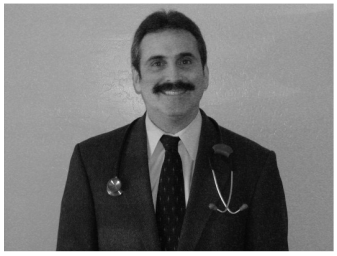
Cardiovascular considerations for Aviators
Part 1 Risk and evaluation.



David Bryman, D.O
Senior *International* Aviation Medical Examiner
FAA, Transport Canada, JAA, Australia CASA

This article will examine the cardiovascular considerations that are important to pilots. I will try and present some rational as to why Aviation Medical Examiners(AME's) assess cardiovascular risk in part 1, then I will discuss some specific cardiac diseases and their significance to pilots in the next article.

One of the main reasons that pilots are required to obtain a medical certificate is to *hopefully* identify and prevent illnesses that can lead to a sudden incapacitation while operating an aircraft. Besides gastrointestinal disorders (most common and generally not predictable), cardiovascular disorders are the most feared cause of sudden pilot incapacitation.

In a perfect world, the AME's will diagnose and treat heart disease prior to the pilot getting any symptoms. Unfortunately, this is not the case and in fact in a large number of patients in the general population (some sources say over 15%) have sudden death as their ***initial*** presenting symptom of unknown and untreated cardiovascular disease.

Even with the current advances of medicine, physicians still cannot ***accurately*** predict who will get sudden death or sudden incapacitation due to cardiovascular disease. We do know that people are more at risk for developing heart disease if they smoke tobacco, are overweight, have a sedentary lifestyle, have high blood pressure, high cholesterol, diabetes and a family history of heart disease(to name a few).

There are many thoughts and opinions regarding what constitutes an ***acceptable*** risk for airline pilots in regards to public safety in general. Airworthiness requirements set acceptable limits for failure rates of aircraft components, but what about the pilot component?

One accepted limit for airline pilot incapacitation is known as the "1% rule". This is somewhat arbitrary and was designed to be approximately the same risk of an accident due to a mechanical failure (this risk number is old and the actual risk these days is much less for mechanical failures). The 1% rule assumed 600 flying hours per pilot per year**.**

This means that the risk of a sudden cardiac incapacitation not be more than 1% (10^{-9}) per pilot. An interesting note is that in the general population the average 60-65 year old reaches this 1% level of risk based on their age alone (coincidence that this is the same age as mandatory retirement in the USA). Of course having 2 pilots increases the safety margin by 10^{2}, probably part of the rational for many countries allowing operations of 2 crew pilots over the age of 60.

For the purpose of simplicity, I will leave out the complicated mathematical formulas and graphs that help press the point of the 1% rule. Suffice it to say that this business of assigning a numerical value for cardiovascular risk is difficult to say the least. I prefer the simple model of low, medium and high risk as far as determining if further testing is necessary.

The medical history is still the most important tools the physician has to use in determining risk. For example, a pilot that has shortness of breath or chest pain with exertion may have symptoms of cardiovascular disease. Further questions regarding the presence of dizziness, ankle swelling, palpitations, chest pressure, and family history of heart disease should be discussed.

If there are symptoms as above, a careful examination should ensue. The physician should listen to the heart, measure the blood pressure, check the circulation in the legs, listen to the carotid arteries in the neck and perform an electrocardiogram(ECG) as well as some lab work to check for cholesterol(as well as other items).

The ECG is a painless test that is required by most Aeromedical regulatory agencies world wide, especially for commercial pilots. The private pilots (3^{rd} class) in the USA do not need an EGK as part of a routine exam, unless the AME feels that it is necessary (for example, required if the pilot has high blood pressure). The ECG is somewhat limited as a screening test in young patients that have no symptoms. In this case, there are many "abnormalities" that are considered as normal variants. Also, one *could* have significant coronary artery narrowing and still have a normal ECG. This is why the medical history and a high level of clinical suspicion are important, because further testing beyond the ECG can uncover potentially treatable coronary disease.

Exercise (or stress) ECG testing increases the predictive value of the resting ECG in identifying significant coronary disease. The interpretation of the findings of exercise testing is not free of problems however, and the use of this investigation for mass screening of individuals(particularly those without any symptoms) for coronary disease is not indicated. Exercise stress ECG is required in cases where symptoms are present, or there are numerous risk factors for coronary heart disease (for example; a diabetic will die of coronary heart disease more that 70% of the time).

In certain cases a specialized stress test called an isotopic myocardial perfusion study (a nuclear stress test) may be ordered if the cardiologist feels it will provide more information than a standard stress test.

It is important to note that the FAA has special standards regarding a stress test. Be sure to have your AME give you that information to bring to the cardiologist so that the test will be done to the FAA standards.

If there is still strong suspicion as to the presence of coronary artery disease after the above studies, a cardiologist may suggest a cardiac catheterization (angiography," heart cath"). Angiography is likely to be required following a myocardial infarction (heart attack), to assess the outcome of an intervention such as bypass, stent and in a variety of other circumstances. These situations and their ramifications to the pilot will be discussed in the next article.

Another useful test that helps in cardiac assessment is a cardiac ultrasound. This painless quick exam can easily assess valve structure and function, heart muscle wall thickness and volumes, as well as the overall pumps efficiency.

Now that you have a good idea on the overview of the risks and evaluation I would like to present a case that may shed some light on this discussion. It concerns a 42 year old airline captain that presented to the AME for his routine 6 month exam. He was in good shape and exercised on the treadmill 3 times per week. He was not a smoker, and had normal blood pressure. His father had a heart attack at age 54 and his mother and brothers were in good health.

The pilot had his physical and ECG all of which were reported as normal. Prior to leaving the exam room, he stated that during exercise the week prior, he experienced some light headedness but denied chest pain or shortness of breath. The AME ordered an exercise stress test due to the symptoms of light headedness, as this could be a sign of coronary artery disease, particularly when associated with exercise.

The exercise stress test was abnormal (even though the ECG was normal) and the pilot underwent a cardiac angiogram which revealed a 99% blocked right coronary artery that was promptly repaired with a stent. He is back to flying today.

This case demonstrates the importance of clinical history and index of suspicion. Luckily for the pilot, the AME pursued the symptoms and there was a good end result. Remember, your AME is a qualified physician. It is important for your health that you are honest about your medical condition. You can fill out the paperwork later if a deferral is necessary to evaluate a potentially life threatening medical condition.

Next month we will discuss specific cardiovascular conditions and the required steps necessary to get your medical through the special issuance process from the FAA.

The views and opinions in this article are those of the author only and in no way represents opinions of the FAA, JAA, transport Canada or the Australian CASA. All medical certifications are subject to final FAA approval.