Harnessing Artificial Intelligence in Imaging to Advance Cardio-Oncology Care

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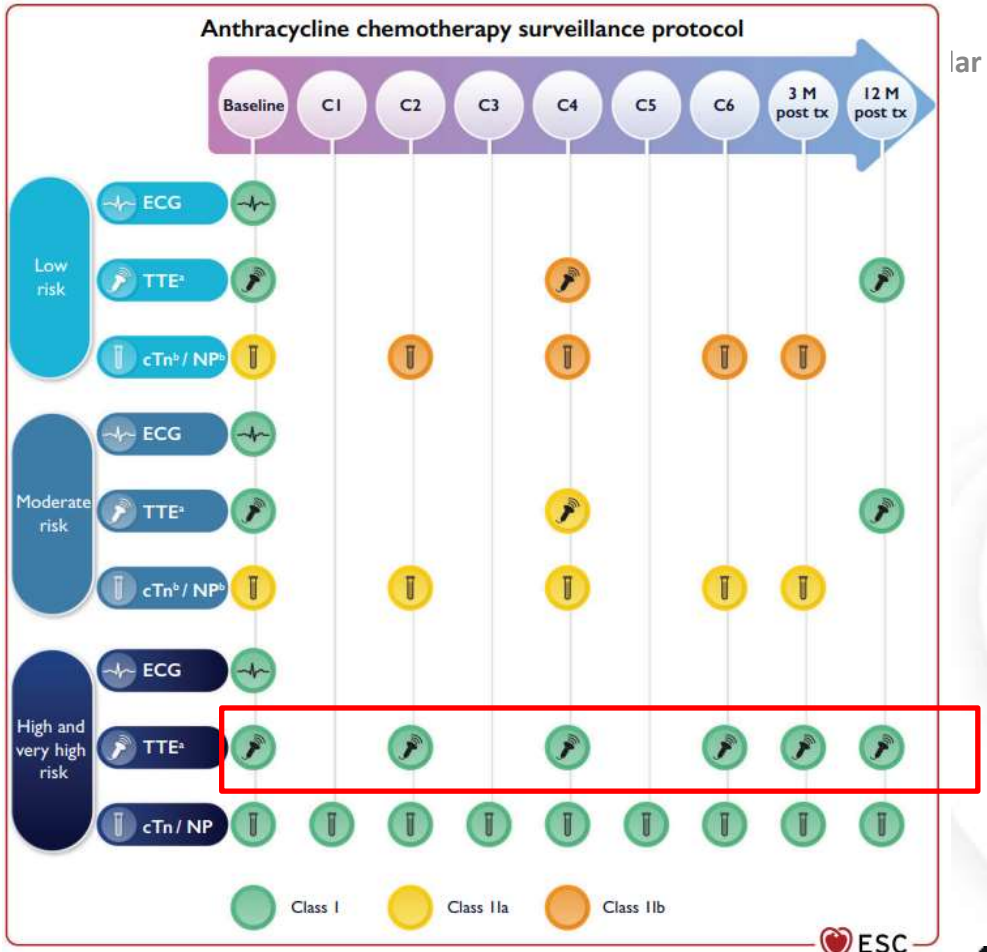
ESC
ESC GUIDELINES

2022 ESC Guidelines on cardio-oncology developed in collaboration with the European Hematology Association (EHA), the European Society for Therapeutic Radiology and Oncology (ESTRO) and the International Cardio-Oncology Society (IC-OS)



Why Cardio-Oncology needs AI *NOW*

ESC Cardiovascular Round Table

Cardio-oncology patients are:

- Increasing in number
- Older, multimorbid
- Exposed to subtle, cumulative cardiotoxicity

AI to scale

PRECISION & CONSISTENCY

Imaging is central but:

- **Time-consuming**
- **Operator-dependent; variability across centres**
- **Often detects damage too late**

Current care gap: we image more, but variability and workload limit impact

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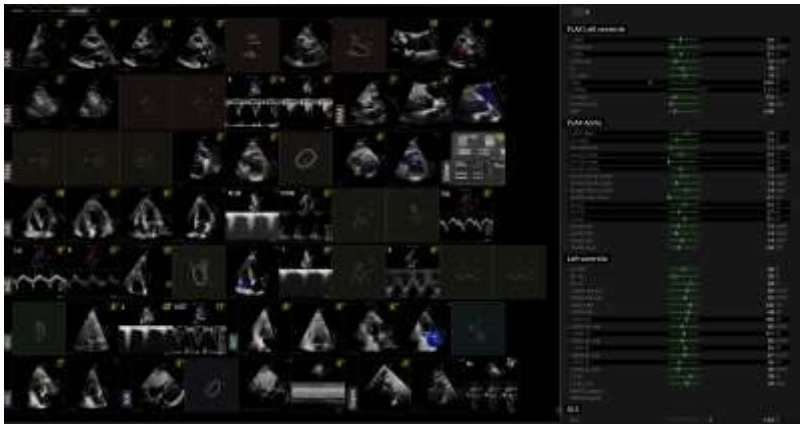
Where AI is Already Adding Value in Imaging

Echocardiography

- Automated acquisition
- Automated analysis
  - LV/RV volumes and EF
  - GLS and regional strain

⇒ **Early sub-clinical dysfunction**

6 min to complete a routine echo exam, from image acquisition to measurements



Complete end to end AI assisted echo measurement

Tracking interval change – measurement consistency, multiple serial scans presented side-by-side

Courtesy Dr Thavendiranathan

Where AI is Already Adding Value in Imaging

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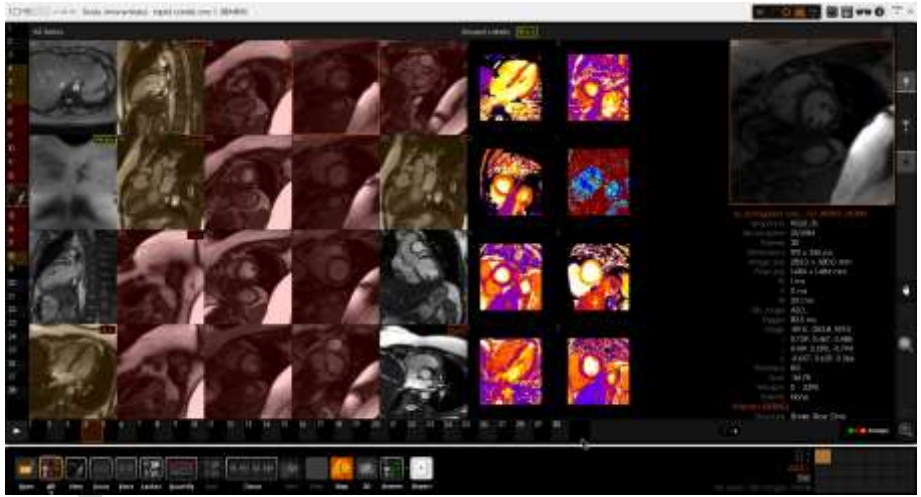
Cardiac MRI

- Automated acquisition
- Automated analysis
  - LV/RV volumes and EF
  - tissue characterisation

Cardiac CT

- Incidental cardiac findings on oncologic scans

⇒ **Early myocardial injury before EF declines**



ORIGINAL ARTICLE

A Multicenter, Scan-Rescan, Human and Machine Learning CMR Study to Test Generalizability and Precision in Imaging Biomarker Analysis

But with the advent of artificial intelligence (AI) and machine learning algorithms, a scan can be analyzed with similar accuracy in approximately **4 seconds –nearly 186 times faster!**

Bhuva A et al Circ Imaging 2019

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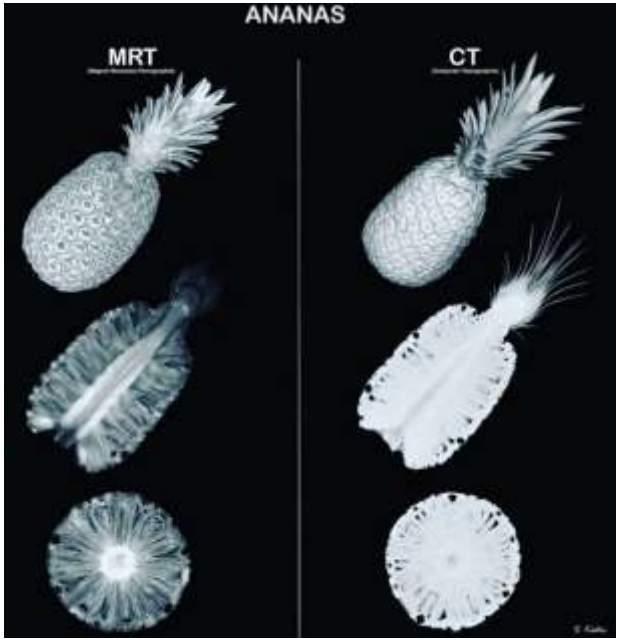
Deep Cardiac Tissue Phenotyping

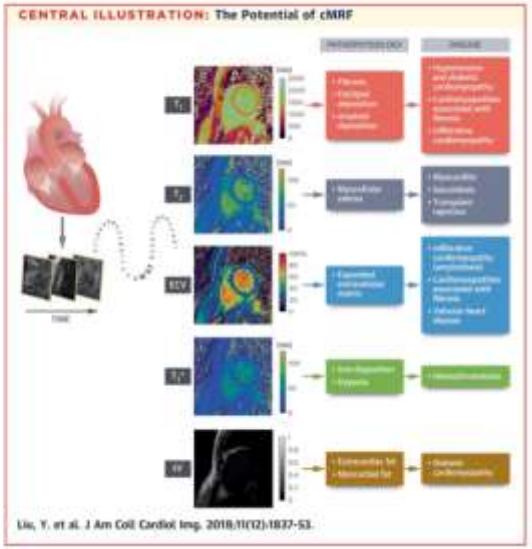


Myocardial Tissue Phenotyping

- Inflammation (global, regional)
- Fibrosis (infarction, myocarditis)

CMR Fingerprinting

Powerful tool to measure multiple tissue properties in the myocardium simultaneously



Clinical validation phase

ESC European Society of Cardiology
European Heart Journal (2023) 44, 636–637
https://doi.org/10.1093/eurheartj/ehac814

Global Spotlights

Smart cardiac magnetic resonance delivering one-click and comprehensive assessment of cardiovascular disease

Aurelien Bustin [1,2,3]*, Matthias Stuber [1,3,4], Maxime Sermesant [1,5], and Hubert Cochet [1,2]

Fast, one-click, fully automated, and comprehensive imaging pipeline applicable to diagnosis, prognosis, and therapy selection in cardiology

2023-2028

https://pmc.ncbi.nlm.nih.gov/articles/PMC9940986/pdf/ehac814.pdf

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Beyond Measurement to Prediction

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Move from “what is the EF?” to “what will happen to this patient?”

AI models combining:

- Imaging features
- Cancer type & therapy
- Baseline CV risk

Predict:

Who will develop cardiotoxicity

Who needs closer imaging follow-up

Who can safely continue cancer therapy

⇒

personalized surveillance
not one-size-fits-all protocols

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Myostrain & MyoHealth (new bi… …rker)

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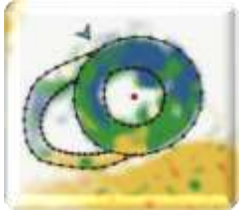
10 min per scan -> 6 patients in 1h



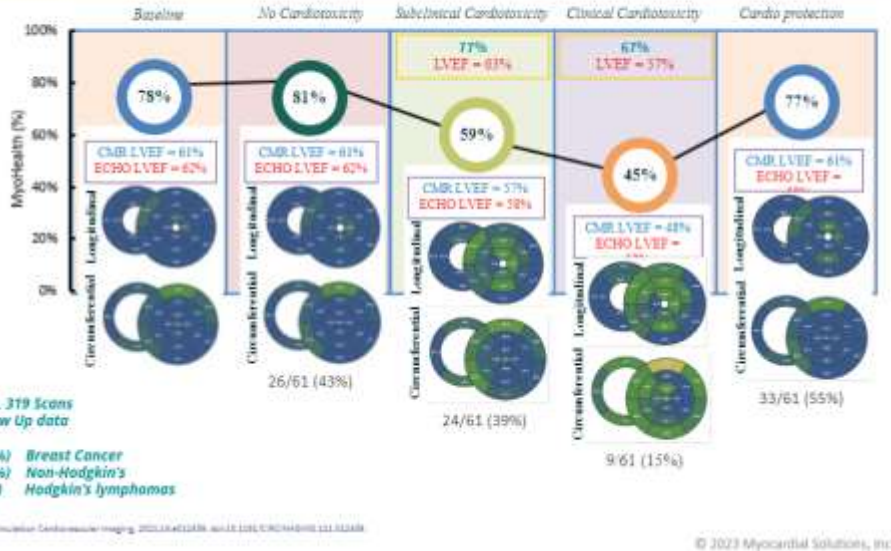
ESC 2022 Cardio Oncology Guidelines for cardiac imaging modalities in …

General		
Echocardiography is … first-line …	…	C
… to measure	I	B
… in all patients with cancer … echocardiography, if available	I	C
CMR should be considered for the assessment of cardiac function when echocardiography is unavailable or non-diagnostic	IIa	C
MUGA may be considered when TTE is not diagnostic and CMR is not available	IIb	C

1. The cardiac imaging technique used should be based on local expertise and availability, and the **same imaging modality is reco… treatment to de…**
2. ECHO and CMR… management of …

In patients with … not diagnostic, … **available.**

MyoHealth ™ Predicts from Baseline, Detects and Manages Cardiotoxicity



Ultra fast
Contrast free
10 min acquisition!
5 min analysis!

Workflow Integration: Real Bottleneck

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Challenges:

- Fragmented imaging platforms
- Poor integration with EHRs
- AI output are not clinically interpretable

What clinicians need:

- AI embedded inside existing imaging workflow
- Clear outputs
  - risk category
  - trends over time
  - actionable alerts (no black boxes)

Adoption depends less on algorithm performance and more on usability and trust.

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AI- Enabled Cardio-Oncology Pathways

Cardiovascular Round Table

A system-level vision

Future model

- Automated baseline risk stratification
- Adaptive imaging schedules
- Continuous learning systems
- Multidisciplinary dashboards (imagers/oncologists)

THE WALL STREET JOURNAL.

HEALTH | HEALTHCARE | THE FUTURE OF EVERYTHING

A 'Digital Twin' of Your Heart Lets Doctors Test Treatments Before Surgery

Researchers create digital replicas of individual patients' organs using data from exams and wearable devices: 'You can run an infinite number of experiments'

Outcome

- Earlier intervention
- Fewer therapy interruptions
- Better long-term CV outcomes for cancer survivors

BBC

Scans in shopping centres and AI - can ideas like these help save the NHS?