongest predictors of poor driving outcomes under low-contrast visibility conditions were worse scores on measures of visual processing speed and attention, motion perception, contrast sensitivity, visuospatial construction, motor speed, and activities of daily living score.

Conclusions: During driving simulation under low-contrast visibility conditions, drivers with Parkinson disease (PD) had poorer vehicle control and were at higher risk for crashes, which were primarily predicted by decreased visual perception and cognition; motor dysfunction also contributed. Our results suggest that drivers with PD may be at risk for unsafe driving in low-contrast visibility conditions such as during fog or twilight. Neurology 2009;73:1103-1110
Impaired navigation in drivers with Parkinson’s disease

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Navigating a new route during automobile driving uses the driver’s cognitive resources and has the potential to impair driving ability in people with Parkinson’s disease (PD). Our aim was to assess navigation and safety errors during a route following task (RFT) in drivers with the illness. Seventy-seven subjects with mild-moderate PD (median Hoehn–Yahr stage = 2.0) and 152 neurologically normal elderly adults, all active and licensed drivers, were tested with a battery of visual, cognitive and motor tests of abilities. Each driver also performed a RFT administered on the road in an instrumented vehicle. Main outcome variables included: number of incorrect turns, times lost and at-fault safety errors. All group comparisons were adjusted for age, gender, education and familiarity with the region. Drivers with PD performed significantly worse on cognitive, visual and motor tests compared to controls, and took longer to finish the RFT. Higher proportions of these drivers made incorrect turns (53.9% in PD versus 21.1% in controls, Odds Ratio (OR) [95% Confidence Interval (CI)] = 2.8 [1.4, 5.7], P = 0.006), got lost (15.8% versus 2.0%, OR [95%CI] = 4.7 [1.1, 20.0], P = 0.037), or committed at-fault safety errors (84.2% versus 46.7%, OR [95%CI] = 7.5 [3.3, 17.0], P < 0.001). Within the patient group, the navigational and safety errors were predicted by poor performances on cognitive and visual tests, but not by the severity of motor dysfunction. Drivers with PD made more navigation and safety errors than neurologically normal drivers on a RFT that placed demands on driver memory, attention, executive functions and visual perception. The PD group driver safety was degraded possibly due to an increase in the cognitive load in patients with limited reserves. Navigational errors and lower driver safety were associated more with impairments in cognitive and visual function than the motor severity of their disease in drivers with PD.
Quantitative assessment of driving performance in Parkinson’s disease

J M Wood, C Worthingham, G Kerr, K Mallon, P Silburn

Objectives: The primary aim of this study was to determine how Parkinson’s disease (PD) affects driving performance. It also examined whether changes in driver safety were related to specific clinical disease markers or an individual’s self rating of driving ability.

Methods: The driving performance of 25 patients with idiopathic PD and 21 age matched controls was assessed on a standardised open road route by an occupational therapist and driving instructor, to provide overall safety ratings and specific driving error scores.

Results: The drivers with PD were rated as significantly less safe (p<0.05) than controls, and more than half of the drivers with PD would not have passed a state based driving test. The driver safety ratings were more strongly related to disease duration (r = −0.60) than to their on time Unified Parkinson’s Disease Rating Scale (r = −0.24). Drivers with PD made significantly more errors than the control group during manoeuvres that involved changing lanes and lane keeping, monitoring their blind spot, reversing, car parking, and traffic light controlled intersections. The driving instructor also had to intervene to avoid an incident significantly more often for drivers with PD than for controls. Interestingly, driver safety ratings were unrelated to an individual’s rating of their own driving performance, and this was the case for all participants.

Conclusions: As a group, drivers with PD are less safe to drive than age matched controls. Standard clinical markers cannot reliably predict driver safety. Further studies are required to ascertain whether the identified driving difficulties can be ameliorated.
Real-life driving outcomes in Parkinson disease

ABSTRACT

Objective: To determine the incidence of and risk factors for driving outcomes in drivers with Parkinson disease (PD).

Methods: In a prospective cohort study, we ascertained the time until driving cessation, a crash, or a traffic citation using self-report and state Department of Transportation records in 106 licensed, active drivers with PD and 130 controls.

Results: Drivers with PD stopped driving earlier than controls, hazard ratio (95% confidence interval) = 7.09 (3.66-13.75), p < 0.001. Cumulative incidence of driving cessation at 2 years after baseline was 17.6% (11.5%-26.5%) for PD and 3.1% (1.2%-8.1%) for controls. No significant differences between groups on times to first crash or citation were detected. However, the number of observed crashes was low. Cox proportional hazards models showed that significant baseline risk factors for driving cessation in PD were older age, preference to be driven by somebody else, positive crash history, use of compensatory strategies, low driving exposure, impairments in visual perception (especially visual processing speed and attention) and cognitive abilities, parkinsonism (especially activities of daily living score and total daily dose of antiparkinsonian medications), and higher error counts on a road test. Within PD, crashes were associated with poorer postural stability and history of driving citations, and citations were associated with younger age and road errors at baseline.

Conclusions: Drivers with PD are at a higher risk of driving cessation than elderly control drivers. A battery evaluating motor and nonmotor aspects of PD, driving record, and performance can be useful in assessing future driving outcomes in PD. Neurology® 2011;76:1894-1902
UNIFIED PARKINSON’S DISEASE RATING SCALE (UPDRS)

I. MENTATION, BEHAVIOR AND MOOD

1. Intellectual Impairment
   0 = None.
   1 = Mild. Consistent forgetfulness with partial recollection of events and no other difficulties.
   2 = Moderate memory loss, with disorientation and moderate difficulty handling complex problems.
   3 = Severe memory loss with disorientation for time and often to place.
   4 = Severe impairment in handling problems.

2. Thought Disorder (Due to dementia or drug inteoxication)
   0 = None.
   1 = Vivid dreaming.
   2 = "Benign" hallucinations with insight retained.
   3 = Occasional to frequent hallucinations or delusions; without insight;
     could interfere with daily activities.
   4 = Persistent hallucinations, delusions, or florid psychosis. Not able to care for self.

3. Depression
   0 = None.
   1 = Periods of sadness or guilt greater than normal, never sustained for days or weeks.
   2 = Sustained depression (1 week or more).
   3 = Sustained depression with vegetative symptoms (insomnia, anorexia, weight loss, loss of interest).
   4 = Sustained depression with vegetative symptoms and suicidal thoughts or intent.

4. Motivation/Initiative
   0 = Normal.
   1 = Less assertive than usual; more passive.
   2 = Loss of initiative or disinterest in elective (nonroutine) activities.
   3 = Loss of initiative or disinterest in day to day (routine) activities.
   4 = Withdrawn, complete loss of motivation.

II. ACTIVITIES OF DAILY LIVING (for both "on" and "off")

5. Speech
   0 = Normal.
   1 = Mildly affected. No difficulty being understood.
   2 = Moderately affected. Sometimes asked to repeat statements.
   3 = Severely affected. Frequently asked to repeat statements.
   4 = Unintelligible most of the time.

6. Salivation
   0 = Normal.
   1 = Slight but definite excess of saliva in mouth; may have nighttime drooling.
   2 = Moderately excessive saliva; may have minimal drooling.
   3 = Marked excess of saliva with some drooling.
   4 = Marked drooling, requires constant tissue or handkerchief.

7. Swallowing
   0 = Normal.
   1 = Rare choking.
   2 = Occasional choking.
   3 = Requires soft food.
   4 = Requires NG tube or gastrostomy feeding.

8. Handwriting
   0 = Normal.
   1 = Slightly slow or small.
   2 = Moderately slow or small; all words are legible.
   3 = Severely affected; not all words are legible.
   4 = The majority of words are not legible.

9. Cutting food and handling utensils
   0 = Normal.
   1 = Somewhat slow and clumsy, but no help needed.
   2 = Can cut most foods, although clumsy and slow; some help needed.
   3 = Food must be cut by someone, but can still feed slowly.
   4 = Needs to be fed.

10. Dressing
    0 = Normal.
    1 = Somewhat slow, but no help needed.
    2 = Occasional assistance with buttoning, getting arms in sleeves.
    3 = Considerable help required, but can do some things alone.
    4 = Helpless.

11. Hygiene
    0 = Normal.
    1 = Somewhat slow, but no help needed.
    2 = Needs help to shower or bathe; or very slow in hygienic care.
    3 = Requires assistance for washing, brushing teeth, combing hair, going to bathroom.
    4 = Foley catheter or other mechanical aids.

12. Turning in bed and adjusting bed clothes
    0 = Normal.
    1 = Somewhat slow and clumsy, but no help needed.
    2 = Can turn alone or adjust sheets, but with great difficulty.
    3 = Can initiate, but not turn or adjust sheets alone.
    4 = Helpless.

13. Falling (unrelated to freezing)
    0 = None.
    1 = Rare falling.
    2 = Occasionally falls, less than once per day.
    3 = Falls an average of once daily.
    4 = Falls more than once daily.

14. Freezing when walking
    0 = None.
    1 = Rare freezing when walking; may have stathesitation.
    2 = Occasional freezing when walking.
    3 = Frequent freezing. Occasionally falls from freezing.
    4 = Frequent falls from freezing.

15. Walking
    0 = Normal.
    1 = Moderate difficulty, may not swing arms or may tend to drag leg.
    2 = Moderate difficulty, but requires little or no assistance.
    3 = Severe disturbance of walking, requiring assistance.
    4 = Cannot walk at all, even with assistance.

16. Tremor (Symptomatic complaint of tremor in any part of body.)
    0 = Absent.
    1 = Slight and infrequently present.
    2 = Moderate; bothersome to patient.
    3 = Severe; interferes with many activities.
    4 = Marked; interferes with most activities.
IV. COMPLICATIONS OF THERAPY (in the past week)

A. DYKSINESIAS

32. Duration: What proportion of the waking day are dyskinesias present? (Historical information.)
0 = None
1 = 1-25% of day.
2 = 26-50% of day.
3 = 51-75% of day.
4 = 76-100% of day.

33. Disability: How disabling are the dyskinesias? (Historical information; may be modified by office examination.)
0 = Not disabling.
1 = Mildly disabling.
2 = Moderately disabling.
3 = Severely disabling.
4 = Completely disabled.

34. Painful Dyskinesias: How painful are the dyskinesias?
0 = No painful dyskinesias.
1 = Slight.
2 = Moderate.
3 = Severe.
4 = Marked.

35. Presence of Early Morning Dystonia (Historical information.)
0 = No
1 = Yes

B. CLINICAL FLUCTUATIONS

36. Are "off" periods predictable?
0 = No
1 = Yes

37. Are "off" periods unpredictable?
0 = No
1 = Yes

38. Do "off" periods come on suddenly, within a few seconds?
0 = No
1 = Yes

39. What proportion of the waking day is the patient "off" on average?
0 = None
1 = 1-25% of day.
2 = 26-50% of day.
3 = 51-75% of day.
4 = 76-100% of day.

C. OTHER COMPLICATIONS

40. Does the patient have anorexia, nausea, or vomiting?
0 = No
1 = Yes

41. Any sleep disturbances, such as insomnia or hypersomnia?
0 = No
1 = Yes

42. Does the patient have symptomatic orthostasis? (Record the patient's blood pressure, height and weight on the scoring form)
0 = No
1 = Yes

V. MODIFIED HOEHN AND Yahr STAGING

STAGE 0 = No signs of disease.
STAGE 1 = Unilateral disease.
STAGE 1.5 = Unilateral plus axial involvement.
STAGE 2 = Bilateral disease, without impairment of balance.
STAGE 2.5 = Mild bilateral disease, with recovery on pull test.
STAGE 3 = Mild to moderate bilateral disease; some postural instability; physically independent.
STAGE 4 = Severe disability; still able to walk or stand unassisted.
STAGE 5 = Wheelchair bound or bedridden unless aided.

VI. SCHWAB AND ENGELAND ACTIVITIES OF DAILY LIVING SCALE

100% = Completely independent. Able to do all chores without slowness, difficulty or impairment. Essentially normal. Unaware of any difficulty.
90% = Completely independent. Able to do all chores with some degree of slowness, difficulty and impairment. Might take twice as long. Beginning to be aware of difficulty.
80% = Completely independent in most chores. Takes twice as long. Conscious of difficulty and slowness.
70% = Not completely independent. More difficulty with some chores. Three to four times as long in some. Must spend a large part of the day with chores.
60% = Some dependency. Can do most chores, but exceedingly slowly and with much effort.
50% = More dependent. Help with half, slower, etc. Difficulty with everything.
40% = Very dependent. Can assist with all chores, but few alone.
30% = With effort, now and then does a few chores alone or begins alone. Much help needed.
20% = Nothing alone. Can be a slight help with some chores. Severe invalid.
10% = Totally dependent, helpless. Complete invalid.
0% = Vegetative functions such as swallowing, bladder and bowel functions are not functioning. Bedridden.