CARDIOVASCULAR SYSTEM[1]

I. INTRODUCTION

The cardiovascular system can be divided into the following groups of disorders to facilitate consideration of cardiac fitness and the ability to perform the job functions of a patrol officer.

A. Congenital

B. Valvular

C. Cardiomyopathy

D. Hypertension

E. Coronary Artery Disease (CAD)

F. Arrhythmias

II. IMPLICATIONS FOR JOB PERFORMANCE

Patrol officers engage in vigorous, aerobic activities requiring above-average degrees of fitness (Adams, 2010). A cardiac limitation to exercise may cause serious injury to both the patrol officer and the public. The impact of cardiac conditions on peace officer job performance is codified in California Government Code 12940.1, which establishes that law enforcement candidates with heart trouble are presumed to be unable to perform their duties in a manner that would not endanger their health or safety or the health and safety of others. While this presumption may be overcome by evidence showing that the candidate would be able to perform the job, the legislative intent of this statute is clear.[2]

The following are examples of peace officer physical job demands[3]:

- **Running in pursuit of suspects**: speed is important in up to 90% of incidents; distances may range up to 500 yards.
- **Pursuit followed by physical altercation**: subduing combative subjects takes an average of three minutes.

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[2] It is important to note that the U.S. Americans with Disabilities Act (which trumps state law if there is a conflict) includes no such presumption; therefore, it is necessary to conduct an individualized assessment of candidates with cardiovascular conditions, and base the determination of their medical suitability in the same way as all other peace officer candidates.

[3] See Patrol Officer Job Demands: Their Implication for Medical Screening in the Background Information section of this Manual.

- **Moving incapacitated persons**: ability to lift and carry someone distances of 40+ feet when speed is critical.

The minimum exercise capacity required to perform these tasks can be estimated from published tables of oxygen consumption (Jetté, et al., 1990). These indicate that oxygen consumption at a level of approximately 42 ml O_2/kg/min (12 METS) is necessary to perform activities such as those listed above and specifically with wrestling, running, and extensive lifting at a level of moderate to heavy intensity (Adams 2010). Since oxygen consumption in a life-or-death struggle could easily exceed 42 ml O_2/kg/min, this value represents a valid minimal level of fitness. Historically, this value has been noted to represent the average fitness level of the most common group of arrestees, males < 30 years old (Pollack, et al., 1980).

III. MEDICAL EXAMINATION AND EVALUATION GUIDELINES

Evaluation of patrol officer candidates for cardiovascular diseases requires a comprehensive history, physical examination and an electrocardiogram (EKG). A treadmill stress test may be indicated in those believed to be at increased risk of sudden incapacitation.

A. History

Responses to the cardiovascular system items in the POST Medical History Statement (POST 2-252) or equivalent questionnaire should be reviewed. Positive responses require further questioning and will need to be correlated with physical findings to assess their importance and the need for confirmatory medical records and further assessment.

B. Physical Examination

A thorough physical examination of the cardiovascular system is essential. This examination should include listening for carotid and abdominal bruits, assessment for elevated jugular venous pressure, auscultation of the heart for murmurs, gallops and rubs, palpation of the radial and femoral pulses, and inspection of the lower legs and feet for signs of vascular insufficiency.

C. Routine Testing

A 12-lead electrocardiogram should be performed and examined for ST-T wave abnormalities, Q waves, conduction abnormalities, ventricular hypertrophy, arrhythmias, prolonged QTc, or heart block. Further evaluation of abnormal EKGs may be indicated. Lipid testing should be performed on all male candidates age 35 or older and on all female candidates age 45 or older to allow the calculation of a 2-year Framingham cardiac event risk score (Table I-1a for males; Table I-1b for females; D'Agostino, 2000).

Table I-1a (Males): Calculation of 2-year Framingham Risk Score (No Prior CAD)

Age	Points	Age	Points	Age	Points		POINTS
35-39	0	45-49	3	55-59	6		
40-44	1	50-54	4	60-64	7	Subtotal	

Total Cholesterol	HDL								
	25	30	35	40	45	50	60	70	80
160	8	7	5	5	4	3	2	1	0
170	8	7	6	5	4	4	2	1	0
180	9	7	6	5	5	4	3	2	1
190	9	8	7	6	5	4	3	2	1
200	9	8	7	6	5	5	3	2	1
210	10	8	7	6	6	5	4	3	2
220	10	9	8	7	6	5	4	3	2
230	10	9	8	7	6	6	4	3	2
240	10	9	8	7	7	6	5	4	3
250	11	9	8	8	7	6	5	4	3
260	11	10	9	8	7	6	5	4	3
270	11	10	9	8	7	7	5	4	3
280	11	10	9	8	8	7	6	5	4
290	12	10	9	9	8	7	6	5	4
300	12	11	10	9	8	7	6	5	4

Subtotal

Diabetes		Cigarette Smoking	
Yes	No	Yes	No
3	0	4	0

Subtotal

Systolic BP							
Treated				Untreated			
<110	0	165-184	4	<110	0	135-144	4
110-124	1	185-214	5	110-114	1	145-154	5
125-144	2	≥ 215	6	115-124	2	≥ 155	6
145-164	3			125-134	3		

Subtotal

TOTAL POINTS

Total Points	2-year Risk	Risk Level
0 - 15	<2%	Low
16 - 20	2 - 4%	Intermediate
21+	>4%	High

Table I-1b (Females): Calculation of 2-year Framingham Risk Score (No Prior CAD)

Age	Points	Age	Points	If Menopausal	
35-39	0	50-54	4	35-49	17
40-44	1	55-59	6	50-74	16
45-49	3	60-64	7		

	POINTS
Subtotal	

Total Cholesterol	HDL								
	25	30	35	40	45	50	60	70	80
160	5	4	3	3	2	2	1	1	0
170	5	4	4	3	3	2	1	1	0
180	5	5	4	3	3	2	2	1	0
190	5	5	4	4	3	3	2	1	1
200	6	5	4	4	3	3	2	1	1
210	6	5	5	4	4	3	2	2	1
220	6	6	5	4	4	3	2	2	1
230	6	6	5	4	4	3	3	2	1
240	6	6	5	5	4	4	3	2	2
250	7	6	5	5	4	4	3	2	2
260	7	6	5	5	4	4	3	3	2
270	7	6	6	5	5	4	3	3	2
280	7	6	6	5	5	4	3	3	2
290	7	6	6	5	5	4	4	3	2
300	7	7	6	5	5	5	4	3	3

Subtotal	

Diabetes		Alcohol oz/wk		Cigarette Smoking	
Yes	No	0-4	6-40	Yes	No
3	0	0	-1	2	0

Subtotal	

Systolic BP	Treated			Untreated			
< 114	0	155-164	6	110-114	1	165-184	6
115-124	2	165-194	7	115-124	2	185-194	7
125-134	3	195-214	8	125-134	3	195-214	8
135-144	4	215-234	9	135-154	4	215-234	9
145-154	5	≥ 235	10	155-164	5	≥ 235	10

Subtotal	
TOTAL POINTS	

Without menopause		With prevalent menopause		
Total Points	2-year Risk	Total Points	2-year Risk	Risk Level
0 - 13	<2%	0 - 25	<2%	Low
14 – 17	2 - 4%	26 - 28	2 - 4%	Intermediate
18+	>4%	29+	>4%	High

D. Supplemental Testing Procedures

Exercise Testing (ET)

There are several exercise testing protocols that can be used with either a cycle ergometer or a treadmill. Classification is based on the manner in which the work rate is applied: (1) progressive incremental exercise (every minute) or continuous ramp protocol; (2) a multistage exercise protocol (every 3 minutes, with a "pseudo"- steady state at each level); or (3) a constant work rate (the same work rate, usually for 5 to 30 minutes).

The exercise test should be performed as a maximal rather than a submaximal test. In a maximal test, a subject exercises until exhaustion and the final heart rate is reasonably close to the predicted maximal heart rate. Estimates of predicted maximal heart rate for each year of age for both males and females are provided in Table I-2.

Table I-2: Predicted Maximal Heart Rate by Age (both males and females)

Age	Max HR	Age	Max HR	Age	Max HR	Age	Max HR
18	194	28	187	38	180	48	173
19	194	29	187	39	180	49	173
20	193	30	186	40	179	50	172
21	192	31	185	41	178	51	171
22	192	32	185	42	178	52	171
23	191	33	184	43	177	53	170
24	190	34	183	44	176	54	169
25	190	35	183	45	176	55	169
26	189	36	182	46	175		
27	188	37	181	47	174		

(Tanaka, 2001)

Submaximal exercise tests (often stopped at 85-90% of maximal predicted heart rate) are used in the clinical setting to evaluate the presence and extent of coronary artery disease. However, they do not give as accurate a determination of aerobic capacity, and should not be used in the context of determining fitness for hire.

An exercise test is required for candidates with a 2-year Framingham risk (FRS) of 2% or more, or with findings on a resting EKG of AV block, complete left or right bundle branch block or left ventricular hypertrophy. Although ST changes on an exercise test cannot be interpreted in the presence of left bundle branch block (LBBB) and in some cases of left ventricular hypertrophy (LVH), the test can still be used to determine cardiopulmonary fitness. Findings on the resting EKG of small Q waves (< 0.03 seconds and < 0.1 mV deep) in the inferior leads are often seen, especially in lead III alone. These are not pathologic. Poor R wave progression (PRWP), also frequently seen, is defined as the loss of the normal reversal of dominance of the S wave over the R wave as the EKG leads progress from V1 to V6. Some define PRWP as an R wave < 3 mm in V3. One cause of this phenomenon is a prior anterior myocardial infarction (MI). In the presence of PRWP, factors that may require referral to a cardiologist (not counting history of MI) are older, male candidates who present STT abnormalities in V2 or V3 (DePace, 1983).

During maximal exercise testing of young (< age 40) physically fit individuals, at high workloads (> 10 METS), ST segment depression > 1.0 mm can be seen at peak exercise. If these changes immediately resolve at the end of exercise, and do not recur in recovery, some cardiologists feel that these ST changes are physiologic and not pathologic.

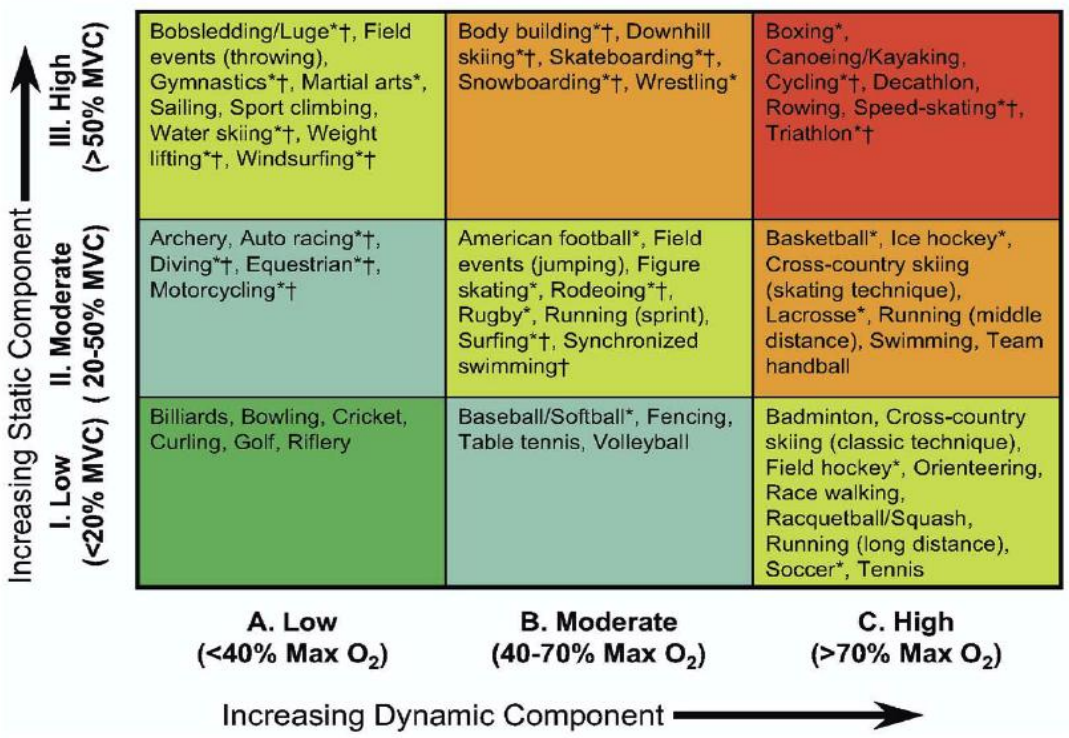
IV. EVALUATION OF COMMON CLINICAL SYNDROMES

The 36th Bethesda Conference on Eligibility Recommendations for Competitive Athletes with Cardiovascular Abnormalities (Bethesda Guidelines, 2005) analyzed the impact of various athletic activities, including wrestling, running, and extensive lifting at levels of moderate to heavy intensity on cardiovascular conditions. Since the physical demands of these activities were found to be sufficiently comparable to peace officer job duties, the Bethesda analysis and recommendations were used as a template for evaluating cardiovascular conditions.

The Bethesda Guidelines categorized athletic activities using two scales, as depicted in Figure I-1.

Figure I-1: 36th Bethesda Conference Recommendations: Classification of Sports

(Reprinted from 36th Bethesda Conference: Eligibility recommendations for competitive athletes with cardiovascular abnormalities, with permission from Elsevier.)



This classification is based on peak static and dynamic components achieved during competition. It should be noted, however, that higher values may be reached during training. The increasing dynamic component is defined in terms of the estimated percent of maximal oxygen uptake (MaxO2) achieved and results in an increasing cardiac output. The increasing static component is related to the estimated percent of maximal voluntary contraction (MVC) reached and results in an increasing blood pressure load. The lowest total cardiovascular demands (cardiac output and blood pressure) are shown in green and the highest in red. Blue, yellow, and orange depict low moderate, moderate, and high moderate total cardiovascular demands. *Danger of bodily collision. †Increased risk if syncope occurs.

The first scale involves a dynamic demand continuum and the second involves static demand. The dynamic component represents the aerobic stress experienced while participating in that sport, and the static demand describes the requirement for muscular work. Each axis is rated as low, moderate, and high, resulting in a 3x3 table. Each sport was placed in one of the nine cells. For example, basketball is in the cell encompassing high dynamic and moderate static demands.

Based on a review of peace officer physical job demands, it was determined that the cell that best characterizes these physical demands is designated by moderate dynamic and high static. Athletic activities in that classification include wrestling and downhill skiing.

The following recommendations for evaluating candidates with congenital or valvular conditions, cardiomyopathy, hypertension, CAD, or arrhythmias are generally based on the Bethesda Guidelines with three major exceptions. The first is that the POST recommendations are narrowed specifically for the moderate aerobic and high static demands of a peace officer. Second, the Bethesda Guidelines include recommendations based on concerns regarding both sudden incapacitation and the gradual worsening of the underlying cardiovascular condition; the POST recommendations only consider sudden incapacitation in the immediate future. Third, unlike the Bethesda Guidelines, the POST recommendations include use of FRS scoring in decision-making.

A. Congenital

Candidates may have a history of congenital heart disease, with or without repair of the abnormality. In several types of congenital heart disease, the key factor in both the risk of sudden incapacitation and ability to exercise is the presence of pulmonary hypertension (defined as resting mean pulmonary artery pressure of > 30 mm Hg.). Candidates with congenital heart disease should undergo cardiac stress testing and Doppler echocardiography whether or not the abnormality has been corrected.

ATRIAL SEPTAL DEFECT: Acceptable if there is no pulmonary hypertension.

VENTRICULAR SEPTAL DEFECT: Acceptable if there is no pulmonary hypertension.

LEFT VENTRICULAR DYSFUNCTION: Impairment of left ventricular function should be evaluated with an exercise test. If a candidate can reach a maximal level of 12 METS, then left ventricular function is adequate to perform the job of a peace officer.

B. Valvular

Candidates with known valvular disease should undergo cardiac stress testing and Doppler echocardiography. These candidates must demonstrate the ability to reach a maximal level of 12 METS during exercise. Additionally, echocardiograms should be required for candidates with a negative history who present with either grade III systolic murmurs, grade II systolic murmurs that radiate to the neck or axilla, systolic murmurs that increase in intensity on standing, and any diastolic murmurs. The examiner should be aware that trace or trivial regurgitant jets on Doppler echocardiography are very common in normal subjects, but are of no clinical significance.

MITRAL STENOSIS: Although mitral stenosis rarely causes sudden death, exercise can cause sudden marked increases in pulmonary capillary and pulmonary artery pressures, at times resulting in sudden acute pulmonary edema. Candidates are acceptable if mild (defined as valve area > 1.5 cm^2 and rest pulmonary artery systolic pressure < 30 mm Hg) and peak pulmonary artery systolic pressure during exercise is < 50 mm Hg. This measurement is performed during an exercise Doppler echocardiogram.

MITRAL INSUFFICIENCY: Similar to mitral stenosis, mitral insufficiency rarely causes sudden death in the absence of congestive heart failure (Carabello, 1999). However, high static exercise with resultant high blood pressure may cause increases in regurgitant volume and deleterious pulmonary capillary pressures. Impairment of cardiopulmonary function should be evaluated with an exercise test. If a candidate can reach a maximal level of 12 METS, then cardiopulmonary function is adequate.

AORTIC STENOSIS: Symptoms of dyspnea, syncope, or angina pectoris occur late in the course of aortic stenosis (Carabello, 2002), and the likelihood of sudden death increases significantly with the onset of symptoms. However, even transient symptoms are important in marking the onset of increased risk of sudden death. Although sudden death is more frequent in symptomatic patients with severe aortic stenosis, it may also occur in completely asymptomatic patients (Rosenhek, 2000). Candidates should be deemed acceptable if mild (defined as valve area > 1.5 cm^2 or mean pressure gradient of < 25 mm Hg). Aortic stenosis is often progressive, and candidates who are otherwise acceptable should be monitored at least on an annual basis.

AORTIC INSUFFICIENCY: Individuals with severe aortic insufficiency may remain asymptomatic and active for many years, but angina pectoris, syncope, and ventricular arrhythmias ultimately may appear. Sudden death is rare among asymptomatic individuals (less than 0.2% per year) (Bonow, 2006). Candidates are acceptable if exercise testing to maximum capacity (12 METS minimum) demonstrates no symptoms or ventricular arrhythmias.

Candidates with a history of valve repair or replacement require a cardiac stress test with the ability to reach a maximal level of 12 METS, as well as a Doppler echocardiogram. Candidates on full anticoagulation, such as warfarin, should be evaluated using guidance in the Hematology chapter.

MITRAL VALVE PROLAPSE: In general, MVP is characterized by a mostly favorable prognosis and low event rate. However, a small increased risk of sudden incapacitation from embolic events, atrial and ventricular tachyarrhythmias, and sudden death is associated with diffuse leaflet thickening, elongation, and redundancy. All candidates with this condition should have a recent echo Doppler and ET.

Candidates should be deemed acceptable if they have none of the following:

a. prior syncope, judged probably to be arrhythmogenic in origin
b. sustained or repetitive and nonsustained supraventricular tachycardia or frequent and/or complex ventricular tachyarrhythmias on ET or ambulatory Holter monitoring

c. severe mitral regurgitation assessed with color-flow imaging

d. LV systolic dysfunction (ejection fraction less than 50%)

e. prior embolic event

C. Cardiomyopathy

Hypertrophic cardiomyopathy (HCM) is the most common cause of sudden unexpected cardiac death in young people, including competitive athletes, with an estimated annual mortality of 2% (Maron, 2003). Sudden death may occur at any age, but is most common in individuals 30 years of age or younger. The disease is characterized by heterogeneous presentation and natural history in which the most consistent diagnostic feature demonstrated by echocardiography is otherwise unexplained and usually asymmetric hypertrophy associated with a non-dilated left ventricle (LV). Clinical diagnosis of HCM is made by recognition of the disease phenotype with LV hypertrophy and no other etiology of LVH. In this regard, a maximal LV end-diastolic wall thickness of 15 mm or more is the absolute dimension generally accepted for the clinical diagnosis of HCM. This cut-point is applicable even in athletes.

> Candidates with a probable or unequivocal clinical diagnosis of HCM should be disqualified. This recommendation is independent of age, the absence of symptoms or LV outflow obstruction, or prior treatment with drugs or major interventions with surgery, alcohol septal ablation, pacemaker, or implantable defibrillator**.**

Candidates with congestive heart failure whether systolic, diastolic or combined, should be disqualified. An exercise test can further define extent with respect to aerobic capacity. There is an increased risk of ventricular arrhythmias and sudden death with heart failure.

D. Hypertension

Hypertension can be divided into Prehypertension (120-139/80-89), Stage I (140/90 to 159/99) and Stage II (160/100 or higher). Stage II hypertension is incompatible with peace officer job performance. In addition, if left ventricular hypertrophy (as determined by echocardiography) is present, only candidates whose blood pressure is under control (< 140/90) should be deemed acceptable. Left ventricular hypertrophy (LVH) has been identified as one of the strongest blood pressure-independent risk factors for sudden death (Messerli,1999).

E. Coronary Artery Disease (CAD)

ELEVATED RISK OF NEW-ONSET CAD: Certain candidates with a negative history may be at high risk of a sudden cardiac event during a critical incident involving physical exertion. The traditional definition of high risk used in cardiology for a coronary event is >20% over a 10-year period. Given that a cardiac event is likely to be suddenly incapacitating and that numerous studies have shown that episodic physical exertion can trigger these events

(Dahabreh, 2011), this risk level would appear to be too high for safe peace officer performance.

Clinicians typically use on-line calculators based on the Framingham data to generate 10-year risk estimates of a first coronary event. However, a more accurate estimate of immediate risk can be found in the work of D'Agostino, et al, 2000. This study reanalyzed the Framingham data while factoring in the presence or absence of diabetes to generate 2-year risk estimates [see Tables I-1a (males) and I-1b (females)].

To improve the accuracy of Framingham risk estimates for those in the "intermediate" risk category (10-20% 10-year risk), the AHA and the American College of Cardiology recommend use of cardiac computed tomography to measure coronary calcium. Patients with a coronary calcium score of 400 or more should be reclassified into the high-risk category (Greenland, 2007).

Based on current lipid and blood pressure testing and use of Tables I-1a and I-1b, candidates should be evaluated as follows:

LowRisk (<2% 2-year risk): Acceptable

Intermediate Risk (2-4% 2-year risk): A candidate with this level of risk is acceptable on demonstration of all of the following:

1. Exercise tolerance of 12 METS (estimated VO_2 max of 42 ml O_2/kg/min).
2. Absence of exercise-induced ischemia and exercise-induced or post-exercise complex ventricular arrhythmias, including frequent premature ventricular contractions (greater than 10% of beats/min), couplets, or ventricular tachycardia.
3. A coronary calcium score using electron beam computed tomography (EBCT) of <400.

High Risk (> 4% 2-year risk): Unacceptable

Disqualified candidates should be offered a re-evaluation if they are able to improve their lipid profiles or other risk factors. However, their subsequent medical clearance should be made conditional to their agreement to demonstrate continued control of their risk factors based on monitoring at least annually.

PRIOR HISTORY OF ISCHEMIC CAD: This includes candidates with a history of a myocardial infarction (MI) confirmed by conventional diagnostic criteria or a history of angina pectoris with objective evidence of inducible myocardial ischemia. Virtually all of these candidates are at high risk for having recurrent ischemic events (D'Agostino, et al, 2000).

Only candidates who can demonstrate **all** of the following should be deemed acceptable:

1. No more than a 4% 2-year probability of a recurrent ischemic event using Table I-3a (males) or I-3b (females).

2. Preserved LV systolic function at rest (i.e., ejection fraction greater than 50%, as determined by echocardiogram).
3. Exercise tolerance of 12 METS (estimated VO_2 max of 42 ml O_2/kg/min).
4. Absence of exercise-induced ischemia and exercise-induced or post-exercise complex ventricular arrhythmias, including frequent premature ventricular contractions (greater than 10% of beats/min), couplets, or ventricular tachycardia.
5. If PCI or CABG has been performed, evidence by stress imaging of no inducible myocardial ischemia.

F. Arrhythmias

ATRIAL FLUTTER: An echocardiogram should be performed to evaluate cardiovascular structure and function. Candidates should be found acceptable if there are no episodes for 2 months with or without drug treatment, or if there are no episodes for two weeks after successful ablation. Asymptomatic candidates who have transient episodes of atrial flutter lasting less than 10 seconds that do not increase in duration during exercise are also acceptable.

ATRIAL FIBRILLATION: Evaluation should include determination of the ventricular response during an exercise test. Candidates are acceptable if ventricular rate increases appropriately with exercise or four weeks after successful ablation. Asymptomatic candidates who have episodes of atrial fibrillation of 5 to 15 seconds that do not increase in duration during exercise are acceptable. Those on full anticoagulation such as warfarin should be evaluated using the guidelines contained in the Hematology chapter.

SUPRAVENTRICULAR TACHYCARDIA: Candidates are acceptable if asymptomatic and episodes last less than 15 seconds. If episodes last >15 seconds, or there is a history of syncope, near-syncope, or significant symptoms, candidates should be deemed unacceptable unless successful ablation has been performed.

WOLF-PARKINSON-WHITE SYNDROME (WPW): Candidates should undergo exercise testing and echo. Asymptomatic candidates who are 25+ years old without structural heart disease on echo or abnormal tachycardia on exercise testing are acceptable. All others should undergo electrophysiology study (EPS). Individuals with an accessory pathway of less than 250 milliseconds or ventricular rates exceeding 240 beats/min should be referred to their personal physician for catheter ablation of the accessory pathway (Pappone, 2003).

To be acceptable after successful ablation of an accessory pathway, candidates must be asymptomatic and have normal AV conduction without inducible arrhythmia on a follow-up electrophysiology study. If no follow-up electrophysiology study is performed, candidates must be asymptomatic for at least four weeks following ablation.

VENTRICULAR TACHYCARDIA (VT): Unsustained or sustained monomorphic or polymorphic VT is always a potentially serious occurrence. Noninvasive tests to be performed include

a 12-lead EKG, exercise test, and echocardiography. In some candidates, 24-hour ambulatory EKG recording during high level exercise may be indicated. Echocardiography, cardiac catheterization, and an electrophysiologic study should be considered to verify that the heart is structurally normal and to establish the mechanism or location, or both, of the VT. Candidates are acceptable if less than 10 beats of monomorphic VT and no structural heart disease, or two months after successful ablation. Candidates with implantable cardiac defibrillators (ICDs) should be deemed unacceptable (Epstein et al, 2006; ACC/AHA/ESC, 2006).

FIRST DEGREE AV BLOCK: Acceptable.

SECOND DEGREE TYPE I AV BLOCK: Asymptomatic candidates are acceptable if they have a structurally normal heart and no worsening or actual improvement of AV block with exercise or recovery.

SECOND DEGREE TYPE II AV BLOCK: Candidates are unacceptable if QRS is wide, except after pacemaker placement (ACC/AHA/HRS, 2008).

THIRD DEGREE AV BLOCK: Candidates are acceptable if there is a structurally normal heart and normal cardiac function, with no history of syncope or near syncope, a narrow QRS complex, ventricular rates at rest greater than 40 to 50 beats/min increasing appropriately with exertion, absent or only occasional premature ventricular complexes, and no VT during exertion.

RIGHT BUNDLE BRANCH BLOCK: Candidates are acceptable if there are no symptoms, no ventricular arrhythmias, and AV block does not occur on ET.

LEFT BUNDLE BRANCH BLOCK: Candidates are acceptable if there are no symptoms, no ventricular arrhythmias, and AV block does not occur on ET.

IMPLANTED PACEMAKER: Due to risk of damage during physical exertion or altercation, a candidate should be deemed unacceptable, if they are pacemaker-dependent (Maisel, 2006; Maisel et al, 2006; Wilkoff, 2006; Brown, et al, 1991).

PROLONGED QT: The corrected QT interval (QTc) is prolonged if $\geq$ 470 ms in males, or $\geq$ 480 ms in females. There are genetic variants of inherited prolonged QT syndrome. Most are associated with an increased risk of sudden death. Prolonged QTc is unacceptable even if the candidate is asymptomatic. This restriction may be liberalized for the asymptomatic candidate with genetically proven type 3 LQTS (LQT3), which is much less likely to result in sudden death. However, caution is necessary to prevent violation of the federal GINA regulations, which prohibit employers from utilizing genetic information during employment-related medical evaluations. Therefore, while candidates may be free to submit the results of genetic testing as part of an appeal of a disqualification, it is unlawful for an employer to request submission of such tests.

Table I-3a (Males): Risk of Recurrent Ischemic Coronary Event within 2 Years

Age	Points	Age	Points	Age	Points	
35-39	0	45-49	3	55-59	6	
40-44	1	50-54	4	60-64	7	POINTS
					Subtotal	

Total Cholesterol	HDL								
	25	30	35	40	45	50	60	70	80
160	10	9	7	6	5	4	3	1	0
170	11	9	8	7	6	5	3	2	1
180	11	10	8	7	6	5	4	2	1
190	12	10	9	8	7	6	4	3	2
200	12	11	9	8	7	6	5	3	2
210	13	11	10	9	7	7	5	4	2
220	13	11	10	9	8	7	5	4	3
230	13	12	10	9	8	7	6	4	3
240	14	12	11	10	9	8	6	5	4
250	14	13	11	10	9	8	6	5	4
260	15	13	12	10	9	8	7	5	4
270	15	13	12	11	10	9	7	6	5
280	15	14	12	11	10	9	7	6	5
290	16	14	13	11	10	9	8	6	5
300	16	14	13	12	11	10	8	7	6

Subtotal	

Diabetes	
Yes	No
4	0

Subtotal	
TOTAL POINTS	

Total Points	2-year Risk
0 - 4	3 - 4%
5+	>4%

Table I-3b (Females): Risk of Recurrent Ischemic Coronary Event within 2 Years

Age	Points	Age	Points
35-39	0	50-54	3
40-44	1	55-59	4
45-49	2	60-64	5

	POINTS
Subtotal	

Total Cholesterol	HDL								
	25	30	35	40	45	50	60	70	80
160	10	9	7	6	5	4	3	1	0
170	11	9	8	7	6	5	3	2	1
180	11	10	8	7	6	5	4	2	1
190	12	10	9	8	7	6	4	3	2
200	12	11	9	8	7	6	5	3	2
210	13	11	10	9	8	7	5	4	2
220	13	12	10	9	8	7	5	4	3
230	14	12	11	9	8	7	6	4	3
240	14	12	11	10	9	8	6	5	4
250	14	13	11	10	9	8	7	5	4
260	15	13	12	11	9	9	7	6	4
270	15	13	12	11	10	9	7	6	5
280	15	14	12	11	10	9	8	6	5
290	16	14	13	12	10	10	8	7	5
300	16	14	13	12	11	10	8	7	6

Subtotal	

Diabetes		Cigarette Smoking	
Yes	No	Yes	No
8	0	4	0

Subtotal	

Systolic BP - Treated			
<110	0	155-164	7
110-114	1	165-184	8
115-124	3	185-194	9
125-134	4	195-214	10
135-144	5	≥ 215	11
145-154	6		

Subtotal	
TOTAL POINTS	

Total Points	2-year Risk
0 - 18	1 - 4%
19+	>4%

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