

CT and CMR Value in Cardio-oncology

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Introduction

- Cancer is one of the leading causes of death worldwide.
- Recent advances in the management of cancer led to improvement in the survival of those patients.
- However, the cardiotoxic effect of both chemo- and radio-therapy emerged the need of close monitoring of those patients.

Cardiovascular Complications From Cancer Therapy

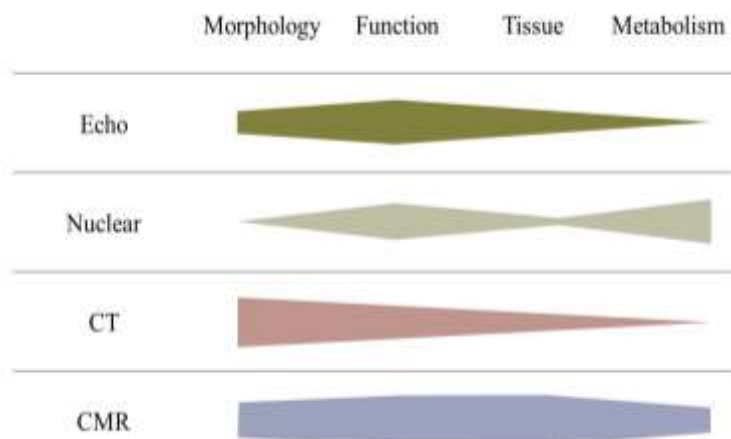
Chemotherapy

- Cardiomyopathy
 - Asymptomatic
 - Symptomatic
- Arrhythmias
- Hypertension
- Coronary heart disease
- Dyslipidemia

Radiation therapy

- Coronary heart disease
- Valvular heart disease
- Pericardial disease
- Vascular disease
- Congestive heart failure
- Arrhythmias

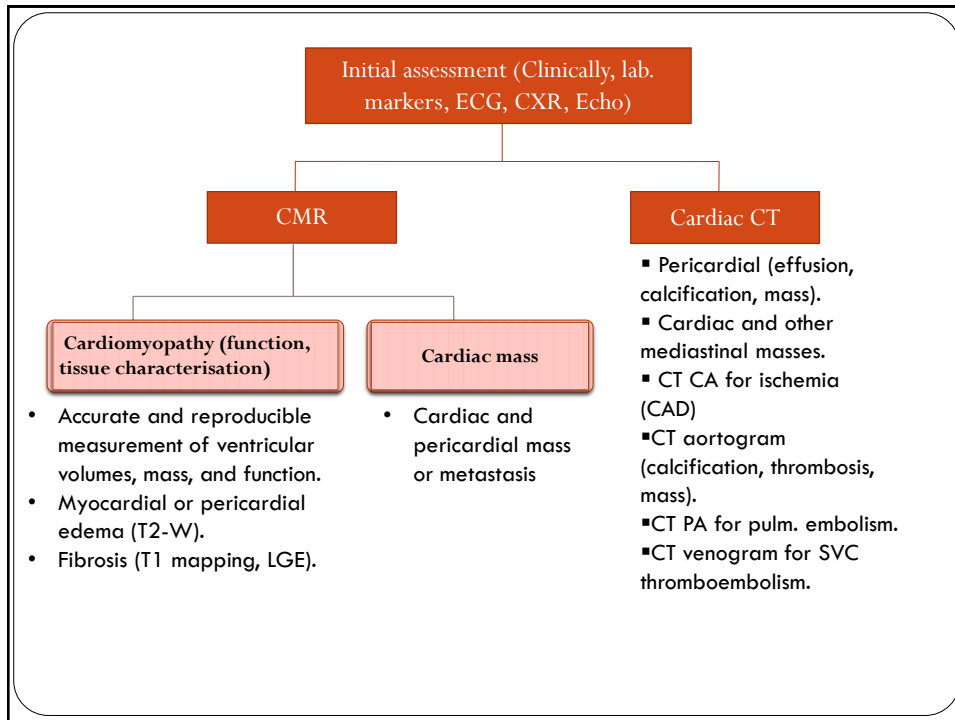
Which imaging method do we use?



Echocardiography is the initial imaging modality to identify cardiac complications of cancer patients

Cross section Imaging (CT and MRI)

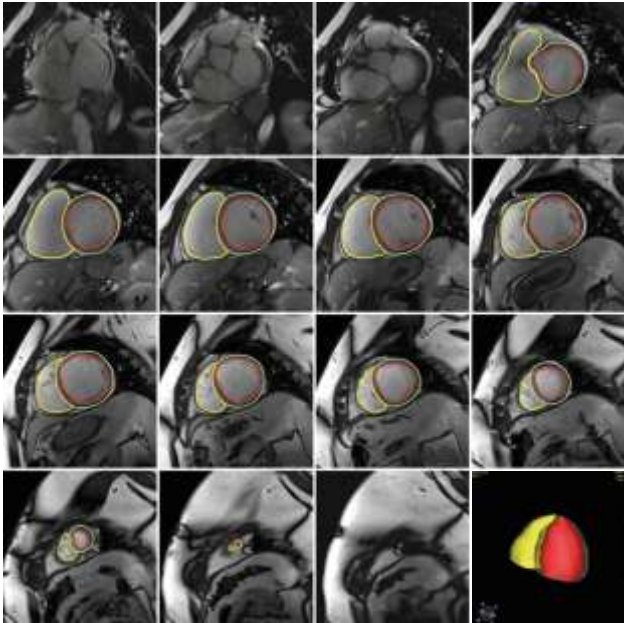
- Images can be obtained in any plane and any orientation which enable to take measures in anatomical-corrected imaging positions.
- In case of echocardiography poor acoustic windows, cross section imaging is helpful.
- A large field of view (up to 50 cm) accomplishes a good general view of the heart and its neighboring structures.



The Role of Cardiac Computed Tomography in Cardio-Oncology Patients

Advantages of CMR

- For LV and RV functional determination, CMR offers the advantages of true 3D volumetric coverage.
- CMR has a high contrast-to-noise ratio providing excellent discrimination of endocardial and epicardial borders.
- The lack of reliance on geometric assumptions allows accurate calculation of LV volumes, mass, and function.

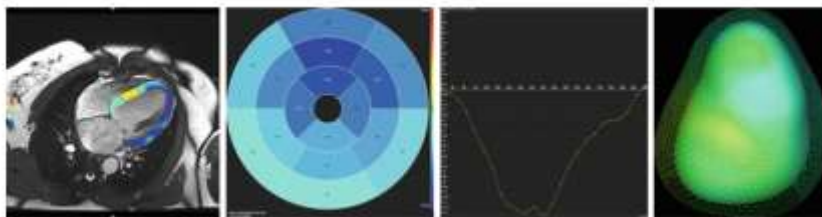


Strain Imaging

- In echocardiography, strain imaging is able to detect preclinical changes in LV systolic function, before conventional changes in LV EF.
- Strain imaging by MRI is an evolving field of research but not widely used in the daily clinical practice.
- A study of Drafts et al. showed the development of subclinical abnormalities of cardiac function after exposure to anthracycline as follow:

End-systolic volume and strain increased, whereas LVEF decreased within 6 months (1).

1. Drafts et al., JACC Cardiovasc. Imaging. 2013

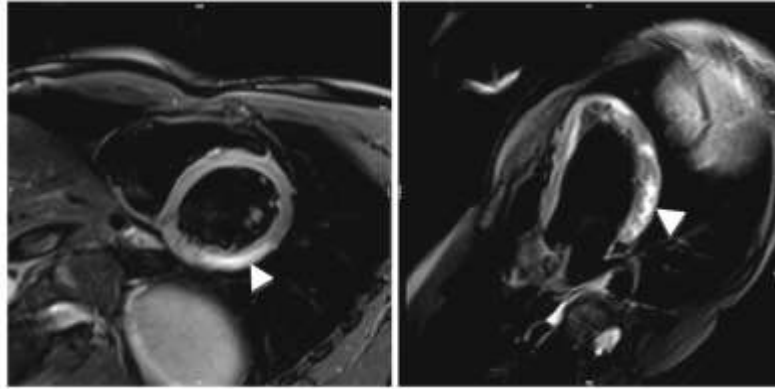


Abnormal global longitudinal strain of a patient with cardiomyopathy especially the septal and inferior segments

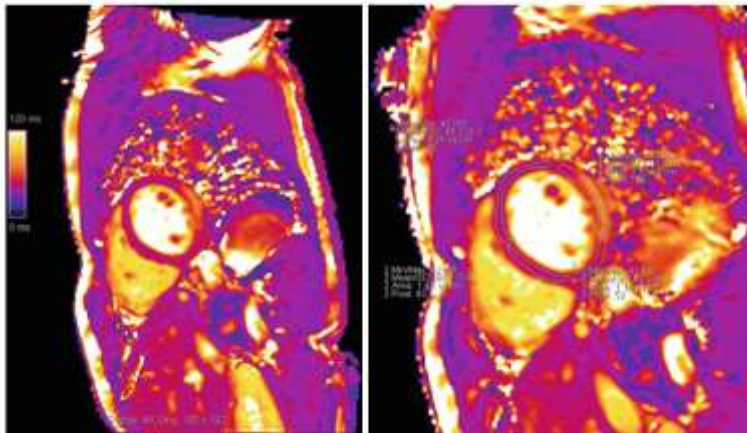
CMR in the assessment of myocardial tissue characterization

Myocardial inflammation (edema)

- Myocardial edema after chemotherapy has been documented by CMR in several studies using T2W sequences.
- There is now a growing body of evidence which could answer, in the near future, the question whether myocardial edema is an indicator for early cardiotoxicity and if it has a prognostic impact.



T2 W (STIR) sequence: focal myocardial edema (bright areas) in the infero-lateral wall (arrowhead)



T2 mapping: higher values indicating a myocardial edema

Myocardial fibrosis (scar)

- Late gadolinium enhancement (LGE) imaging allows detection of focal myocardial fibrosis (10-15 min.) after administration of Gd-based contrast material.
- The pattern and location of enhancement enable the differentiation of ischemic from non-ischemic causes.
- The existence of late enhancement has an important prognostic value in many cardiovascular diseases. However, whether late enhancement has prognostic relevance in chemotherapy-induced cardiotoxicity is still under investigation.



Sub-epicardial LGE



Intramural LGE



LGE at RV – insertion points

- The pattern of LGE described in anthracycline-treated patients includes subepicardial, intramural, and LGE at right ventricular insertion points.

T1 Mapping

- T1 mapping has been proposed as a noninvasive early marker of interstitial myocardial fibrosis.
- Quantitative myocardial T1 mapping is a potential biomarker of chemotherapy cardiotoxicity that may have the ability to detect signs of remodeling or tissue damage earlier than conventional functional metrics.

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IMAGE FOCUS

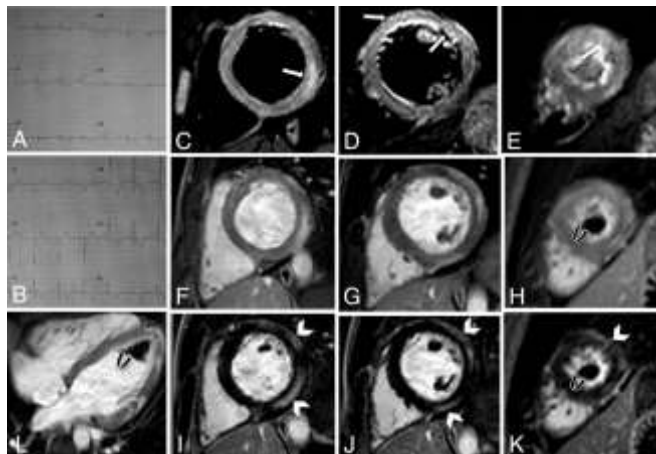
doi:10.1093/itcy/itv150
Online publish-ahead-of-print 7 August 2014

Chemotherapy-related cardiomyopathy in acute myeloid leukaemia assessed by cardiovascular magnetic resonance imaging

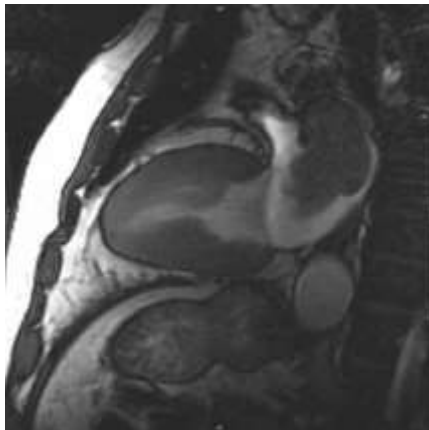
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CMR in the assessment of cardiac and pericardial Masses



Pulmonary metastasis of renal cancer with invasive growth into the left atrium



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POSITION PAPER

Expert consensus for multimodality imaging evaluation of adult patients during and after cancer therapy: a report from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Juan Carlos Plana¹, Maurizio Galderisi², Ana Barac³, Michael S. Ewer⁴, Bonnie Ky⁵, Marielle Scherrer-Crosbie⁶, Javier Ganame⁷, Igal A. Sebag⁸, Deborah A. Agler¹, Luigi P. Badano⁹, Jose Banchs⁴, Daniela Cardinale¹⁰, Joseph Carver¹¹, Manuel Cerqueira¹, Jeanne M. DeCara¹², Thor Edvardsen¹³, Scott D. Flamm¹, Thomas Force¹⁴, Brian P. Griffin¹, Guy Jerusalem¹⁵, Jennifer E. Liu¹⁶, Andreia Magalhães¹⁷, Thomas Marwick¹⁸, Liza Y. Sanchez⁴, Rosa Sicari¹⁹, Hector R. Villarraga²⁰, and Patrizio Lancellotti¹⁵

Consider the use of CMR in situations in which:

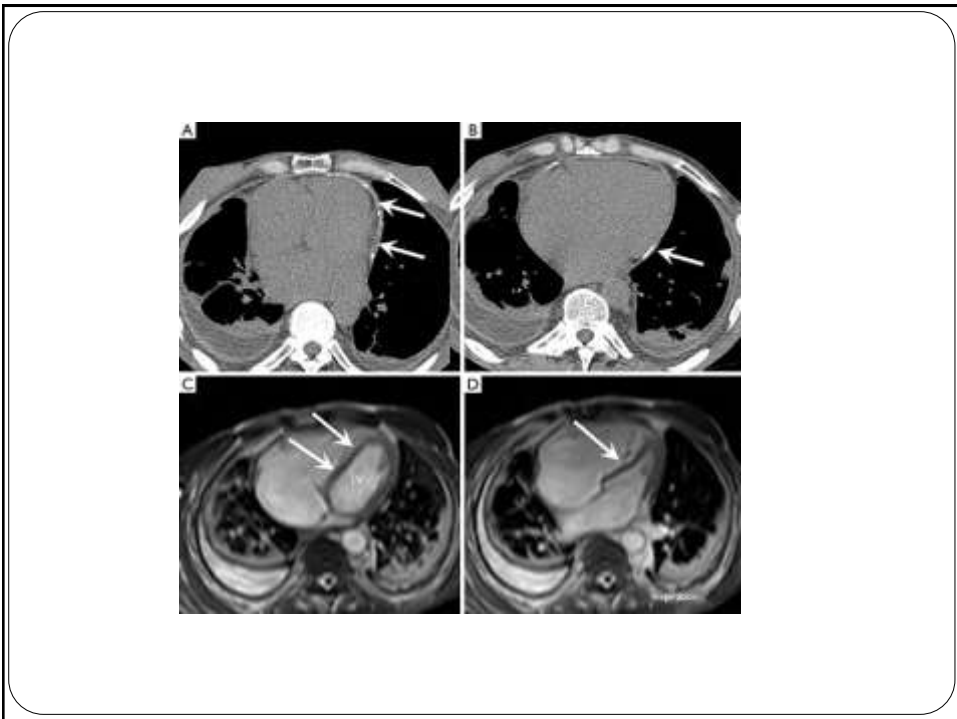
- Consideration of discontinuation of chemotherapeutic regimens secondary to cardiac dysfunction.
- Poor quality of echocardiographic images.
- The estimation of the LVEF is controversial by echo.
- In patients with cardiac or extracardiac masses.

CTCA in the assessment of CAD

- A 71-y woman with prior radiation therapy and chemotherapy for breast ca. Echo showed LVEF 40 % and diffuse hypokinesis.



- Invasive CA confirmed severe ostial stenosis of the LAD & LCx coronary artery.
- The patient underwent coronary artery bypass surgery.



Thank You