Postgrad Med J 1995; 71: 525–528 © The Fellowship of Postgraduate Medicine, 1995

Medicine in the elderly

The older driver – a review

Rosemary Morgan, Debra King

Summary
There are differences between elderly drivers and younger drivers in that the elderly are more likely to have cognitive, motor and sensoriperceptual deficits affecting their driving performance. The elderly driver is more likely to have a chronic illness and to be on medication, that might adversely affect driving. The elderly driver requires more study and help either by retraining or provision of adaptations to vehicles. Fitness to drive is of clinical importance to doctors in most specialities and recent studies would suggest that doctors need to be more aware of the current guidelines on driving and be prepared to offer advice.

Keywords: elderly, driving

Driving is dependent on the following
• cognitive function • motor function • sensoriperceptual function

Box 1

Withington Hospital, Nell Lane, West Didsbury, Manchester M20 8LE, UK
R Morgan

Arrowe Park Hospital, Arrowe Park Road, Wirral, Merseyside, UK
D King

Accepted 3 May 1995

Although elderly drivers form only a small percentage of the approximately 25 million licence holders in the UK, the number is likely to increase in future years as a result of an ageing population. It is estimated that by the year 2000 about a quarter of the driving population in the UK will be over 55 years of age.[1] Recent media interest in road traffic accidents (RTAs) involving elderly patients has led to increased public concern about the safety of elderly drivers. However, is this concern justified and are elderly drivers any different from drivers of other ages?

The act of driving is taken for granted but it is a complex task and is dependent on cognitive, motor and sensoriperceptual functions (box 1). All decline to some extent with advancing age.[2] The elderly driver is more likely to have a physical illness (either single or multiple) than the younger driver and is also more likely to be on medication which may have an effect on driving.

It has been found[3] that many elderly drivers, as a result of being aware of a reduction in motor/sensoriperceptual function, tend to drive shorter distances at slower speeds. In addition they drive less at night and avoid rush hours.[4] Although the elderly drive fewer miles than the average driver they have higher crash rates per mile driven than any other age group with the exception of those under the age of 24 years.[5] Moreover, RTAs are 3.5 times more likely to be fatal for older drivers.[6]

Driving is an important means of maintaining freedom and independence for older people. They are more likely to have disabilities restricting mobility and access to routine transport, so without their own cars they are limited and their quality of life is reduced. It is therefore important to protect an individual's right to drive provided they have the ability to do so. Doctors have an important role to play in assessing, advising and helping elderly drivers.

Age-related changes affecting driving

COGNITIVE IMPAIRMENT

Cognitive impairment increases with age, is common and may affect over 20% of people over 85 years of age in the community.[7] Many patients with dementia lack insight and continue to drive.[8] Cognitive impairment may result in memory loss, reduced attention span, difficulties in visual perception and impaired judgement which may interfere with driving skills.[9] Cognitive impairment has been linked to higher rates of RTAs in elderly individuals.[10]

PSYCHOMOTOR SLOWING

Psychomotor slowing is also a frequent sequel of ageing. The reasons for slowing are unclear but are probably due to a combination of peripheral and central processes.[11] Motor strength is important for driving, even for power-assisted control devices and also appears to deteriorate with age. Although there is loss of all muscle fibres in the elderly the loss of muscle tissue is greater for fast twitch fibres than for slow twitch fibres, a likely contributing factor to psychomotor slowing.[12] There is also a reduction in myosin adenosine triphosphatase activity and in responsiveness to electrical stimulation which also reduces muscle strength.[12] A measure of psychomotor function is simple reaction time, ie, the speed of response to onset of a single stimulus, which is likely to increase with age.[11] Reductions in musculoskeletal function, including decreases in muscle strength, flexibility, co-ordination and reductions in reaction time, adversely influence driving performance.[13]

Sensoriperceptual changes with age

There is a decline in visual acuity with age. Peripheral vision is also affected and the total horizontal peripheral visual field typically drops from 170 degrees in a young adult to 140 degrees by the age of 50.[14] The majority of sensory input for the driver comes from visual perception, and much of this is from the periphery.

Optical changes affecting the older eye

- decreased night visual acuity
- decreased visual acuity
- decreased resistance to glare
- reduction in amplitude of accommodation – presbyopia
- progressive decline in visual fields
- increased dark-adaptation time

Box 2

It is not surprising that those with poor peripheral vision have RTA rates twice as high as those with normal peripheral vision.[15]

With advancing years difficulty with night-time driving results from several factors. Resistance to glare declines by 50% every 12 years,[1,6] due to age-associated lens protein changes and increased lens density causing increased scatter of light. The time required to recover from glare also increases with age. Pupillary miosis and increased lens density also reduce illumination reaching retinal photoreceptors.

The law states that a licence holder must be able to read in good daylight a registration mark fixed to a motor vehicle and containing letters and figures 79.4 millimetres high at a distance of 20.5 metres. In practice this corresponds to between 6/9 and 6/12 on the Snellen chart.

In addition to the ageing changes affecting the eye, some ocular diseases increase in prevalence with age and can result in additional visual impairment.[16] Cataracts, glaucoma, macular degeneration and corneal disease can interfere with driving safety. Moreover, these disorders have an insidious onset and may not cause symptoms although they result in visual impairment. Consequently drivers may not be aware of having a significant visual disability.

Type of RTAs affecting elderly drivers

RTAs in elderly drivers compared to younger drivers

- more likely to involve multiple vehicles
- more likely to result in more serious injury
- more likely to occur at junctions

Box 3

The type of RTA the elderly driver is involved in differs from those in younger age groups (see box 3). Right of way and traffic sign violations are more common in older people.[5] There is also a higher incidence of RTAs in elderly drivers at junctions compared to younger drivers.[17] This suggests that some elderly drivers may have problems with decisions requiring complicated perceptual and cognitive functions. RTAs involving elderly drivers are more likely to involve multiple vehicles and result in more serious injuries.[6]

Medical conditions affecting drivers

Medical conditions affecting driving

Conditions affecting the level of consciousness
- epilepsy
- diabetes mellitus
- cardiogenic syncope

Conditions affecting body control
- stroke
- Parkinson's disease
- visual acuity, visual fields, night vision
- ophthalmic disease
- degenerative joint disease
- dementia

Box 4

Currently in the UK a driver is issued with a Group 1 licence until the age of 70 years and thereafter a three-year licence by completion of a medical questionnaire. Sometimes a medical by an independent medical practitioner is required by the Driver Vehicle Licensing Authority (DVLA).

The Road Traffic Act[18] states that if a driver has a relevant disability they must notify the DVLA on being made aware of that disability. It is a doctor's duty to inform a patient if they have a relevant disability or disease which requires them to stop driving. Studies in the UK have shown that many doctors are unaware of the recommendations made by the DVLA for particular medical conditions.[19,20] Moreover recent studies[21-23] have shown that doctors fail to advise drivers with particular conditions. There has been at least one case in which a doctor who failed to advise a patient to stop driving and notify the DVLA was held to be legally liable when the patient was subsequently involved in an RTA.[20] If a patient refuses to discontinue driving even after a doctor's advice the doctor should inform the patient that he/she will inform the medical adviser at the DVLA. The doctor is within his/her rights to breach doctor/patient confidentiality as he/she has a responsibility to society as well as his/her patient.

A number of chronic illnesses are more prevalent in the elderly. It has been shown that drivers with epilepsy, heart disease, renal disease and diabetes mellitus had higher crash rates than the general public.[24]

EPILEPSY

Epilepsy has a high incidence in the elderly. The DVLA currently recommends that a licence can only be granted provided the patient has been free of an epileptic attack for one year or that the patient has only had an epileptic attack whilst asleep in the past three years.[25]

DIABETES MELLITUS

Ward *et al*[26] found that almost all of the insulin-dependent diabetics recruited had experienced a hypoglycaemic episode at some time and for 30% of the patients hypoglycaemia is a major problem. An RTA was attributable to a hypoglycaemic episode in 13%.

The DVLA recommendations on diabetes and driving include the following: insulin-dependent diabetics must demonstrate satisfactory control, recognise hypoglycaemia and meet visual standards. They are granted a 1, 2 or 3 year licence. Renewal is on confirmation of satisfactory health by a doctor. For non-insulin dependent diabetics a licence is granted subject to satisfactory medical enquiries until the age of 70 provided they do not develop relevant disabilities, (hypoglycaemic episodes and visual disturbances). If managed by

diet alone they do not have to notify the DVLA unless they develop complications.

CARDIOVASCULAR DISEASE

The risk of a patient driving with a cardiac condition is related to the probability of an incapacitating event occurring and the time spent whilst driving. Most studies to date have reported a low incidence of cardiac-related events whilst driving. Sudden death or loss of consciousness by a driver has accounted for less than 2% of RTAs involving injury or death.[27]

The DVLA currently recommends that if angina occurs at the wheel driving must cease. When symptoms are controlled driving may resume. Following a myocardial infarction or insertion of a pacemaker, driving should cease for at least one month. If a patient has heart failure, provided there is satisfactory control, driving is permitted. If a patient has an arrhythmia likely to distract his attention, driving should cease.

ARTHRITIS

Musculoskeletal problems, especially osteoarthritis, are common in the elderly. Cervical spine stiffness may add to a reduction in peripheral vision and limit perception of oncoming traffic. Specific driving tasks most at risk from osteoarthritis and rheumatoid arthritis are breaking, turning and gripping the wheel. A hand deformity may be sensitive to pressure and make the patient unwilling to apply full strength to the steering wheel. Foot pain is important because lower extremity function for breaking and acceleration is important.

Arthritis may affect driving in two ways

- pain producing involuntary hesitancy
- restriction in range of movement

Box 5

CEREBROVASCULAR DISEASE

In the UK all patients are automatically suspended from driving for one month following either a transient ischaemic attack or stroke because of the high risk of recurrence of both cerebrovascular disease as well as ischaemic heart disease.[25] The diagnosis of stroke alone is insufficient to determine whether a patient is competent enough to drive or not. Physical and cognitive impairment need to be assessed for each individual patient.

In a recent study,[28] subjects who had been regular drivers prior to their stroke were referred to three Stroke Units for assessment of their driving ability. Subjects undertook a road test and were graded into pass or fail groups. All subjects were then randomised into two groups. The first group was tested using the stroke drivers screening assessment, a brief screening measure designed for nurses or therapists to administer. The patient's general practitioner was given the results of the assessment with a recommendation about fitness to drive. Patients in the control group were instructed to ask their general practitioners for advice regarding fitness to drive. For each group, the decision made was compared with performance on the driving test. The stroke drivers screening assessment correctly predicted the road performance of 81% of the patients whereas the decision made by the general practitioner or the DVLA only predicted the performance of 56% of the patients. It would appear that the present system allows a substantial proportion of unsafe drivers to resume driving and use of the stroke drivers screening assessment would be a cheap and simple improvement on the present system. However, since even this is not entirely accurate, road testing is recommended.

PARKINSON'S DISEASE

Provided medical assessment confirms that driving performance is not impaired, a licence can be issued until the age of 70. The licence may be restricted to 'with controls to suit the disability'. The DVLA should be informed by the patient.

DEMENTIA

The DVLA guidelines for dementia are not clearcut. If a patient has early dementia, provided there is 'adequate retention of insight and judgement and there is no significant disorientation in time and space, driving may be permitted, although annual medical review is required'.

Age-related changes in pharmacokinetics/ pharmacodynamics

- reduced hepatic circulation
- reduced efficiency of oxidative metabolism
- reduction in renal function
- increase in the fat-to-lean body mass ratio
- reduction in serum albumin with higher concentrations of free protein-bound drugs
- increased receptor sensitivity for some drugs

Box 6

Medications and driving

Elderly drivers are more likely to be on medication than other drivers. They are also more likely to be sensitive to the side effects of medications as a result of age-related changes in pharmacokinetics and pharmacodynamics. The effects of medications on driving have been assessed by experimental studies of drug effects on psychomotor function and epidemiological studies of the association between RTAs and medication use (see box 7). Those drugs suppressing

Medications used by elderly patients which may have adverse effects on driving

- benzodiazepines
- antidepressants
- opioid analgesics
- hypoglycaemics
- antihistamines

Box 7

Guidelines for assessing the older driver

- visual screening: evaluate visual acuity and fields. Refer for ophthalmological assessment if in doubt
- cognitive screening: Mini-Mental State Examination; history from patient and relative where possible
- musculoskeletal assessment: test cervical mobility, gait and balance
- assessment of functional status: Activities of Daily Living scale
- assessment of medications: advise patient of any sedative side-effects and reduce where possible. Also advise on possible interactions with alcohol.
- driving record, details of any past or near crashes
- if in doubt refer for formal assessment at a Driving Centre
- if ethical dilemmas arise, discuss with the Medical Adviser at the DVLA

Box 8

psychomotor function by sedative or other mechanisms are prescribed more commonly in the elderly.

In the Tenessee Medicaid Cohort Study[29] 16 262 people aged between 65–84 years were followed up for four years and details on any RTA they were involved in obtained from police records. Medicaid prescription records gave information on those taking benzodiazepines. The annual rate of involvement in RTAs with injury involving drivers not on benzodiazepines was 12/1000 person years. This rate was 50% higher in benzodiazepine users ($p < 0.05$). In the same study, users of tricyclic antidepressants had a more than doubled risk of RTA with injury ($p < 0.01$). In the DVLA guidelines on fitness to drive it is stated that patients should be advised about the possible effects of any medication which may affect fitness to drive.

Duty of care

The medical profession needs to be aware of the current guidelines advised by the DVLA on driving and medical conditions, not just for medicolegal purposes but to safeguard all drivers and the public. Although no one wants to restrict personal freedom, especially in the elderly for whom driving may be central to their continued independence, we have a duty of care to the patient to advise them when their health may have a negative effect on driving. Physicians who care for elderly patients have a crucial role to play in screening for a variety of conditions, often reversible, with potential effects on driving safety.

Advice on driving may not necessarily be negative. There are 10 driving assessment centres in the UK where elderly drivers can be referred for further assessment and advice on modifications to their cars which would help make driving safer for them.[30]

1 Bull JP, Raffle PAB. The aging driver. *J R Soc Med* 1992; **85:** 188–9.
2 Welford AT. Psychomotor performance. *Annu Rev Gerontol Geriatr* 1984; **4:** 237.
3 Case HW, Hulbert S, Beers J. *Driving ability as affected by age.* Final report (No 70–17). Los Angeles: Institute of Transportation and Traffic Engineering, 1970.
4 Planek TW, Overend RB. Profile of the ageing driver. *Traffic Safety* 1973; **13:** 9.
5 Cerreli E. *Older drivers, the age factor in traffic safety.* DOT HS 807 402, NHTSA Technical Report, Feb 1989.
6 Klamm ER. Auto insurance: needs and problems of drivers 55 and over. In: Malfetti JL, ed. *Proceedings of the older driver colloquium.* Falls Church, VA: AAA Foundation for Traffic Safety, 1985; p26.
7 Pfeiffer RI, Afifi AA, Chance JM. Prevalence of Alzheimer's disease in a retirement community. *Am J Epidemiol* 1987; **125:** 420–36.
8 Retchin SR, Cox J, Fox M, Irwin L. Performance based measurements among elderly drivers and non drivers. *J Am Geriatr Soc* 1988; **36:** 813–9.
9 Hart S, Semple JM. *Neuropsychology and the dementias.* London: Taylor and Francis, 1991.
10 Friedland RP, Koss E, Kumar A. Motor vehicle crashes in dementia of the Alzheimers type. *Ann Neurol* 1988; **24:** 782–6.
11 Welford AT. Between bodily changes and performance: some possible reasons for slowing with age. *Exp Aging Res* 1984; **10:** 73–88.
12 Larsson L. Ageing in mammalian skeletal muscle. In: Mortimer JA, Pirrozolo FJ, Maletta GJ, eds. *The aging motor system.* New York: Praeger, 1982; pp 60–97.
13 Halpern D. Age differences in response time to vehicle traffic signs. *Exp Aging Res* 1984; **10:** 201–4.
14 Panek PE, Barrett GV, Sterns HL. A review of age related changes in perceptual information processing ability with regard to driving. *Exp Aging Res* 1977; **3:** 387.
15 Allen MJ. Vision of the older driver: implications for vehicle and highway design and for driver testing. In: Malfetti JL ed. *Proceedings of the older driver colloquium.* Falls Church, VA: AAA Foundation for Traffic Safety, 1985; p1.
16 Keltner JL, Johnson CA. Visual function, driving safety and the elderly. *Ophthalmology* 1987; **94:** 1180–8.
17 Hakamies-Blomqvist L. Aging and fatal accidents in male and female drivers. *J Gerontol* 1994; **4:** S286–90.
18 *Road Traffic Act.* London: HMSO, 1988.
19 King D, Benbow SJ, Barrett JA. The law and medical fitness to drive: a study of doctors' knowledge. *Postgrad Med J* 1992; **68:** 624–8.
20 O'Neill D, Crosby T, Shaw A, Haigh R, Hendra TJ. Fitness to drive and the older patient: awareness among hospital physicians. *Lancet* 1994; **344:** 1366–7.
21 MacMahon M, Lawson J, O'Neill D, Kenny RA. Syncope and driving. *Age Ageing* 1994; **23** (Suppl 4): 12.
22 Potamitis T, Aggarwal RK, Tsaloumas M, McLaughlin J, O'Neill E. Driving, glaucoma, and the law. *BMJ* 1994; **309:** 1057–8.
23 Morgan R, Turnbull CJ, King D. The prevalence of drivers in acute geriatric wards. *Postgrad Med J* 1995; in press.
24 Waller JA. *Medical impairment to driving.* Springfield IL: CC Thomas, 1973.
25 *For medical practitioners at a glance. Guide to current medical standards to fitness to drive.* Medical Advisory Branch Driving and Vehicle Licensing Agency, September 1993.
26 Ward CM, Stewart AW. Hypoglycaemia in insulin-dependent diabetic patients attending an outpatient clinic. *N Z Med J* 1990; **103:** 339–41.
27 Petersen BJ, Patty CS. Sudden natural death among automobile drivers. *J Forensic Sci* 1962; **7:** 274–85.
28 Nouri FM, Lincoln NB. Predicting driving performance after stroke. *BMJ* 1993; **307:** 482–3.
29 Ray WA, Fought RL, Decker MD. Pyschoactive drugs and the risk of injurious motor vehicle crashes in elderly drivers. *Am J Epidemiol* 1992; **136:** 873–83.
30 Murray-Leslie C. Aids for disabled drivers. *BMJ* 1990; **301:** 1206–9.