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# FLIGHT SURGEON'S GUIDELINES

# CARDIOVASCULAR RISK SCREENING/AIRCREW ECG'S

References: CFMO 27-05 Periodic Health Examination - Aircrew

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## BACKGROUND

1. Cardiovascular disease remains a common medical problem resulting in restriction or grounding of CF aircrew. Our understanding of the causes of atherosclerotic disease continues to evolve. Classic risk factors including gender, age, lipids, smoking, hypertension, left ventricular hypertrophy and diabetes identify groups at higher risk, but do not reliably identify individuals nor account for all cases of coronary heart disease. New conceptual models for atherosclerosis are evolving in which the prime mechanism involves vessel-wall injury and includes consideration of other risk factors such as inflammation, hyperhomocystinemia, viruses and bacteria.

2. Control of classic risk factors and associated life-style changes have had a dramatic impact on the incidence of coronary heart disease in North America over the last decade. As our understanding atherosclerosis evolves, control of known risk factors should continue to be our goal. As new risk factors are identified, it will be necessary to integrate these into our global approach.

3. This Guideline outlines the current approach for risk factor screening and control in Canadian Forces aircrew. With the introduction of this Guideline, the responsibility for risk screening and ECG interpretation are delegated to the Wing/Base Surgeons, and the requirement to send this data to DCIEM is cancelled. ECGs may still be sent on a clinical as required basis for DCIEM interpretation.

4. Two components are included in the Aircrew CV Risk Screening Program:

   a. Primary prevention: identification of individuals with classic risk factors placing them at increased risk for future disease, in whom intervention is indicated to help reduce this risk.

b. Secondary screening: identification of aircrew at high probable risk for a coronary event based on classic risk factors, with recommendations for additional screening procedures to exclude asymptomatic coronary disease.

5. In this context, the following definitions apply:

a. Relative risk: the individual's estimated risk for developing coronary disease compared to a person with "normal" risk factors. Expressed as a ratio eg 2.0 – twice normal risk

b. Absolute risk: the individual's estimated annual risk for having a coronary event, expressed as a percent eg 1.5% per year

6. The CF aircrew cardiovascular risk screening program is based on classic risk factors and estimates risk using the Framingham risk equation, shown in graphic form in Appendix A.

7. Periodicity and Screening for Risk Factors:

a. As defined in Reference A, risk data should be collected during type I medicals once every four years to age 40, then biannually after age 40. Note the periodicity does NOT require a "routine" aircrew ECG with every medical. (Routine ECGs are ineffective for screening, and are personnel-intensive from performing to interpreting to filing).

b. The following risk factors should be collected with the above periodicity:

(1) Total cholesterol

(2) HDL cholesterol

(3) FBS (screen for diabetes)

(4) Blood pressure

(5) ECG screen for LVH. If ECG LVH present, consider an echo (LVH is a risk factor only if echo confirmed, and ECG LVH criteria are frequently "false positive")

(6) Smoking – daily consumption of any tobacco product is considered a positive

(7) Family history – of a coronary heart event (heart attack or angina) in a first degree male relative under 55 or female relative under 60

CALCULATINTG RISK: RELATIVE RISK AND ABSOLUTE RISK

8. Using the attached Framingham graph (attachment A), and the risk factor data for the individual, the risk for a coronary event is calculated. Note the graph represents 10 year risk in percent. The entry point on the graph is based on the individual's age. This entry point represents the baseline risk for a coronary event in the next 10 years in a person with "normal" risk factors, and is the base point for calculating "relative" risk. Starting from this entry point, using the point adjustments for each risk factor indicated in the boxes, find the 10 year risk for the individual. This is given in percent on the ordinate axis. Using this number, calculate:

a. Absolute risk per year = 10 year risk/10

b. Relative risk = final point risk/entry point risk

**Note:** Three examples are given in Appendix B

ACTION LEVELS

9. Primary prevention: Relative risk > 2

a. Individuals with high relative risk (>2x normal) require intervention to reduce their risk

b. Dyslipidemia – Medical Directive 1/95 applies. Identify and treat secondary causes; dietician referral; pharmacologic intervention only if target levels by Health Canada guidelines not achievable after six months of dietary/lifestyle change

(1) If absolute risk > 2% per year, target levels are LDL-C < 3.5, TC/HDL ratio <5

(2) If absolute risk 1-2% per year, target levels are LDL-C < 4.0, TC/HDL ratio < 6

c. Smoking cessation counseling/intervention as appropriate

d. Blood pressure monitoring/control intervention if required

e. Life-style modifications – exercise, weight reduction, alcohol reduction

10. Secondary Screening: Absolute risk > 2% per year

a. Individuals whose absolute risk is equal to or greater than 2% per year should be referred for additional screening for asymptomatic coronary heart disease. This may be accomplished by:

(1) Maximum exercise stress ECG

(2) Maximum exercise stress echo

(3) Sestamibi or thallium nuclear stress imaging with maximum exercise

(4) High resolution CT scan for coronary calcification

b. Although the standard stress ECG is most commonly available, the sensitivity (ability to detect the disease) is low, particularly for single vessel disease, in the range of 50-60%. Stress echo and sestamibi stress imaging both have a higher sensitivity and specificity than a standard stress ECG, and are recommended if available. A positive result on any of these tests is generally an indication for coronary angiography.

c. Secondary screening with stress echo can be arranged for all CF aircrew at DCIEM with minimal delay and can be co-ordinated with Service Air to minimize costs. Base/Wing Surgeons are encouraged to utilize this service, which can be arranged by calling the Medical Assessment Section (416) 635-2082 AVN 827-4101 x2082

FAMILY HISTORY

11. The family history is not factored in the Framingham equation. In assessing risk levels, both absolute and relative, intervention levels should be adjusted downwards for individuals with a positive family history eg. An aircrew with an absolute risk of, say, 1.5% per year and a positive family history may be considered for second level screening. Primary prevention targets should also be tighter in individuals with a positive family history.

AIRCREW DISPOSITION

12. Relative Risk > 2

a. Aircrew with elevated relative risk do not require a geographic or flying restriction during investigation or risk factor intervention unless clinically indicated eg to control significant hypertension.

13. Absolute Risk >2% annual risk

a. Aircrew with elevated absolute risk do not require grounding or a flying restriction while arrangements are being made for second level screening. However, if the second-level screen is positive eg a positive stress test, stress echo etc, the aircrew must be grounded and geographically restricted from deployment while more definitive investigation (coronary angiography) is arranged. Final disposition will depend on the outcome of the further investigations.

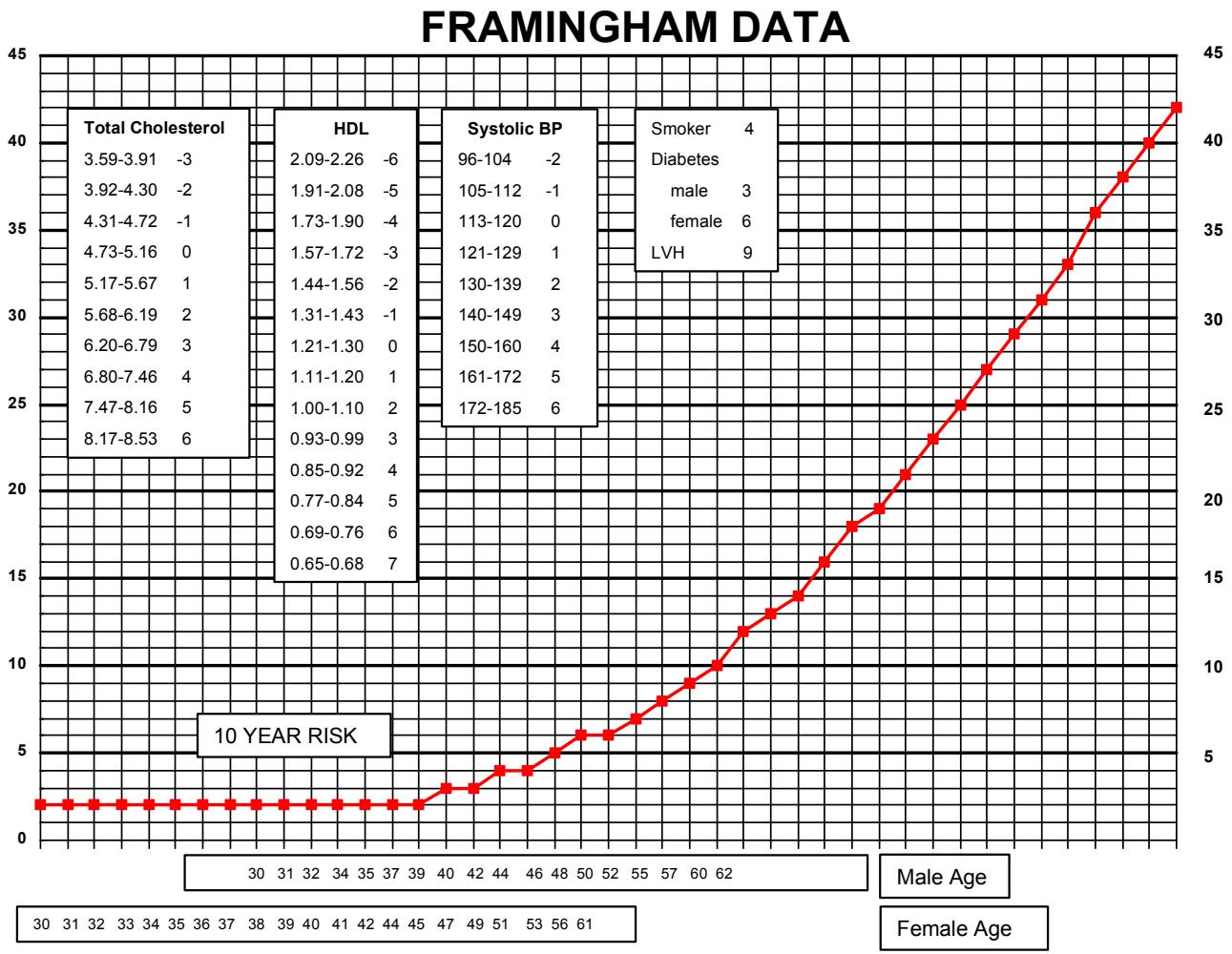
INTERPRETATION OF AIRCREW ECGs

14. The Canadian Forces has maintained a centralized database on aircrew ECGs for decades. As a result of this and other databases, the natural history of most ECG anomalies such as right and left bundle branch block have been defined. There is no longer a requirement to maintain a centralized database on aircrew ECGs, and responsibility for interpretation of aircrew ECGs is delegated to Base/Wing level. Many ECG machines provide an automated interpretation, and the following guidelines are offered

15. ECGs with an automated interpretation as “normal” can be so accepted

16. ECGs with an abnormal or borderline interpretation should be further reviewed by an internist or cardiologist. This can be arranged either locally, or by forwarding the ECG to DCIEM, for review. ECGs can be forwarded to DCIEM either as hard-copy or through the modem service (contact DCIEM for details if necessary)

FRAMINGHAM DATA




APPENDIX A

**Example 1:** **40 year old pilot.**

| **Risk factors**: | | |
|---|---|---|
| | Age | 40 |
| | Cholesterol | 4.75 |
| | HDL | 1.25 |
| | Systolic BP | 120 |
| | Smoker | No |
| | Diabetes | No |
| | LVH | No |

**Using the Framingham chart:**

| | | |
|---|---|---|
| | Entry risk for age 40 male | 3% for 10 years, or 0.3% per year |
| | No adjustment required for this individuals risk factors | |

| | | Disposition |
|---|---|---|
| **Therefore**: | Absolute risk = 0.3% per year | No action required |
| | Relative risk = 1 | No action required |

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**Example 2:** **35 year old Flight Engineer**

| **Risk factors**: | | |
|---|---|---|
| | Age | 35 |
| | Cholesterol | 6.01 (+2 on chart) |
| | HDL | 0.95 (+3 on chart) |
| | Systolic BP | 135 (+2 on chart) |
| | Smoker | yes (+4 on chart) |
| | Diabetes | no |
| | LVH | no |
| | Family history | neg |

**Using the Framingham chart:**

| | | |
|---|---|---|
| | Entry risk for age 35 male | 2% for 10 years, or 0.2% per year |
| | Adjusted risk +11 squares | 8% for 10 years, or 0.8% per year |

| | | Disposition |
|---|---|---|
| **Therefore:** | Absolute risk = 0.8% per year | Secondary testing not required |
| | Relative risk = 8/2 = 4 x normal | Primary prevention intervention indicated<br>• smoking cessation<br>• dietary referral re hyperlipidemia |

**Example 3:** **46 year old navigator**

| **Risk factors**: | | |
|---|---|---|
| | Age | 46 |
| | Cholesterol | 6.90 (+4) |
| | HDL | 0.87 (+4) |
| | Systolic BP | 135 (+4) |
| | Smoker | yes (+4) |
| | Family Hx | Positive (father MI age 52) |

**Using the Framingham chart:**

| | |
|---|---|
| Entry risk for age 46 male | 4% for 10 years, or 0.4% per year |
| Adjusted risk +16 squares | 25 % for 10 years, or 2.5% per year |

| | | Disposition |
|---|---|---|
| **Therefore:** | Absolute risk = 2.5% per year | Second level screening eg stress test, stress echo |
| | Relative risk = 25/4 = 6.25 | Primary prevention intervention required |