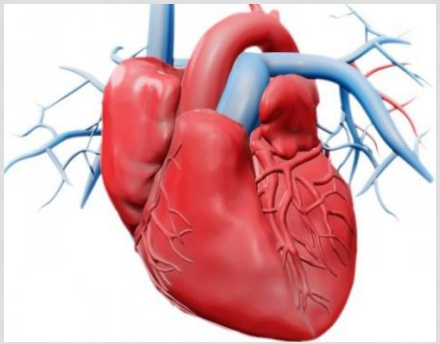
65th International Congress of Aviation and Space Medicine
Rome, 10-14 september 2017

CORONARY ARTERY DISEASE SCREENING IN AIRCREW MEMBERS: A FRENCH RETROSPECTIVE STUDY



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DISCLOSURE INFORMATION
65TH INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE
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I have no financial relationships to disclose.

I will not discuss off-label use and/or investigational use in my presentation

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INTRODUCTION

Live Science > Health

Pilot's Heart Attack: How Often D… Flight Emergencies Happen?

By Bahar Gholipour, Staff Writer | September 27, 2013 02:17pm ET

Credit: Airplane photo via Shutterstock

A pilot's heart attack turned a United Airlines flight to Seattle into a dramatic scene w… passengers attempted t… the pilot's life, and one h… the co-pilot make an emergency landing in B… Idaho. The pilot died at t… hospital, according to n… reports.

A midair heart attack is a scary scenario for sure, but the incident last night (Sept. 26) was unusual -- heart attacks on flights are rare, and deaths are even rarer.

Pilot suffers heart attack at Glasgow airport as he prepares to take off with 128 aboard

theguardian

KLM captain on Amsterdam route was resuscitated by crew and a passenger after becoming unwell while heading for runway

If both pilots of an airplane were to die of simultaneous heart attacks, could the autopilot prevent a crash?

Quora

METHODS

- Aims of the study:
  - To describe the population of AM with a CAD
  - To evaluate the differences according to the clinical presentation (myocardial infarction, moderate symptoms, screening)

METHODS

Included population:

- Aircrew members examined in the AeMC of Clamart between 2010 and 2015
- History of coronary artery disease

86,691 files

Could be previous to 2010

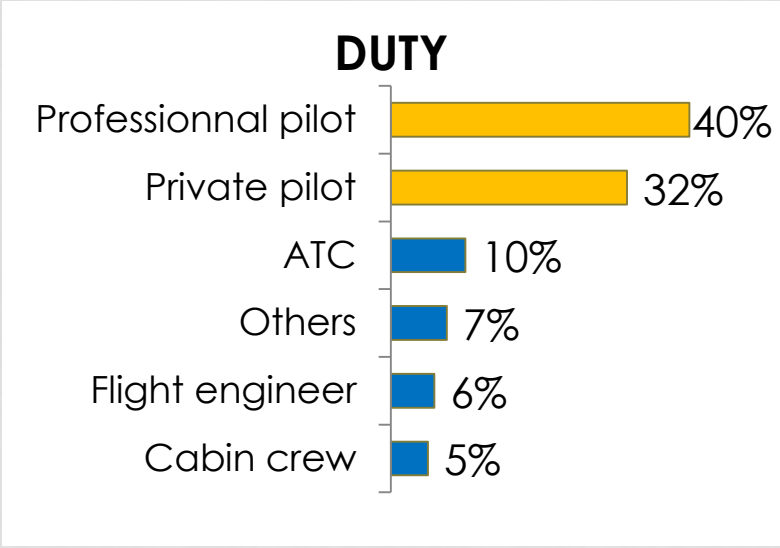
METHODS

Analyzed Data:

- Age, sex, BMI, flight duty
- Cardio-vascular risk factors and SCORE risk
- Diagnosis, treatment, sequelae
- Fitness assessment

RESULTS AND DISCUSSION

- **120 AM with CAD**:
  - Mean age: 53.2+/-8.9yo
  - 98.3% males
  - 79.2% civilians
  - BMI: 26.7+/-3.1kg/m²

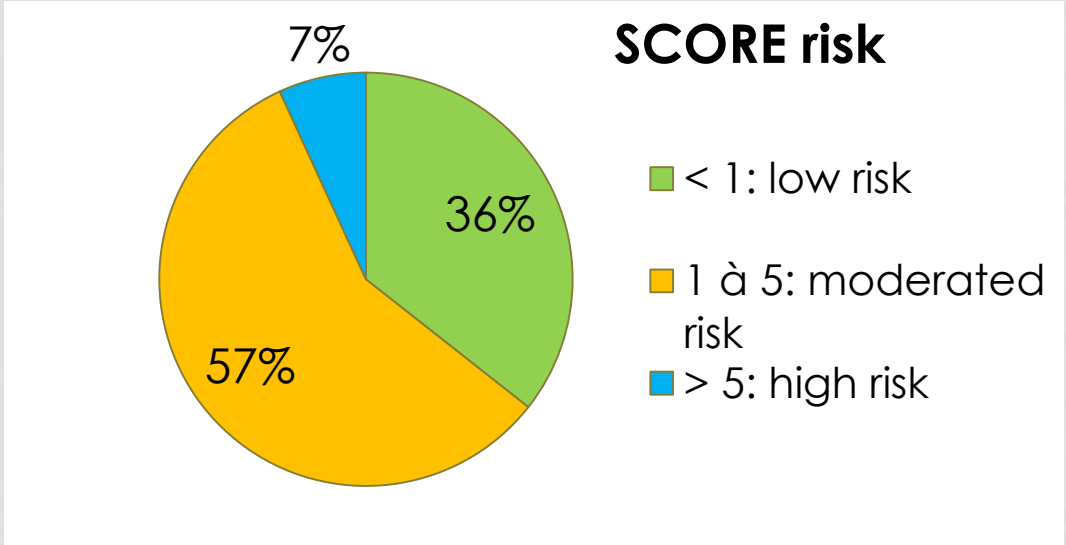


Incidence : 88 cases per 100,000 AM per year
(vs 400/100,000/y in french general population)

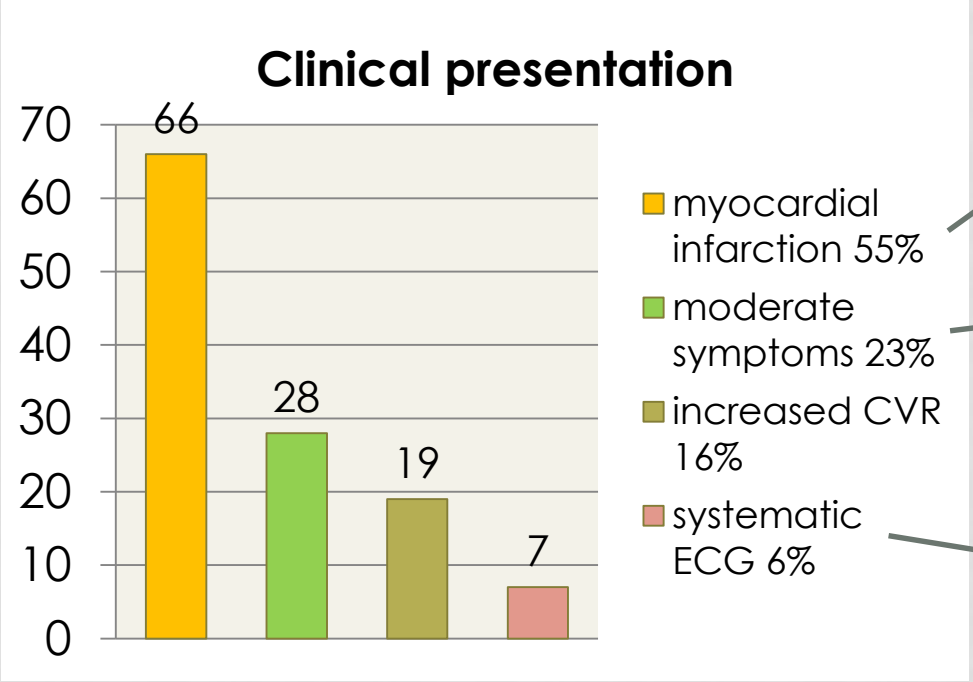
CARDIOVASCULAR RISK

CVRF	n (%)
Age	81(67.5)
Tobacco use	49(40.8)
Dyslipidemia	49(40.8)
Family history	31(25.8)
Hypertension	30(25)
Diabetes	7(5.8)
Obesity	18(15)
Sedentarity	16(13.3)

87% with 2 or more CVRF



DIAGNOSIS

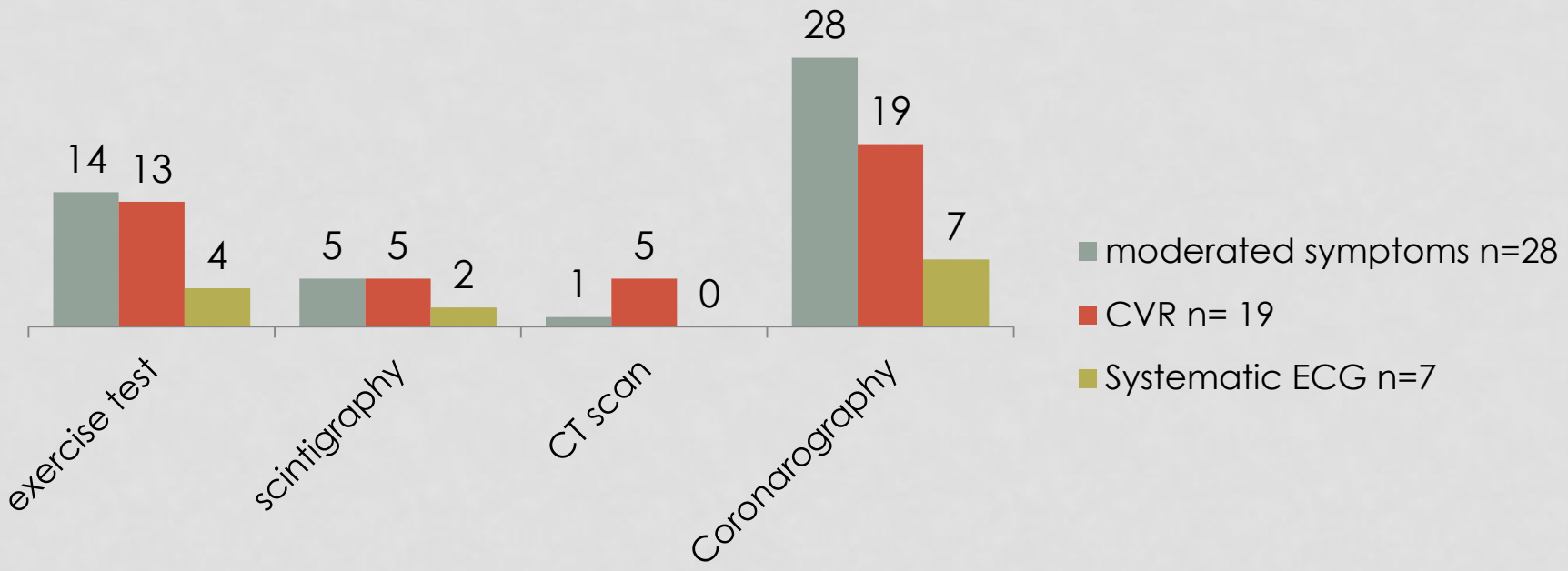


Including 2 pilots with in flight events

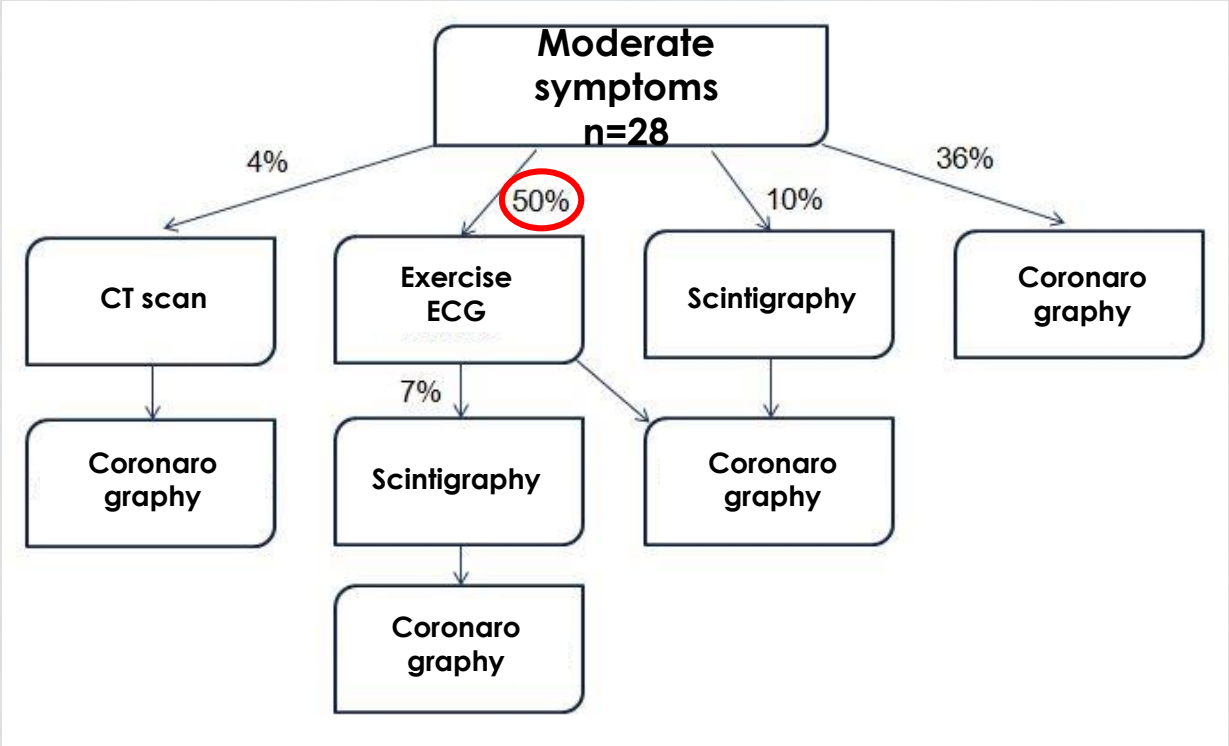
62% of them during physical activities

Premature ventricular beats n=3
Abnormal repolarization n=2
LBBB
Necrosis sequelae

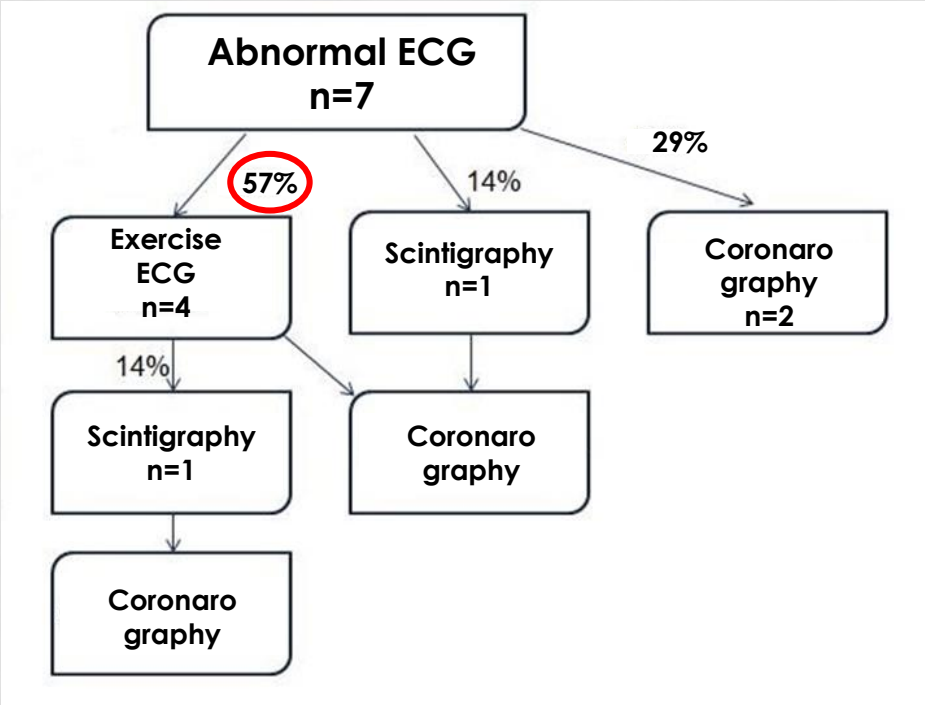
DIAGNOSIS


14
13
4
5
5
2
1
5
0
28
19
7
exercise test
scintigraphy
CT scan
Coronarography
moderated symptoms n=28
CVR n= 19
Systematic ECG n=7

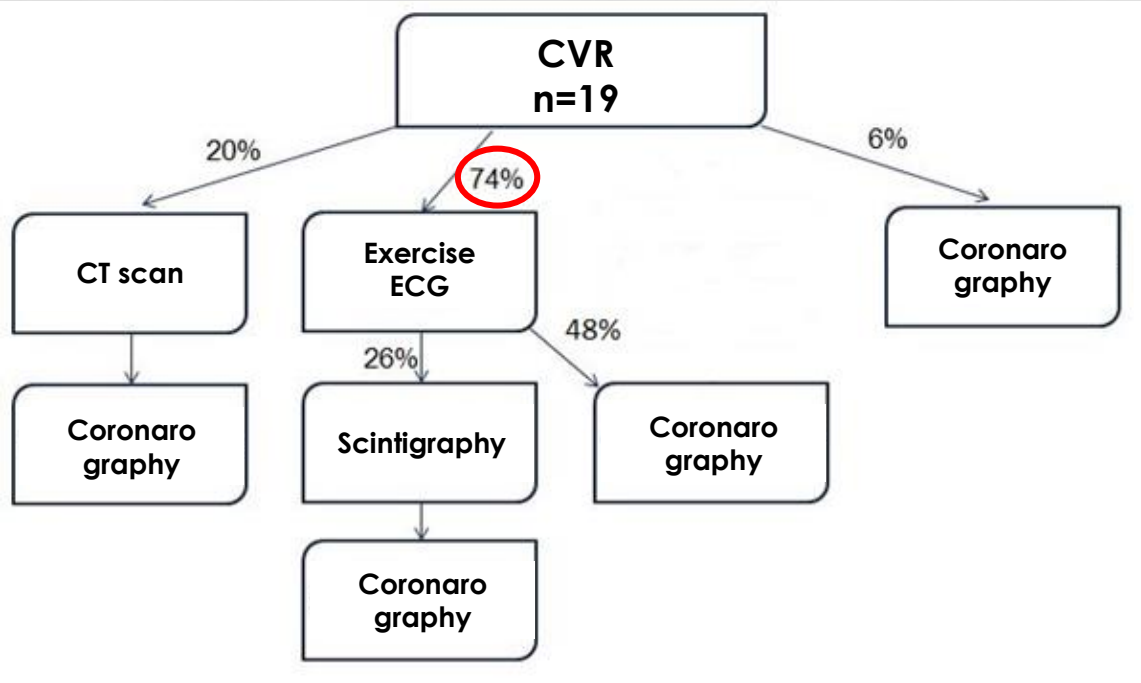
DIAGNOSIS


Moderate symptoms n=28
4%
50%
10%
36%
CT scan
Exercise ECG
Scintigraphy
Coronaro graphy
7%
Coronaro graphy
Scintigraphy
Coronaro graphy
Coronaro graphy

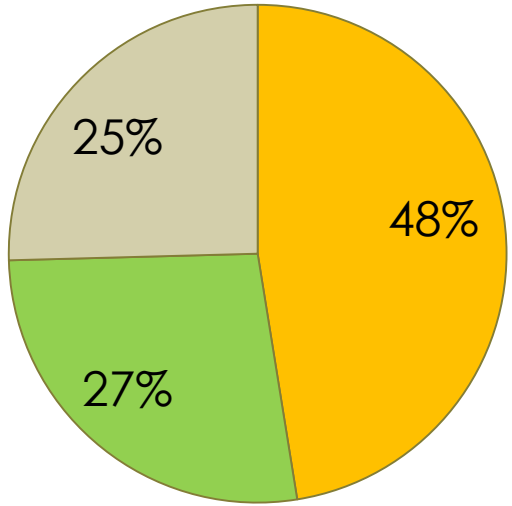
DIAGNOSIS

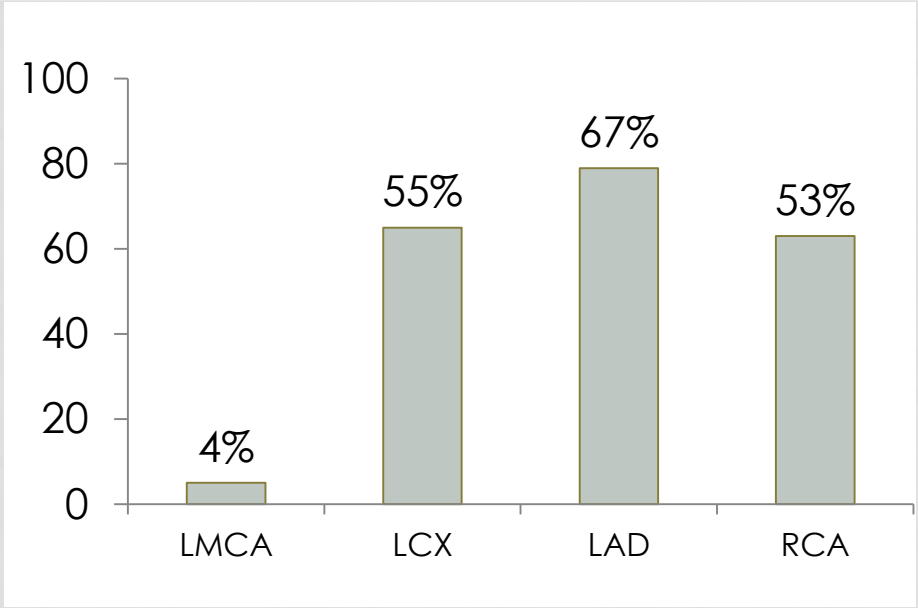

Abnormal ECG
n=7
57%
14%
29%
Exercise
ECG
n=4
Scintigraphy
n=1
Coronaro
graphy
n=2
14%
Scintigraphy
n=1
Coronaro
graphy
Coronaro
graphy

DIAGNOSIS

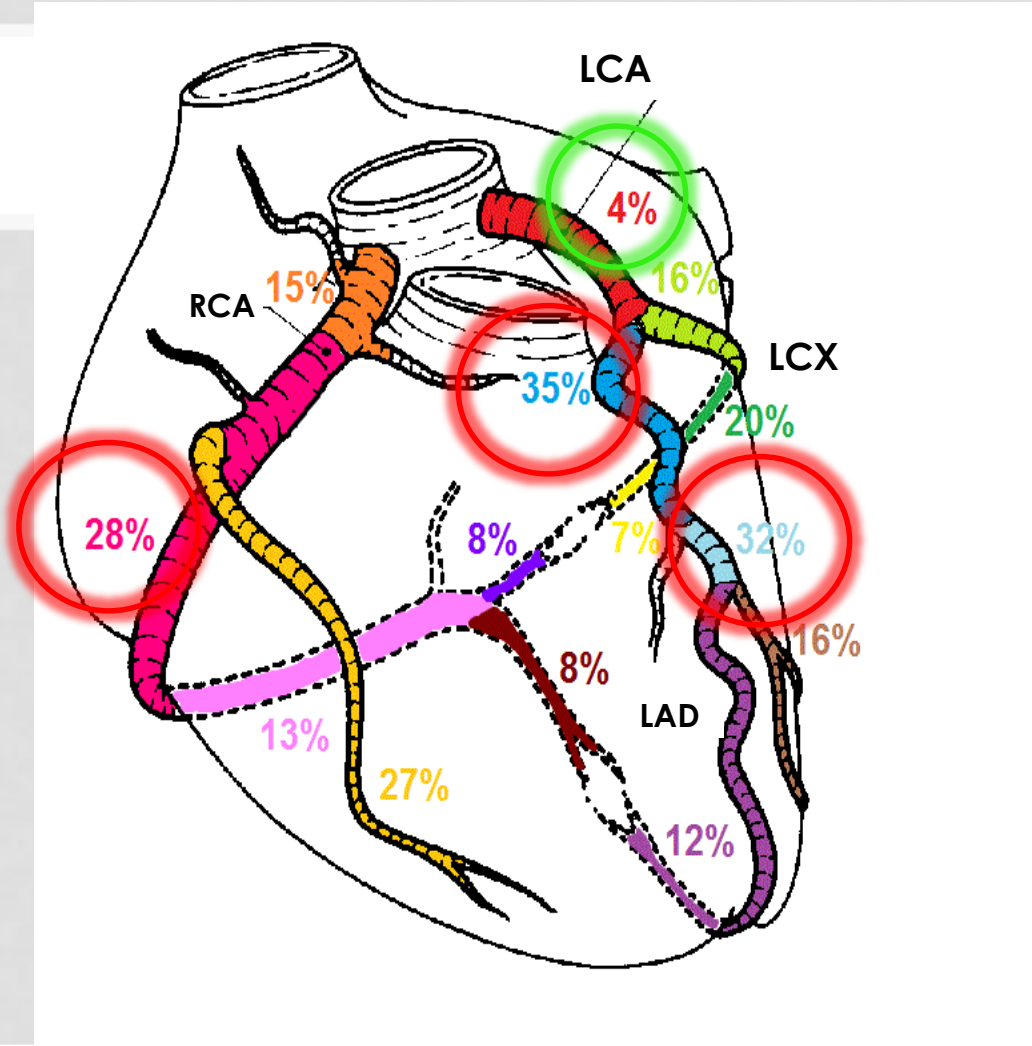

CVR
n=19
20%
74%
6%
CT scan
Exercise
ECG
Coronaro
graphy
48%
26%
Coronaro
graphy
Scintigraphy
Coronaro
graphy
Coronaro
graphy

DIAGNOSIS





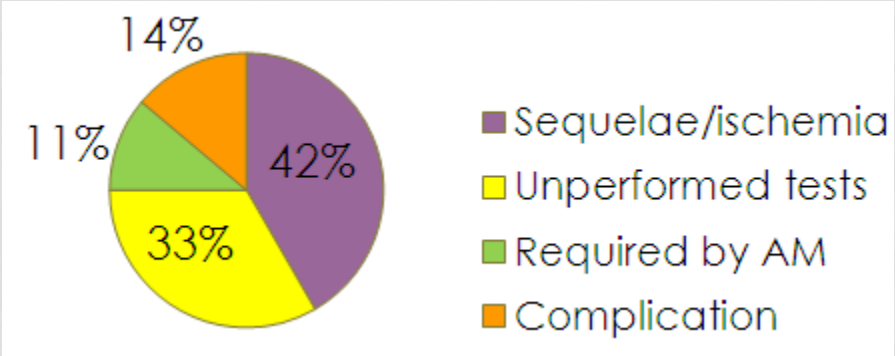
LMCA: Left main coronary artery
LCX: Left circumflex artery
LAD: Left anterior descending artery
RCA: Right coronary artery


LCA
4%
16%
RCA
15%
LCX
35%
20%
28%
8%
7%
32%
16%
8%
LAD
13%
27%
12%

TREATMENT AND FITNESS ASSESSMENT

- 74% treated by percutaneous coronary intervention
  - 2 or more stents for 45% of the population

- 71% declared fit:
  - Time limitation 91%
  - Multi pilot limitation 81%
- 29% declared unfit



CLINICAL PRESENTATION

	Myocardial infarction (n=66)	Moderate symptoms (n=28)	No symptom (n=26)	p value
BMI (kg/m²)	27.06 ± 3.19	26.32 ± 3.12	26.30 ± 3.01	NS
Age (yo)	51.11 ± 8.03	53.86 ±10.39	↑57.58 ± 7.98	< 0.01
number of CVRF	2.03 ± 1.09	2 ±1.09	2.31 ± 1.09	NS
SCORE CV risk	1.52 ± 1.20	1.75 ± 2.40	↑ 3.64 ± 3.58	< 0.05
Period between diagnosis and decision (months)	25.06 ± 36.9	23.71 ± 27.86	↓10.92 ± 4.92	< 0.01

CLINICAL PRESENTATION

		Myocardial infarction (n=66)	Moderate symptoms (n=28)	No symptom (n=26)
Coronary lesion	LCX	30 (46.9%)	13 (46.3%)	22 (84.6%) ↑
Treatment	Bypass	4 (6.1%)	7 (25%) ↑	3 (11.5%)
Investigations	Normal TTE	26 (39.4%) ↓	21 (75%)	19 (73.1%)

No significant difference for :

- crew duty
- civilian/military status
- **fitness decision**…

CAD SCREENING IN ASYMPTOMATIC AIRCREW MEMBERS

MED.B.010 Cardiovascular System

(a) *Examination*

(1) A standard 12-lead resting electrocardiogram (ECG) and report shall be completed on clinical indication and:

(i) for a Class 1 medical certificate, at the examination for the first issue of a medical certificate, then every 5 years until age 30, every 2 years until age 40, annually until age 50, and at all revalidation or renewal examinations thereafter;

(ii) for a Class 2 medical certificate, at the first examination after age 40 and then every 2 years after age 50.

(2) Extended cardiovascular assessment shall be required when clinically indicated.

(3) For a Class 1 medical certificate, an extended cardiovascular assessment shall be completed at the first revalidation or renewal examination after age 65 and every 4 years thereafter.

(4) For a Class 1 medical certificate, estimation of serum lipids, including cholesterol, shall be required at the examination for the first issue of a medical certificate, and at the first examination after having reached the age of 40.

No ECG between 40 and 50yo

CAD screening = After 65yo

CVRF screening = Serum lipids at 40yo

CAD SCREENING: CV RISK

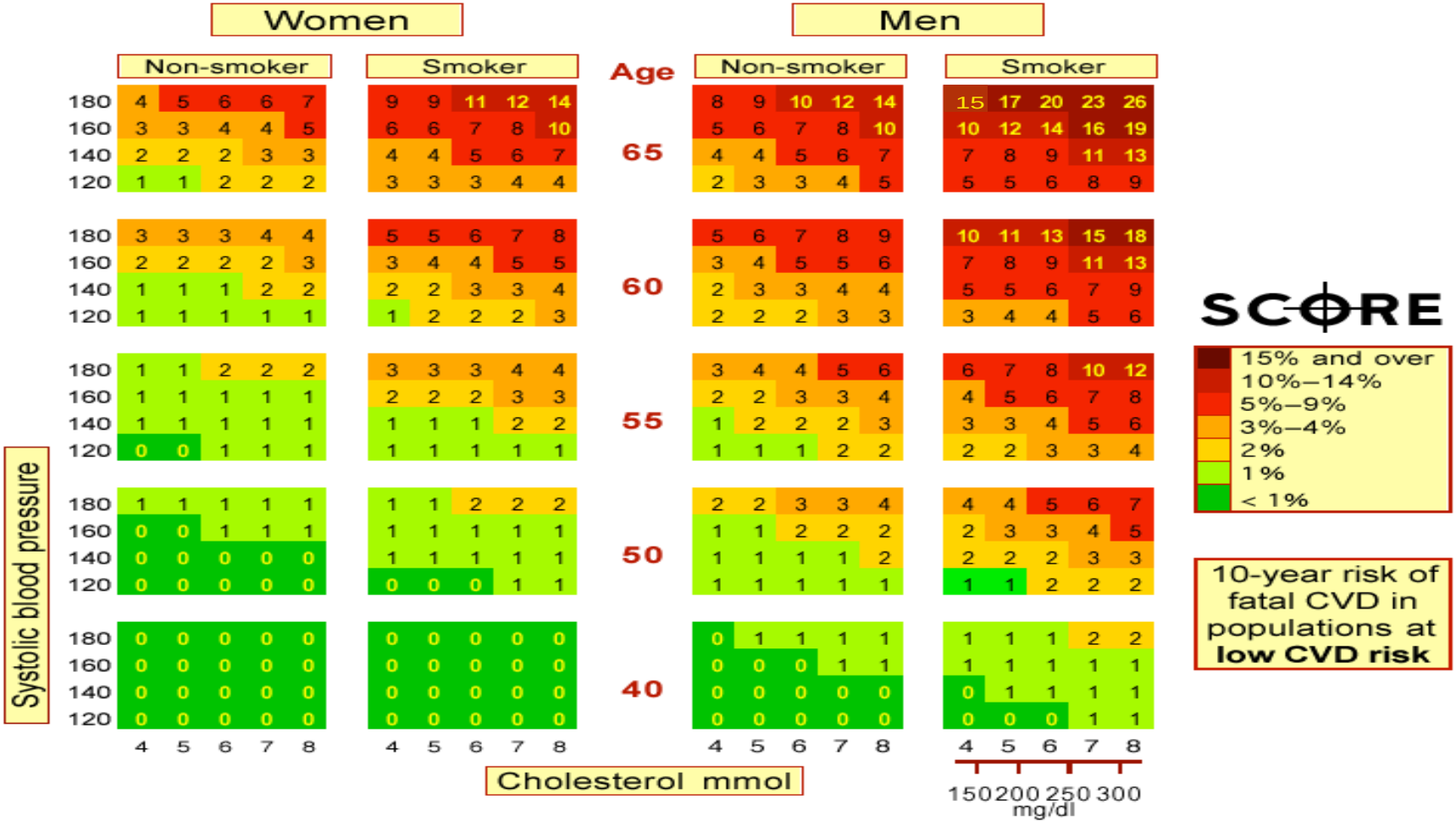
- Importance of interrogatory and clinical examination

  - Family history
  - Tobacco use
  - Hypertension
  - Sedentarity
  - Obesity
  - Sleep apnea…

- Blood tests

  - Diabetes
  - Cholesterol

- Evaluation of the CV risk


Women
Men
Non-smoker
Smoker
Non-smoker
Smoker
Age
65
60
55
50
40
Systolic blood pressure
180 160 140 120
4 5 6 7 8
Cholesterol mmol
150 200 250 300
mg/dl
SCORE
15% and over
10%–14%
5%–9%
3%–4%
2%
1%
< 1%
10-year risk of fatal CVD in populations at low CVD risk

e 21 Testing in asymptomatic patients at risk for stable coronary artery disease

Recommendations	Class [a]	Level [b]
In asymptomatic adults with hypertension or diabetes a resting ECG should be considered for CV risk assessment.	IIa	C
In asymptomatic adults at intermediate risk (see SCORE for definition of intermediate risk - www.heartscore.org) measurement of carotid intima-media thickness with screening for atherosclerotic plaques by carotid ultrasound, measurement of ankle-brachial index or measurement of coronary calcium using CT should be considered for CV risk assessment.	IIa	B
In asymptomatic adults with diabetes, 40 years of age and older, measurement of coronary calcium using CT may be considered for CV risk assessment.	IIb	B
In asymptomatic adults without hypertension or diabetes a resting ECG may be considered.	IIb	C
In intermediate-risk asymptomatic adults (see SCORE for definition of intermediate risk - www.heartscore.org), (including sedentary adults considering starting a vigorous exercise programme), an exercise ECG may be considered for CV risk assessment particularly when attention is paid to non-ECG markers such as exercise capacity.	IIb	B
In asymptomatic adults with diabetes or asymptomatic adults with a strong family history of CAD or when previous risk assessment testing suggests high risk of CAD, such as a coronary artery calcium score of 400 or greater stress imaging tests (MPI, stress echocardiography, perfusion CMR) may be considered for advanced CV risk assessment.	IIb	C
In low- or intermediate-risk (based on SCORE) asymptomatic adults stress imaging tests are not indicated for further CV risk assessment.	III	C

ESC Guidelines SCAD 2013, European Heart Journal, 2013

CAD SCREENING

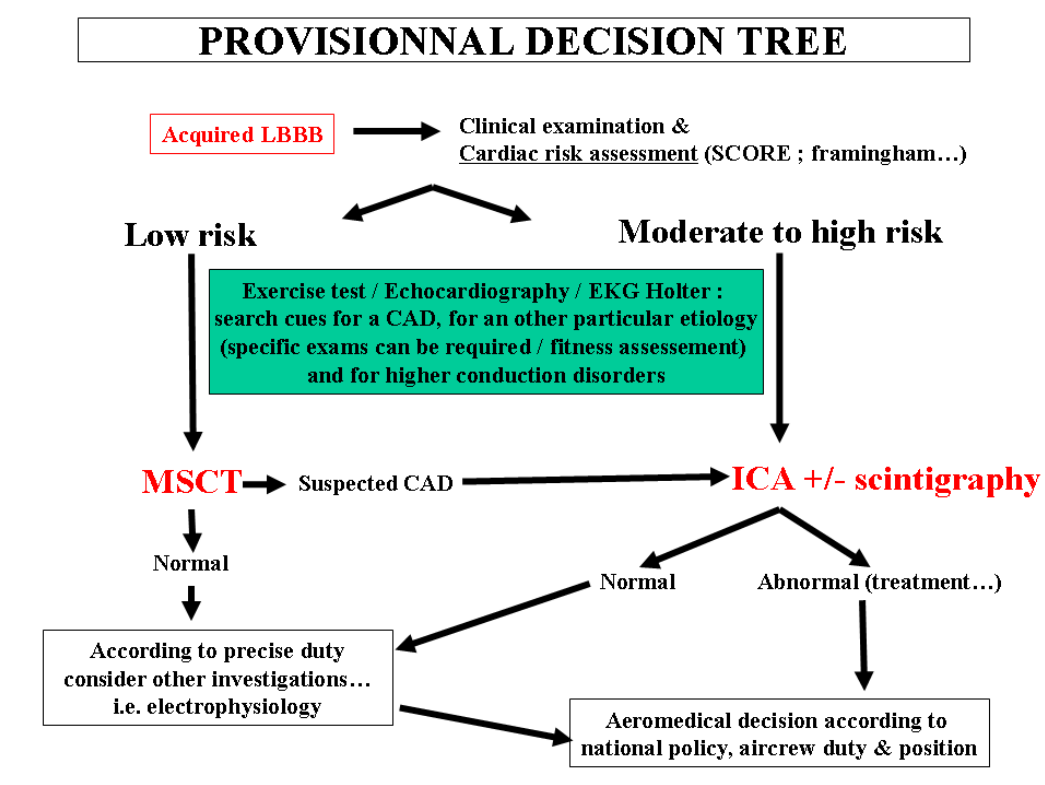
- Non invasive cardiological tests ?
  - Exercise ECG
  - MSCT
  - MRI

For what population ?
- Only for high or moderate CV risk ?
- Abnormal ECG
- Everybody over 40yo?

Table 12 Characteristics of tests commonly used to diagnose the presence of coronary artery disease

	Diagnosis of CAD	
	Sensitivity (%)	Specificity (%)
Exercise ECG [a, 91, 94, 95]	45–50	85–90
Exercise stress echocardiography[96]	80–85	80–88
Exercise stress SPECT[96-99]	73–92	63–87
Dobutamine stress echocardiography[96]	79–83	82–86
Dobutamine stress MRI[b,100]	79–88	81–91
Vasodilator stress echocardiography[96]	72–79	92–95
Vasodilator stress SPECT[96, 99]	90–91	75–84
Vasodilator stress MRI[b,98, 100-102]	67–94	61–85
Coronary CTA[c,103-105]	95–99	64–83
Vasodilator stress PET[97, 99, 106]	81–97	74–91

ESC Guidelines SCAD 2013, European Heart Journal, 2013



Perrier E et al.

Aviat Space Environ Med 2006.

Am Heart J 2006

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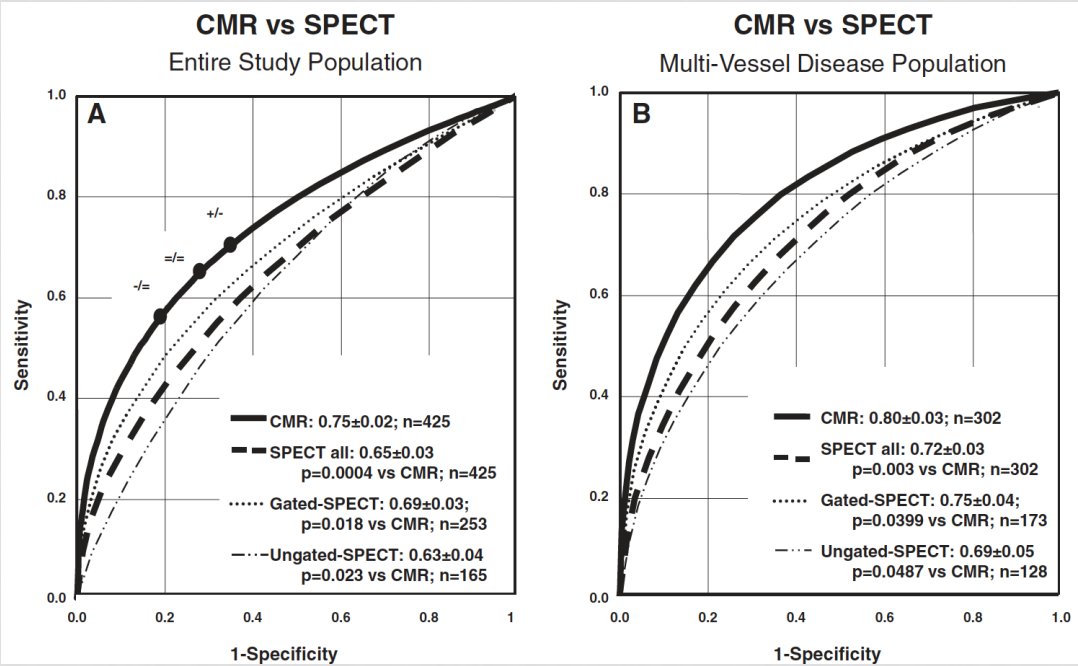
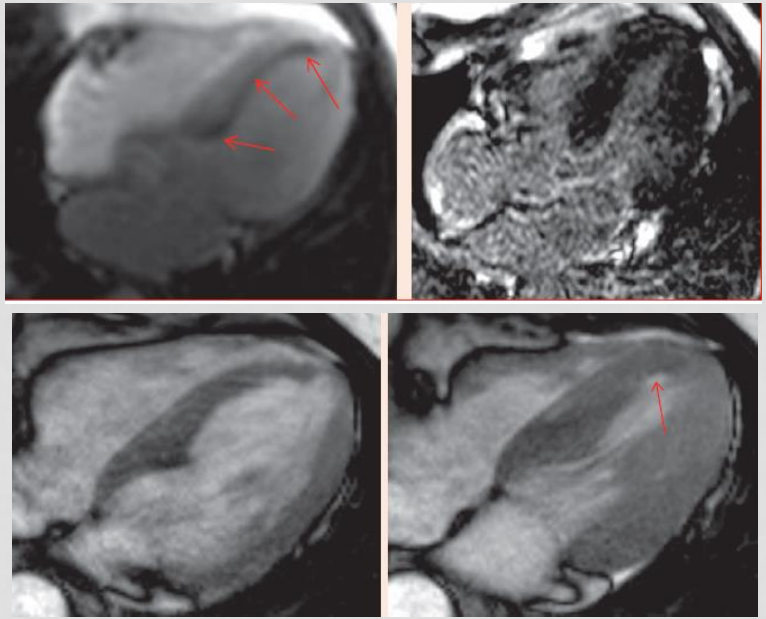
Cardiac computed tomography: Indications, applications, limitations, and training requirements - Report of a Writing Group deployed by the Working Group Nuclear Cardiology and Cardiac CT of the European Society of Cardiology and the European Council of Nuclear Cardiology 2008*European Heart Journal* 29 (4), pp. 531-556

CARDIAC MRI





Schwitter et al EHJ 2013, JCMR 2012

MAIN FEATURES OF AM WITH CAD

- Presentation: myocardial infarction (55%)
- CVR : low or moderate (93%)
- At least 2 CVRF (especially age, smoking, dyslipidemia)
- Bi or triconcular lesions (52%)
- >1/3 with lesion on proximal LAD or LMCA
- Treated with PCI (≥ 2 stents in 45% of cases)
- Declared fit (71%), multi pilot limitation (81%)

CONCLUSION

- 55% of AM with myocardial infarction

⇒Improvement of CAD screening is necessary

  - CV risk evaluation
  - Resting ECG
  - Exercise ECG remains useful
  - MSCT: CAD screening when low risk
  - Stress MRI : CAD screening when moderate or high risk

=>Interest of the coronary calcium score

- Prevention remains essential