Medical Certification of Pilots With Nonsustained Ventricular Tachycardia
Case Report, by An T. Duong, MD, MPH

The incidence of nonsustained ventricular tachycardia (NSVT) in the general population varies between 0 and 4% (1). NSVT, defined as three or more consecutive ventricular beats at a rate of greater than 100 beats/min with duration of less than 30 sec is a relatively common clinical problem (2). While premature ventricular contractions and NSVT are frequently seen in the general population and are sometimes considered clinically insignificant, they mark a population at increased risk for cardiac disease, including sudden cardiac death and cardiomyopathy (3). With careful cardiovascular evaluation and follow up, current practice has been to allow for a Special Issuance to airmen of any class that have been treated with radiofrequency ablation for NSVT without structural heart disease.

History

A 46-yr-old MALE AIR TRANSPORT pilot presented to his aviation medical examiner (AME) for a renewal of first-class medical certificate. He had over 16,000 hours, with 0 hours flown in the preceding 6 months. He was grounded for 6 months following an episode of non-sustained ventricular tachycardia, reproduced by stress testing, subsequently requiring ablation.

The airman had no significant medical history until he presented with having some intermittent chest pain, along with back pain and scapular pain. He was feeling weaker than usual, with some lightheadedness and dizziness. He had coughing associated with palpitations and irregular heartbeat at times. He sought emergency care after walking up the stairs and feeling severely diaphoretic and short of breath.

During his hospital evaluation, myocardial infarction and pulmonary embolism were ruled out. Exercise treadmill stress testing showed several episodes of isolated premature ventricular contractions (PVCs), plus couplets and triplets, consistent with monomorphic non-sustained ventricular tachycardia. Initially, his burden of PVCs decreased on beta blockers, and he was released for an outpatient workup, which showed no evidence of underlying coronary artery disease, valvular disease, or thyroid dysfunction. Stress echo and stress tests showed frequent ventricular ectopy. A follow-up Holter monitor revealed HR ranging from 49 to 144 bpm, with 10,152 isolated uniform ventricular ectopic beats, including 8 pairs of 3 runs lasting up to 5 beats, with rates up to 198 bpm. Trigeminy and quadrigeminy rhythms were observed. The patient reported symptoms of palpitations that were associated with isolated ventricular ectopic beats.

The airman opted for and was successfully treated for symptomatic PVCs with radiofrequency ablation, specifically right ventricular outflow tract PVC. Post-ablation, a 24-hour Holter monitor showed a significant reduction of ventricular ectopy to less than 0.2% of previous. His symptoms resolved after ablation.

Aeromedical Issues

The primary aeromedical concern with new onset cardiac arrhythmia is the airman’s ability to safely operate an aircraft and not subsequently endanger the safety of his passengers; another concern is disabling cardiopulmonary compromise to impede his ability to egress an aircraft in the event of a mishap.

In addition to addressing functional impairment from cardiac arrhythmia, an aviation medical examiner should consider other underlying diseases associated with non-sustained ventricular tachycardia. Three major concerns regarding the presence of PVCs and NSVT are:

1. Monomorphic VT increases the risk for sustained VT.
2. NSVT is typically diagnosed during cardiac monitoring (e.g., ambulatory monitoring or inpatient telemetry) or during exercise stress testing. Once NSVT has been diagnosed, it is important to determine the presence or absence of any associated structural heart disease. A thorough history and physical examination, 12-lead electrocardiogram, transthoracic echocardiography, and exercise stress testing are generally sufficient to exclude prognostically significant structural heart disease in asymptomatic patients (10).

In patients that present with syncope felt to be related to NSVT, or those with a strongly positive family history suggesting an inherited cardiomyopathy (e.g., hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy), additional testing may be useful, including genetic testing for specific mutations, as well as advanced non-invasive imaging with cardiac computed tomography or magnetic resonance imaging (10).

For patients with NSVT who are asymptomatic and have no evidence of structural heart disease, we suggest no specific medical therapy. However, for patients with disabling symptoms, use of a β-blocker is advised unless there is a contraindication (e.g., uncontrolled asthma), in which case a calcium channel blocker, usually verapamil or diltiazem, can help. If the arrhythmia persists despite treatment with these drugs, the therapeutic options include more potent antiarrhythmic medications or catheter-based ablative therapy (10).

In contrast to persons with underlying structural heart disease, the prognosis of NSVT is generally benign in those without apparent structural heart disease (1, 3, 8-9).

Non-Sustained Ventricular Tachycardia

Nonsustained ventricular tachycardia (NSVT), defined as three or more consecutive ventricular beats at a rate of greater than 100 bpm with a duration of less than 30 sec, is a relatively common clinical problem that occurs in up to 4% of the population (1,2). NSVT is typically diagnosed during cardiac monitoring (e.g., ambulatory monitoring or inpatient telemetry) or during exercise stress testing (10).
2. Another concern, particularly with increased automaticity and polymorphic VT is that a ventricular beat may be coupled closely with the preceding QRS complex and produce ventricular fibrillation.

3. Finally, frequent ventricular ectopy is known to adversely affect cardiac function itself, namely tachycardia-induced cardiomyopathy (3).

In all cases, follow up evaluations and current status reports of further testing are required prior to issuance of a medical certificate (RefMan, 5-2, 5-4, 5-7). The AME must refer to the Aerospace Medical Certification Division or Regional Flight Surgeon if the airman has received radiofrequency ablation (Guide for Aviation Medical Examiners, pg. 285).

The incidence of PVCs and NSVT in the adult population varies. A Framingham Offspring Study in patients without known cardiac disease reported PVCs during exercise testing in 27% of patients. Those with PVCs had a statistically significant (but small) increased mortality hazards ratio of 1.71-1.86 (3). Patients with heart disease have a higher incidence of complex or frequent arrhythmia. Overall, ventricular ectopy appears to be a frequent finding with a small, but statistically significant, increased sudden cardiac death and mortality risk (3).

It can be difficult to determine whether a primary cardiomyopathy is present resulting in ventricular ectopy or a primary arrhythmia is causing tachycardia-induced (3). The arrhythmias are usually monomorphic, most arise from the right ventricular outflow tract (RVOT), and their frequency and duration can be affected by both exercise and autonomic manipulation. Sixty to 80 percent of patients with idiopathic ventricular tachycardia have VT originating from the RVOT (4). In comparison, with the generally good prognosis associated with idiopathic monomorphic VT, polymorphic VT is associated with an increased risk of sudden death (10). While supraventricular arrhythmias and ventricular tachycardias are recognized mediators of tachycardia-induced cardiomyopathy, PVCs have recently been shown to cause tachycardia-induced cardiomyopathy (5, 6). Differentiating a primary cardiomyopathy from tachycardia-induced cardiomyopathy is essential, as the latter may be reversible, particularly by radiofrequency ablation (7).

In the case that treatment is radiofrequency ablation of a by-pass tract, a 3-month recovery period is recommended before consideration for medical certification. A current clinical status report, a resting electrocardiogram, and a 24-hour Holter monitor are recommended after the 3-month recovery period (RefMan, 5-8; Guide for Aviation Medical Examiners, pg.79).

Role of the AME

The disposition guidance indicates that, for all classes of medical certificates, “any episode of tachycardia during the course of the examination, and any other irregularities of pulse other than an occasional ectopic beat or sinus arrhythmia” must be noted and reported by the AME. If there is bradycardia, tachycardia, or arrhythmia, further evaluation may be warranted and deferral may be indicated (Guide for Aviation Medical Examiners, item 35, heart).

Outcome

Seven months following the NSVT event and 5 months after his ablation of his monomorphic NSVT, the airman has had at least 3 months of recovery from ablation and is asymptomatic. His post-ablative 3-month follow up 24-hour Holter study has shown a significant improvement (6 isolated supraventricular ectopic beats with no pairs or runs, 19 isolated uniform ventricular ectopic beats with no pairs or runs), and his ECG is normal. Echocardiography reveals no chamber enlargement, wall motion abnormalities, or significant valvular disease. His only current medication is Losartan (Cozaar) 50mg QD for control of blood pressure, which is normal. He reports no further symptoms since his ablation.

Based on his favorable evaluation with normal studies, an Authorization for Special Issuance of a first-class medical certificate was granted under 14 CFR §67.401. Required follow up will include annual cardiovascular evaluation, including repeat 24-hour Holter monitoring to include the representative tracings, summary sheet, the tabular report, and a statement regarding medication prescribed, including the type, purpose, dosage, frequency, and any side effects noted. He will be required to have regular first-class physical examinations at the frequency prescribed under the provisions of §61.23.