Fitness to Drive in Cardiovascular Disease

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SUMMARY

Background: Medical students are taught little or nothing about the medical considerations related to the driving of motor vehicles. Physicians treating patients with cardiovascular disease need to acquire competence in traffic medicine in order to be able to advise them about their fitness to drive.

Methods: We present the current governmental regulations and recommendations concerning fitness to drive in patients with cardiovascular disease. We also review pertinent publications that were retrieved by a selective search in PubMed with the search terms “cardiovascular disease and traffic accidents” and “cardiovascular disease and traffic deaths” for the decade 2007–2016, as well as further publications collected by us individually.

Results: Cardiovascular disease can make a driver lose control of a vehicle without warning and thereby lead to an accident. The main pathophysiological mechanisms of sudden loss of control are disturbances of brain perfusion (e.g., syncope with or without cardiac arrhythmia, sudden cardiac death due to ventricular fibrillation or asystole, stroke, aneurysm rupture) and marked general weakness (e.g., after major surgery or in cardiac insufficiency).

Conclusion: Patients with cardiovascular disease should be advised by their physicians about their fitness to drive, and the discussion should be documented in writing. Because of the German law on the confidentiality of medical data, only the affected patient should receive this information, with very few exceptions.

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With few exceptions, any person driving a motor vehicle on public roads must be in possession of a driving license. Individuals in possession of a driving license are regarded as fit to drive if they can meet the physical and mental demands of dealing with road traffic. If a person with a driving license has any physical or mental disability, § 2, paragraph 1 of the German Driving License Regulations (FeV, *Fahrerlaubnisverordnung*) provides that he or she may only drive if care is taken to ensure that other road users are not put at risk. This is a question that particularly affects patients with chronic diseases (1). Chronic diseases are covered in Appendix 4 of the German Driving License Regulations. They include visual and hearing impairments, impaired mobility, cardiovascular disease, diabetes mellitus, neurological disease, mental disorders, and drug and/or alcohol addiction. Appendix 4 of the German Driving License Regulations details the circumstances under which persons with any of these chronic conditions are fit to drive or have restrictions laid on their fitness to drive. Restricted fitness to drive usually involves regular testing, expert medical opinion, or restrictions on motor vehicle type or driving time, which are specified in reports from experts in traffic medicine. The term „fitness to drive“ (*Fahreignung*) refers to expected long-term capacity to drive, whereas the term „ability to drive“ (*Fahrtüchtigkeit*) refers to the driver’s ability in their current state of health to control a vehicle over a long distance even in difficult traffic situations (1).

At medical school, medicine in relation to road safety is a subject that is barely touched upon, if at all (2). However, to be able to tell a patient with cardiovascular disease that he or she is not fit to drive, the treating physician must have acquired some knowledge of traffic medicine. Cardiovascular disease that can render a patient unfit to drive includes coronary heart disease, myocardial infarction, cardiac insufficiency of various etymologies, brady- or

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Permission to drive

If the holder of a driving license has any physical or mental disability, he or she may only drive if precautions have been taken to ensure that other road users are not put at risk.

tachyarrhythmias with or without pacemaker/defibrillator implantation, and syncope. Assessment of fitness to drive is based on Appendix 4 of the German Driving License Regulations (FeV) and on the Assessment Guideline issued by the German Federal Highway Research Institute (BAST, *Bundesanstalt für Straßenwesen*), which implement European Union standards in Germany. The present article reproduces the contents of these documents in shortened form.

Learning goals

After reading this article, readers should

- know which legal provisions govern assessment of a patient's fitness to drive.
- be able to assess a patient's fitness to drive in accordance with current guidelines.
- know when it would be appropriate to consult a physician specializing in traffic medicine.

Road accidents following cardiovascular events

Cardiovascular disease can lead to accidents due to sudden loss of control by drivers. The most important pathophysiological mechanisms behind sudden loss of control of this kind are:

- cerebral perfusion disorders (e.g., syncope with or without cardiac arrhythmia, sudden cardiac death in patients with ventricular fibrillation or asystole, stroke, aneurysm rupture) or
- pronounced general weakness (after major surgery or severe heart failure).
- Other diseases that can likewise lead to accidents include alcohol or drug consumption, epileptic seizures, hypoglycemia in patients with diabetes mellitus, daytime fatigue related to sleep apnea, cognitive disorders in persons suffering from psychosis, or disturbances of vision following a stroke.

Disease as a cause of road traffic accidents is not recorded in Germany, and only a very vague estimate of its incidence can be made. Old (1963) data from England suggest that about 1.5 out of every 1000 accidents are caused by sudden illness of the driver, and chronic illness may have been a factor in 5 out of 1000 accidents (3). A retrospective study of fatal road accidents in Finland and Switzerland concluded that about 2.5% of road deaths in Finland between 1984 and 1989 and 6.4% of road deaths in the Swiss canton of Waadt between 1986

BOX

Driving license categories

For the purposes of assessing fitness to drive, German driving licenses fall into two groups. Group 1 contains categories A, A1, A2, B, BE, AM, L, and T. This group, referred to for simplicity as „private drivers," includes the driving of motorcycles, cars, trucks up to 3.5 tons weight overall, and tractors. Group 2, referred to for simplicity as „occupational drivers," includes the driving license categories C, C1, CE, C1E, D, DE, D1E, and FzF. These categories include the driving of trucks >3.5 tons weight overall or commercial vans and commercial passenger transport (e.g., buses, taxis, hire cars, ambulances). The medical standards applied to assessing group 2 drivers are generally higher than those applied to group 1 drivers. For example, Appendixes 5 and 6 of the German Driving License Regulations lay down that from a certain age onwards, drivers in group 2 must have their fitness to drive assessed every 5 years.

and 1989 were related to a driver's sudden loss of consciousness at the wheel (4). According to a retrospective study in Germany, about 0.4% of road deaths are of persons who die a sudden natural death at the wheel. Among these, the main cause of death is coronary heart disease (5). In Japan, between 2004 and 2006, 211 cases of sudden incapacity to drive were notified to the Ministry of Transport; these were due to cerebrovascular disease (28.4%), cardiac and aortic disease (26.1%), syncope (8.5%), and gastrointestinal disease (8.1%). In 64.7% of these cases an accident occurred. Thirty-six percent of the drivers died immediately of their illness (6). According to other studies, disease-related road traffic accidents occur more often. A retrospective study in Finland estimates that in 20% to 30% of all fatal road accidents involving persons over 65 years of age, impaired concentration due to disease may have been involved, and in most cases (70%) the disease is cardiovascular (7). An autopsy study from Canada also suggests that coronary heart disease in drivers over the age of 60 plays an important role in road accidents. In this age group, 86% of drivers who died at the wheel had significant coronary heart disease. Of these, 40% had been driving

Assessment of fitness to drive

Assessment of fitness to drive is governed by Appendix 4 of the FeV and on the Assessment Guideline issued by the German Federal Highway Research Institute (BAST), which implement European Union standards in Germany.

Coronary heart disease the main cause of death

According to a retrospective German study, about 0.4% of road deaths are of persons who die a sudden natural death at the wheel. Among these, the main cause of death is coronary heart disease.

TABLE 1

Extract from Appendix 4 of the German Driving License Regulations relating to fitness to drive of individuals with cardiovascular disease

Diagnosis	Group 1 (private) drivers Fit to drive: yes/no	Group 2 (occupational) drivers Fit to drive: yes/no
4.1 Cardiac arrhythmia with episodes of impaired consciousness or loss of consciousness – After successful treatment with medication or cardiac pacemaker	No Yes	No Yes
4.2 Hypertension (blood pressure too high) 4.2.1 Elevated blood pressure with cerebral symptoms and/or visual disturbances 4.2.2 Blood pressure >180 mmHg (systolic) and/or 110 mmHg (diastolic)	No Usually yes	No Case-by-case decision
4.3 Hypotension (blood pressure too low) 4.3.1 Usually no relevant health impairment 4.3.2 Rarely, hypotension-related sudden episodes of impaired consciousness	Yes Yes, if blood pressure values are stabilized by treatment	Yes Yes, if blood pressure values are stabilized by treatment
4.4 Acute coronary syndrome (myocardial infarction) – EF >35% – EF <35% or acute decompensated heart failure in the context of acute myocardial infarction	Yes if no complications May be fit to drive 4 weeks after the event	May be fit to drive 6 weeks after the event Usually no
4.5 Heart failure due to congenital or acquired heart defects or other causes – NYHA I (cardiac disease without limitation of physical activity) – NYHA II (slight limitation of physical activity) – NYHA III (symptoms occur during mild activity) – NYHA IV (symptoms occur at rest)	Yes Yes Yes (if stable) No	Yes, if EF >35% Yes, if EF >35% No No
4.6 Peripheral arterial occlusive disease – With pain at rest – After intervention – After surgery – Aortic aneurysm, asymptomatic	No Yes after 24 hours Yes after 1 week No restriction	No Yes after 1 week Yes after 4 weeks No restriction if aneurysm diameter up to 5.5 cm. Unfit to drive if aneurysm diameter >5.5 cm

EF, left ventricular ejection fraction; NYHA, New York Heart Association classification of heart failure

Group 1 drivers

Group 1 drivers can, for example, continue to drive with NYHA stage I, II, or III heart disease, even if their physical activity is limited or symptoms occur with only mild activity.

Group 2 drivers

Group 2 drivers must always, or from a given age onwards, have their fitness to drive assessed every 5 years. The requirements relating to disease in this group are stricter than those for Group 1 drivers.

TABLE 2

Pacemakers/implanted defibrillators (ICDs) and fitness to drive*

Measure	Group 1 (private) drivers	Group 2 (occupational) drivers
With implanted pacemaker or replacement pacemaker	No restriction	Fit to drive after 1 week (after 4 weeks if history of syncope or dependent on pacemaker)
ICD		
For primary prevention	Fit to drive after 1–2 weeks	Usually unfit to drive
For secondary prevention	Fit to drive after 3 months	Usually unfit to drive
After appropriate shock	Usually fit to drive after 3 months	Usually unfit to drive
After inappropriate shock	Fit to drive after underlying cause has been removed	Usually unfit to drive
After box change	Fit to drive after 1 week	Usually unfit to drive
After electrode change/revision	Usually fit to drive after 1–2 weeks	Usually unfit to drive
Recurrent ventricular tachycardia	Case-by-case decision, cardiological examination	Usually unfit to drive
ICD refused	For primary prevention: no restriction; For secondary prevention: fit to drive after 6 months	Usually unfit to drive

*Adapted from (14)

erratically before the accident, and this was inferred to be due to loss of control caused by acute myocardial ischemia (8). In patients with acute myocardial ischemia, the main concerns are tachyarrhythmias such as ventricular tachycardia or ventricular fibrillation. In Ontario, Canada, patients who were regarded by their physician as unfit to drive were reported to the licensing authority. Loss of fitness to drive could result from diseases such as alcoholism, epilepsy, dementia, syncope, or cardiovascular disease. From April 2006 to December 2009, more than 100 000 patients received a warning from over 6000 physicians about their fitness to drive. Before receiving the warning, each year 0.476% of these drivers had been treated in an emergency department in Ontario because of a road accident in which they had been involved as a driver. After the warning, the annual rate of emergency department visits due to a road accident dropped to 0.273%, meaning that in this patient group this preventive measure reduced the accident rate by about 45%. Nevertheless, the accident rate was still higher than among the general population in Ontario (9). It may be assumed that disease plays a significant part in road accidents, and that cardiovascular disease as a cause of accidents increases with age (*Box*).

Confidentiality and the duty to inform

Treating physicians are under an obligation to tell their patients if they believe they are unfit to drive, and to record the fact that they have done so (10). This duty to inform, which previously was based on the medical treatment contract, has since February 2013 been formally laid down in the law governing patient rights as § 630 of the German Civil Code. Under this law, the physician is required to tell the patient all the important facts about his or her illness—and that includes the medical assessment of the patient's fitness or otherwise to drive. Withholding such information is held to be a medical treatment error (10).

Because of the confidentiality law in Germany, the only person informed by the physician about a loss of fitness to drive is the patient concerned. Informing the authorities (licensing authority, police) is not required and indeed is not permitted. The topic of patient confidentiality and fitness to drive was discussed extensively at the 50th Road Traffic Law Conference in Goslar in 2012 in Working Group III: Risk to Road Traffic from Disease-Related Impairments of Fitness to Drive and Driving Safety. This working group confirmed what had already been affirmed at the Road Traffic Law Conference in 2005—that in extreme cases the

Loss of fitness to drive

In Canada, loss of fitness to drive was caused by diseases such as alcoholism, epilepsy, dementia, syncope, and cardiovascular disease.

Confidentiality and fitness to drive

Because of the confidentiality laws in Germany, the treating physician informs only the patient that he or she is unfit to drive. Informing the authorities is neither required nor permitted.

TABLE 3

Syncope and fitness to drive

	Group 1 (private) drivers	Group 2 (occupational) drivers
After first episode of syncope	No restriction	No restriction, in the absence of any indication of a high risk of recurrence
Recurrent (unexplained) syncope	Further diagnostic investigation; fit to drive after 6 months at the earliest; case-by-case decision	Usually unfit to drive; case-by-case decision

physician is not obligated to maintain confidentiality—and supported the view that in cases of extreme risk the physician has the right to report to the police a patient that the physician regards as medically unfit to drive but who does not agree with this view and is unwilling to cooperate (11). An example given was of a bus driver with acute myocardial infarction who refused admission to hospital for treatment, so that he could drive a class of schoolchildren in his bus. It was not concluded during this discussion that physicians are obligated to break patient confidentiality in cases where there is acute risk. If the patient asks the physician to produce a report on his or her fitness to drive, the obligation to maintain confidentiality is of course removed.

Risk stratification

Concerning risk stratification, the Canadian Cardiovascular Society's "risk of harm"-formula has become the gold standard for Germany and for the other countries in the European Union (12). This formula says that the probability that cardiac disease in the driver of a vehicle will lead to serious injury to another road user is directly proportional to:

- The time spent at the wheel
- The type of vehicle being driven (private car, truck)
- The annual probability of sudden loss of control („sudden cardiac incapacitation“, SCI).

Given normal hours per day at the wheel (8 hours for commercial drivers, 30 minutes for private drivers), unfitness to drive is assumed when the probability of sudden loss of control (syncope, sudden cardiac death, stroke) is >1% per year for an occupational driver and >22% per year for a private driver (12). The use of the

„risk of harm“ formula is discussed in detail in the German Cardiac Society's position paper on fitness to drive in patients with cardiovascular disease (13). This formula served as the basis for assessment of fitness to drive of persons with cardiovascular disease both in the German Cardiac Society's position paper (13) and in the unpublished recommendations of the European Union, „New Standards for Driving and Cardiovascular Diseases,“ Brussels 2013, which for Germany are implemented in the current BAST recommendations regarding fitness to drive in patients with cardiovascular disease. However, the distinction made in the „risk of harm“ formula between bus drivers and taxi drivers in regard to fitness to drive was not adopted by the Brussels Expert Advisory Panel, and hence was not adopted by the BAST in Germany either. The Brussels Expert Advisory Panel agreed to treat all occupational drivers of passenger transport vehicles as the same, even though the general risk of bus drivers is estimated to be much higher than that of taxi drivers.

Requirements and recommendations for the assessment of fitness to drive

At present, the currently applicable requirements of Appendix 4 of the German Driving License Regulations (14) and the BAST recommendations (15) relating to cardiovascular disease must be adhered to. Both of these are currently available only on the Internet. All the tables displayed in the present article are drawn from the official requirements of the Driving License Regulations and the assessment guidelines of the BAST.

Compared with the BAST recommendations, Appendix 4 of the Driving License Regulations is couched in more general terms and goes into fewer diseases in detail. As a legal instrument, the requirements of this Appendix must be adhered to. Every assessment of fitness to drive must be undertaken on an individual basis. Factors that increase risk at the wheel—for example, several risk-promoting chronic diseases—or factors that reduce risk—for example, driving only rarely—must be included in the assessment. The position paper published by the German Cardiac Society on fitness to drive in patients with cardiovascular disease (13) helped to push forward a review of the official regulations and guidelines, and was used by the Expert Advisory Panel in Brussels as the basis for their recommendations. Today it has lost some of its importance since the revised official regulations reflect a more up-to-date state of scientific knowledge.

Risk stratification

In relation to cardiovascular diseases, the „risk of harm“ formula developed by the Canadian Cardiovascular Society has been adopted for risk stratification in assessment of fitness to drive in Germany and other countries of the European Union.

Regulations and recommendations regarding assessment of fitness to drive

At the present time, the current regulations of Appendix 4 of the FeV and the recommendations of the BAST relating to cardiovascular disease must be adhered to.

TABLE 4

Acute coronary syndrome, stable coronary heart disease, and fitness to drive*

	Group 1 (private) drivers	Group 2 (occupational) drivers
Acute coronary syndrome (myocardial infarction)	Fit to drive if no complications (EF >35%). EF <35% or acute decompensated heart failure in the context of an acute infarction: may be fit to drive after 4 weeks; case-by-case decision	EF >35%: may be fit to drive after 6 weeks. EF <35% unfit to drive
Stable angina pectoris	No restriction	Symptomatic angina on mild exertion: unfit to drive
After PCI	No restriction after PCI and good clinical result	Fit to drive 4 weeks after good clinical result; annual cardiological review
Coronary bypass operation	Fit to drive after 2–4 weeks	Fit to drive after 3 months

EF, left ventricular ejection fraction; PCI, percutaneous coronary intervention

*Adapted from (14)

An abbreviated extract from the current regulations in Appendix 4 of the German Driving License Regulations relating to fitness to drive in patients with cardiovascular disease (16) is shown in *Table 1*. Follow-up assessments are not shown in *Table 1*. Where „Case-by-case decision“ is shown for patients with systolic blood pressure >180mmHg, the physician must consider carefully whether he or she believes the patient to be fit to drive. A value >180 mmHg could be 185 mmHg, which could be tolerated, or it could be 250 mmHg, which in an occupational driver would suggest unfitness to drive. To date there have been no scientific studies to establish a threshold value for blood pressure in relation to fitness to drive. The entry „May be fit to drive after 4 to 6 weeks“ means that the patient will be fit to drive after this time so long as no events occur during in the interim that would count against fitness to drive. An example of such an event might be symptomatic ventricular tachycardia.

The BAST guidelines on fitness to drive in persons with cardiovascular disease, which have applied since December 2016, go into some detail about patients with various arrhythmias, cardiac pacemakers and/or implanted defibrillators (ICDs), arterial hypertension, coronary heart disease including acute myocardial infarction, arterial occlusive disease, aortic aneurysm, heart valve disease, cardiomyopathies, rare ion channel diseases, heart failure, and syncope. Some of the most important of these disease entities are dealt with in more detail below.

Pacemakers and implanted defibrillators (ICDs) and fitness to drive

The indications for ICD and pacemaker treatment are given in the current guidelines of the European Society of Cardiology and the German Cardiac Society (17, 18). The now-updated recommendations from BAST on fitness to drive differ considerably from the previous ones in regard to patients with pacemakers and ICDs. Group 2 drivers with a functioning cardiac pacemaker are now held to be fit to drive after 1 week. Group 2 drivers who experienced syncope before the pacemaker was implanted, or who are is dependent on the pacemaker, are not fit to drive until 4 weeks have elapsed. Patients with ICDs are usually unfit to be group 2 drivers. However, it is not the presence of the ICD but the heart condition that makes them unfit to drive. In some cases, the heart condition of a patient with an ICD may improve (e.g., healing of myocarditis), so that after a time the ICD is no longer indicated. In an individual case of this kind, even a patient with an ICD could be an occupational driver. *Table 2* shows the BAST guidelines for patients with cardiac pacemakers and defibrillators. After an appropriate ICD shock in a patient with ventricular tachycardia or ventricular fibrillation, fitness to drive may be assumed in the absence of any new dangerous arrhythmic event that is treated with a shock within the subsequent three months. This recommendation is also supported by the findings of a large study of 2786 patients who had ICDs placed for primary or secondary prevention of sudden

Blood pressure and fitness to drive

No scientific studies have been carried out to define a threshold value for blood pressure in relation to fitness to drive.

Pacemakers and ICDs

Group 2 drivers with a functioning cardiac pacemaker are fit to drive after 1 week. Patients with ICDs are usually unfit to be group 2 drivers.

TABLE 5

Bradyarrhythmias and fitness to drive*

	Group 1 (private) drivers	Group 2 (occupational) drivers
SA block		
– Without syncope	No restriction	No restriction
– With syncope	Unfit to drive until treated effectively, thereafter see Pacemaker (PM)	Unfit to drive until treated effectively, thereafter see Pacemaker (PM)
AV block I	No restriction	No restriction
AV block II (Mobitz)		
– Without syncope	May be fit to drive until PM implanted	May be fit to drive until PM implanted
– With syncope	Unfit to drive until treated effectively, usually with PM	Unfit to drive until treated effectively, usually with PM
AV block III (congenital)	No restriction provided no syncope and no criteria indicating PM implantation	Usually unfit to drive
AV block III (acquired)	Unfit to drive until treated effectively, thereafter see PM	Unfit to drive until treated effectively, thereafter see PM
Left bundle branch block/ right bundle branch block/ hemiblocks	No restriction	No restriction
Alternating bundle branch block	Unfit to drive until treated effectively	Unfit to drive until treated effectively
Bifascicular block with syncope	Unfit to drive until treated effectively	Unfit to drive until treated effectively

*Adapted from (14)

AV, atrioventricular; SA, sinoatrial; PM, pacemaker

cardiac death (19). Even though the driving restrictions for patients with ICDs have been scientifically proven to be well founded, it has been found that 35% do not obey these restrictions (20). If the treating physician is in doubt about the fitness of a patient with a pacemaker or defibrillator to drive, he or she should contact physicians in the center in which the device was implanted.

Fitness to drive after syncope

Patients with syncope are a very heterogeneous group, with varying degrees of severity of disease (21). In all cases, an attempt should be made to identify the precise cause of the syncope, so that a mechanism-specific treatment can be implemented. Causes of loss of consciousness include the vasovagal, cardiac, orthostatic, and neurological syncope, as well as those not otherwise classified (22). It may be assumed that patients

who experience syncope at the steering wheel have the same range of causes of syncope as those who experience syncope in other circumstances (21). About 87% of patients with syncope at the wheel experience prodromal symptoms, which if correctly interpreted can allow them to find a safe place to stop (23). Syncope patients should be informed about the possibility that their syncope may recur, so that if they experience prodromal symptoms they can stop their vehicle. A defensive driving style should always be recommended. According to a recent Danish study, it may be assumed that the accident risk of individuals with syncope is double that of the general population for at least the 2 years following hospital admission for syncope (24). Table 3 shows the current BAST guidelines on fitness to drive of patients with syncope. Individual assessment may result in a judgment that the patient

ICD shock in patients with ventricular tachycardia or ventricular fibrillation

Fitness to drive is assumed if no new dangerous arrhythmia event has occurred in a 3-month period.

Fitness to drive after syncope

It may be assumed that patients who experience syncope at the wheel show the same range of causes of syncope as those who experience syncope in other circumstances.

TABLE 6

Selected tachyarrhythmias and fitness to drive*

	Group 1 (private) drivers	Group 2 (occupational) drivers
AV nodal reentrant tachycardia /atrial ectopic tachycardia – Without syncope – With syncope	No restriction Fit to drive after effective treatment	No restriction Fit to drive 1 month after effective treatment, cardiological follow-up required
WPW syndrome – Without atrial fibrillation, without syncope – With atrial fibrillation – With syncope	No restriction No restriction Fit to drive after effective treatment	No restriction After successful ablation Fit to drive 1 month after effective treatment, follow-up by specialist
Atrial fibrillation/flutter with syncope	Fit to drive after effective treatment	Fit to drive 1 month after effective treatment, cardiological follow-up
Non-sustained ventricular tachycardia without syncope (NSVT), no structural heart disease	No restriction	Case-by-case decision, usually fit to drive, cardiological examination required for polymorphous NSVT, Case-by-case decision, may be fit to drive
Ventricular tachycardia with syncope, no structural heart disease	Fit to drive after effective treatment	Fit to drive 1 month after effective treatment, cardiological follow-up
Non-sustained ventricular tachycardia – Without syncope (NSVT), structural heart disease – With syncope	Case-by-case decision, usually fit to drive Unfit to drive	Case-by-case decision, cardiological examination Unfit to drive

*Adapted from (14)

AV, atrioventricular; WPW, Wolff-Parkinson-White syndrome

may be fit to drive despite recurrent syncope, if the syncope is not associated with driving. This is the case, for example, for syncope associated with medical procedures (e.g. venipuncture) or after being on the toilet (micturition, defecation).

Acute coronary syndrome (ACS) and/or stable coronary heart disease (CHD) and fitness to drive

Table 4 shows the BAST guidelines on fitness to drive of persons with acute coronary syndrome and/or coronary heart disease. These recommendations also differ fundamentally from earlier BAST recommendations. Regarding myocardial infarction, no distinction is now made between a first myocardial infarction and a recurrence, nor between ST-elevation myocardial infarction

(STEMI) and non-ST-elevation myocardial infarction (NSTEMI). The highest risk of dying of a myocardial infarction is during the first 10 days after the onset of the infarction (25). It may be assumed that about one-third of cardiovascular deaths after myocardial infarction are sudden cardiac deaths (26). In the BAST guidelines, the most important prognostic parameter in determining fitness to drive is now left ventricular ejection fraction (EF). Since many large studies have set the primary preventive indication for an ICD at EF <35%, this threshold value for restricted ventricular function after myocardial infarction has also been chosen by the European Union Expert Advisory Panel for unfitness to drive. Patients with group 2 driving licenses and an EF <35% are always unfit to be occupational drivers.

Patients with syncope

should be informed about the possibility of recurrence, so that if prodromal symptoms occur they can stop the car. A defensive driving style should always be recommended.

Acute coronary syndrome and stable coronary heart disease

Group 2 drivers with these diseases and an EF <35% are always unfit to be occupational drivers.

Bradyarrhythmias and fitness to drive

Patients with bradyarrhythmias (heart rate <50 to 60/min) are at risk of reduced cerebral perfusion leading to syncope. The higher the estimated risk of syncope, the more likely it is that the patient is unfit to drive. If a patient fulfills the criteria defined in the current guidelines of the German Cardiac Society for implantation of a cardiac pacemaker, it must be carefully considered whether that patient is fit to drive without a pacemaker. The current BAST recommendations regarding fitness to drive and bradyarrhythmias are summarized in *Table 5*.

Tachyarrhythmias and fitness to drive

Depending on heart rate and left ventricular function, tachyarrhythmias (ventricular rate >100/min) can lead to syncope. Patients with tachyarrhythmias should be referred to a cardiologist for better evaluation of the cardiac disease. The main question of interest is whether any cardiological disease is present in addition to the arrhythmia (structural heart disease, e.g. valve disease; hypertensive heart disease; cardiomyopathy) which might be important for the prognosis. Supraventricular tachycardia may be successfully treated by ablation or medication. In patients with ventricular tachycardia, although the most frequent cause is previous myocardial infarction with underlying coronary heart disease, the possibility of various forms of cardiomyopathy or ion channel disease must also be considered. The current BAST recommendations regarding fitness to drive of persons with various tachyarrhythmias are shown in *Table 6*.

Conflict of interest statement

Professor Sechtem holds shares in Daimler, VW, General Motors, Ford, and BMW.

Professors Klein and Trappe declare that no conflict of interest exists.

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REFERENCES

1. Weiß J: Fahrtüchtigkeit bei chronischen Erkrankungen – Ärzte in der Pflicht. Dtsch Med Wochenschr 2006; 131: 2200–1.
2. Hennighausen R: Verkehrsmedizinische Kompetenzen – quo vadis Erwartungen – medizinische und behördliche Anforderungen – Notwendigkeit der Aus-, Fort- und Weiterbildung. ZfVerkehrssicherheit 2016; 62: 173–80.
3. Grattan E, Jeffcoate GO: Medical factors and road accidents. BMJ 1968; 1: 75–9.

4. Halinen MO, Jaussi A: Fatal road accidents caused by sudden death of the driver in Finland and Vaud, Switzerland. Europ Heart J 1994; 15: 888–94.
5. Büttner A, Heimpel M, Eisenmenger W: Sudden natural death at the wheel: a retrospective study over a 15-year time period (1982–1996). Forensic Sc Int 1999; 103: 101–12.
6. Hitosugi M, Gomei S, Okubo T, Tokudome S: Sudden illness while driving a vehicle – a retrospective analysis of commercial drivers in Japan. Scand J Work Environ Health 2012; 38: 84–7.
7. Tervo TM, Neira W, Kiviola A, Sulander P, Parkkari K, Halopainen JM: Observational failures/distraction and disease attack/incapacity as cause of fatal road crashes in Finland. Traffic Inj Prev 2008; 9: 211–6.
8. Oliva A, Flores J, Meriglioli S, et al.: Autopsy investigation and Bayesian approach to coronary artery disease in victims of motor-vehicle accidents. Atherosclerosis 2011; 218: 28–32.
9. Redelmeier DA, Yarnell CJ, Thiruchelvam D, Tibshirani RJ: Physicians' warnings for unfit drivers and the risk of trauma from road crashes. N Engl J Med 2012; 367: 1228–36.
10. Roesgen M, Jaeger L, Bertram E, et al.: Patientenrechte-Arztspflichten (I). Versicherungsmedizin 2015; 67: 70–4.
11. Deutscher Verkehrsgerichtstag: Empfehlungen. www.deutscher-verkehrsgeschichtstag.de/images/empfehlungen_pdf/empfehlungen_50_vgt.pdf (last accessed on 1 August 2017).
12. Simpson C, Dorian P, Gupta A, et al.: Assessment of cardiac patient for fitness to drive: drive subgroup executive summary. Can J Cardiol 2004; 20: 1314–20.
13. Klein HH, Krämer A, Pieske BM, Trappe HJ, de Vries H: Fahreignung bei kardiovaskulären Erkrankungen. Kardiologie 2010; 4: 441–73.
14. Anlage 4 (zu §§ 11, 13 und 14) Eignung und bedingte Eignung zum Führen von Kraftfahrzeugen. www.fahrerlaubnisrecht.de/FeV%20neu/Anlage%20FeV/Anlage%2004.pdf (last accessed on 1 August 2017).
15. Begutachtungsleitlinien zur Kraftfahreignung. www.bast.de/DE/Verkehrssicherheit/Fachthemen/BLL/BLL-Hintergrund.html (last accessed on 1 August 2017).
16. Bundesgesetzblatt Jahrgang 2016 Teil I Nr. 64, ausgegeben zu Bonn am 27. 12. 2016, 3087–8.
17. Priori SG, Blomström-Lundqvist C, Mazzanti A, et al.: 2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: the task force for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death of the European Society of Cardiology (ESC). Eur Heart J 2015; 36: 2793–867.
18. Israel CW, Bänsch D, Breithardt O, et al.: Kommentar zu den neuen ESC-Leitlinien zur Schrittmacher- und kardialen Resynchronisationstherapie. Kardiologie 2015; 9: 35–45.
19. Thijssen J, Borleffs CJW, van Rees JB, et al.: Driving restrictions after implantable cardioverter defibrillator implantation: an evidence-based approach. Eur Heart J 2011; 32: 2678–87.
20. Mylotte D, Sheahan RG, Nolan PG, et al.: The implantable defibrillator and return to operation of vehicles study. Europace 2013; 15: 212–8.
21. Moya A, Sutton R, Ammirati F, et al.: Guidelines for the diagnosis and management of syncope (version 2009). Eur Heart J 2009; 30: 2631–71.
22. Soteriades ES, Evans JC, Larson MG, et al.: Incidence and prognosis of syncope. N Engl J Med 2002; 347: 878–85.
23. Sorajja D, Nesbitt GC, Hodge DO, et al.: Syncope while driving. Circulation 2009; 120: 928–34.
24. Nume AK, Gislason G, Christiansen CB, et al.: Syncope and motor vehicle crash risk: a Danish nationwide study. JAMA Intern Med 2016; 176: 503–10.
25. Fox KAA, Anderson FA, Goodman SG, et al.: Time course of events in acute coronary syndromes: implications for clinical practice from the GRACE registry. Nat Clin Pract Cardiovasc Med 2008; 5: 580–9.

Bradyarrhythmias

The higher the estimated risk of syncope, the more likely it is that the individual is unfit to drive. If the individual fulfills the criteria for a cardiac pacemaker, it must be carefully considered whether he or she is fit to drive without a pacemaker.

26. Hess PL, Woidyla DM, Al-Katib SM, et al.: Sudden cardiac death after non-ST-segment elevation acute coronary syndrome. *JAMA Cardiol* 2016; 1: 73–9.

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FURTHER INFORMATION ON CME

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- „Cystic Fibrosis“ (issue 33–34/17) until 12 November 2017.

CLINICAL SNAPSHOT

Massive Paraesophageal Varices in the Absence of Liver Cirrhosis

This 43-year-old man sustained an upper gastrointestinal hemorrhage 20 years after the diagnosis of a coinfection with HIV and hepatitis B (HBV). In view of his existing infectious conditions, hepatic cirrhosis was suspected as the cause of his bleeding from esophageal varices. He had also, however, been treated for a long time with antiretroviral drugs including tenofovir; this had resulted in the complete suppression of HIV and HBV. There was no laboratory evidence of hepatic cirrhosis, and the FibroScan values were normal. Abdominal ultrasonography revealed splenomegaly as the sole positive finding, and further evaluation revealed portal venous thrombosis. The only possible cause that could be found was an earlier treatment for HIV with the drug didanosine, over a period of six years. In the meantime, this drug has been found to be associated with the development of non-cirrhotic portal hypertension (NCPH). Supplementary diagnostic assessment with computerized tomography revealed massive paraesophageal varices with a diameter of approximately 10 cm. At endoscopy, however, only grade I esophageal varices were seen, due

to non-cirrhotic portal hypertension and portal venous thrombosis. The patient is being followed regularly by endoscopy with variceal ligation and has not had any further hemorrhages. This case underscores the point that portal venous thrombosis can arise in the absence of liver cirrhosis.

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Please answer the following questions to participate in our certified Continuing Medical Education program. Only one answer is possible per question. Please select the answer that is most appropriate.

Question 1

A truck driver with stable angina pectoris on strenuous exertion has a coronary stent inserted. There are no complications. At the earliest, when is he or she likely to be fit to drive a truck again?

- a) After 1 day
- b) After 1 week
- c) After 4 weeks
- d) After 3 months
- e) After 6 months

Question 2

A patient with coronary heart disease with left ventricular EF <35% (group 1 driver) refuses to undergo primary preventive implantation of an ICD. How should his fitness to drive be assessed?

- a) Fit to drive after 6 months if no syncope occurs during that period.
- b) Permanently unfit to drive because he lacks the protection provided by an ICD.
- c) Fit only to drive routine local journeys.
- d) Fit to drive up to a limit of 50 km/h.
- e) Fit to drive (no restriction).

Question 3

A taxi driver (group 2 driver) is admitted to the hospital for recurrent syncope. Under what circumstances can the driver continue to be assessed as fit to drive?

- a) The syncope episodes occur exclusively in situations that do not arise while driving (e.g., venipuncture, micturition syncope).
- b) The patient has not yet sustained injury from the syncope episodes.
- c) The syncope episodes are usually preceded by prodromal symptoms.
- d) The syncope episodes started during adolescence.
- e) The syncope is related to AV block III.

Question 4

When does an asymptomatic aortic aneurysm make a group 2 driver unfit to drive?

- a) When it is located in the region of the thoracic aorta.
- b) When it is 4 cm in diameter.
- c) When it has been treated with a stent graft.
- d) When its diameter exceeds 5.5 cm.
- e) When physical effort leads to neurological deficit.

Question 5

Which of the following is used as a measure of heart failure in assessing fitness to drive?

- a) pro-BNP
- b) Left ventricular ejection fraction (EF)
- c) Troponin I
- d) Vital capacity
- e) Peripheral oxygen saturation

Question 6

When can raised blood pressure be a threat to fitness to drive?

- a) When it cannot rapidly be brought down to <140 mmHg (systolic).
- b) When treatment requires five different drugs.
- c) When it is associated with visual and/or cerebral symptoms.
- d) When it is not checked three times a day.
- e) When it does not show a normal nocturnal dip.

Question 7

How would you assess the fitness for occupational driving of Group 2 drivers who have undergone replacement of an implantable defibrillator (ICD) unit?

- a) They are fit to drive 2 weeks after implantation.
- b) They are fit to drive 3 months after implantation.
- c) They are fit to drive 6 months after implantation.
- d) They are fit to drive 12 months after implantation.
- e) They are not fit for occupational driving.

Question 8

A bus driver is admitted to hospital with an acute myocardial infarction. On discharge, his left ventricular ejection fraction (EF) is 30%. What must the bus driver be told when he leaves hospital?

- a) That he is not fit to drive group 2 vehicles because his EF is <35%.
- b) That he may drive a bus again after he has been discharged from hospital.
- c) That he may drive a bus again after rehabilitation treatment.
- d) That he will be able to work as a bus driver again once he has had an ICD implanted.
- e) That he may drive a bus for a maximum of 4 hours a day.

Question 9

How would you assess the fitness of a 75-year-old patient with acute myocardial infarction and pulmonary edema related to the myocardial infarction?

- a) Permanent loss of fitness to drive must be assumed.
- b) The patient may be fit to drive 4 weeks after the event.
- c) The patient may be fit to drive 3 months after the event at the earliest.
- d) The patient may be fit to drive 1 week after the event.
- e) The patient is fit to drive immediately.

Question 10

Whom must the treating physician inform that a patient with cardiovascular disease is unfit to drive?

- a) The police
- b) The driving license authority
- c) The patient
- d) The health authority
- e) The patient's next of kin