WORKSHOP “INNOVAZIONE”

Intelligenza Artificiale Alleata di Medici e Pazienti?

Doctor I.A.: Basta un click?

Presente e Futuro in Cardiologia e Oncologia dell’invisibile all’occhio umano

Camera dei Deputati – Sala del Refettorio

Via del Seminario, 76 – Roma

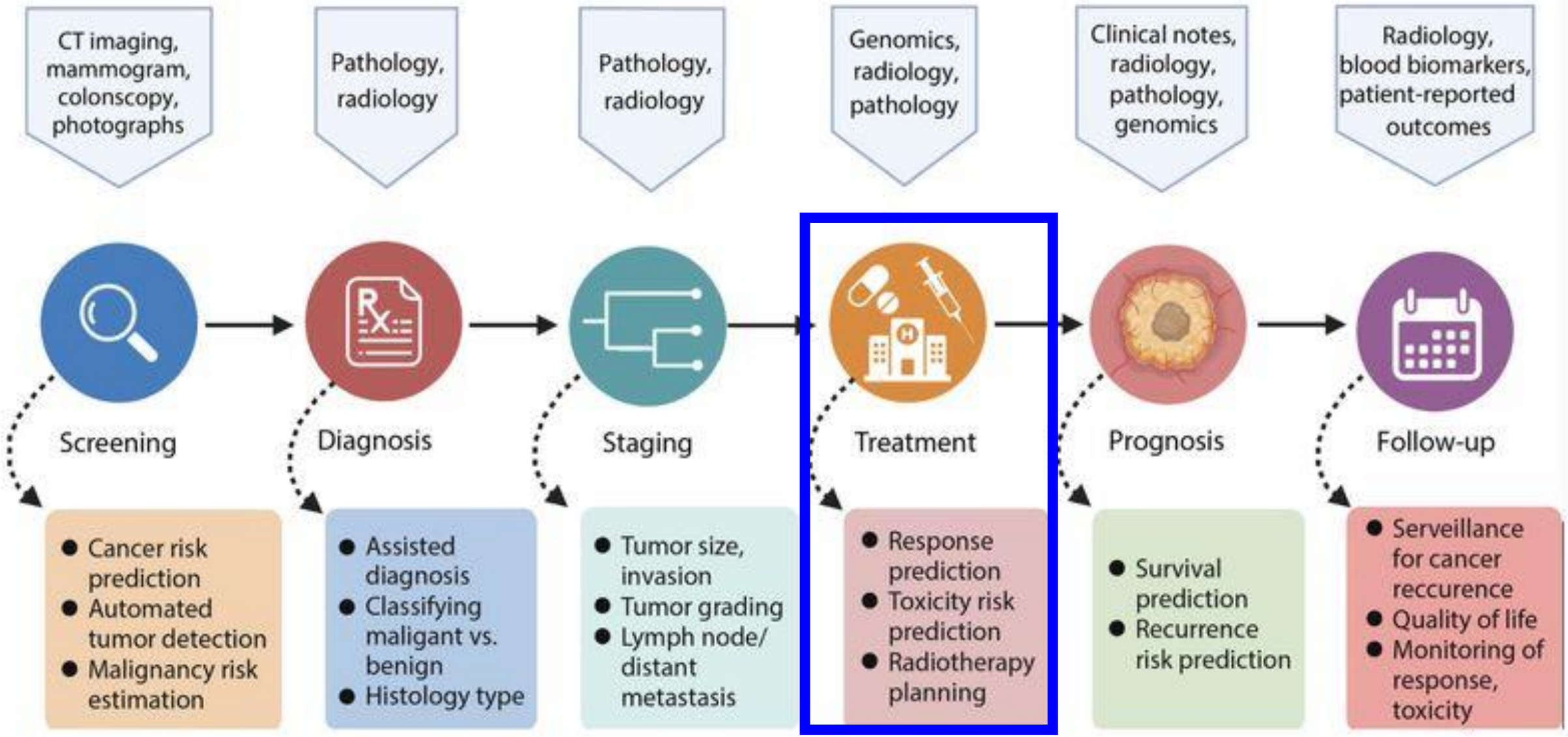
Mercoledì, 3 luglio 2024 Ore 09.00 – 14.00

FOCUS Applicazione della AI nella pratica clinica

L’oncologo **Gaetano Lanzetta** e il cardiologo **Amir Kol**

CLINICAL MEDICAL RECORDS

Examples of potential applications of AI in clinical oncology







Linee guida CARDIONCOLOGIA

Edizione 2021

Aggiornata ad aprile 2021

In collaborazione con:



ESC European Society of Cardiology

European Heart Journal (2022) **43**, 4229–4361
https://doi.org/10.1093/eurheartj/ehac244

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)

Developed by the task force on cardio-oncology of the European Society of Cardiology (ESC)

Authors/Task Force Members: Alexander R. Lyon*† (Chairperson) (United Kingdom), Teresa López-Fernández*† (Chairperson) (Spain), Liam S. Couch (Task Force Coordinator) (United Kingdom), Riccardo Asteggiano (Italy), Marianne C. Aznar[1] (United Kingdom), Jutta Bergler-Klein (Austria), Giuseppe Boriani (Italy), Daniela Cardinale (Italy), Raul Cordoba[2] (Spain), Bernard Cosyns (Belgium), David J. Cutter (United Kingdom), Evandro de Azambuja (Belgium), Rudolf A. de Boer (Netherlands), Susan F. Dent[3] (United States of America), Dimitrios Farmakis (Cyprus), Sofie A. Gevaert (Belgium), Diana A. Gorog (United Kingdom), Joerg Herrmann[3] (United States of America), Daniel Lenihan[3] (United States of America), Javid Moslehi (United States of America), Brenda Moura (Portugal), Sonja S. Salinger (Serbia), Richard Stephens (United Kingdom), Thomas M. Suter (Switzerland), Sebastian Szmit (Poland), Juan Tamargo (Spain), Paaladinesh Thavendiranathan (Canada), Carlo G. Tocchetti (Italy), Peter van der Meer (Netherlands), Helena J.H. van der Pal (Netherlands), and ESC Scientific Document Group

*Corresponding authors: Alexander R. Lyon, National Heart and Lung Institute, Imperial College London and Cardio-Oncology Service, Royal Brompton Hospital, London, United Kingdom. Tel: +44 207 352 8121, E-mail: a.lyon@imperial.ac.uk.

Teresa López-Fernández, Cardiology Department, La Paz University Hospital, IdiPAZ Research Institute, Madrid, Spain. Tel: +34 619 227 076, E-mail: tlfernandez8@gmail.com.

† The two chairpersons contributed equally to the document and are joint corresponding authors.

Author/Task Force Member affiliations are listed in Author information.

[1]Representing the European Society for Therapeutic Radiology and Oncology (ESTRO); [2]representing the European Hematology Association (EHA); [3]representing the International Cardio-Oncology Society (IC-OS).

ESC Clinical Practice Guidelines (CPG) Committee: listed in the Appendix.

ESC subspecialty communities having participated in the development of this document:

Associations: Association for Acute CardioVascular Care (ACVC), European Association of Cardiovascular Imaging (EACVI), European Association of Preventive Cardiology (EAPC), European Association of Percutaneous Cardiovascular Interventions (EAPCI), European Heart Rhythm Association (EHRA), Heart Failure Association (HFA).

Councils: Council of Cardio-Oncology, Council on Hypertension, Council on Valvular Heart Disease.

Working Groups: Aorta and Peripheral Vascular Diseases, Cardiovascular Pharmacotherapy, e-Cardiology, Myocardial Function, Pulmonary Circulation and Right Ventricular Function, Thrombosis.

Patient Forum

Downloaded from https://academic.oup.com/eurheartj/article/43/41/4229/6573995 by guest on 21 June 2024

Check for updat

VOLUME 35 · NUMBER 8 · MARCH 10, 2017

JOURNAL OF CLINICAL ONCOLOGY ASCO SPECIAL ARTICLE

Prevention and Monitoring of Cardiac Dysfunction in Survivors of Adult Cancers: American Society of Clinical Oncology Clinical Practice Guideline

Saro H. Armenian, Christina Lacchetti, Ana Barac, Joseph Carver, Louis S. Constine, Neelima Denduluri, Susan Dent, Pamela S. Douglas, Jean-Bernard Durand, Michael Ewer, Carol Fabian, Melissa Hudson, Mariell Jessup, Lee W. Jones, Bonnie Ky, Erica L. Mayer, Javid Moslehi, Kevin Oeffinger, Katharine Ray, Kathryn Ruddy, and Daniel Lenihan

Author affiliations and support information (if applicable) appear at the end of this article.

Published at jco.org on December 5, 2016.

Clinical Practice Guideline Committee Approved: June 13, 2016.

Editor's note: This American Society of Clinical Oncology (ASCO) Clinical Practice Guideline provides recommendations, with comprehensive review and analyses of the relevant literature for each recommendation. Additional information, including a Data Supplement with additional evidence tables, a Methodology Supplement, slide sets, clinical tools and resources, and links to patient information at www.cancer.net, is available at www.asco.org/cardiac-guideline.

Endorsed by the American Heart Association.

Corresponding author: Saro Armenian, DO, MPH, American Society of Clinical Oncology, 2318 Mill Rd, Ste 800, Alexandria, VA 22314; e-mail: guidelines@asco.org.

© 2016 by American Society of Clinical Oncology

0732-183X/17/3508w-893w/$20.00

A B S T R A C T

Purpose

Cardiac dysfunction is a serious adverse effect of certain cancer-directed therapies that can interfere with the efficacy of treatment, decrease quality of life, or impact the actual survival of the patient with cancer. The purpose of this effort was to develop recommendations for prevention and monitoring of cardiac dysfunction in survivors of adult-onset cancers.

Methods

Recommendations were developed by an expert panel with multidisciplinary representation using a systematic review (1996 to 2016) of meta-analyses, randomized clinical trials, observational studies, and clinical experience. Study quality was assessed using established methods, per study design. The guideline recommendations were crafted in part using the Guidelines Into Decision Support methodology.

Results

A total of 104 studies met eligibility criteria and compose the evidentiary basis for the recommendations. The strength of the recommendations in these guidelines is based on the quality, amount, and consistency of the evidence and the balance between benefits and harms.

Recommendations

It is important for health care providers to initiate the discussion regarding the potential for cardiac dysfunction in individuals in whom the risk is sufficiently high before beginning therapy. Certain higher risk populations of survivors of cancer may benefit from prevention and screening strategies implemented during cancer-directed therapies. Clinical suspicion for cardiac disease should be high and threshold for cardiac evaluation should be low in any survivor who has received potentially cardiotoxic therapy. For certain higher risk survivors of cancer, routine surveillance with cardiac imaging may be warranted after completion of cancer-directed therapy, so that appropriate interventions can be initiated to halt or even reverse the progression of cardiac dysfunction.

J Clin Oncol 35:893-911. © 2016 by American Society of Clinical Oncology

INTRODUCTION

Recent advances in cancer treatment and supportive care have resulted in a growing number of survivors of cancer.[1] With longer survival, attention to the chronic and long-term adverse treatment effects has become increasingly important. Heart failure (HF), presenting during or after completion of cancer treatment, is a well-recognized complication impacting survival and quality of life. The American College of Cardiology (ACC) and American Heart Association (AHA) describe HF as a progressive disorder.[2] This process begins with risk factors known to be associated with the development of HF, including the toxicity of chemotherapy and/or radiation (RT; stage A), and is commonly progressive after structural changes to the heart occur. The initial manifestation may be asymptomatic cardiac dysfunction (stage B), which precedes eventual development of overt signs and symptoms (stages C and D). In patients with cancer, onset of either asymptomatic or symptomatic disease may also be responsible for interruption or discontinuation of cancer-directed therapy, potentially reducing

ASSOCIATED CONTENT

Appendix
DOI: 10.1200/JCO.2016.70.5400

Data Supplement
DOI: 10.1200/JCO.2016.70.5400

DOI: 10.1200/JCO.2016.70.5400

American Heart Journal Plus: Cardiology Research and Practice 15 (2022) 100129

Contents lists available at ScienceDirect

American Heart Journal Plus:
Cardiology Research and Practice

journal homepage: www.sciencedirect.com/journal/american-heart-journal-plus-cardiology-research-and-practice

Research paper

Artificial intelligence opportunities in cardio-oncology: Overview with spotlight on electrocardiography

Daniel Sierra-Lara Martinez [a], Peter A. Noseworthy [b], Oguz Akbilgic [c,d], Joerg Herrmann [b], Kathryn J. Ruddy [e], Abdulaziz Hamid [f], Ragasnehith Maddula [f], Ashima Singh [g], Robert Davis [h], Fatma Gunturkun [h], John L. Jefferies [i,j], Sherry-Ann Brown [b,k,*]

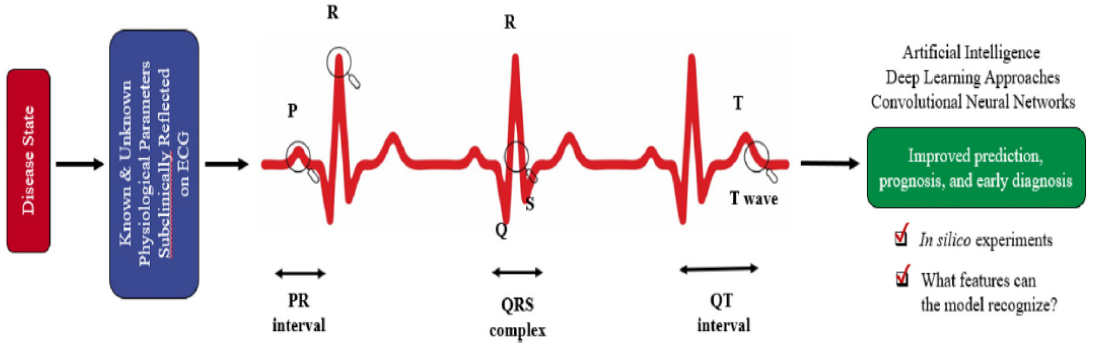


Fig. 1. The use of convolutional neural networks, a deep learning approach as a form of artificial intelligence, can be used to computationally predict cardiac dysfunction or atrial fibrillation in in silico experiments. Traditional multivariate discrimination approaches in statistics typically use known prespecified physiological parameters for analyses. In comparison, artificial intelligence methods can uncover and use subclinical unknown physiological parameters reflected in subtle changes on the ECG for improved prediction, early diagnosis, and prognosis of cardiac dysfunction and atrial fibrillation.

- **Cardiovascular disease is a leading cause of death among cancer survivors, second only to cancer recurrence or development of new tumors.**
- **Cardio-oncology has therefore emerged as a relatively new specialty focused on prevention and management of cardiovascular consequences of cancer therapies.**
- Yet challenges remain regarding precision and accuracy with predicting individuals at highest risk for cardiotoxicity.
- Barriers such as access to care also limit screening and early diagnosis to improve prognosis.
- **We then examine research in which machine learning has been applied to improve prediction of cardiac dysfunction in cancer survivors. We also highlight the use of artificial intelligence (AI) in conjunction with electrocardiogram (ECG) to predict cardiac malfunction and also atrial fibrillation (AF), and we discuss the potential role of wearables.**

American Heart Journal Plus: Cardiology Research and Practice 15 (2022) 100126

Contents lists available at ScienceDirect

American Heart Journal Plus:
Cardiology Research and Practice

journal homepage: www.sciencedirect.com/journal/american-heart-journal-plus-cardiology-research-and-practice

Research paper

Artificial intelligence and imaging: Opportunities in cardio-oncology

Nidhi Madan [a], Julliette Lucas [b], Nausheen Akhter [c], Patrick Collier [d], Feixiong Cheng [e], Avirup Guha [f], Lili Zhang [g], Abhinav Sharma [h], Abdulaziz Hamid [b], Imeh Ndiokho [b], Ethan Wen [b], Noelle C. Garster [h], Marielle Scherrer-Crosbie [i], Sherry-Ann Brown [j,*]

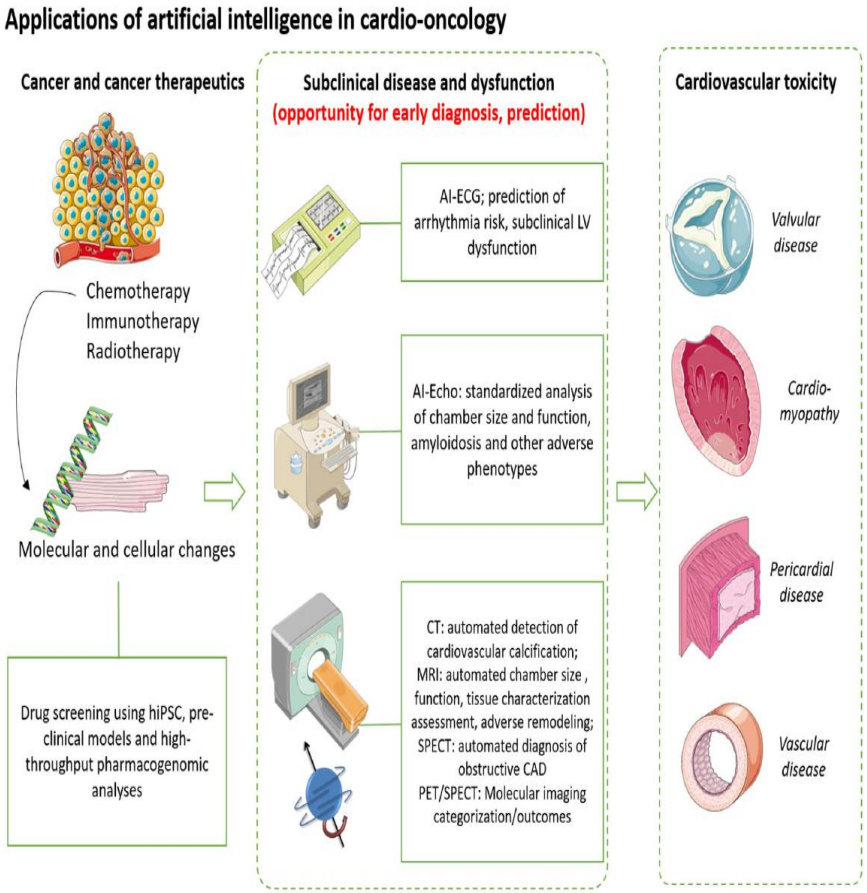
- **Cardiovascular disease is a leading cause of death in cancer survivors.**
- It is critical to apply new predictive and early diagnostic methods in this population, as this can potentially inform cardiovascular treatment and surveillance decision-making.
- We discuss the application of artificial intelligence (AI) technologies to cardiovascular imaging in cardio-oncology, with a particular emphasis on prevention and targeted treatment of a variety of cardiovascular conditions in cancer patients.
- **Recently, the use of AI-augmented cardiac imaging in cardio-oncology is gaining traction**.
- **The application of AI to cardiovascular magnetic resonance imaging (CMR), computed tomography (CT; especially coronary artery calcium or CAC scans), single proton emission computed tomography (SPECT) and positron emission tomography (PET) imaging acquisition is also in early stages of analysis for prediction and assessment of cardiac tumors and cardiovascular adverse events in patients treated for childhood or adult cancer. The opportunities for application of AI in cardio-oncology imaging are promising, and if availed, will improve clinical practice and benefit patient care.**

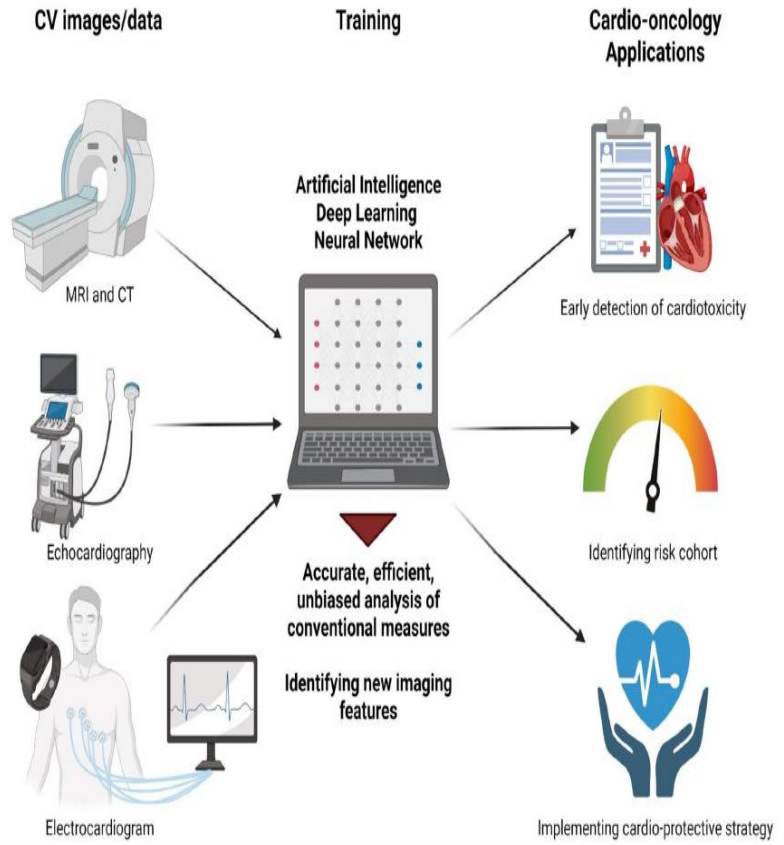
frontiers | Frontiers in Cardiovascular Medicine

TYPE Perspective
PUBLISHED 26 July 2022
DOI 10.3389/fcvm.2022.941148

Artificial intelligence applications in cardio-oncology: Leveraging high dimensional cardiovascular data

Haidee Chen[1], David Ouyang[2], Tina Baykaner[3], Faizi Jamal[1], Paul Cheng[3]* and June-Wha Rhee[1]*



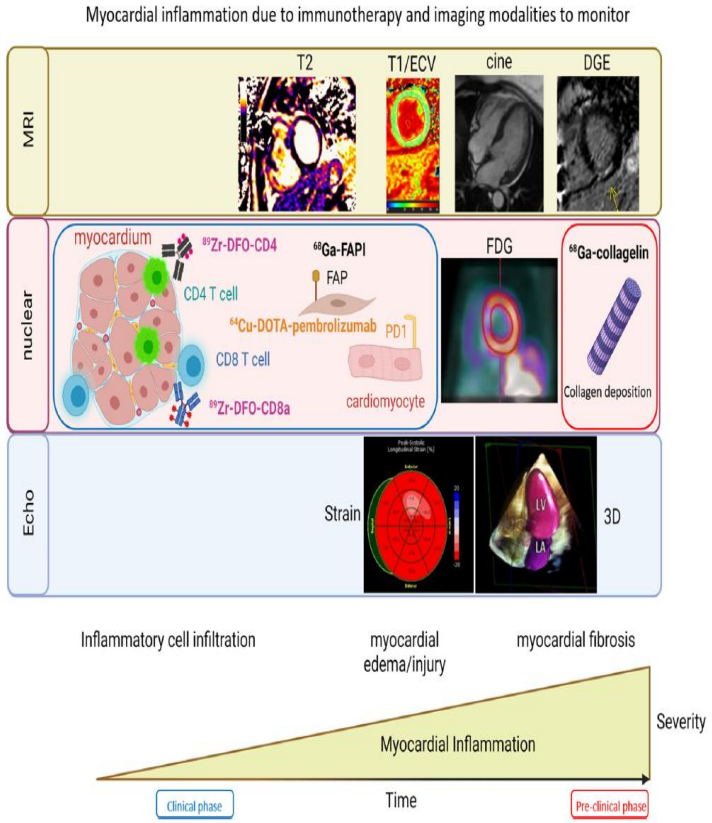


frontiers in Cardiovascular Medicine

REVIEW
published: 15 March 2022
doi: 10.3389/fcvm.2022.829553

Multimodality Advanced Cardiovascular and Molecular Imaging for Early Detection and Monitoring of Cancer Therapy-Associated Cardiotoxicity and the Role of Artificial Intelligence and Big Data

*Jennifer M. Kwan[1], Evangelos K. Oikonomou[1], Mariana L. Henry[2] and Albert J. Sinusas[1,3,4]**



American Heart Journal Plus: Cardiology Research and Practice 15 (2022) 100126

Contents lists available at ScienceDirect

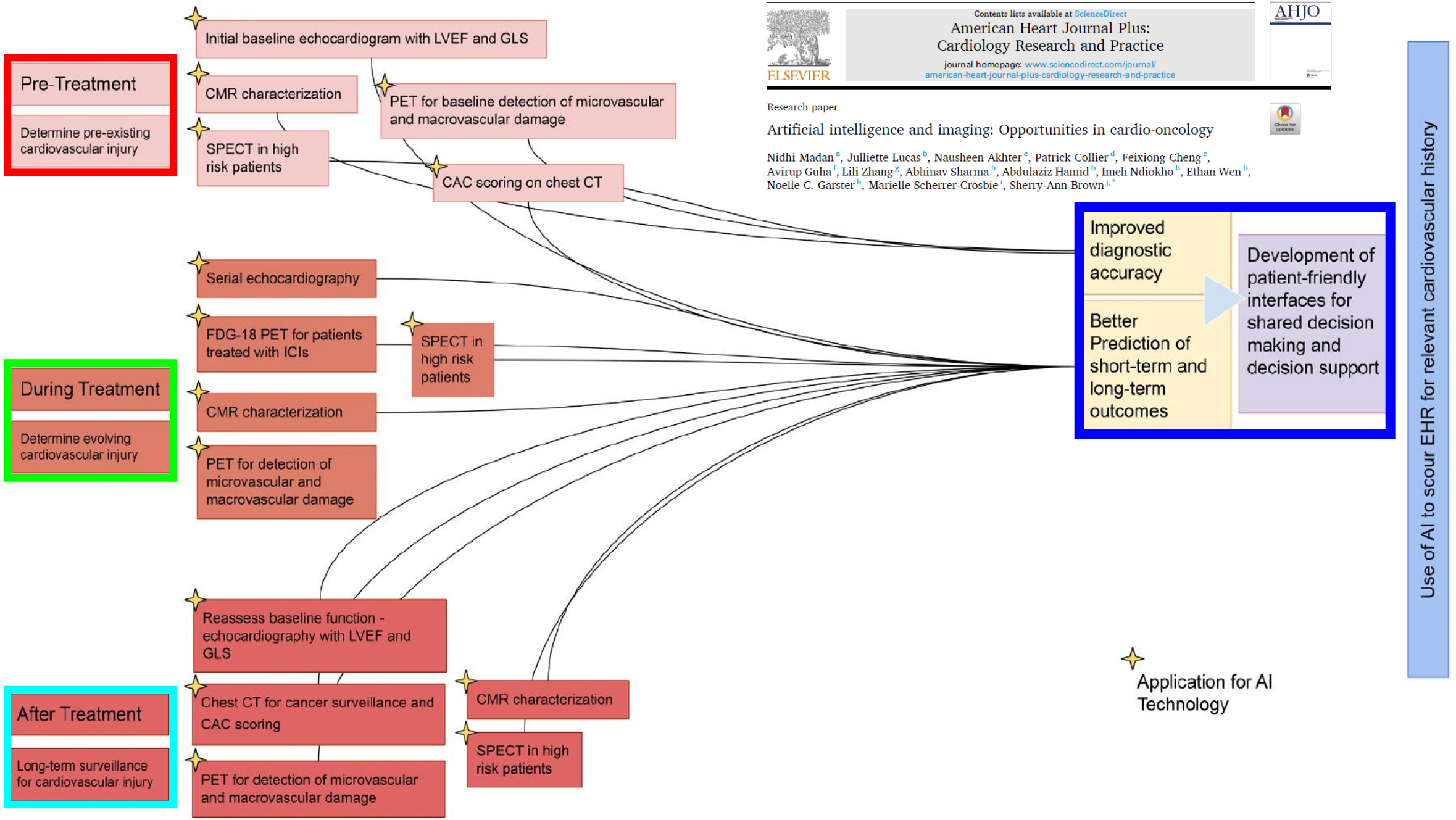
American Heart Journal Plus: Cardiology Research and Practice

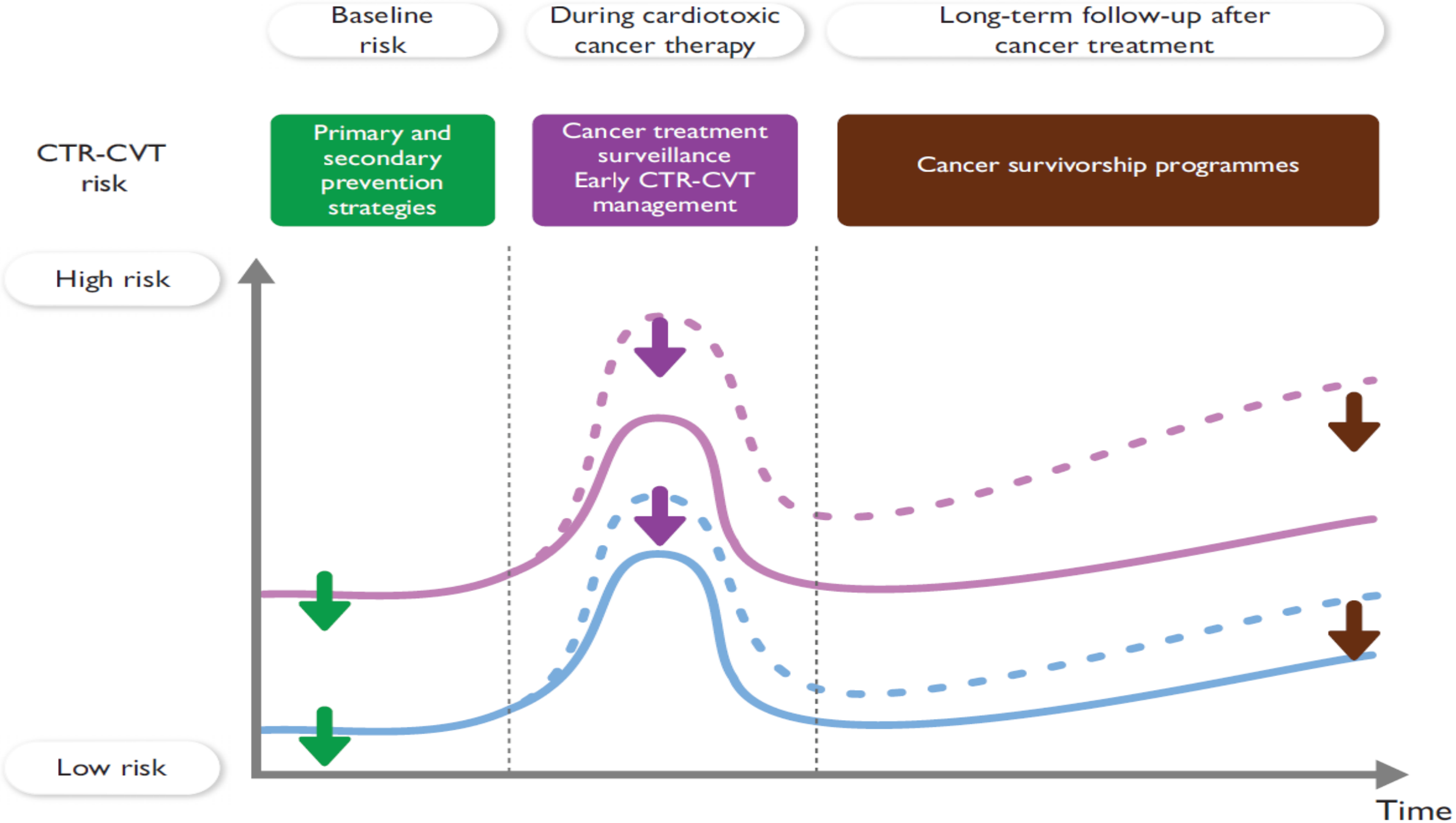
journal homepage: www.sciencedirect.com/journal/american-heart-journal-plus-cardiology-research-and-practice

Research paper

Artificial intelligence and imaging: Opportunities in cardio-oncology

Nidhi Madan[a], Julliette Lucas[b], Nausheen Akhter[c], Patrick Collier[d], Feixiong Cheng[e], Avirup Guha[f], Lili Zhang[g], Abhinav Sharma[h], Abdulaziz Hamid[b], Imeh Ndiokho[b], Ethan Wen[b], Noelle C. Garster[h], Marielle Scherrer-Crosbie[i], Sherry-Ann Brown[j,*]




Baseline risk
During cardiotoxic cancer therapy
Long-term follow-up after cancer treatment
CTR-CVT risk
Primary and secondary prevention strategies
Cancer treatment surveillance Early CTR-CVT management
Cancer survivorship programmes
High risk
Low risk
Time

MANAGING COMPLEX CHANGE



SOURCE: ADAPTED FROM THE MANAGING COMPLEX CHANGE MODEL, COPYRIGHTED BY DR. MARY LIPPITT OF ENTERPRISE MANAGEMENT, LTD., IN 1987

ARITMIE NEL PAZIENTE ONCOLOGICO

- ✓ Bradiaritmie
- ✓ Fibrillazione atriale
- ✓ Aritmie ventricolari

I Loop Recorder sono i dispositivi cardiaci impiantabili che richiedono maggior tempo nella gestione remota.

Perché quindi utilizzare gli algoritmi di IA?



Riducono i falsi allarmi, senza compromettere la sensibilità.[1,2,3]



Semplificano le valutazioni più complesse



Consentono di approfittare delle innovazioni future che verranno applicate ai dispositivi già impiantati mediante aggiornamenti basati su cloud

[1] Radtke, A, et al. Artificial Intelligence Enables Dramatic Reduction of False Atrial Fibrillation Alerts from Insertable Cardiac Monitors. Presentato durante la HRS 2021.
[2] AccuRhythm™ Clinician Manual Supplements M015316C001 and M015314C001
[3] Cheng YJ Ousdigian, KT, Koehler J, Cho YK, Kloosterman M. Innovative Artificial Intelligence Application Reduces False Pause Alerts while Maintaining. Perfect True Pause Sensitivity for Insertable Cardiac Monitors. Presentato durante la HRS 2021

Flusso dei dati provenienti dal Loop Recorder con gli algoritmi AI

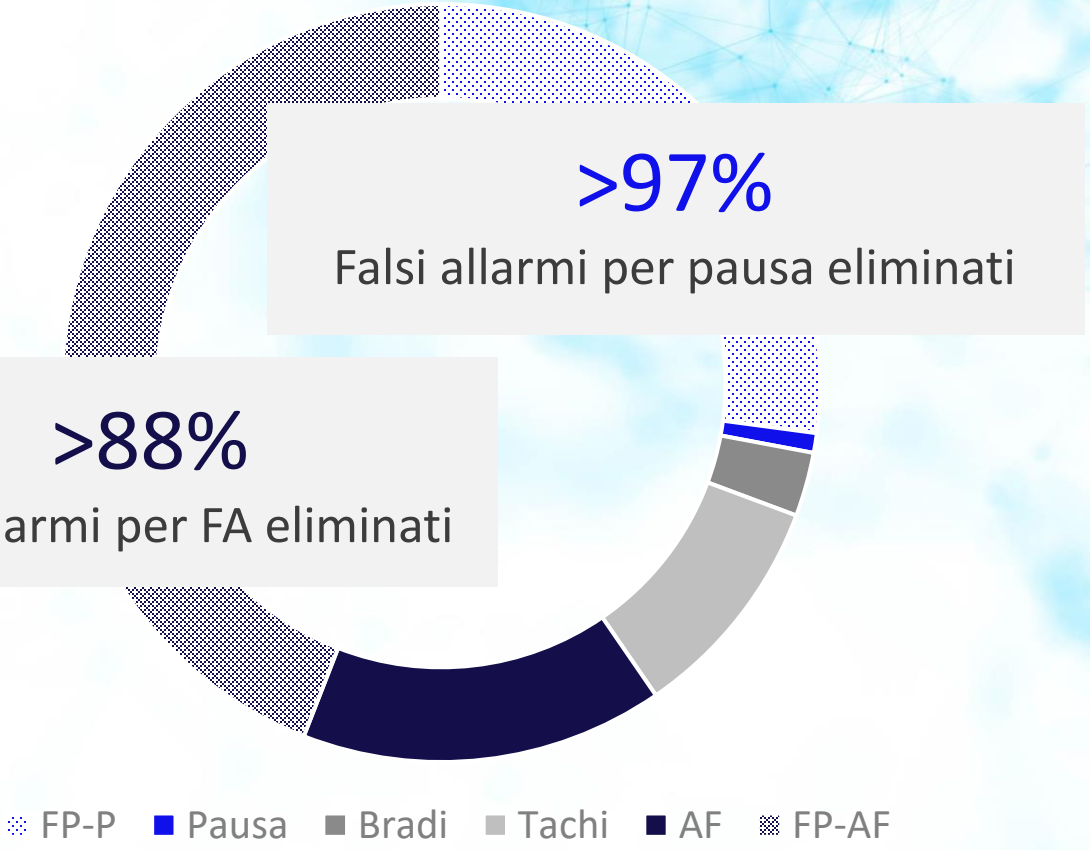


Un evento non viene processato dall'analisi AI se:

- Correlato ad un evento Sintomo del paziente
- Evento AF ≥ 1 ora
- Evento di pausa raro (≤ 1 episodio al mese)
- Eventi di pausa quando la durata della pausa è impostata a 1.5sec

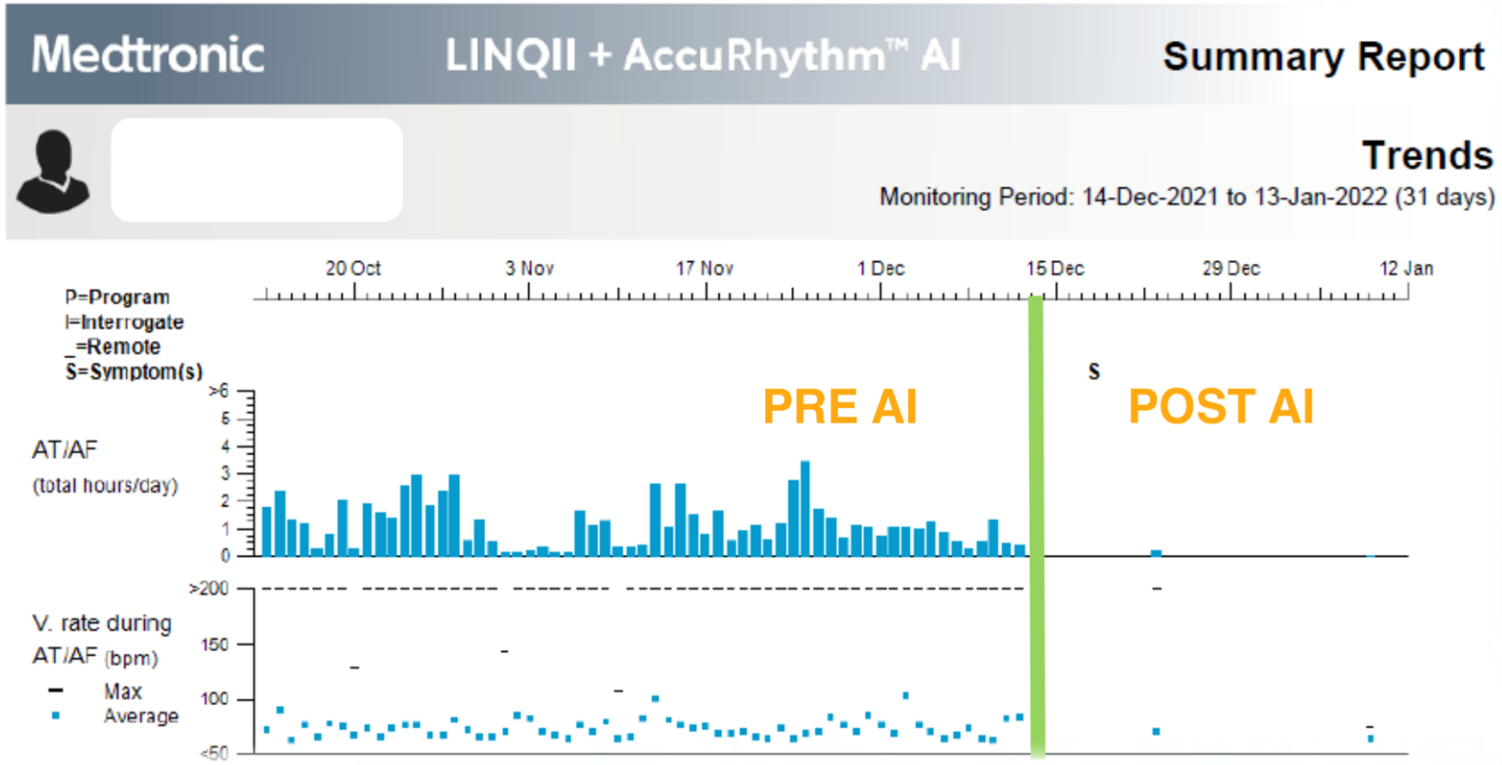
Gli algoritmi di IA riducono drasticamente gli alert su falsi positivi conservando la sensibilità





Radtke, A., et al. Artificial Intelligence Enables Dramatic Reduction of False Atrial Fibrillation Alerts from Insertable Cardiac Monitors. Heart Rhythm Journal. Presentato il 31 luglio 2021 alla Heart Rhythm Society Conference. Pubblicato online il 1° agosto 2021.
Cheng, YJ., et.al . Innovative Artificial Intelligence Application Reduces False Pause Alerts while Maintaining Perfect Trye Pause Sensitivity for Insertable Cardiac Monitors. Heart Rhythm Journal. Presentato il 31 luglio 2021 alla Heart Rhythm Society Conference. Pubblicato online il 1° agosto 2021.
Ousdigian K, Cheng YJ, Koehler J, et al. Artificial Intelligence Dramatically Reduces Annual False Alerts from Insertable Cardiac Monitors. Presentato alla AHA Conference 2021.

Caso Real-life



L'utilizzo degli algoritm
diminuisce in mani
consistente il numero
allarmi per Fibrillazione





Report generato sulla base dell'azione degli algoritmi di IA sulla popolazione di Loop Recorder impiantati presso l'ospedale San Camillo De Lellis di Rieti tra il 2022 e il 2024

La ragione di monitoraggio maggiormente utilizzata nella popolazione di pazienti impiantati presso il centro è la SINCOPE

Negli ultimi due anni
70 pazienti

- 52 per sincope
- 18 per stroke