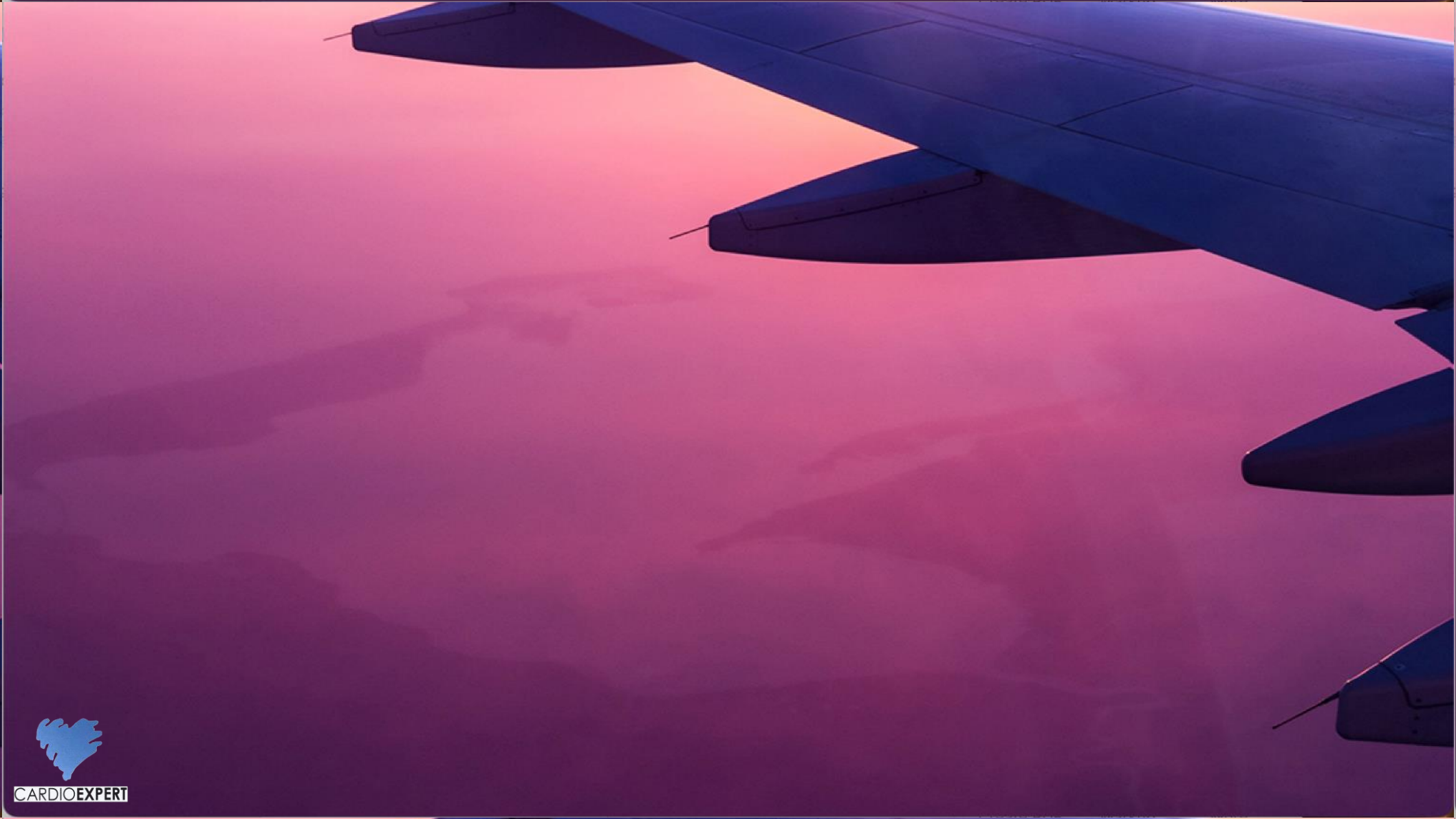




CARDIOEXPERT



Knelpunten bij uitvoering van cardiologische luchtvaart expertises

dr. Jeroen J.J. Bucx, cardioloog
partner CardioExpert Bunnik
Luchtvaart Cardiologie Symposium 19.04.24
Centrum voor Mens en Luchtvaart, Soesterberg



Potentiële belangenverstrengeling	Geen
Voor bijeenkomst mogelijk relevante relaties met bedrijven	n.v.t.
Sponsoring of onderzoeksgeld Honorarium of andere (financiële) vergoeding Aandeelhouder Andere relatie, namelijk ...	Partner CardioExpert



Agenda

- Rapport specification ILT
- Wanneer is er sprake van een verhoogd risico ?
- Wat is een acceptabel risico op acute invaliditeit (“incapacitation”)
- Methoden van risico schatting
- Verwijzing klanten CardioExpert Bunnik
- Vraagstelling en onderzoek CardioExpert Bunnik
- Casus (2)
- Conclusies en aanbevelingen



Report specifications ILT 1/3

1. Diagnoses

2. History

- Presenting symptoms

- Nature of conditions, circumstances surrounding onset, precipitating factors

- Other relevant medical history

3. Examination and investigation findings

Clinical examination

- Blood Pressure within acceptable parameters
(Flowchart - Hypertension certification)

- Blood tests (Urea & NaK, Renal/Liver Profile, Lipid Profile, Glucose)
Confirmation no end organ damage



Report specifications ILT 2/3

3. Examination and investigation findings (cont'd)

Cardiovascular risk assessment

- Family history, smoking, alcohol, weight (BMI), lifestyle intervention
- Resting ECG
- Exercise Tolerance Test Report (where indicated)
- Echocardiogram (where indicated)
- 24-hour ECG (where indicated)
- Angiogram (where indicated)
- Cardiac MRI, Myocardial Perfusion Scan, Stress Echocardiogram (dobutamine or exercise), CT (as indicated)



Report specifications ILT 3/3

4. Treatment

Current and recent past medication (dose, frequency, start and finish date)

Confirmation no side effects from medication

5. Follow up and further investigations/ referrals planned or recommended

Plan of management and anticipated follow up

6. Clinical implications

Any concerns regarding disease progression, treatment compliance or risk of sudden incapacity



Evaluatie vereist (ILT/FAA/CAA) 1/2

- Coronarialijden
- Hartfalen (NB: LVEF < 50% altijd “unfit to fly”)
- Hartklep afwijkingen
- Geleidingsstoornissen (RBBB, LBBB, WPW, Brugada)
- Ritmestoornissen (PVCs, atriumfibrilleren, syncope)
- Nadere evaluatie indien (on)behandeld, actueel of in verleden



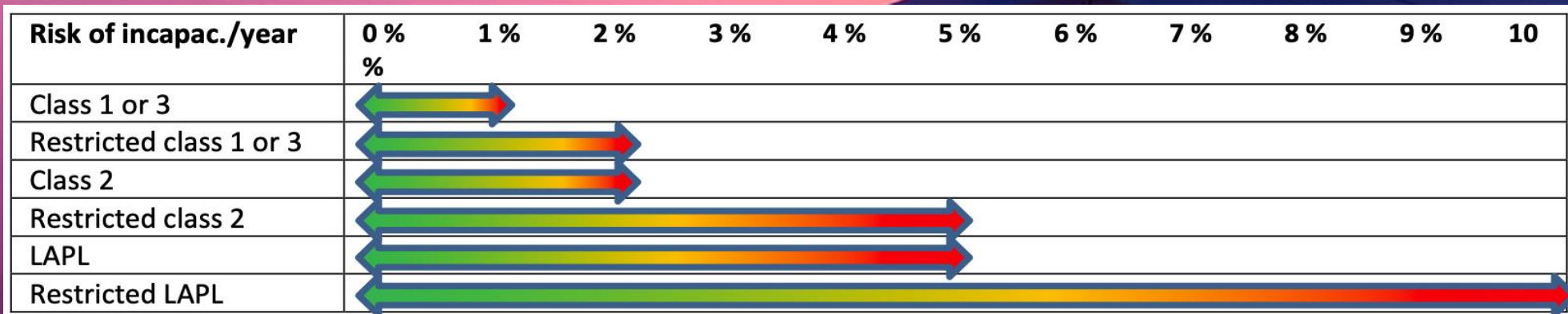
Evaluatie vereist (ILT/FAA/CAA) 2/2

- Kamerhypertrofie (hypertensie, H(O)CM)
- ECG afwijkingen (zie: Table investigation of ECG abnormalities)
- Vaatafwijkingen (aneurysma thoracaal/abdominaal)
- Medicatie (antiarritmica / stolling / ander)
- Permanente pacemaker / harttransplantatie
- ICD: unfit to fly



Nadere evaluatie indien (on)behandeld, actueel of in verleden

Acceptabel risico acute incapacitatie



-  Acceptable level of risk for incapacitation due to acute pain attacks or similar medical incidents (grade 1 incapacitation)
-  Acceptable level of risk for incapacitation due to syncope or similar medical incidents (grade 2 incapacitation)
-  Acceptable level of risk for incapacitation due to epileptic seizures or similar medical incidents (grade 3 incapacitation)



Risk assessment

- Risico calculator
- Electrocardiogram (ECG)
- Echocardiogram
- Inspannings onderzoek
- Hartritme registratie
- Aanvullende beeldvorming
- Aanvullend functie onderzoek



Risico calculator: QRISK[®]3 (1/4)



Welcome to QRISK[®]3-lifetime cardiovascular risk calculator: <https://qrisk.org/lifetime>

This calculator is only valid if you do not already have a diagnosis of coronary heart disease (including angina or heart attack) or stroke/transient ischaemic attack.

Reset

UKCA

About you

Age (25-84):

Sex: ☒ Male ☐ Female

Ethnicity:

UK postcode: leave blank if unknown

Postcode:

Clinical information

Diabetes status:

Angina or heart attack in a 1st degree relative < 60? ☐

Chronic kidney disease (stage 3, 4 or 5)? ☐

Atrial fibrillation? ☐

On blood pressure treatment? ☐

Do you have migraines? ☐

Rheumatoid arthritis? ☐

Systemic lupus erythematosus (SLE)? ☐

Severe mental illness? (this includes schizophrenia, bipolar disorder and moderate/severe depression) ☐

On atypical antipsychotic medication? ☐

Are you on regular steroid tablets? ☐

A diagnosis of or treatment for erectile dysfunction? ☐

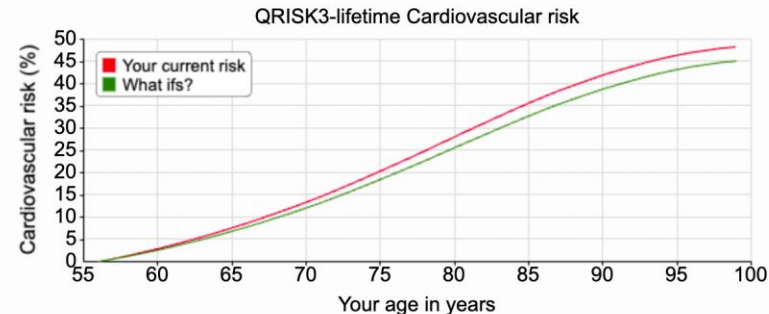
Your results

Your QRISK3-lifetime score

Current What if?

Your lifetime risk (i.e. by the time you are 99)

48.2% 45.1%



In other words, in a crowd of 100 people like you,

- 48 will develop heart disease or have a stroke/TIA by the time they reach 99.

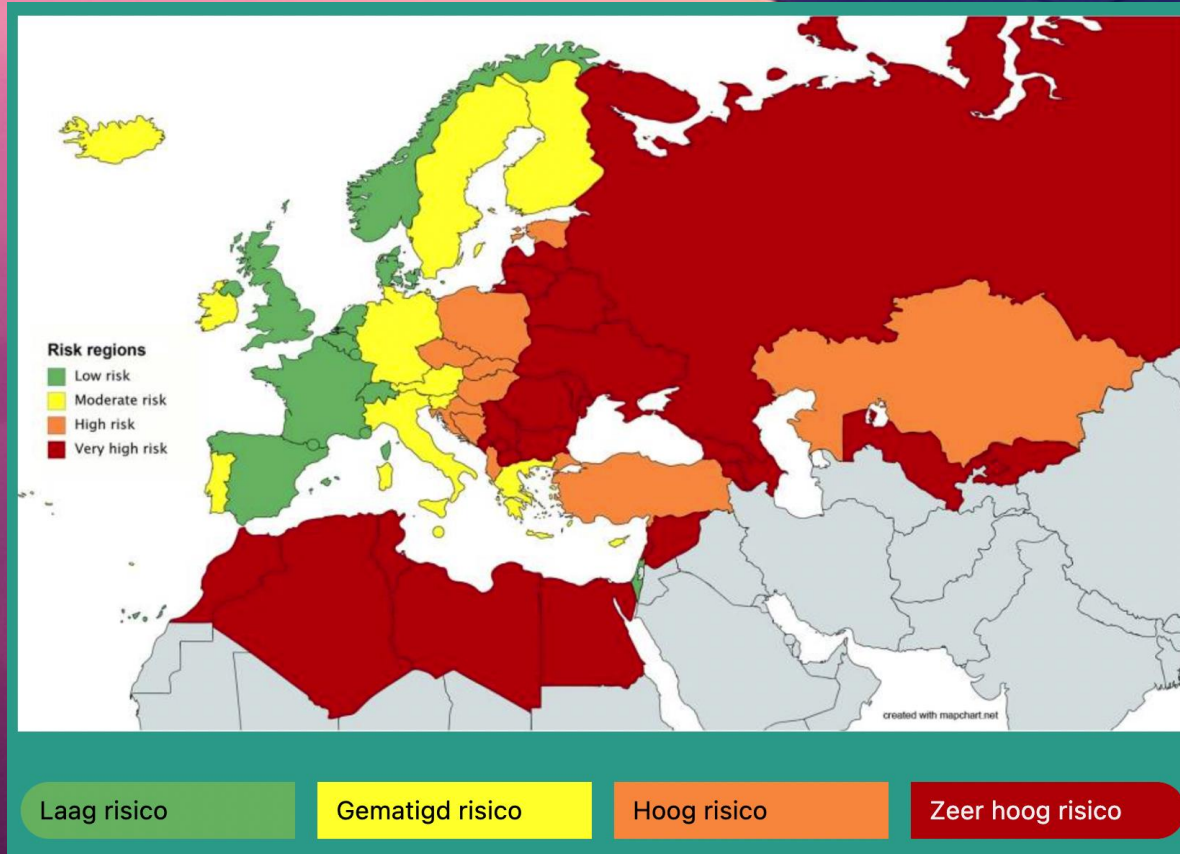
Your score has been calculated using estimated data, as some information was left blank.



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Hippisley-Cox J, Coupland C, and Brindle P. Development and validation of QRISK3 risk prediction algorithms to estimate future risk of cardiovascular disease: prospective cohort study. BMJ 2017; 357

Risico calculator: Score2 (2/4)



SCORE2 working group and ESC Cardiovascular risk collaboration. SCORE2 risk prediction algorithms: new models to estimate 10-year risk of cardiovascular disease in Europe. EHJ (2021) 42, 2439–2454



Risico calculator: Score2 (3/4)

U-Prevent⁺ CALCULATOREN HANDLEIDING OVER CONTACT NL

Persoonlijk risicoprofiel ⁱ

Risico van de geografische regio	...La*	Systolische bloeddruk	140	mmHg
Geslacht	M*	Totaal cholesterol	6	mmol/L
Leeftijd	56	HDL-cholesterol	1.2	mmol/L
Roken	-	LDL-cholesterol	4	mmol/L

jaar

Aanpassen gegevens

10-jaars risico

Huidig 10-jaars risico op een hartinfarct, beroerte of cardiovasculaire sterfte

Percentage

5.2%	1.9%	52
Huidig risico ⁱ	Reductie door behandeling ⁱ	10-jaars NNT ⁱ

Toekomstige behandeling ⁱ

LDL-cholesterol

< 3.0 mmol/L / < 116 mg/dL

Systolische bloeddruk

< 130 mmHg

Bloedverduunners ☐

Resetten

SCORE2 working group and ESC Cardiovascular risk collaboration. SCORE2 risk prediction algorithms: new models to estimate 10-year risk of cardiovascular disease in Europe. EHJ (2021) 42, 2439–2454



ASCVD Risk Estimator Plus (4/4)

**AMERICAN COLLEGE of CARDIOLOGY**

8.9%
Intermediate

Current 10-Year ASCVD Risk**

Lifetime ASCVD Risk: 46% **Optimal ASCVD Risk: 3.9%**

Current Age ⓘ *

Age must be between 20-79

Sex *

☒ Male

☐ Female

Race *

☒ White

☐ African American

☐ Other

Systolic Blood Pressure (mm Hg) *

Value must be between 90-200

Diastolic Blood Pressure (mm Hg) *

Value must be between 60-130

Total Cholesterol (mmol/L) *

Value must be between 3.367 - 8.288

HDL Cholesterol (mmol/L) *

Value must be between 0.518 - 2.59

LDL Cholesterol (mmol/L) ⓘ ○

Value must be between 0.777-7.770

History of Diabetes? *

☐ Yes

☒ No

Smoker? ⓘ *

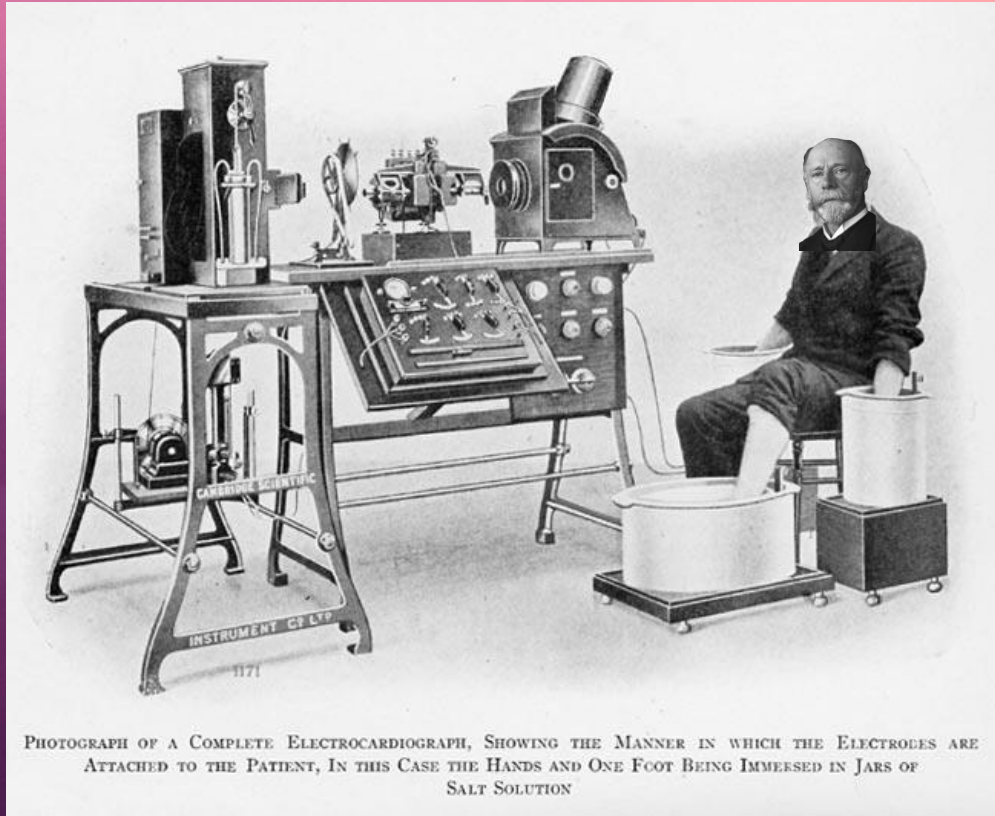
☐ Current ⓘ

☐ Former ⓘ

☒ Never ⓘ



Electrocardiogram (ECG)



22 maart 1905:
W. Einthoven
Eerste (tele)
electrocardiogram

2024:
Nobel prijs Geneeskunde
“for his discovery of the
mechanism of the
electrocardiogram”

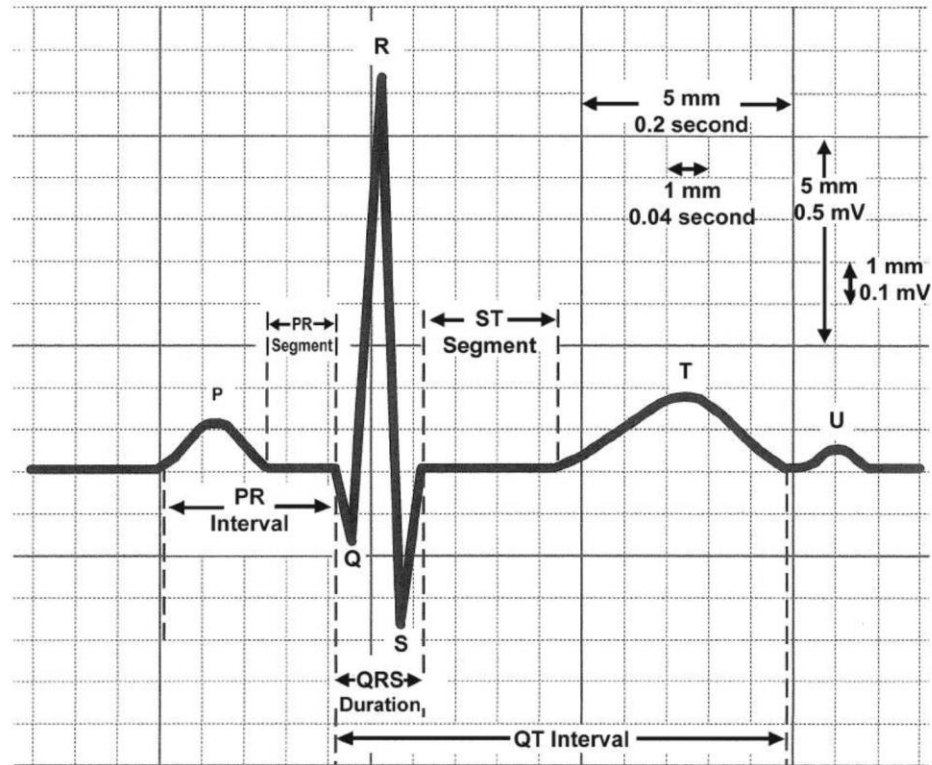


Essentials Electrocardiogram (ECG)

Systematic Approach to the Interpretation of ECG (with normal values in parenthesis)

- **Rhythm**
 - Determine regularity
 - Identify atrial activities
 - Determine P - QRS relationship
- **Rate** (50-100/min)
- **P wave morphology**
- **P-R interval** (120-200 msec)
- **QRS**
 - Morphology
 - Duration < 100 msec)
 - Voltage
 - Axis (-30° to 90°)
- **ST segment**
- **T wave**
- **U wave**
- **Q-T interval**
- **Delta wave, Osborne wave (J wave), Epsilon wave (ARVD)**

ECG Waves, Intervals & Segments



Investigation of ECG abnormalities

1: Cardiologist review
2: Exercise ECG

3: 24hr Holter
4: Echocardiogram

Diagnosis	Class 1		Flowcharts and guidance material available (Class 1/2)	Class 2	
	Fitness assessment	Minimum investigations, others if clinically indicated		Fitness assessment	Minimum investigations, others if clinically indicated
Incomplete RBBB	AME	Investigate if other abnormalities are present	No	AME	Investigate if other abnormalities are present
Atrial fibrillation atrial flutter	MA	1, 2, 3, 4	Yes		1, 2, 3, 4
Sinoatrial dysfunction or sinus pauses			No		
Mobitz type 2 AV block			No		
Complete RBBB			Yes		
Complete LBBB (or RBBB+left axis deviation)			Yes		
Broad/narrow complex tachycardia			No		
Pacemakers			Yes		
Mobitz type 1 AV block			1, 3		
SVEs/VEs simple		1, 3 Then possibly 2, 4	Yes		1, 3
SVEs/VEs complex					



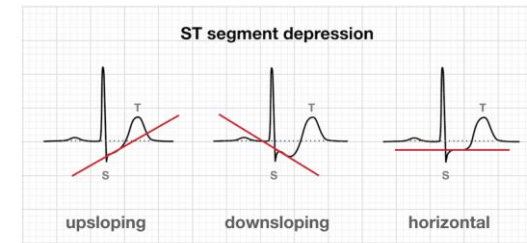
Electrocardiogram (ECG): ischemie

Specific

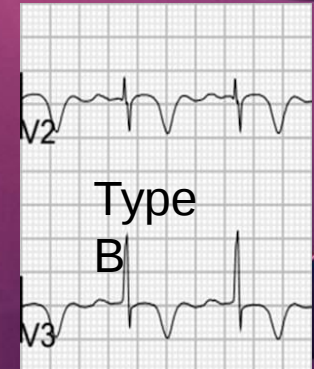
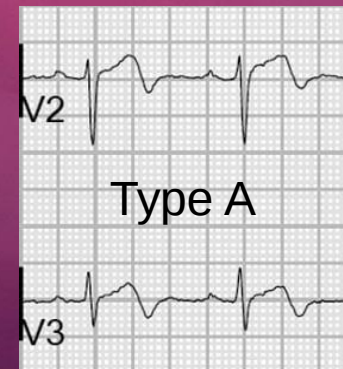
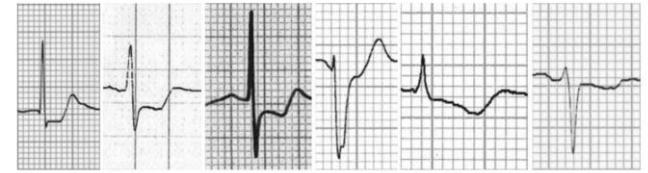
- ST segment depression
- T wave flattening or inversion (type A or B)
- Hyperacute (peaked) T waves
- Pseudonormalization
- U-wave inversion

Non-specific

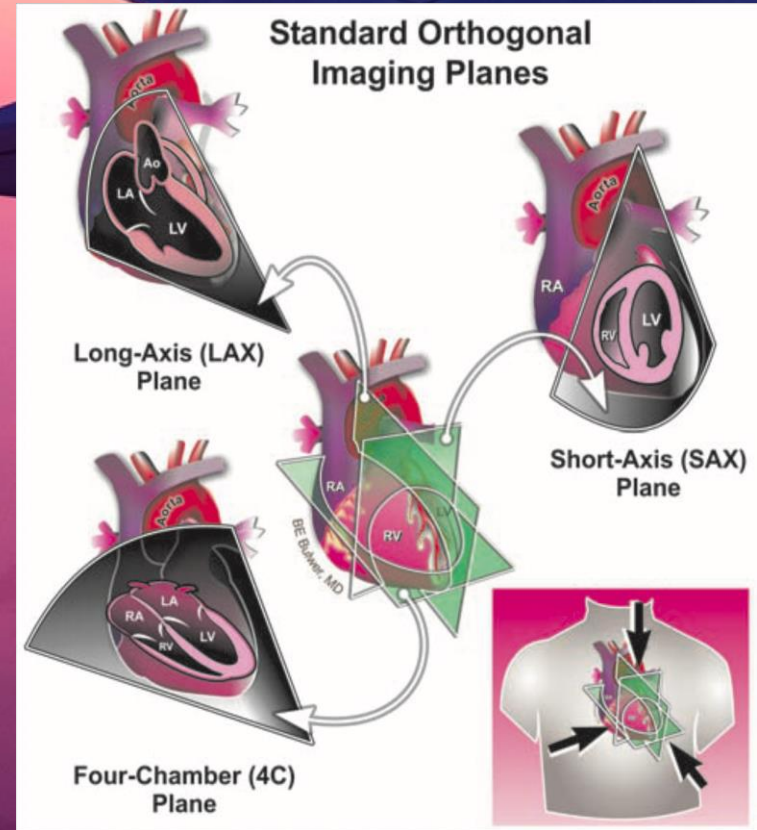
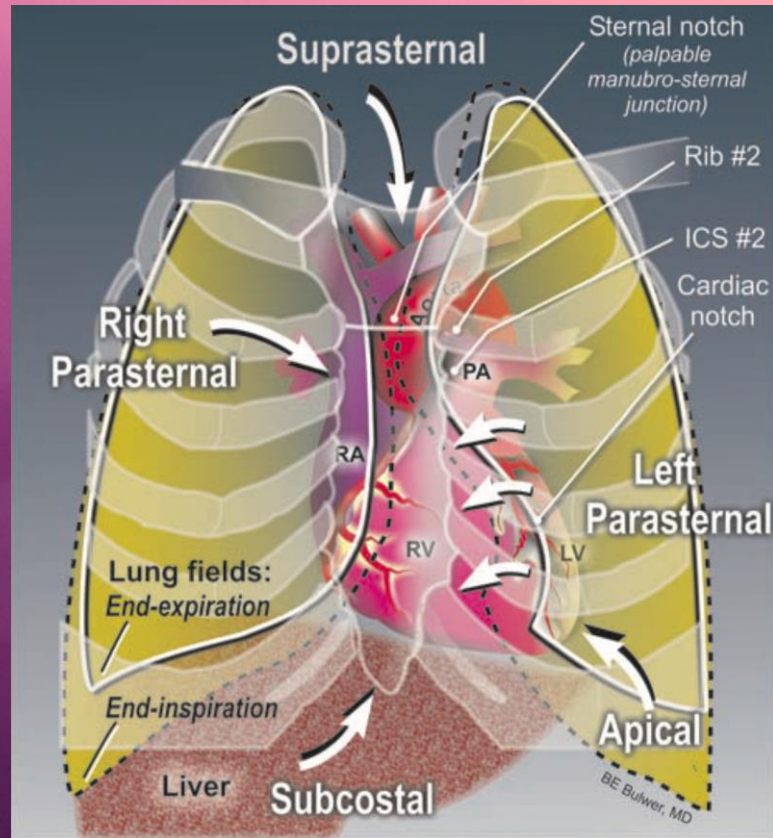
- ST depression < 0.5 mm
- T wave inversion < 1 mm
- T wave flattening
- Upsloping ST depression



Examples of ST segment morphology in myocardial ischaemia



Echocardiografie



Bulwer BE and Rivero JM. Echocardiography pocket guide: the Transthoracic Examination. 2011. Jones and Bartlett Publishers, LLC



Echocardiografie

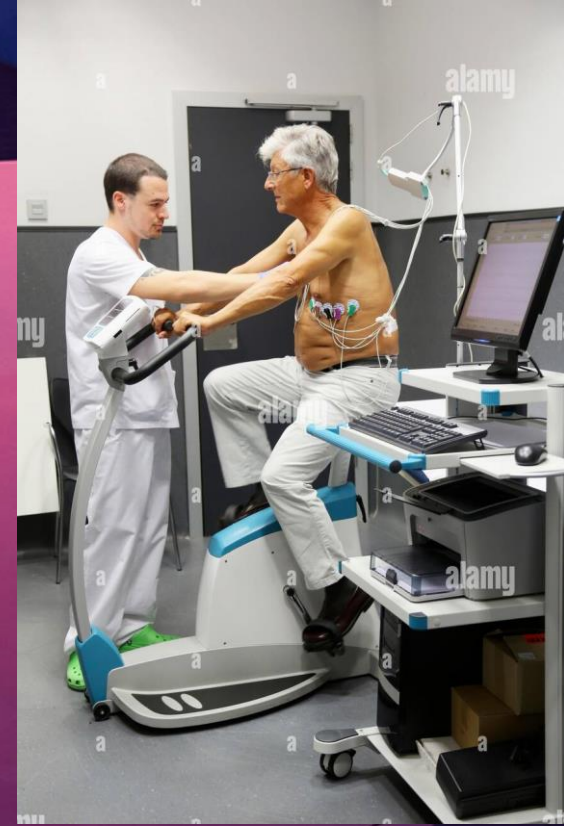
- 1) Left Ventricle
- 2) Left Atrium
- 3) Right Atrium
- 4) Right Ventricle
- 5) Aortic Valve
- 6) Mitral Valve
- 7) Tricuspid Valve
- 8) Pulmonic Valve
- 9) Pericardium
- 10) Aorta
- 11) Pulmonary Artery
- 12) Inferior Vena Cava

- 1) Left Ventricle:
 - a) Size: Dimensions or volumes, at end-systole and end-diastole
 - b) Wall thickness and/or mass: Ventricular septum and left ventricular posterior wall thicknesses (at end-systole and end-diastole) and/or mass (at end-diastole)
 - c) Function: Assessment of systolic function and regional wall motion. Assessment of diastolic function
- 2) Left Atrium:
 - Size: Area or dimension
- 3) Aortic Root:
 - Dimension
- 4) Valvular Stenosis:
 - a) For Valvular Stenosis: Assessment of severity. Measurements that provide an accurate assessment of severity include trans-valvular gradient and area.
 - b) For Subvalvular Stenosis: Assessment of severity. Measurement of subvalvular gradient provides the most accurate assessment of severity and is, therefore, recommended.
- 5) Valvular Regurgitation: Assessment of severity with semi-quantitative descriptive statements and/or quantitative measurements
- 6) Prosthetic Valves:
 - a) Transvalvular gradient and effective orifice area
 - b) Description of regurgitation, if present
- 7) Cardiac Shunts: Assessment of severity. Measurements of $Q_p:Q_s$ (pulmonary-to-systemic flow ratio) and/or orifice area or diameter of the defect are often helpful.



Vereisten inspannings onderzoek

- Fiets ergometer / loopband
- Bloeddruk meter
- ECG registratie apparatuur
- Inspanningsprotocol (Balke / Naughton/ Bruce)
- Zuurstof saturatie meter (optioneel)
- Ervaren functielaborant en cardioloog
- CPR apparatuur en protocol



Doel inspannings onderzoek

Table 2

Summary of ACC/AHA indications for ordering functional VO_2 exercise testing*

Classification [†]	Indication
Class I	Evaluation of exercise capacity and response to therapy in candidates for heart transplant
Class IIa	Evaluation of exertional dyspnea Evaluation of exercise capacity when indicated medically
Class IIb	Functional significance of valvular disease Congenital heart disease, need for treatment/repair Evaluation of response to medical and surgical interventions Determine intensity for exercise training as part of cardiac rehab
Class III	Routine evaluation of exercise capacity

ACC = American College of Cardiology; AHA = American Heart Association; VO_2 = oxygen consumption.

Other potential indications for exercise testing*

Evaluation for exertional dyspnea
Direct measure of functional capacity
Risk stratification and prognosis for congestive heart failure
Disability determination/readiness for work
Assess response to medical or surgical treatments
Development of an exercise prescription

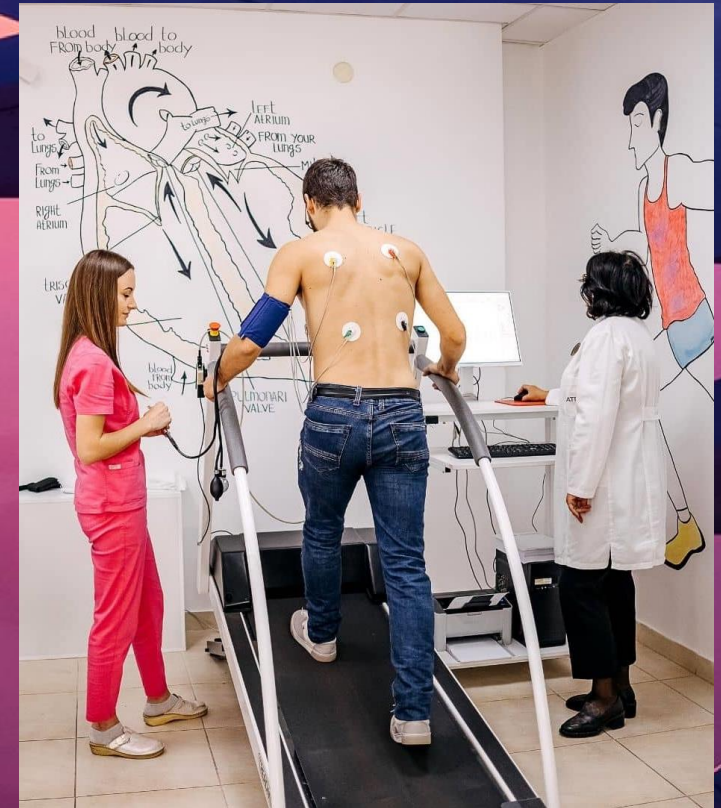
* Reprinted from Mayo Clin Proc, Vol 81, Milani RV, Lavie CJ, Mehra MR, et al, Understanding the basics of cardiopulmonary exercise testing, Pages 1603-1611, Copyright 2006, with permission from Elsevier [2].



Treadmill test (Bruce protocol)

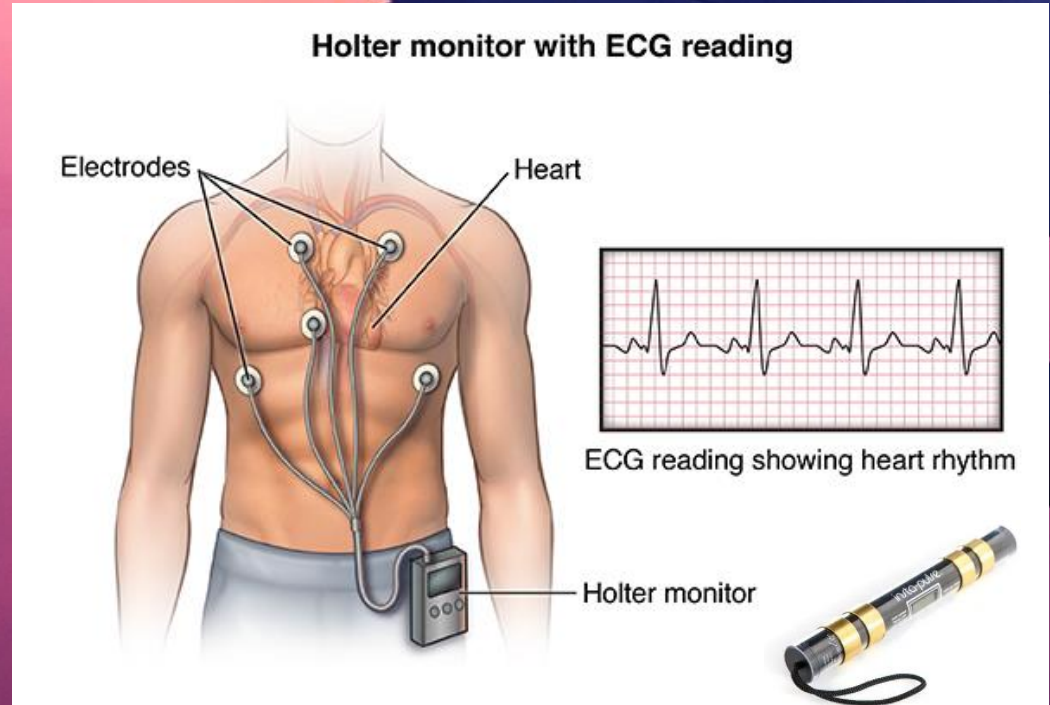
Step	Time(min)	Speed (km/h)	Slope(%)
1	0	2.74	10%
2	3	4.02	12%
3	6	5.47	14%
4	9	6.76	16%
5	12	8.05	18%
6	15	8.85	20%
7	18	9.65	22%
8	21	10.46	24%
9	24	11.26	26%
10	27	12.07	28%

Piloot: Vereiste VO_2 max = 35 ml O_2 / kg / min
Minimale test duur: Man 10 min, Vrouw 8 min



Hartritme registratie

- Electrocardiogram
- 24/48/72-uurs Holter ECG
- Event recorder
- Loop recorder
- PDA / Apple watch
- Heart rate bar



Obstructive Sleep Apnoea certification

- Usually diagnosed by history and confirmed by sleep studies.
- Acceptable medical treatments and clinical reports should be assessed by MA (Class 1) or AME (Class 2).
- Epworth Sleepiness Scale (ESS) score should be less than 10.

Scores: 1 - 6 normaal; 7 -8 gemiddeld, meer dan 9 afwijkend. Gemiddelde normale score ligt rond de 6 (2-10); een gemiddelde score van een Narcolepsiepatiënt rond de 18 (13-23).

0 = ik zou nooit indutten

1 = ik zou af en toe indutten

2 = ik zou vrij vaak indutten

3 = ik zou altijd indutten

Score

a. Tijdens een gesprek met iemand anders

b. Tijdens een bezoek aan familie of vrienden

c. Tijdens een passieve ontspanning (lezen, tv kijken)

d. Tijdens een actieve ontspanning (klusjes, handwerken)

e. Als medereiziger tijdens een auto- of treinrit van 1 uur

f. In de auto wanneer u 5 minuten moet wachten

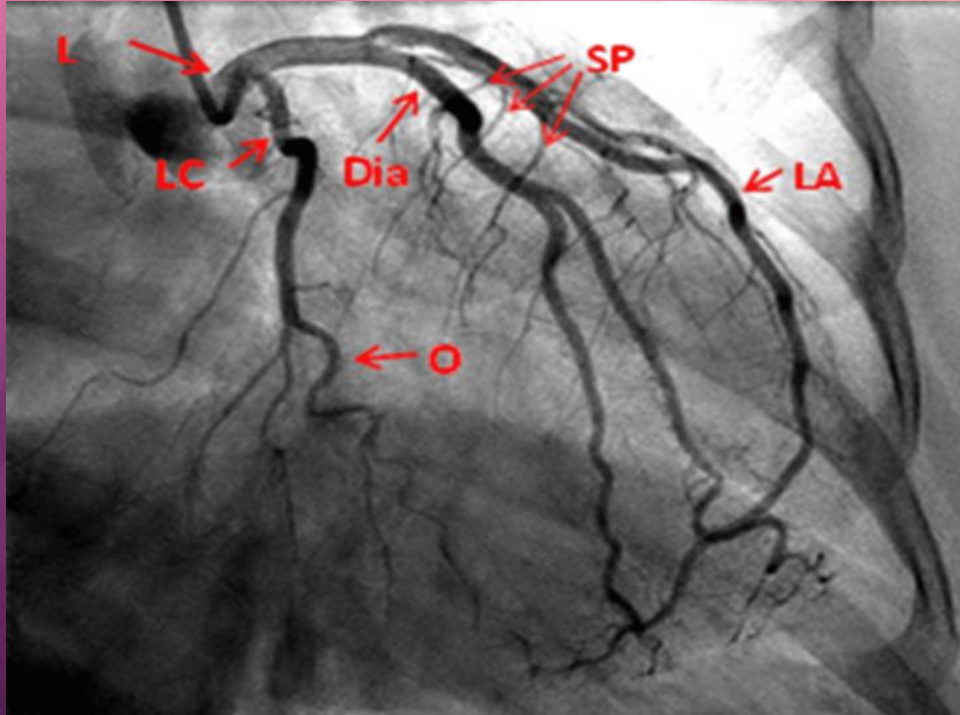
g. Middags of 's avonds na het eten

h. Tijdens werktijd

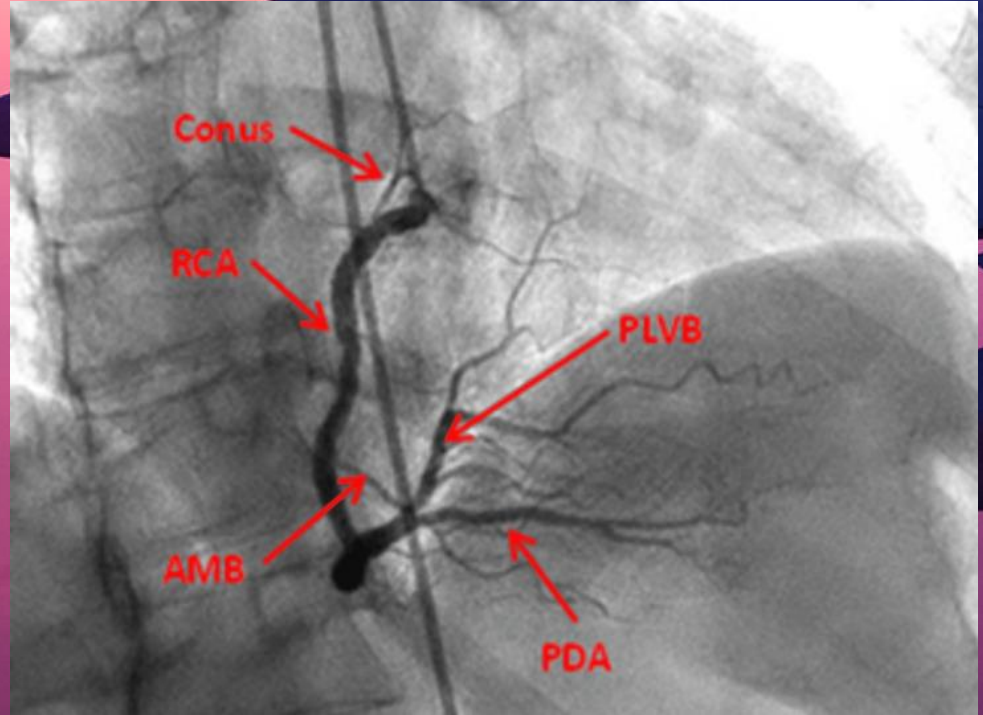
.Totale score:



Coronair angiografie (LCA en RCA)



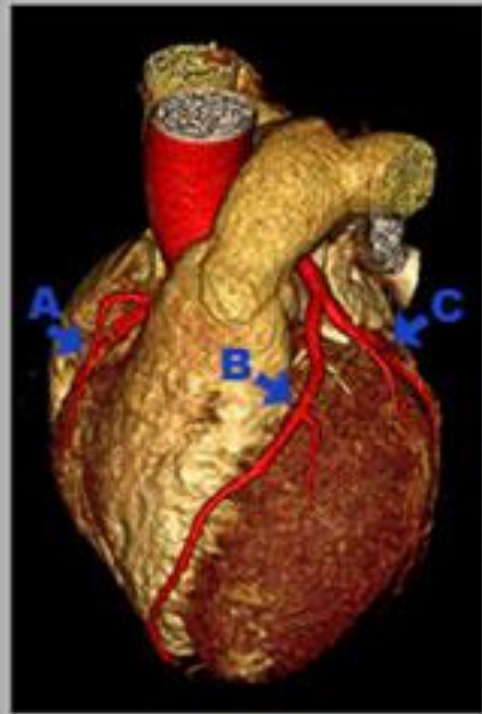
RAO opname LCA



RAO opname RCA



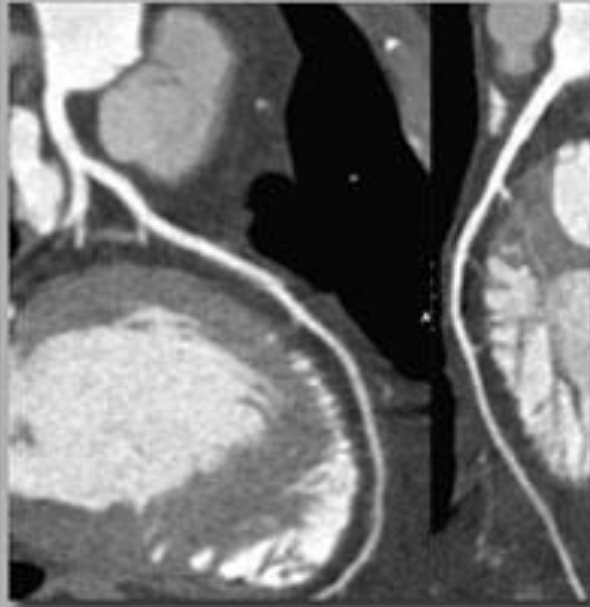
Coronaire CT angiografie



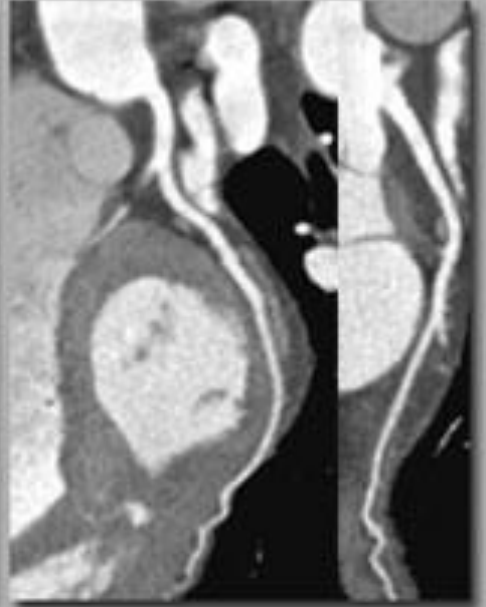
(A)
Right Coronary Artery



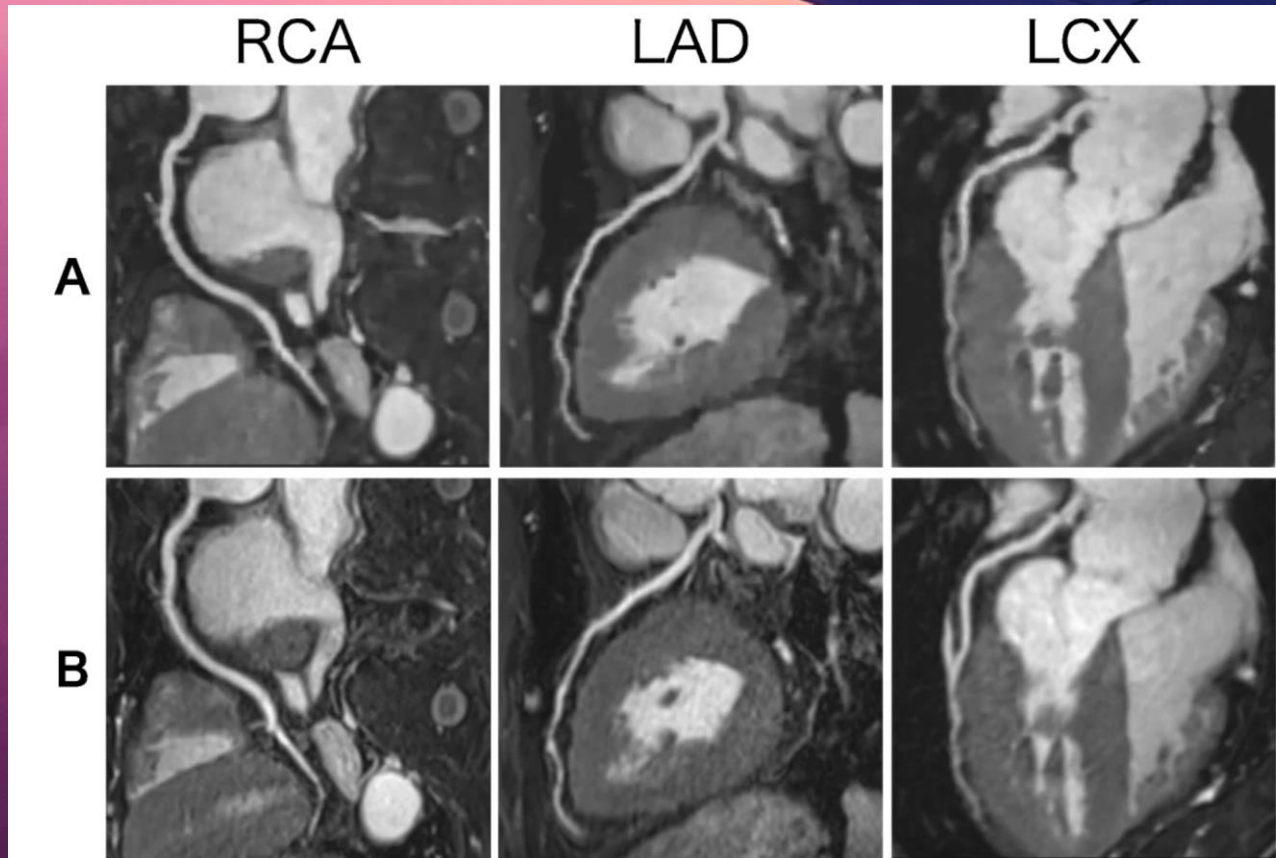
(B)
Left Anterior Descending Artery



(C)
Left Circumflex Artery



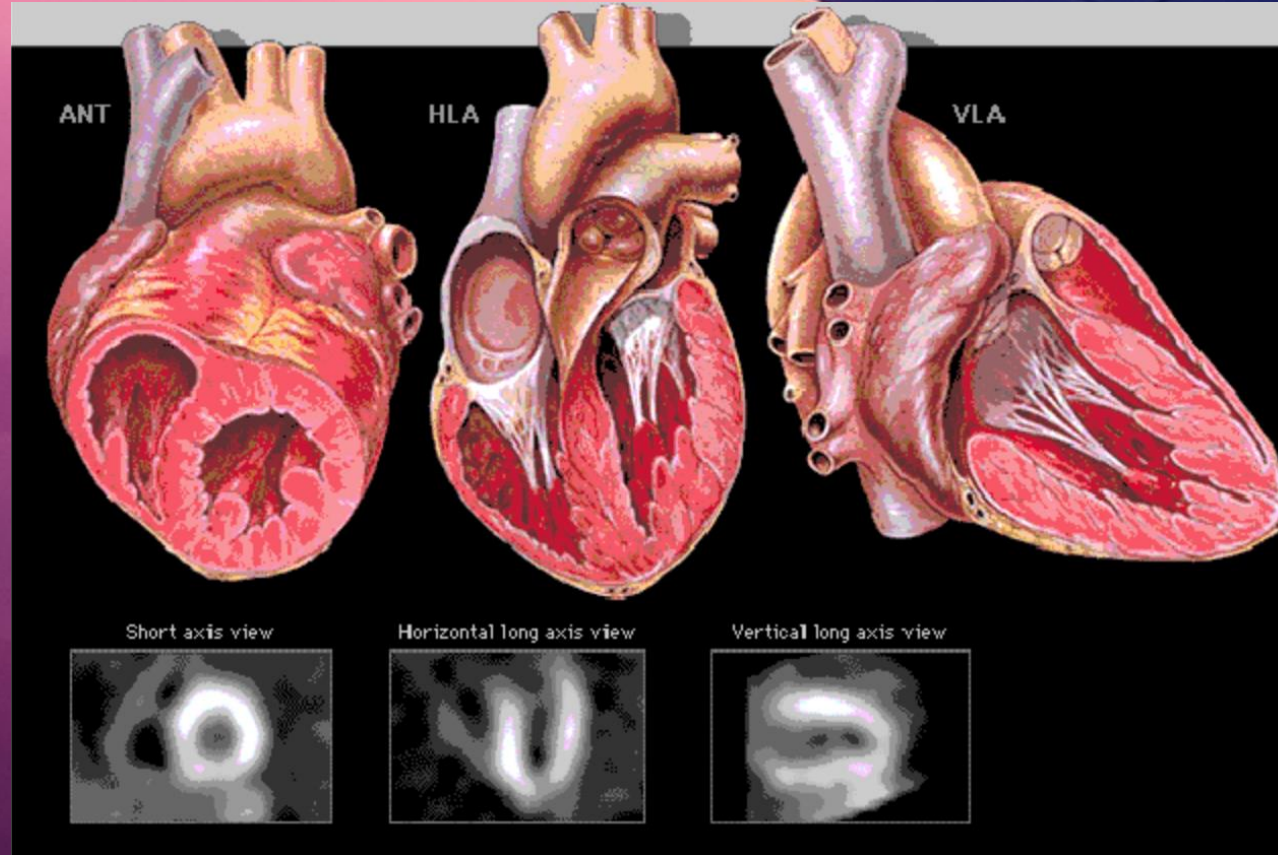
Coronary MR imaging



Curved planar reconstruction of CS (a) and conventional (b) CMRA. Both image sets were acquired from a 63-year-old patient. Visible vessel length was similar in the two techniques (RCA: CS 154 mm vs. conventional 156 mm; left anterior descending (LAD): CS 148 mm vs. conventional 149 mm; left circumflex (LCX): CS 127 mm vs. conventional 129 mm)



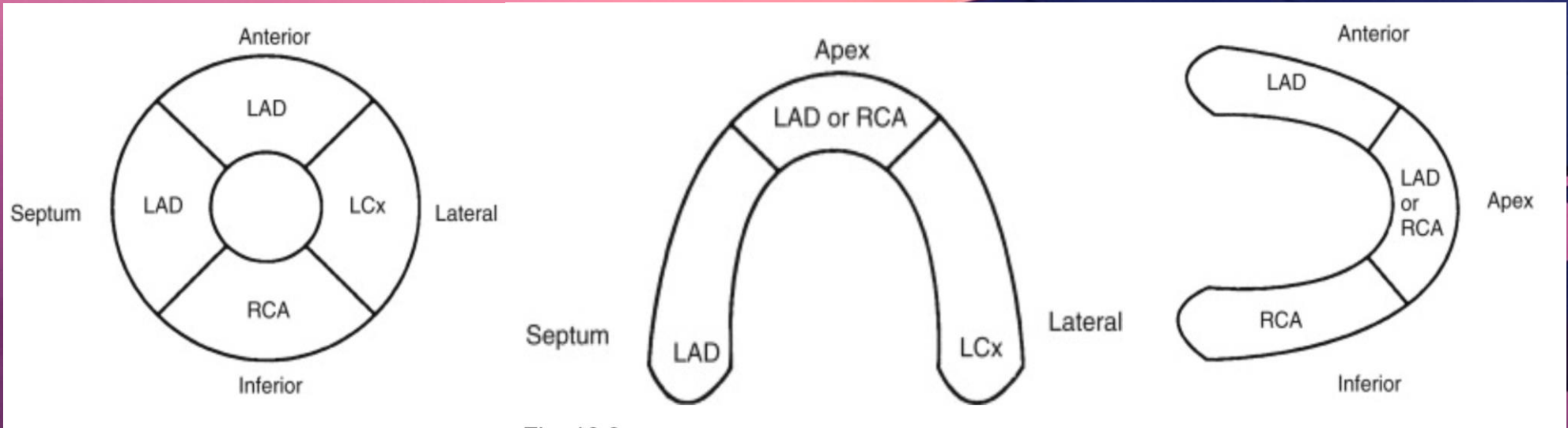
SPECT (= MPS)



SPECT = Single-Photon Emission Computerized Tomography
MPS = Myocardial Perfusion Scintigraphy



SPECT (= MPS)



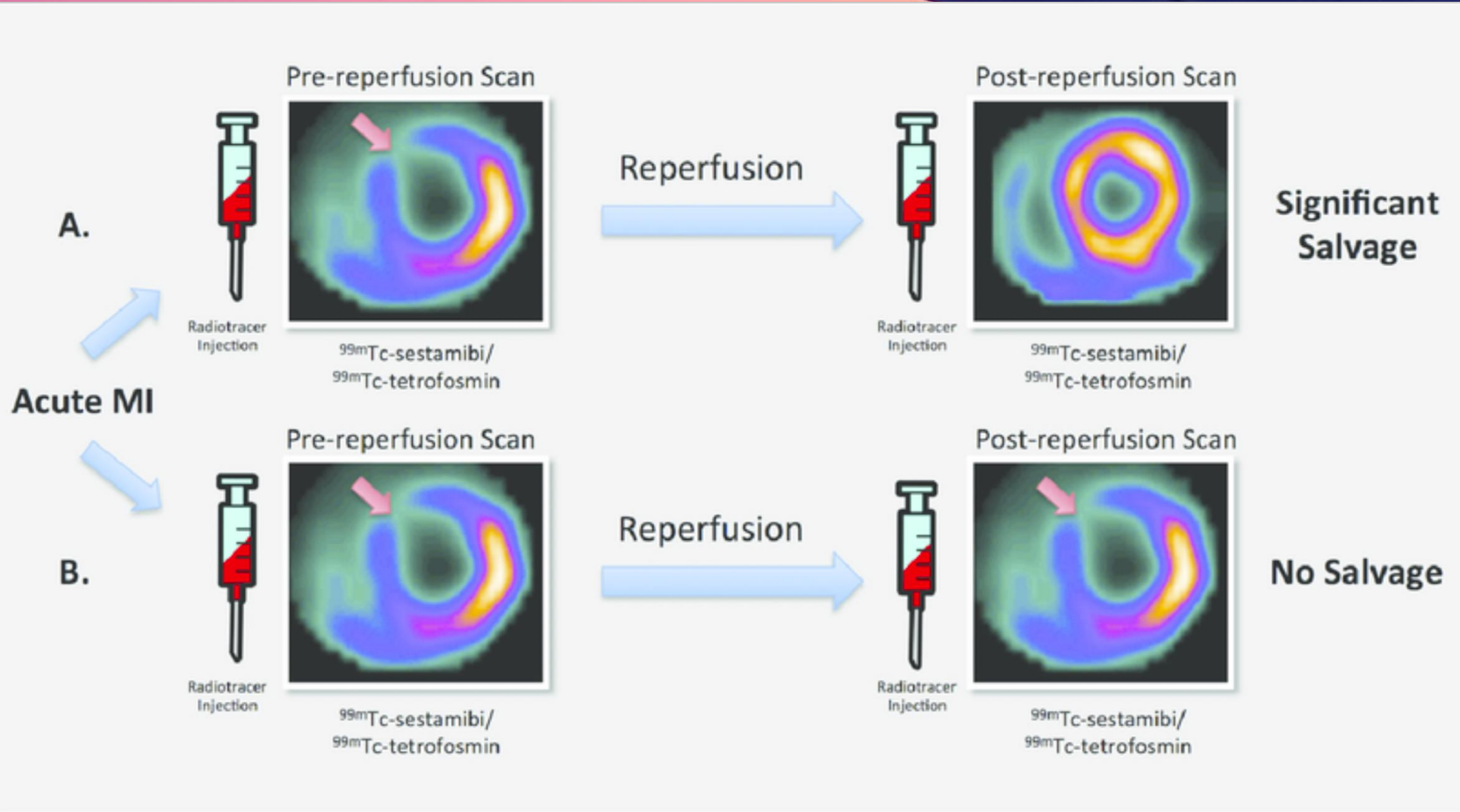
Verticale korte as
(Transversaal)

Horizontale lange as
(Coronaal)

Verticale lange as
(Sagittaal)



SPECT in MI and REPERFUSION



Betrouwbaarheid beeldvorming AP

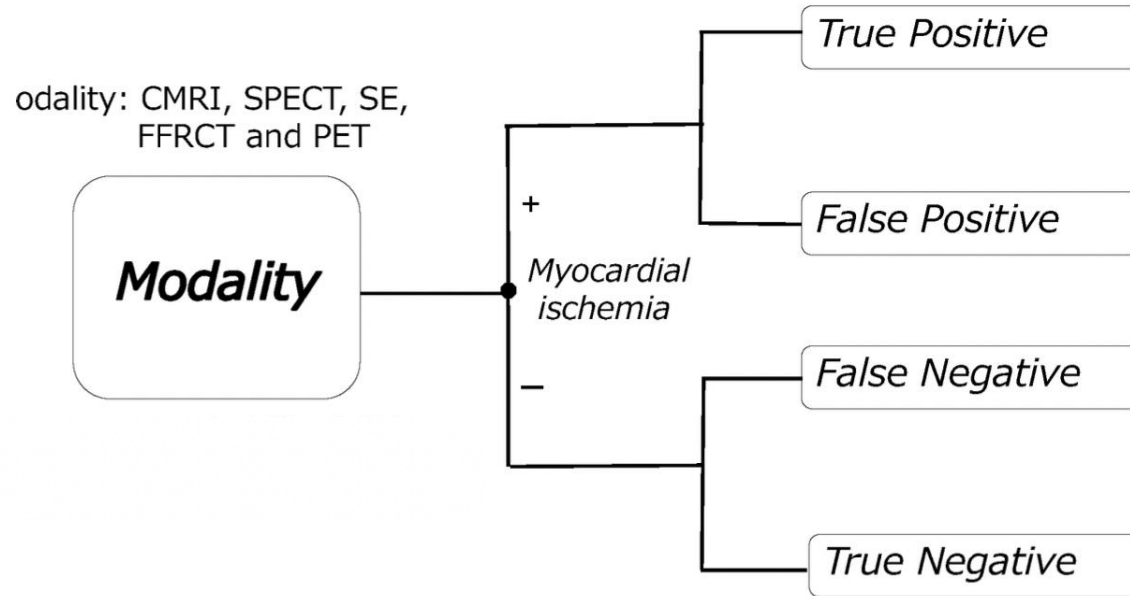


Figure 1. Decision tree model. CMRI: cardiac magnetic resonance imaging, SPECT: single-photon emission computed tomography, SE: stress echocardiography, FFRCT: fractional flow reserve derived from coronary computed tomography angiography, PET: positron emission computed tomography.



Betrouwbaarheid beeldvorming AP

Table 3. A summary of efficiencies at the basic settings (Pre-test probability = 30%).

	CMRI	SPECT	PET	SE	FFRCT
Number of TP (<i>n</i>)	261	219	267	192	267
Number of FP (<i>n</i>)	84	119	105	112	168
Number of FN (<i>n</i>)	39	81	33	108	33
Number of TN (<i>n</i>)	616	581	595	588	532
Positive predictive value † (%) (95% CI)	76 (71–80)	65 (59–70)	72 (67–76)	63 (57–69)	61 (57–66)
Negative predictive value (%) (95% CI)	94 (92–96)	88 (85–90)	95 (93–96)	84 (82–87)	94 (92–96)
Post-test probability ‡ (%) (95% CI)	6.0 (4.3–8.1)	12.2 (9.8–15.0)	5.3 (3.6–7.3)	15.5 (12.9–18.4)	5.8 (4.1–8.1)
Diagnostic accuracy (%) (95% CI)	88 (86–90)	80 (77–82)	86 (84–88)	78 (75–81)	80 (77–82)
Number needed to diagnose (95% CI)	1.33 (1.24–1.47)	1.79 (1.57–2.10)	1.35 (1.25–1.49)	2.08 (1.78–2.54)	1.54 (1.40–1.74)

† Positive predictive value = post-test probability (positive result). ‡ Post-test probability (negative result). CI: confidence interval. CMRI: cardiac magnetic resonance imaging, SPECT: single-photon emission computed tomography. PET: positron emission computed tomography, SE: stress echocardiography. FFRCT: fractional flow reserve derived from coronary computed tomography angiography. TP: true positive, FP: false positive, FN: false negative, TN: true negative.

Iwata K, Ogasawara K. Assessment of the Efficiency of Non-Invasive Diagnostic Imaging Modalities for Detecting Myocardial Ischemia in Patients Suspected of Having Stable Angina. Healthcare 2023,11,23.



BREXIT: UK no longer EASA member

The United Kingdom (UK) left the European Union (EU) on February 1, 2020. At the time, the EU and the UK agreed on a **transition period lasting until December 31, 2020**, during which EU law, including EU law on aviation safety, would continue to apply to the UK. The EU and the UK have used this period to negotiate an agreement on their future partnership.

On January 1, 2021, EU aviation safety legislation, including Regulation (EU) 2018/1139 establishing EASA, no longer applies to the UK. As of that date, the UK is considered as a third country and **no longer has the status of an 'EASA Member State'**.



Onderzoeken piloten CE 2020-2024

	#	E	F	H	SE	totaal # klienten	% piloten
CL 1	139	81	111	65	7		
CL 2	106	53	76	55	11		
LAPL	31	12	24	8	3		
Totaal	276	146	211	128	21	698	39,5%



Reden consult piloten CE 2020 - 2024

- 57 Coronarialijden (verdenking/bewezen, s/p myocard infarct, PCI, CABG)
- 0 Hartfalen (NB: LVEF < 50% altijd "unfit to fly")
- 14 Hartklep afwijkingen (aortaklep, mitralisklep, s/p AoVR)
- 21 Geleidingsstoornissen (RBBB, LBBB, WPW, Brugada)
- 53 Ritmestoornissen (PVCs, atriumfibrilleren, syncope)
- 19 Kamerhypertrofie (hypertensie, H(O)CM)
- 23 Overige ECG afwijkingen (volgens: Table Investigation of ECG Abnormalities)
- 4 Vaatafwijkingen (aneurysma thoracaal/abdominaal),(on)behandeld
- 1 Permanente pacemaker
- 25 Piloten 65 +
- 15 Overgewicht / obesitas
- 5 Oncologie / hematologie / pericarditis / GUCH

237 Aantal diagnoses / redenen consult



Casus 1

♂ 43 Class 1 pilot, living in Sofia (Bulgary)

Previous medical history (general)

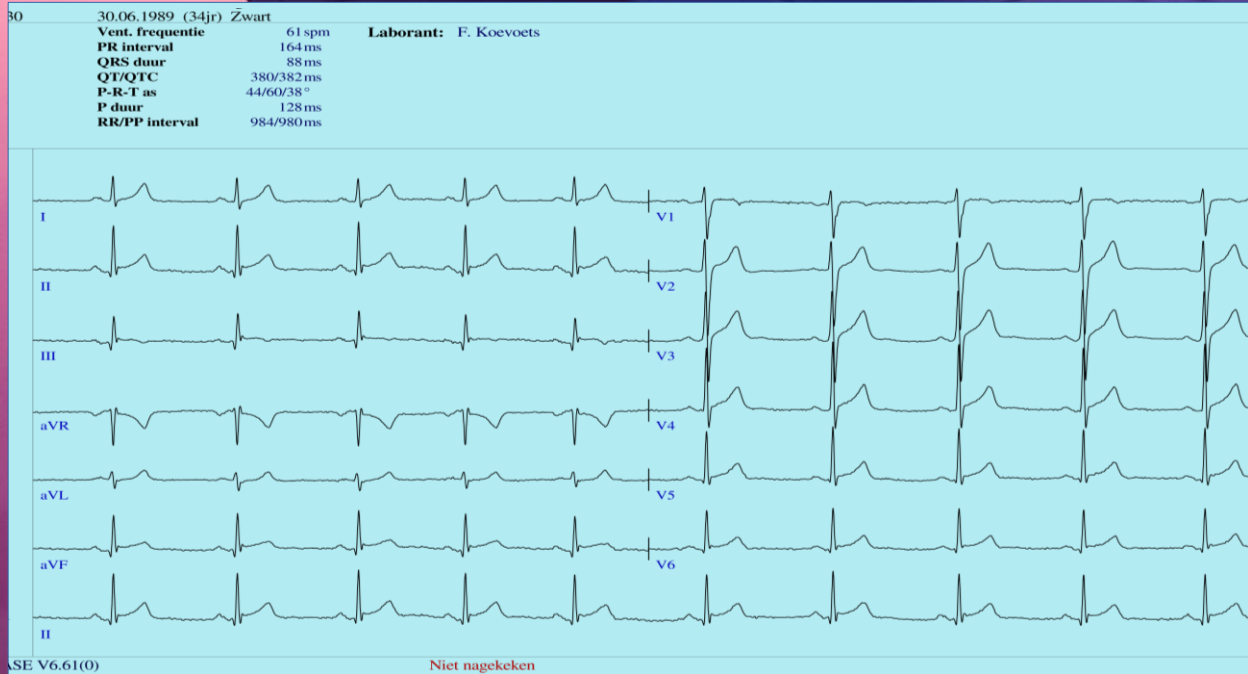
June 23 Admission due to colitis following foot poisoning, treated by antibiotics. Uneventful recovery and no recurrence, Previously no complaints; currently symptom free.

Previous medical history (specific)

04.04.2023 Inferolateral myocardial infarction; 45 minutes following onset complaints, successful primary PCI of distal mid-segment embolization of RCA and occluded RV branch of posterior descending artery (Sofia, Bulgaria).

22.05.2023 PCI of 70-90% stenosis of the LAD following RD1 with implant of DES Xience Pro 3.5/33 stent, resulting in complete revascularization (Sofia, Bulgaria).

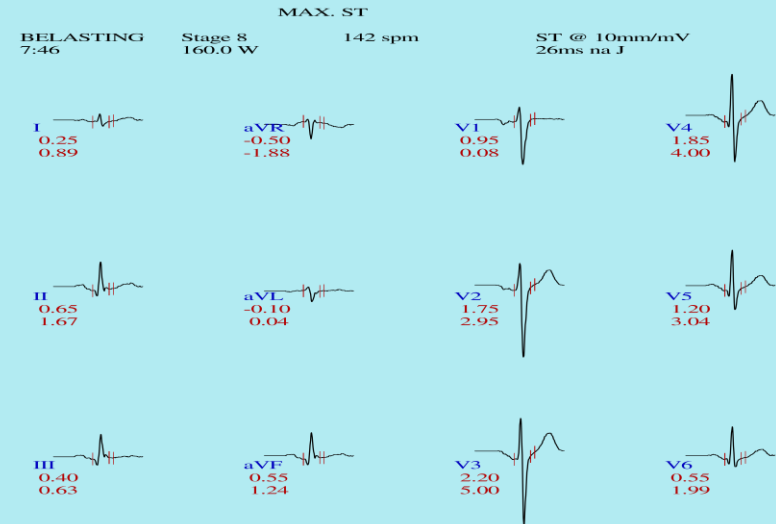
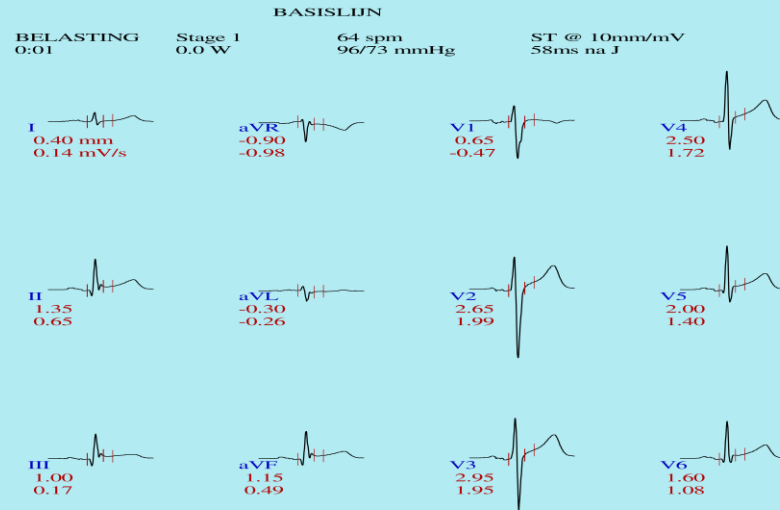




EKG at rest (22.11.23)

Sinus rhythm, heart rate 61 bpm. PQ interval 164 msec (normal). QRS duration 88 msec with intermediate electrical axis (60°). No signs of recent or previous myocardial infarction. No LVH or RVH. Normal STT segments. QT/QTc 380/383 msec (normal). Conclusion: normal EKG.





Exercise tolerance test (bicycle test) (22.11.23)

20 Watt protocol: Total exercise time 07:46 (mm:ss)

Max. HR: 142 bpm (= 76% of max. predicted value of 186 bpm); HR at rest: 65 bpm

Max. BP: 142/76 mmHg. BP at rest: 96/73 mmHg. Max. RPP: 14200 mmHg*bpm

Max. load: 155 Watt (= 72% of target load of 213 Watt)

Max. ST: 1.20 mm, 0.00 mV/s in V5; BELASTING Stage 8 07:46. Aritmie: A:17

Reason termination test: target heart rate reached

Summary: Functional capacity: normal. HR response during exercise: appropriate.

Normale BP at rest. BP response during exercise: appropriate response. Chest pain: absent.

Arrhythmias: absent. ST deviations: absent. **General impression: normal exercise test.**



Echocardiography at rest (22.11.23)

Normal dimensions and contractility of the left ventricle. Normal diastolic function, no hypertrophy, no wall motion abnormalities. LVEF at rest 63% (HR 65). No valvular disorders. Normal right sided pressure.

Echocardiography following stress (22.11.23)

During exercise the overall LVEF increases from 63% (HR 65) to 76% (HR 115) without dilation, nor wall motion abnormalities, demonstrating that there is no evidence of myocardial ischaemia.

Conclusion and advice

In absence of signs of myocardial ischaemia we recommend to renew the class 1 flight license of the pilot without restrictions. According to ILT/EASA regulations, periodic cardiologic follow-up (at least annually for the first 5 years) is mandatory and shall include a specialist cardiology review, cardiovascular risk assessment and an acceptable exercise ECG.



Casus 1

Rapportage aan de Ierse CAA aangeboden: voorstel goedkeuring met OML en SIC.
MA Irish CAA eist dat myocard perfusiescan wordt uitgevoerd.

Toegelicht dat er een stress echocardiogram is gedaan (staat niet duidelijk in de cardiologische rapportage); na revisie wordt de rapportage opnieuw aangeboden.

Irish CAA houdt vast aan het standpunt dat een myocard perfusiescan verplicht is.
AME reageert dat dit afwijkt van de EASA regels, en dat de Nederlandse CAA stress echocardiogram als gelijkwaardig beschouwt.

De assistent reageert dat de MA meent dat er volgens EASA regels een myocard perfusiescan vereist is. De AME verzoekt de MA te spreken voor overleg.
Later toch accoord met medical met OML, SIC en TML 6 mnd, met voorafgaand inspanningstest en cardiologische beoordeling.



Casus 2

♂ Class 1 pilot, intended to obtain UK flight license

Reason examination

In the setting of renewal of his license to fly, the UK AME recorded a possibly abnormal EKG with "minimal voltage criteria of LVH, may be normal variant, nonspecific ST and T wave abnormality". On the basis of this observation the UK Civil Aviation Authority requires additional cardiac function tests, notably echocardiogram, exercise testing and 24 hours Holter monitoring in order to exclude cardiological pathology.

Previous medical history (general)

2019 HNP caused by high intensity Crossfit; successful operation L5-S1, Crossfit stopped.

Previous medical history (specific)

2014 Abnormal T wave, cardiological analysis (echocardiogram, ergometry and 24 hours holter monitoring: all normal. No follow up required.



06.05.1977 (46jr) Kaukasisch

Vent. frequentie 66 bpm

PR interval 184 ms

QRS duur 104 ms

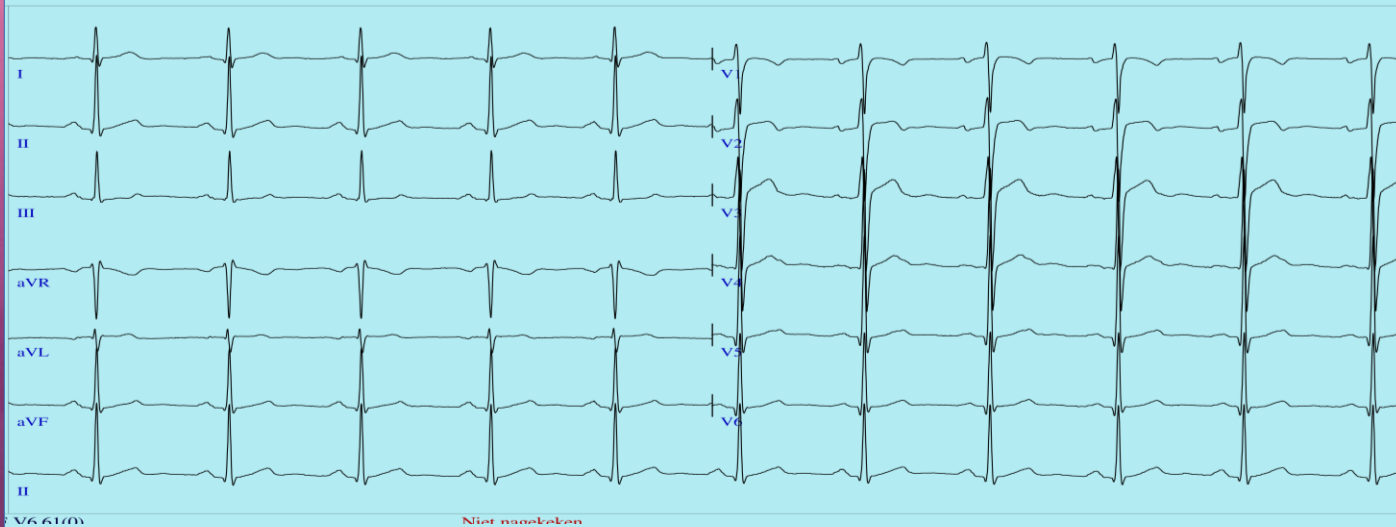
QT/QTc 400/419 ms

P-R-T as 74/70/52°

P duur 132 ms

RR/PP interval 906/905 ms

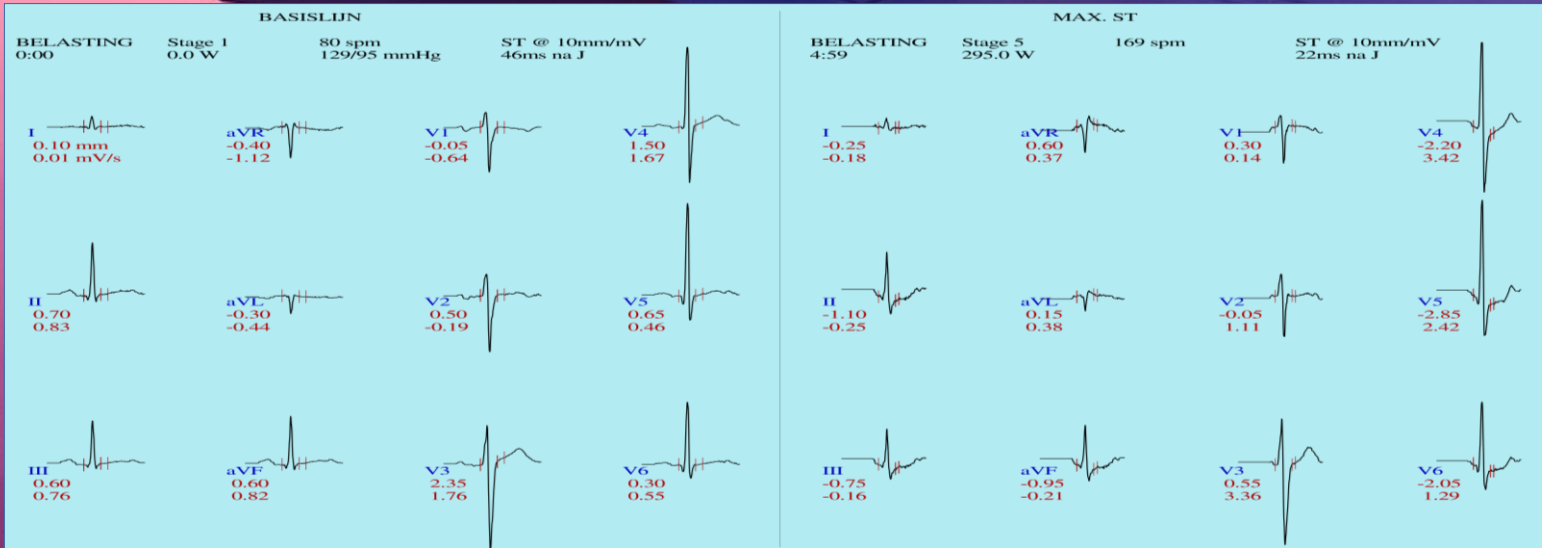
Laborant: F. Koevoets



EKG at rest (10.01.24)

Sinus rhythm 66 bpm. PQ interval 184 msec (normal). QRS duration 104 msec (normal), intermediate axis. No signs of recent or previous myocardial infarction. No LVH or RVH. Normal ST- segments. QT/QTc 400/419 msec (both normal). **In summary: normal EKG**





Exercise tolerance test (bicycle test) (10.01.24)

CE sport: Total exercise time 04:58 (mm:ss)

Max. HR: 169 bpm (= 97% of maximal predicted value of 174 bpm). HR in rust: 75

Max. BP: 186/103 mmHg. BP at rest: 129/95 mmHg. Max. RPP: 25296 mmHg*bpm

Max. load: 300 Watt (= 14.0 METS = 159 % of target load of 188 watt)

Max. ST: -2.85 mm, 0.00 mV/s in V5; Stage 5 04:59

Arrhythmias: PVC:2, PSVC:1

Reason termination test: exhaustion

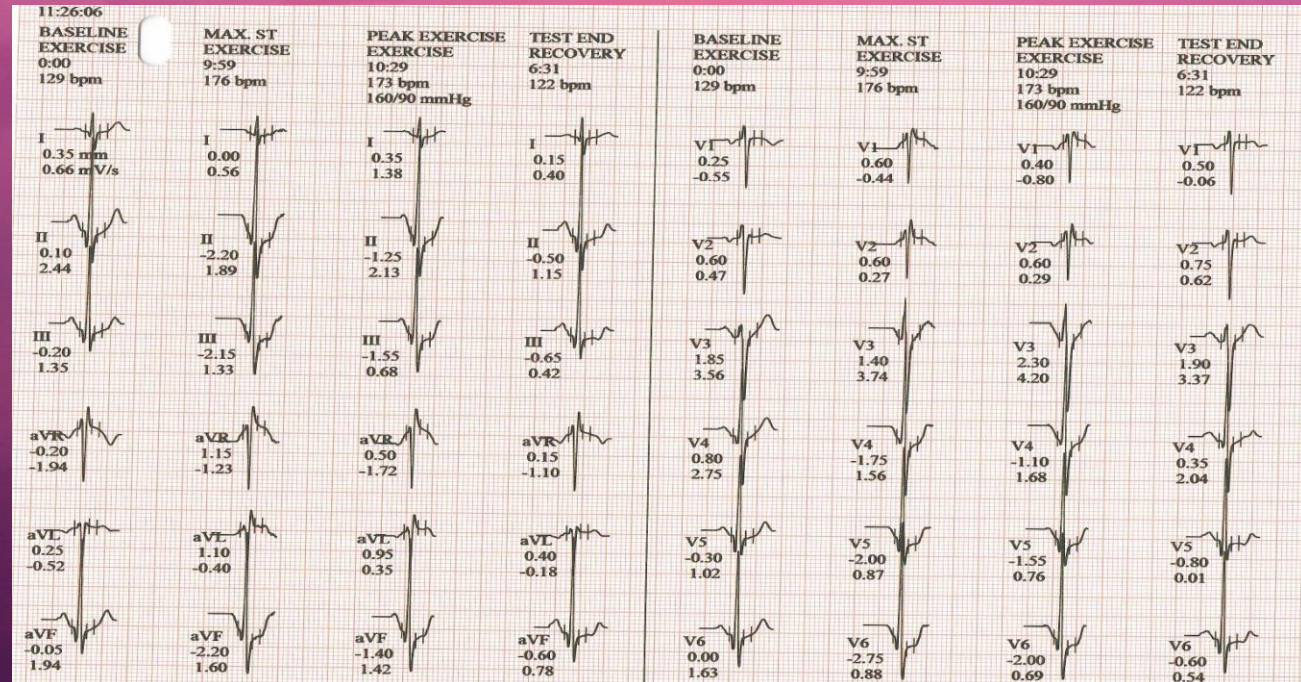
Summary: Functional capacity: normal. HR response during exercise: appropriate.

BP response during exercise: appropriate. Normal BP at rest. Chest pain: absent.

Arrhythmias: absent. ST deviations: absent. General impression: normal exercise test.



On January 29, 2024 you mailed the pilot that "The CAA do not accept the bicycle test and expect you to exercise to the full Bruce Protocol (attached). Please obtain it, have the cardiologist report, and send the raw data ETT with the report."



Subsequently, on Februari 6, 2024 the pilot performed a treadmill test (See copy of the report, enclosed with this letter). The pilot exercised according to the BRUCE protocol for 10:28 (mm:ss), achieving a work level of max METS of 13.4. Resting heart rate of 116 bpm rose to maximum heart rate of 179 bpm (= 102 % of the maximum, age-predicted heart rate). Resting blood pressure of 130/80 mmHg rose to a maximum blood pressure of 160/90 mmHg. Resting EKG showed a right bundle branch block. No chest pain, no arrhythmias. The EKG showed T waves inversion in leads V5-V6, in the recovery phase. The consulted cardiologist advised to perform adenosine MRI in order to assess blood flow.

Accordingly, on Februari 15, 2024 the pilot performed cardiac MR imaging with adenosine stimulation (See copy of the reports, enclosed with this letter). The result of the investigation was:

1. MR-morphologically unremarkable cardiac findings, in particular without evidence of inducible ischaemia or structural heart disease.
2. We also refer to the detailed findings report created using Medis Suite 4.0.



Conclusion and advice

Based on the additional tests and imaging we conclude that there is no evidence of inducible ischaemia or structural heart disease. Therefore we recommend to grant the pilot a class 1 flight license without any restrictions, nor the need for cardiological follow-up.

On February 24, 2024 mr. [REDACTED] mailed us that the CAA, in addition to all other tests that recently have been presented, also demands the results of a 24 hours ambulatory blood pressure measurement.



Subsequently, a 24 hours ambulatory blood pressure measurement has been performed that started on 26.02.2024 11:51; the last measurement was performed on 27.02.2024 12:21.

The overall average blood pressure is 124/78 mmHg. The average blood pressure during the day is 124/80 mmHg; the average blood pressure during the night is 122/73 mmHg. For further details of the collected data we refer to the 24 hours blood pressure measurement report, that is enclosed with this letter.

Conclusion and advice

Based on all recently performed tests we recommend to grant the pilot a class 1 flight license without any restrictions, nor the need for cardiological follow-up.



Conclusies en aanbevelingen

- Linker kamer ejectie fractie $< 50\%$ → “not fit to fly”.
- Bij aanwezigheid van myocard ischemie → “not fit to fly”.
- Snelle en volledige communicatie tussen cardioloog en AME vereist.
- Internationale verschillen in interpretatie treadmill test en fietstest.
- Incidentele onderzoeks bevindingen kunnen belangrijke gevolgen hebben (carotis souffle, verhoogde bloeddruk).
- Zorg voor complete documentatie voorafgaande aan expertise.
- Adekwate verzekering tegen medische aansprakelijkheid van belang.





Dank voor uw aandacht





Discussie / Vragen



