Review Article

Guidelines and Regulations for Driving in Heart Disease

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Driving is a universal activity in all developed nations. It has been estimated that ordinary drivers of private vehicles, depending upon age and occupation, may spend an average of 250 hours a year at the wheel.[1] For professional drivers this figure is much higher. Car driving is a highly regarded freedom in the developed world, yet it represents an inherently dangerous activity and is associated with significant mortality and morbidity. Road traffic accidents are the commonest cause of death in young people and account for a significant number of deaths each year in most developed countries, e.g. 40,000 in the USA, 10,000 in Germany and 4,000 in the UK.[1,2] According to data from the Greek National Statistics Service, 1,612 people were killed in Greece as a result of traffic accidents in 2007. In Greece, deaths from traffic accidents constitute a significant cause of death, ranging from <1% in the elderly to >40% for the ages 15-29 years (authors' calculations from the National Statistics Service data).[3]

The actual contribution of medical causes to motor vehicle accidents is not known, and the likelihood of obtaining more precise data on cardiac disease as a cause of motor vehicle accidents is remote, given the difficulty of documenting such events in the general population. However, the proportion is believed to be very small. Data from Canada and the US suggest that less than 5% of accidents involving commercial vehicles can be attributed to cardiovascular disease.[2,4] Experience in Europe also suggests that the impact of arrhythmia-induced loss of consciousness on road accidents is relatively small. Approximately 0.1% of reportable road accidents are attributed to medical causes, and only 10-25% of these are due to cardiac events.[1,2] Nevertheless, patients with disturbed cardiac function, arrhythmias in particular, may experience complete or partial loss of consciousness, threatening their own safety and that of the general public, when engaged in certain personal or professional activities such as private and especially commercial driving. Case fatality rates for accidents involving drivers of commercial vehicles are 3-4 times greater than those involving ordinary private motor cars.[5] Driving guidelines and regulations in heart disease are of importance, not only for the proper recuperation and well-being of the patient, but also for the protection of society. There is, therefore, a need for the cardiology community to address this important issue and provide learned opinion.

Driving regulations for patients with heart disease that are enforced by law are not unanimous across Europe. There is a relative lack of hard scientific data and the strong socio-economic dimensions of the matter make decisions difficult. Guidelines on driving were published by

the European Society of Cardiology (ESC) in 1998[1] and were partially updated in the 2004 report on syncope.[6] Driving by patients with arrhythmias has been addressed by the 1996 AHA/HRS (American Heart Association/Heart Rhythm Society) guidelines,[2] which were updated in 2007 regarding patients with an ICD.[7] However, the most comprehensive and recent guidelines on driving and heart disease have been provided by the Canadian Cardiovascular Society (CCS).[4] In the ESC and the CCS reports, two groups of drivers are defined: private, or group one drivers, and commercial, or group two drivers (Table 1). In 1991 a directive regulating the minimum standards of physical and mental fitness for driving a motor vehicle was issued by the European Council (91/439/EEC). This directive has been widely implemented; however it is characterised by a lack of detail and precision concerning cardiovascular disease (see Appendix 1).

Specific cardiac conditions

Stable coronary artery disease

According to ESC guidelines, patients with stable coronary disease are allowed private driving as long as they remain asymptomatic or their symptoms are controlled. The CCS has issued similar guidelines allowing private and commercial driving in asymptomatic patients (Table 1). The ESC requires that professional drivers are asymptomatic without use of anti-anginal medication, and undergo exercise evaluation, which in the presence of established coronary heart disease is performed at regular intervals, usually annually. The exercise time, coupled with relevant clinical observations, was favoured by the European Task Force over a more complex prognostic score, which would be difficult to administer and interpret.

Resuming driving after percutaneous coronary intervention (PCI) is allowed after 2 to 7 days by both so-

Table 1. Ischaemic heart disease.

Organisation	Condition	Group1: Private drivers	Group 2: Commercial drivers
	Stable angina		
ESC		Driving allowed when symptoms controlled	Driving allowed for: - asymptomatic patients, - requiring no anti-anginal medication - regular exercise evaluation
CCS		Driving allowed if asymptomatic	Driving allowed if asymptomatic
	Myocardial infarction		
ESC		Driving allowed 1 month post-MI	Driving allowed 6 weeks post-MI
CCS	(STEMI or NSTEMI with significant LV damage)	Driving allowed 1 month after discharge	Driving allowed 3 months after discharge
	(NSTEMI with minor LV damage)	Driving allowed after 48 h or 7 days whether PCI performed or not	Driving allowed after 7 days or 30 days whether PCI performed or not
	PCI		
ESC		Driving allowed 1 week following PCI	Driving allowed 6 weeks post-PCI
CCS		Driving allowed 48 hours post-PCI	Driving allowed 7 days after PCI
	CABG		
ESC		1 month following CABG	6 weeks following CABG
CCS		1 month after discharge	3 months after discharge

CABG – coronary artery bypass grafting; CCS – Canadian Cardiovascular Society; ESC – European Society of Cardiology; LV – left ventricular; MI – myocardial infarction; NSTEMI – non-ST elevation MI; PCI – percutaneous coronary intervention; STEMI – ST elevation MI. Group one comprises drivers of motorcycles, cars and other small vehicles with or without a trailer. Group two includes drivers of vehicles over 3.5 metric tonnes or passenger-carrying vehicles exceeding eight seats excluding the driver (ESC). A private driver was defined as one who drives less than 36,000 kilometres per year or spends less than 720 hours behind the wheel per year, drives a vehicle weighing less than 11,000 kg and does not earn a living by driving. A commercial driver was defined as any licensed driver who does not fulfil the definition of a private driver (CCS). NSTEMI with minor LV damage is classified as an MI defined only by elevated troponin with or without ECG changes in the absence of a new wall motion abnormality.

cieties. The CCS requires a waiting period of 7 days for commercial and 2 days for private driving, whereas the ESC suggests a 7-day interval for private drivers as well. In the case of coronary artery bypass grafting (CABG), both the CCS and the ESC recommend that private drivers should wait for a period of 1 month after discharge. Regarding commercial drivers the CCS recommends a period of 3 months before the patient is qualified for driving.

Acute coronary syndromes

Following an ST-elevation myocardial infarction (MI), patients are at risk for arrhythmic sudden death over the next one to two years, particularly when early thrombolysis or primary angioplasty have not been implemented. The risk of sudden cardiac death/cardiac arrest in patients with a recent myocardial infarction is highest in the first 30 days after infarction.[8] Unfortunately, there are no tests with sufficient positive predictive value (>30%) to allow the identification of patients prone to ventricular arrhythmias and sudden death,[9] and routine ICD implantation 8 to 40 days after an MI has not been found beneficial.[10]

Private driving is allowed one month after an acute myocardial infarction, according to both the European and the Canadian guidelines. If the patient has a non-ST elevation myocardial infarction (NSTEMI) with minor left ventricular (LV) damage (Table 1), the CCS recommends that the patient resumes driving after 2 to 7 days, depending on whether or not angioplasty was performed during the initial hospital stay.

Regarding commercial driving there is no unanimous opinion. In general, however, in patients who return to physically demanding activities the safety of the activity can be determined by comparing performance on a graded exercise test with the metabolic equivalent (MET) level required for the activity. The CCS recommends that commercial drivers can resume their work as early as 7 days after an NSTEMI with minor LV damage. For patients with ST-elevation MI or NSTEMI with significant LV damage, a 3-month waiting period is recommended before resuming commercial driving. According to ESC guidelines, commercial driving is not permitted for at least 6 weeks after the index event and re-licensing is subject to exercise evaluation.

Arrhythmias

Patients with brady- or tachyarrhythmias may experience sudden impairment or loss of consciousness. Ventricular tachycardia or fibrillation is the most common cause of out-of-hospital cardiac arrest, accounting for approximately three quarters of cases, the remaining 25% being caused by bradyarrhythmias or asystole.[11]

Bradyarrhythmias and conducting system disorders

Symptomatic bradyarrhythmias usually constitute indications for permanent cardiac pacing. Patients without symptoms do not need a pacemaker and can drive as long as they are symptom free, according to European, Canadian, and American recommendations. Bundle-branch blocks and fascicular blocks do not constitute an indication for pacing, but should prompt a search for evidence of intrinsic cardiac abnormalities or higher degree block, in the absence of which private or commercial driving is permissible.

Permanent pacemakers

Patients who have cardiac pacemakers are unlikely to have further symptomatic bradycardia and if symptoms recur they are unlikely to be due to pacemaker malfunction. For patients treated with permanent pacing, a period of time should pass to ensure stable lead function before they return to driving; this has been recommended unanimously by the AHA/HRS, the ESC and the CCS to be one week for non-commercial drivers and up to 4 weeks for commercial drivers, or until appropriate function is established according to the modification by the 2004 Syncope Task Force of the ESC (Table 2).

Supraventricular tachycardia

There are no data documenting the frequency with which syncope related to supraventricular tachycardia causes motor vehicle accidents, but it is probably a rare occurrence. Patients with atrial fibrillation and flutter should be evaluated for underlying disease and appropriately treated. Patients with persistent or permanent atrial fibrillation or flutter are allowed to drive when adequate rate control is achieved without any evidence of impaired levels of consciousness. In general, treated atrial fibrillation does not constitute a contraindication for driving. Multifocal atrial tachycardia is usually associated with serious underlying metabolic or pulmonary disease. Patients with this arrhythmia should not be

Table 2. Permanent pacemakers and ICDs.

Organisation	Condition	Group1: Private drivers	Group 2: Commercial drivers
	Permanent pacemakers		
ESC		Within one week	Any persistent symptoms are disqualifying (Re-)licensing may be permitted after at least 6 weeks have elapsed[1] or until appropriate function is established[2] and provided that there is no other disqualifying condition
CCS		- Waiting period 1 week after implant - No impaired level of consciousness after implant - Normal sensing and capture on electrocardiogram - No evidence of pacemaker malfunction at regular pacemaker clinic checks	- Waiting period 1 month after implant - No impaired level of consciousness after implant - Normal sensing and capture on electrocardiogram - No evidence of pacemaker malfunction at regular pacemaker clinic checks
AHA/HRS		1 week	4 weeks
	ICD implant		
AHA/HRS	Primary prevention	Driving restricted until recovery from operation (at least 1 week)	Cannot be certified to drive
	Secondary prevention[5]	6 months	Cannot be certified to drive
ESC		Within 6 months if no arrhythmia recurrence and no disabling symptoms at time of ICD discharge. For drivers receiving "prophylactic" ICD implant no restrictions are imposed[1]. Tendency to shorten the time of restriction[2]	Permanent disqualification
CCS	Primary prophylaxis; NYHA class I to III	Driving allowed 4 weeks after implant	Permanent[4] disqualification
	Secondary prophylaxis for VF or VT with decreased level of consciousness; NYHA class I to III	6 months after event[3]	Permanent[4] disqualification
	Secondary prophylaxis for sustained VT with no accompanying decreased level of consciousness; NYHA class I to III	1 week post-implant, in addition to the appropriate waiting period for the VT	Permanent[4] disqualification
	Any event resulting in device therapies being delivered (shock or ATP), in which level of consciousness was impaired, or the therapy(ies) delivered by the device was/were disabling	Additional 6-month restriction	Permanent[4] disqualification

AHA – American Heart Association; ATP – antitachycardia pacing; HRS – Heart Rhythm Society; NYHA – New York Heart Association; VF – ventricular fibrillation; VT – ventricular tachycardia. Other abbreviations as in Table 1.

1. According to 1998 ESC document
2. According to 2004 Syncope Task Force
3. The 6-month period begins not at the time of ICD implant, but rather at the time of the last documented episode of sustained symptomatic ventricular tachycardia (VT) or syncope judged to be likely due to VT or cardiac arrest. For patients who have a bradycardia indication for pacing as well, the additional pacemaker criteria also apply. All patients must be followed from a technical standpoint in a device clinic with appropriate expertise.
4. ICDs may sometimes be implanted in low-risk patients. Individual cases may be made for allowing a commercial driver to continue driving with an ICD provided the annual risk of sudden incapacitation is believed to be 1% or less.
5. Patients who have received an ICD for primary prevention who subsequently receive an appropriate therapy for VT or VF, especially with symptoms of cerebral hypoperfusion, should then be considered to be subject to the driving guidelines previously published for patients who received an ICD for secondary prevention

considered fit to drive, at least until the underlying disease is diagnosed and treated. Although the general prognosis in patients with Wolff-Parkinson-White syndrome and other supraventricular tachycardias is generally quite favourable, at least a single episode of syncope is reported in approximately 25% of patients referred to electrophysiology labs for assessment.[12] Catheter ablation is now recommended in all patients with overt pre-excitation.[13] Patients with atrioventricular re-entrant tachycardia due to an accessory pathway or atrioventricular nodal re-entrant tachycardia that appears to have been successfully ablated may drive after recovery from the procedure, because the risk of arrhythmia recurrence and risk of injury from arrhythmia recurrence are both low.[2]

Ventricular tachycardia and fibrillation (VT/VF)

Patients susceptible to life-threatening ventricular arrhythmias span a wide range of underlying pathology, from various cardiomyopathies to apparent normality, as occurs in various inherited conditions, and "channelopathies" that usually present as idiopathic VF or unexplained cardiac arrest. However, the majority of patients (>90%) with a cardiac arrest have demonstrable coronary artery disease, although less than half (20 to 30%) seem to have suffered an acute myocardial infarction.[11] Patients presenting with ventricular tachyarrhythmias are at considerable risk of recurrence, but still—with the exception of LV ejection fraction, which serves as a general guide—there are no tests with sufficient positive predictive value to allow identification of patients prone to sudden death.[9] Thus, the modern therapy of most cases of sustained VT and VF consists of implantation of an antiarrhythmia device. Guidelines for private or commercial driving in this respect are cited in Table 2 regarding regulations for patients with an ICD. A notable exception is probably patients with idiopathic VT in the context of an apparently normal heart, who do not have symptoms of impaired consciousness with their presenting arrhythmia.[2] Such patients have a favourable prognosis and catheter ablation is successful in this setting. Accordingly, it is likely that if the patient has not had symptoms of impaired consciousness with the presenting arrhythmia, future episodes will be equally well tolerated. Thus, in selected individuals, a shorter period of driving restriction may be appropriate following catheter ablation and initiation of treatment with beta-blockers or calcium channel blockers. Patients who have symptomatic congenital long-QT syndrome, Brugada syndrome or other forms of channelopathy associated with VF should not have driving privileges until ICD implantation. Patients with long-QT syndrome who are asymptomatic or who have a history of symptoms but are asymptomatic on treatment should receive driving privileges after a 6-month symptom-free interval, according to the 1996 AHA recommendations.[2]

Syncope

Syncope is a rare cause of traffic accidents—although it is responsible for 20% of accidents involving loss of consciousness at the wheel—since sudden driver incapacity is only reported in one per thousand traffic accidents. In an anonymous survey, 3% of patients with syncope reported having had syncope while driving, but only 1% reported having had a car crash. Interestingly, only 9% of those who received a driving abstinence recommendation stopped driving because of syncope.[14] Syncope due to documented arrhythmias has been discussed in the previous sections. The ESC published relevant guidelines in 2004, which are presented in comparison with guidelines from the CCS in Table 3.[6] The decision to allow a patient to resume driving should be based on the severity and nature of the presenting event.[15]

Implantable cardioverter defibrillators

In 1996 and 1997, the AHA and the ESC published scientific statements with recommendations about driving for patients who had been treated with an ICD because of a previous episode of a life-threatening arrhythmia, i.e. secondary prevention therapy. Both the AHA and the ESC recommended that driving should be prohibited for the first 6 months after ICD implantation. This recommendation was based on the fact that the risk for another event follows an exponential decay pattern, with the greatest chance for another arrhythmia in the period immediately after an event. Three months later the curve flattens significantly and at 6 months it is flat. In 2007, the AHA and the HRS updated these recommendations by considering patients who receive an ICD because they are at risk for life-threatening ventricular arrhythmias, i.e. primary prevention of sudden cardiac death.[7] Patients receiving ICDs for primary prevention should be restricted from driving a private au-

Table 3. Syncope.

Organisation	Condition	Group1: Private drivers	Group 2: Commercial drivers
	Neurally-mediated syncope		
ESC	Vasovagal	- Single/mild: No restrictions	- Single/mild: Specialist evaluation including neurological review.[1] No restrictions unless it occurred during high risk activity[2]
		- Severe:[3] Until symptoms controlled	- Severe:[3] Until symptoms controlled. (Re-) licensing after 3 months and possibly negative tilt-test; careful follow-up mandatory.[1] Permanent restriction unless effective treatment has been established[2]
	Carotid sinus	- Single/mild: No restrictions	- Single/mild: No restrictions unless it occurred during high risk activity[2]
		- Severe:[3] Until symptoms controlled	- Severe:[3] Permanent restriction unless effective treatment has been established[2]
	Situational	- Single/mild: No restrictions	- Single/mild: No restrictions unless it occurred during high risk activity[2]
		- Severe:[3] Until appropriate therapy is established	- Severe:[3] Permanent restriction unless effective treatment has been established[2]
CCS	Single episode of typical vasovagal syncope[4]	No restriction	No restriction
	Recurrent (within 12 months) vasovagal syncope	Wait 1 week	Wait 12 months
	Situational syncope with avoidable trigger (e.g. micturition syncope, defecation syncope)	Wait 1 week	Wait 1 week
	Syncope of uncertain cause		
ESC		- Single/mild: No restrictions unless it occurred during high risk activity[2]	- Single/mild: Disqualifying until diagnosis and appropriate therapy is established
		- Severe:[3] In case of severe syncope until cause identified, especially in patients with heart disease or at least 3 months without symptoms before (re-)licensing.[1] Disqualifying until diagnosis and appropriate therapy is established[2]	- Severe:[3] Requires specialist evaluation including a neurological review if appropriate. Following unexplained syncope, provocation testing and investigation for arrhythmia must be implemented, especially also in patients with heart disease. If the results are satisfactory (re-) licensing may be permitted after 3 months. Careful follow-up is mandatory.[1] Disqualifying until diagnosis and appropriate therapy is established[2]
CCS	Single episode of unexplained syncope	Wait 1 week	Wait 12 months
	Recurrent episode of unexplained syncope (within 12 months)	Wait 3 months	Wait 12 months

1. According to 1998 ESC document
2. According to 2004 Syncope Task Force
3. Neurally-mediated syncope is defined as severe if it is very frequent, or occurring during the prosecution of a "high risk" activity, or recurrent or unpredictable in "high risk" patients.
4. No restriction is recommended unless the syncope occurs in the sitting position or if it is determined that there may be an insufficient prodrome to pilot the vehicle to the road side to a stop before losing consciousness. If vasovagal syncope is atypical, the restrictions for "unexplained" syncope apply.

tomobile for at least one week to allow for recovery from implantation of the defibrillator. Thereafter, in the absence of symptoms potentially related to an arrhythmia, these driving privileges should not be restricted. However, when highway (high-speed) or long-distance travel is anticipated, patients should

be encouraged to have an adult companion driver. If ICD discharge occurs after implantation, either with or without associated syncope or pre-syncope, patients should be advised against driving for the following six months. Commercial drivers carry a substantially increased risk of causing harm to other road users as a consequence of syncope or pre-syncope in association with ICD discharge. Thus, it was recommended in the American, the Canadian and the European guidelines that all commercial driving be prohibited permanently after ICD implantation (Table 2).

Most of these recommendations, however, are hampered by a lack of good data regarding the actual risk of an ICD discharge during driving. Although no public data exist concerning symptoms at the time of shocks in patients enrolled in trials of ICDs for primary prevention, the frequency of inappropriate shocks can be used as a surrogate marker of risk of driving in patients with ICDs. In early trials involving patients with ICDs, device discharge rates were high. In the CABG-Patch trial,[16] 50% of patients received a discharge during a 1-year follow up; in MADIT I,[17] 60% of patients had a shock during 2 years of follow up. The rate of ICD discharges is considerably lower with newer devices. A significantly lower rate (approximately 7.5%) has been consistently documented in more recent trials.[18-20]

Patients randomised in the AVID trial reported resuming driving early, regardless of medical advice to the contrary (80% were driving within 6 months). However, these patients had a very low rate of automobile accidents.[21] Indeed, the frequency of automobile accidents (3.4% of patients per year) was less than that of the general driving population of the United States (7.1% per year). Recently, the TOVA (Triggers of Ventricular Arrhythmias) Study investigators analysed data on driving habits and ICD discharges in 1,188 patients.[22] Of these, 80% reported driving their car at least once per week (as did 75% within 6 months after implantation). Over a median follow-up period of 562 days there were 193 ICD shocks for VT/VF and it was demonstrated that one ICD shock for VT or VF occurred per 25,116 person-hours spent driving. Interestingly, among 7 patients who received an ICD shock for VT or VF during driving, only 1 resulted in a motor vehicle accident. This underlines the relative uncertainty about the actual validity of current guidelines and perhaps allows physicians to consider certain cases on an individual basis.

Valve disease and heart failure

According to the ESC, private driving is not restricted in patients with valve disease, including valve surgery, provided that no other disqualifying condition coexists. Likewise, the CCS recommendations include no restrictions on private driving for patients with valve disease, provided they have no episodes of impaired consciousness and they belong to functional classes I or II according to the New York Heart Association (NYHA). For patients who have undergone valve surgery, the CCS guidelines define a recovery time of at least 6 weeks and require that they present no thromboembolic complications in order to resume driving.

Both the European and the Canadian guidelines permit private driving in all patients with heart failure except those with symptoms at rest or at the wheel (NYHA class IV). According to the CCS, patients with heart transplantation are eligible for (re-)licensing for commercial driving 6 months after discharge if the LV ejection fraction is >35% and there are no signs of ischaemia. The regulations regarding commercial drivers with valve disease or heart failure are summarised in Table 4.

Conclusion

Loss of driving privileges may result in both emotional stress and loss of economic status. At the same time, the citizens of a society have the right to be protected against the harm caused by individuals who are unable to operate a motor vehicle in a safe and prudent manner. Regulations are therefore needed to strike a balance between the liberty of the individual and the well-being of society. We recognise that what constitutes an acceptable risk cannot always be answered by scientific evidence; several published recommendations on driving have a level of evidence C, i.e. consensus of opinion of experts and/or small studies and registries. Thus, driving regulations on certain occasions may have to be a matter of consensus in society. In this respect the role of the cardiology community is crucial in informing the public and influencing relevant legislation. A distinguishing quality of any profession is its acceptance of responsibility to society and the public interest. Systematic, practical and constantly updated guidelines are much needed in Greece and Europe in general, and should attempt to achieve a balance between individual rights and protection of the public safety through ongoing review and update.

Table 4. Valve disease and heart failure.

Organisation	Condition	Group1: Private drivers	Group 2: Commercial drivers
	Valvular heart disease		
ESC	Valve disease including valve surgery	No restriction	Persisting symptoms are disqualifying If asymptomatic, (re-)licensing may be permitted provided that there is no other disqualifying condition and no history of systemic embolism. Following cerebral or systemic embolism whilst receiving anti-coagulant treatment (re-)licensing is not allowed
CCS	Aortic stenosis	NYHA class I or II No episodes of impaired level of consciousness	Asymptomatic NYHA class I AVA ≥1.0cm^2 EF ≥35%
	Aortic regurgitation, mitral stenosis, mitral regurgitation	NYHA class I or II No episodes of impaired level of consciousness	No episodes of impaired level of consciousness NYHA class I EF ≥35%
	Mechanical prostheses Mitral bioprostheses or mitral valve repair with non-sinus rhythm	6 weeks after discharge No thromboembolic complications on anticoagulant therapy	3 months after discharge No thromboembolic complications Anticoagulant therapy NYHA class I EF ≥35%
	Aortic bioprostheses Mitral bioprostheses or mitral valve repair with sinus rhythm	6 weeks after discharge No thromboembolic complications	3 months after discharge No thromboembolic complications NYHA class I EF ≥35%
	Heart failure		
ESC		Symptoms at rest or at wheel are disqualifying. Driving may be permitted once symptoms are controlled	Any persisting symptoms are disqualifying. If asymptomatic (re-)licensing may be permitted provided that: - LV ejection fraction is >0.40 on contrast angiography (or equivalent) -there is no disqualifying arrhythmia -the exercise requirements[1] can be satisfied
CCS	NYHA Class I-II	No restriction	EF ≥35%
	NYHA Class III	No restriction	Disqualified
	NYHA Class IV	Disqualified	Disqualified
	Receiving intermittent outpatient or home inotropes	Disqualified	Disqualified
	Left ventricular assist device	Disqualified	Disqualified

AVA – Aortic valve area; EF – Ejection fraction; NYHA – New York Heart Association

1. Exercise evaluation shall be performed on a bicycle or treadmill. Drivers should be able to complete 3 stages of the Bruce protocol or equivalent (see Guidelines for Cardiac Exercise Testing. Eur Heart J. 1993; 14: 969-988) safely, without anti-anginal medication for 48 h and should remain free from signs of cardiovascular dysfunction, such as angina pectoris, syncope, hypotension, ventricular tachycardia, and/or electrocardiographic ST segment shift (usually >2 mm horizontal or down-sloping) which accredited medical opinion interprets as being indicative of myocardial ischaemia. In the presence of established coronary heart disease, exercise evaluation shall be required at regular intervals, usually annually.

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Appendix I

Annex III of Council Directive of 29 July 1991 on Driving Licenses (91/439/EEC). Section 9

Cardiovascular diseases

9. Any disease capable of exposing an applicant for a first license or a driver applying for renewal to a sudden failure of the cardiovascular system such that there is a sudden impairment of the cerebral functions constitutes a danger to road safety.

Group 1

9.1 Driving licenses will not be issued to, or renewed for, applicants or drivers with serious arrhythmia.

9.2 Driving licenses may be issued to, or renewed for, applicants or drivers wearing a pacemaker subject to authorized medical opinion and regular medical check-ups.

9.3 The question whether to issue or renew a license for applicants or drivers suffering from abnormal arterial blood pressure shall be assessed with reference to the other results of the examination, any associated complications and the danger they might constitute for road safety.

9.4 Generally, a driving license shall not be issued to or renewed to applicants or drivers suffering from angina during rest or emotion. The issuing or renewal of a driving license to any applicant or driver having suffered myocardial infarction shall be subject to authorized medical opinion and, if necessary, regular medical check-ups.

Group 2

9.5 The competent medical authority shall give due consideration to the additional risks and dangers involved in the driving of vehicles covered by the definition of this group.