Developing a Cardio-Oncology Program in an Academic Environment

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Chair of HFA Cardio-Oncology Study Group of ESC
Cardiology advisor to Macmillan Cancer
Conflicts of Interest

• **Consultancies**: Servier, Novartis, AMGEN, Onyx Pharmaceuticals, Ferring Pharmaceuticals, Clinigen Group, Eisai

• **Research grants**: Servier, Pfizer

• **Honoraria, speaker fees, conference support**: Pfizer, Takeda, Servier, Janssen-Cilag, AstraZeneca, Novartis, Boston Scientific, Bayer

• **Advisory boards**: Servier, Novartis, Roche, AMGEN, Onyx Pharmaceuticals, Eli Lily, Stealth Peptides
Overview

• Where to start?
• Clinical Service
• Education
• Research
• Advocacy
• Networks
Cancer and Cardiovascular disease
Two Medical Worlds Collide
Developing a Cardio-Oncology Service

What is the key to success? Partnership with Oncologists and Haematologists
Understand each other’s language
Modern medicine – a jargon rich environment

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFpEF</td>
<td>Neoadjuvant</td>
</tr>
<tr>
<td>DAPT</td>
<td>Grade 3 toxicity</td>
</tr>
<tr>
<td>DES</td>
<td>CA15-3</td>
</tr>
<tr>
<td>TAVI</td>
<td>Oncotype Dx score of 15</td>
</tr>
<tr>
<td>CRT-D</td>
<td>MRD</td>
</tr>
<tr>
<td>ARNI</td>
<td>PFS</td>
</tr>
<tr>
<td>PVI</td>
<td>Bruton Kinase</td>
</tr>
<tr>
<td>TVP</td>
<td>IMRT</td>
</tr>
<tr>
<td>Takotsubo</td>
<td>CTLA-4 inhibitor</td>
</tr>
</tbody>
</table>
Cardio-Oncology Service

General Principles

- Minimise delay to cancer treatment
- Support cardiotoxic cancer treatments
  DO NOT obstruct/stop
- Prevention better than rescue
- Close liaison between cardiology and oncology/haematology
- Multidisciplinary approach
  - Cardiology
  - Oncology
  - Haematology
  - Palliative Care
  - Cardiac Imaging
  - Psychology
  - Specialist nurses
  - Physiotherapy
Cardio-oncology

Royal Brompton Hospital’s cardio-oncology clinic looks after a wide-range of patients before, during and after cancer treatment, for care and assessment of their heart health.

This includes:

- patients who need cancer treatment but need their heart function assessed before treatment starts
- patients who are currently receiving cancer treatment and have developed a cardiac complication
- patients who are clear of cancer but are now suffering from heart problems due to previous cancer treatments.

For patients & carers

- Conditions, tests and treatments
- Cardio-oncology
  - Cardio-oncology for patients
  - Cardio-oncology - meet the team
- Patient leaflets
- Web resources
Cardio-Oncology Service
Royal Brompton Hospital

- Monitoring for early cardiotoxicity
- Secondary treatment of cardiotoxicity
- Investigation of suspected cardiac invasion by tumour
- Pre-operative assessment for cancer surgery
- Management of other cardiovascular toxicity e.g. hypertension
- Primary prevention of cardiotoxicity in high-risk patients
Cardio-Oncology Services: rationale, organization, and implementation

A report from the ESC Cardio-Oncology council

Patrizio Lancellotti\textsuperscript{1,2*}, Thomas M. Suter\textsuperscript{3}, Teresa López-Fernández\textsuperscript{4}, Maurizio Galderisi\textsuperscript{5}, Alexander R. Lyon\textsuperscript{6}, Peter Van der Meer\textsuperscript{7}, Alain Cohen Solal\textsuperscript{8}, Jose-Luis Zamorano\textsuperscript{9}, Guy Jerusalem\textsuperscript{10}, Marie Moonen\textsuperscript{1}, Victor Aboyans\textsuperscript{11}, Jeroen J. Bax\textsuperscript{12}, and Riccardo Astegiano\textsuperscript{13}
Table 1  Goals of the Cardio-Oncology Services

Unification of the cancer care process

- Effective communication and coordination among professionals involved in cancer patients care to minimize unnecessary costs
- Development and adherence to local clinical protocols to reduce individual decisions
- Optimize acute and long-term cardiovascular health for patients who need potentially cardiotoxic drugs
- Prevention, early diagnosis, and treatment of cancer therapy-related cardiovascular complications
- Reduce interruptions of anticancer drugs
- Coordination of continuous medical education, medical training, and clinical research in cardio-oncology
- Health care quality control for clinical and research practice
C-O Service

C-O Clinic

C-O Team

Core members
- Cardiologists
- Hematologists
- Medical Oncologists
- Radiation Oncologists
- Specialized nurses

Allied members
- Family doctors
- Cancer surgeons
- Pathologists
- Hospital pharmacists
- Clinical analysis
- Palliative care team
- Psychologists

Dedicated outpatient facilities
- C-O consultation rooms
- Non-invasive test rooms (ECG, stress tests, echo)
- Meeting rooms
- Administrative support

Cardiology department support
- Cardiac CT and Cardiac MRI
- Inpatients care
- Intensive cardiac care unit
- Cardiac catheterization laboratory
- Electrophysiology unit
- Cardiac surgery

Tertiary/university health centres
Coordinate specialized C-O clinics, research and educational areas in cardio-oncology

Lancellotti et al EHJ 2018 (online)
Cardio-Oncology Service Structure
Royal Brompton Hospital

The Core Team

Two Cardiology Consultants
Alex Lyon and Stuart Rosen

Cardio-Oncology Nurse
Vicki Chambers

Cardio-Oncology Secretary
Steph Harwood

RBH C-O Fellow
Ramsay Tabbara

RBH Echo Fellow
Lucia Venneri

International C-O Fellows
Mohsen Habibian
Ruben Evertz
Multidisciplinary RBH Cardio-Oncology Service

- Echocardiography
  - Raj Khattar
  - Lucia Venneri
- Cardiac Magnetic Resonance
  - John Baksi
  - Suzan Hatipojlu
- Nuclear imaging
  - Kshama Wechaleker
  - Richard Underwood
- Cardiac CT
  - Ed Nicol
  - Simon Padley
- Clinical Psychology
  - Anne-Marie Doyle
- Palliative Care
- Intervention
  - John Foran
  - Ranil De Silva
  - Simon Davies
- Electrophysiology
  - Julian Jarman
  - Tushar Salukhe
- Cardiac surgery
  - Ulrich Rosendahl
  - Cesare Quarto
- Thoracic surgery
  - Simon Jordan
  - Eric Lim
- Pathology
  - Jan Lukas Robertus
>1000 patients reviewed

Reasons for Referral

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline risk assessment and optimisation before cancer treatment</td>
<td>44%</td>
</tr>
<tr>
<td>(surgery, radiotherapy or chemotherapy)</td>
<td></td>
</tr>
<tr>
<td>Post-treatment heart failure</td>
<td>37%</td>
</tr>
<tr>
<td>Acute cardiac problem during chemotherapy</td>
<td>13.5%</td>
</tr>
<tr>
<td>Another non-heart failure cardiac condition</td>
<td>21.3%</td>
</tr>
<tr>
<td>Assessment of cardiac masses</td>
<td>3.4%</td>
</tr>
</tbody>
</table>
Cancer Types

- Breast: 30%
- Sarcoma: 19%
- GI tract: 10%
- Urinary Tract: 9%
- Thyroid: 7%
- Gynaecology: 6%
- Haematological: 6%
- Prostate: 5%
- Skin: 3%
Developing Clinical Pathways
Activity and outcomes of a cardio-oncology service in the United Kingdom—a five-year experience

Nilesh Pareek\textsuperscript{1\dagger}, Joaquim Cevallos\textsuperscript{1\dagger}, Pedro Moliner\textsuperscript{2}, Mit Shah\textsuperscript{1}, Li Ling Tan\textsuperscript{1,3}, Vicki Chambers\textsuperscript{1}, A. John Baksi\textsuperscript{1}, Rajdeep S. Khattar\textsuperscript{1}, Rakesh Sharma\textsuperscript{1}, Stuart D. Rosen\textsuperscript{1,4}, and Alexander R. Lyon\textsuperscript{1,4*}

Pareek, Cevallos et al EJHF 2018 (online this week!)
New Royal Brompton Hospital Classification of Cancer Therapy-induced Myocardial Toxicity
Clinically relevant

<table>
<thead>
<tr>
<th>Group</th>
<th>Classification</th>
<th>Definition</th>
<th>Biomarkers</th>
<th>E/E’ &gt;12 or GLS &gt; -18%</th>
<th>LVEF reduction</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Early biochemical cardiotoxicity</td>
<td>New BNP or Troponin I rise but with normal cardiac imaging</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Early functional cardiotoxicity</td>
<td>New reduction in GLS or grade III-IV diastolic dysfunction and normal biomarkers</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Early mixed cardiotoxicity</td>
<td>Normal LVEF with abnormal biomarkers and GLS↓/diastolic dysfunction</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>HFrEF</td>
<td>Symptomatic heart failure with preserved ejection fraction</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Asymptomatic LVSD</td>
<td>New LVEF reduction to &lt;50% or a reduction in LVEF &gt;10% to a LVEF &lt;55%</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>HFrEF</td>
<td>Symptomatic reduction in LVEF &lt;50% or a reduction in LVEF &gt;10% to a LVEF &lt;55%</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

BNP - Brain Natriuretic Peptide, GLS - Global Longitudinal Strain, LVEF – Left ventricular ejection fraction, HfPEF – Heart Failure with preserved ejection fraction, HFrEF – Heart Failure with reduced ejection fraction, LVSD – Left ventricular systolic dysfunction

Pareek, Cevallos et al EJHF 2018 (online)
Framework for guiding oncology and cardiology treatment decisions during cancer treatment

<table>
<thead>
<tr>
<th>Cardiotoxicity group</th>
<th>Classification</th>
<th>Definition</th>
<th>Management strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Early biochemical cardiotoxicity</td>
<td>New BNP or troponin I rise but with normal cardiac imaging, (if normal at baseline, then any increase above the upper limit of normal, if abnormal at baseline, then 20% rise).</td>
<td>Oncology therapy: Continue</td>
</tr>
<tr>
<td>2</td>
<td>Early functional cardiotoxicity</td>
<td>New reduction in GLS or grade III–IV diastolic dysfunction and normal biomarkers.</td>
<td>Oncology therapy: Continue</td>
</tr>
<tr>
<td>3</td>
<td>Early mixed cardiotoxicity</td>
<td>Normal LVEF with abnormal biomarkers and GLS/diastolic dysfunction.</td>
<td>Oncology therapy: Continue</td>
</tr>
<tr>
<td>4</td>
<td>Symptomatic HFrEF</td>
<td>Symptomatic HFrEF.</td>
<td>Oncology therapy: Interrupt and review risk/benefit</td>
</tr>
<tr>
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<td>Asymptomatic LVSD</td>
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<td>Oncology therapy: Review and balance risk/benefit</td>
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<td>Symptomatic LVSD</td>
<td>Symptomatic reduction in LVEF &lt;50%, or a reduction in LVEF &gt;10% to a LVEF &lt;55%.</td>
<td>Oncology therapy: Interrupt and review risk/benefit</td>
</tr>
</tbody>
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ACEI, angiotensin-converting enzyme inhibitor; BB, beta-blocker; BNP, brain natriuretic peptide; GLS, global longitudinal strain; HF, heart failure; HFrEF, heart failure with preserved ejection fraction; LVEF, left ventricular ejection fraction; LVSD, left ventricular systolic dysfunction.

1. Continuing cardiotoxic cancer therapy may be suitable in selected cases depending on the risk/benefit ratio, severity of left ventricular impairment, symptoms, cancer stage and response.

2. If LVEF fall is to >50%, then incorporate either biomarker elevation or GLS reduction (<−18% if normal at baseline, or <−15% relative reduction of GLS if reduced at baseline).

3. If ACEI or BB are not tolerated, or the patient is already taking these agents when cardiotoxicity is diagnosed, consider adding aldosterone antagonist.

4. If LVEF <35% follow the European Society of Cardiology-HF guidelines regarding eligibility for cardiac resynchronization therapy, sacubitril/valsartan and ivabradine.

Pareek, Cevallos et al EJHF 2018 (online)
Checkpoint Inhibitors and Cardiotoxicity

Conduction disease
- Atrioventricular block

Myocarditis
- Heart failure
- Ventricular arrhythmias

Coronary artery disease
- Atherosclerotic plaque rupture
- Acute myocardial infarction
- Coronary vasculitis

Pericarditis
- Effusion
- Tamponade

Non-inflammatory left ventricular dysfunction
- Heart failure
- Takotsubo syndrome
Panel 2: Proposed surveillance strategy for ICI-related cardiotoxic effects

Baseline cardiac assessment pre-ICI (all patients)
- Clinical history and risk factor assessment
- ECG
- Cardiac troponin
- BNP or NT-proBNP*
- Echocardiogram

Surveillance during ICI treatment (high-risk patients)
- Baseline assessment (as above)
- ECG, cardiac troponin, and BNP assessment before ICI doses two to four
- If normal at dose four, reduce to alternate doses for six to 12; and if still normal then reduce to every three doses until completion of course
- Consider echocardiography (post-second or pre-third dose) in high-risk patients; consider 3-6-monthly echocardiography in selected patients if abnormal left ventricular or right ventricular function at baseline
- If new troponin or BNP elevation*, ECG, or echocardiogram abnormality, refer patient to cardio-oncology specialist

All patients
- If new cardiac symptoms (eg, chest pain, dyspnoea, palpitations, presyncope, or syncope), check ECG, echocardiogram, cardiac troponin, and BNP or NT-proBNP
- Refer patient to cardio-oncology specialist if any new abnormalities arise
Patient Feedback

As asked on a scale of 1 (dissatisfied) to 10 (very satisfied) their overall experience: 185 answers
Mean score 9.36
RBH Cardio-Oncology Service
Patient feedback – n=185

Able to ask questions during consultation

Recommend clinic to friends and family

Consultation clearly explained

Helpful meeting CNS

- 100% Agree or Strongly Agree
- 97% Agree or Strongly Agree
- 100% Agree or Strongly Agree
- 89% Agree or Strongly Agree
RBH Cardio-Oncology Service

Key outcome measure:

90% patients with cardiotoxicity during cancer treatment completed cancer treatment safely

Pareek, Cevallos et al EJHF 2018 (online)
Education and Training
Title: Cardio-Oncology Training: A Proposal From the International CardiOncology Society and Canadian Cardiac Oncology Network for a New Multidisciplinary Specialty


PII: S1071-9164(16)30005-7
DOI: http://dx.doi.org/doi: 10.1016/j.cardfail.2016.03.012
Reference: YJCAF 3738

To appear in: Journal of Cardiac Failure

Received date: 22-10-2015
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Accepted date: 23-3-2016
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RBH Cardio-Oncology Fellows 2012-2018

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Mohsen Habibian
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Yulia Kirichenko
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MANAGING HEART HEALTH DURING AND AFTER CANCER TREATMENT

A quick guide for primary care health professionals

Supported by Macmillan
Research
Cardio-Oncology Research

Molecule Nanoscale imaging

Cell

Isolated heart preparations

In vivo models

Single Centre Cohorts Deep phenotyping

Clinical Trials Registries Population

Bedside to Bench and Bench to Bedside
Publications

2016 ESC Position Paper on cancer treatments and cardiovascular toxicity developed under the auspices of the ESC Committee for Practice Guidelines

The Task Force for cancer treatments and cardiovascular toxicity of the European Society of Cardiology (ESC)

Authors/Task Force Members: Jose Luis Zamorano* (Chairperson) (Spain), Patrizio Lancellotti* (Co-Chairperson) (Belgium), Daniel Rodriguez Muñoz (Spain), Victor Aboyans (France), Riccardo Asteggianno (Italy), Maurizio Galderisi (Italy), Gilbert Habib (France), Daniel J. Lenihan1 (USA), Gregory Y. H. Lip (UK), Alexander R. Lyon (UK), Teresa Lopez Fernandez (Spain), Dania Mohty (France), Massimo F. Piepoli (Italy), Juan Tamargo (Spain), Adam Torbicki (Poland), and Thomas M. Suter (Switzerland)

Cardio-Oncology Services: rationale, organization, and implementation

A report from the ESC Cardio-Oncology council

Patrizio Lancellotti1,2, Thomas M. Suter3, Teresa López-Fernández4, Maurizio Galderisi5, Alexander R. Lyon6, Peter Van der Meer7, Alain Cohen Solal8, Jose-Luis Zamorano9, Guy Jerusalem10, Marie Moonen1, Victor Aboyans11, Jeroen J. Bax12, and Riccardo Asteggianno13

Cancer diagnosis in patients with heart failure: epidemiology, clinical implications and gaps in knowledge

Pietro Ameri11, Marco Canepa11, Markus S. Anker1, Yury Belenkov3, Jutta Bergler-Klein1, Alain Cohen-Solal5, Dimitrios Farmakis6, Teresa López-Fernández1, Mitja Lainscak8, Radek Pudil9, Frank Ruschitska10, Petar Seferovic11, Gerasimos Filippatos4, Andrew Coats12, Thomas Suter13, Stephan Von Haehling14, Fortunato Ciardiello15, Rudolf A. de Boer16, Alexander R. Lyon17, and Carlo G. Tocchetti18, for the Heart Failure Association Cardio-Oncology Study Group of the European Society of Cardiology

Activity and outcomes of a cardio-oncology service in the United Kingdom—a five-year experience

Nilesh Pareek11, Joaquim Cevallos11, Pedro Moliner1, Mit Shah1, Li Ling Tan1, Vicki Chambers, A. John Baks1, Rajdeep S. Khattar1, Rakesh Sharma1, Stuart D. Rosen14, and Alexander R. Lyon14*
Advocacy
1st RBH Cardio-Oncology Patient Awareness Day
7th June 2018

Agenda

14:00 – Welcome
14:10 Alexander Lyon
What is Cardio-Oncology and why do cancer treatments affect the heart?
14:25 Stuart Rosen
What are we doing to prevent heart problems now?
14:35 Ulrich Rosendahl
Advances in modern cardiac surgery relevant for cancer survivors
14:45 Vicki Chambers
Coordinating care between Cardiology and Oncology
14:55 Ask the experts – panel Q&A
15:15 Lesley Smith*
NHS England Cancer Strategy for Living With and Beyond Cancer – what it means for patients
15:30 Break
16:00 Richard Stephens*
My story as a patient advocate
16:20 Anne-Marie Doyle
Stress management – helping your heart
16:35 Small group discussion
17:00 Large group discussion
17:20 Greig Trout*
I’m a survivor
17:45 Closing Comments
“Greig is truly one brave man, and is determined to shine a light and help and inspire those who have faced real battles - I admire his courage and resolve so much. No wonder he is a Scout!”

- Bear Grylls
Patient Information

HEART HEALTH AND CANCER TREATMENT

National and International Cardio-Oncology Strategy
British Cardio-Oncology Society

The British Cardio-Oncology Society (www.BC-OS.org) was formed in 2012 by a group of UK cardiologists and oncologists from multiple sub-specialties interested in and working on the cardiovascular effects of cancer treatment. Our mission is to promote research, best clinical practice and a wider understanding of the effects of cancer treatment on the cardiovascular system. The society is an associated professional group of the British Cardiovascular Society (www.BCS.com) which will host a dedicated cardio-oncology session at the Annual Scientific Meeting in Manchester on 8th June 2015. We work with local, national and international partners to improve patient care and welcome enquiries from cardiologists, oncologists, charities, the NHS and industry.

More information will be available here soon. For further information about the society, contact (info@bc-os.org).

www.bc-os.org
International Collaborators
Cardio-Oncology
International Networks and Professional Societies
Collaboration in International Cardio-Oncology Society