



How To Incorporate Cardio-Oncology As A Cardiology Fellowship Training Emphasis

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ABSTRACT

Background: The burgeoning field of cardio-oncology necessitates formalized subspecialty fellowship training that encompasses patient care, research, and education, and also develops leaders and promotes continued scholarship. Yet, most academic institutions in North America that host general and subspecialty cardiology fellowship programs do not yet also offer cardio-oncology subspecialty fellowship training options.

Methods: To address this need, a cardio-oncology training outline was crafted and integrated into a general cardiology fellowship program. The international cardio-oncology society (ICOS) proposal for training was used as a guide to determine key elements.

Results: The cardio-oncology training outlined consisted of outpatient and inpatient patient care, research, scholarship, education, teaching, presentation, and leadership. A clear plan was made and followed to attain at least 100 unique patient encounters, at least one high-impact scientific journal publication, reading of a variety of landmark manuscripts, participation in hematology and oncology seminars and tumor boards, sharing cases and research findings at local cardiology grand rounds, and presenting a summary of training efforts at a national cardio-oncology meeting.

Conclusion: Cardio-oncology was incorporated into the cardiology fellowship as a subspecialty training by delineating and instituting key elements proposed by the international cardio-oncology society. This model may provide a feasible and replicable option for training and education in programs that have not yet established a formal cardio-oncology fellowship.

BACKGROUND



Figure 1. Representation of Cardio-Oncology Clinics in the United States

Cardio-Oncology Training Demands

- * initial attempts but no nation-wide program
- * need to mitigate wide variations in proficiency and practice
- * need for structured education and training (certification)
- * need for consensus
- * support by societies

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METHODS

| Training Goals | Practical Applications* |
|--|--|
| Advanced understanding of cardiovascular physiology, with a focus on common molecular pathways shared by both cancer and cardiac cells. | Research |
| Basic understanding of oncogenic cellular transformation, tumor growth, metastasis, and disease progression, with a special focus on those affecting the cardiovascular system. | Oncology Core Curriculum |
| Basic knowledge of epidemiology, staging, and prognosis of common malignancies, with a focus on those affecting the cardiovascular system, either directly or by means of its therapies. | Oncology Core Curriculum |
| Advanced knowledge of pathophysiology, diagnosis, management, and prognosis of cardiovascular conditions, with a focus on those resulting from cancer or cancer therapies. | Cardio-Oncology Clinic |
| Basic knowledge of the pathophysiology, diagnosis, management, and prognosis of common malignancies, and related complications. | Oncology Core Curriculum |
| Advanced knowledge of symptoms and clinical findings, with a focus on cardiovascular and oncologic evaluation. | Cardio-Oncology Clinic |
| Advanced knowledge of the rationale, utility, appropriate use, and interpretation of cardiovascular diagnostic testing strategies. | Cardio-Oncology Clinic |
| Advanced knowledge of cardiovascular pharmacology, with a special focus on those drugs that interact adversely with cancer patients or cancer drugs. | Cardio-Oncology Clinic |
| Advanced knowledge of the rationale, effectiveness, and appropriate use of oncological therapies with known cardiovascular effects. | Cardio-Oncology Clinic, Oncology Core Curriculum, ACC National Course |
| Advanced knowledge of the strategies to minimize cardiovascular toxicity associated with cancer therapies. | Cardio-Oncology Clinic, Cardiovascular Imaging Grand Rounds |
| Advanced knowledge of oncologic emergencies that affect the cardiovascular system. | Inpatient Consultation |
| Advanced knowledge of cardiovascular risk factors and risk stratification for negative outcomes after cancer-related procedures and therapies. | Cardio-Oncology Clinic |
| Advanced knowledge of the pathophysiology, diagnosis, management, and prognosis of cardiac tumors. | Cardio-Oncology Clinic |
| Advanced knowledge of the pathophysiology, diagnosis, management, and prognosis of other cancer-related cardiovascular diseases (cardiac amyloidosis, carcinoid heart disease, etc). | Amyloid Clinic |
| Advanced knowledge of the rationale, utility, and appropriate use of palliative and supportive care for the cardio-oncology patient and family. | Cardio-Oncology Clinic, Inpatient Consultation |
| Ability to promote comprehensive strategies for cardiovascular and cancer prevention. | Cardio-Oncology Clinic |
| Ability to initiate individualized monitoring strategies based on the cardio-oncology patient risk and potential toxicity of a given therapy. | Cardio-Oncology Clinic |
| Ability to integrate cardiovascular and oncologic prognoses, the impact of cardiovascular and oncologic therapies on clinical outcomes, and their related complications to individualize prognosis and optimize management strategies. | Cardio-Oncology Clinic |
| Ability to discern the optimal timing and appropriateness for clinical subspecialty referral. | Cardio-Oncology Clinic |
| Involvement in academic endeavors, such as national and international cardio-oncology meetings, basic, translational, and clinical research, and dissemination of knowledge. | Poster Presentation at National ACC Course, Inaugurating Training Workgroup, Research Cardiovascular Grand Rounds, Cardiovascular Imaging Grand Rounds |
| Ability to provide cardio-oncologic training to other health care providers and students. | Cardio-Oncology Clinic |
| Training Venues** | Practical Applications* |
| Outpatient cardio-oncology and survivorship clinics. | Cardio-Oncology Clinic |
| Inpatient cardio-oncology consultation. | Inpatient Consultation |
| Inpatient oncologic consultation. | Inpatient Consultation |
| Solid and liquid malignancy clinics. | Malignancy Clinics |
| Cardiovascular disease subspecialty clinics. | Subspecialty Clinics |
| Oncologic diagnostic centers (positron-emission tomography, computerized tomography, magnetic resonance imaging, etc). | Optional |
| Cardiovascular diagnostic centers (echocardiography, electrophysiology, and catheterization laboratories, cardiac magnetic resonance, etc). | Imaging Rotations |
| Multidisciplinary tumor board conferences. | Tumor Boards |
| Other multidisciplinary conferences (amyloidosis, carcinoid, etc). | Multidisciplinary conferences |

* See Table 2 for Schedule and Figure 2 for Output during Cardiology Fellowship Emphasis, except for Oncologic Consultations and Malignancy Clinics completed in Internal Medicine Residency

** Options during Internal Medicine Residency/Cardiology Fellowship

Table 1. ICOS training goals and venues recommended for Cardiology Fellows [1]. If these were pursued for 52 weeks, this would lead to a proposed designation of level 3 in Cardio-Oncology. The essence of these objectives was used to create a fellowship training emphasis with practical applications.

RESULTS

| Monday | Tuesday | Wednesday | Thursday | Friday |
|----------------------------------|---|--|--|--|
| | Breast eTumor Board Gynecology Oncology Conference GU Multidisciplinary Cancer Conference** | Oncology Core Curriculum Cardiovascular Imaging Grand Rounds Bone Marrow Transplant Group Meetings | Sarcoma Board/Orthopedics Oncology Mayo Clinic Cancer Center Grand Rounds** | Interesting Patient/Research Conferences |
| Cardiovascular Health Clinic | Research | Amyloid Clinic | Women's Heart Clinic | Women's Heart Clinic |
| Preventive Cardiology Conference | Oncology Conference | Survivorship Cross-disciplinary Videoconference** | Cardiovascular Health Clinic | Multidisciplinary Lung Cancer Meeting |
| Cardio-Oncology Clinic | Cardiovascular Health Clinic | Cardio-Oncology Clinic | Cardiovascular Health Clinic | Cardiovascular Health Clinic |

* Three Times Monthly

** Once Monthly

Table 2. Sample Weekly Schedule (January-June 2019).

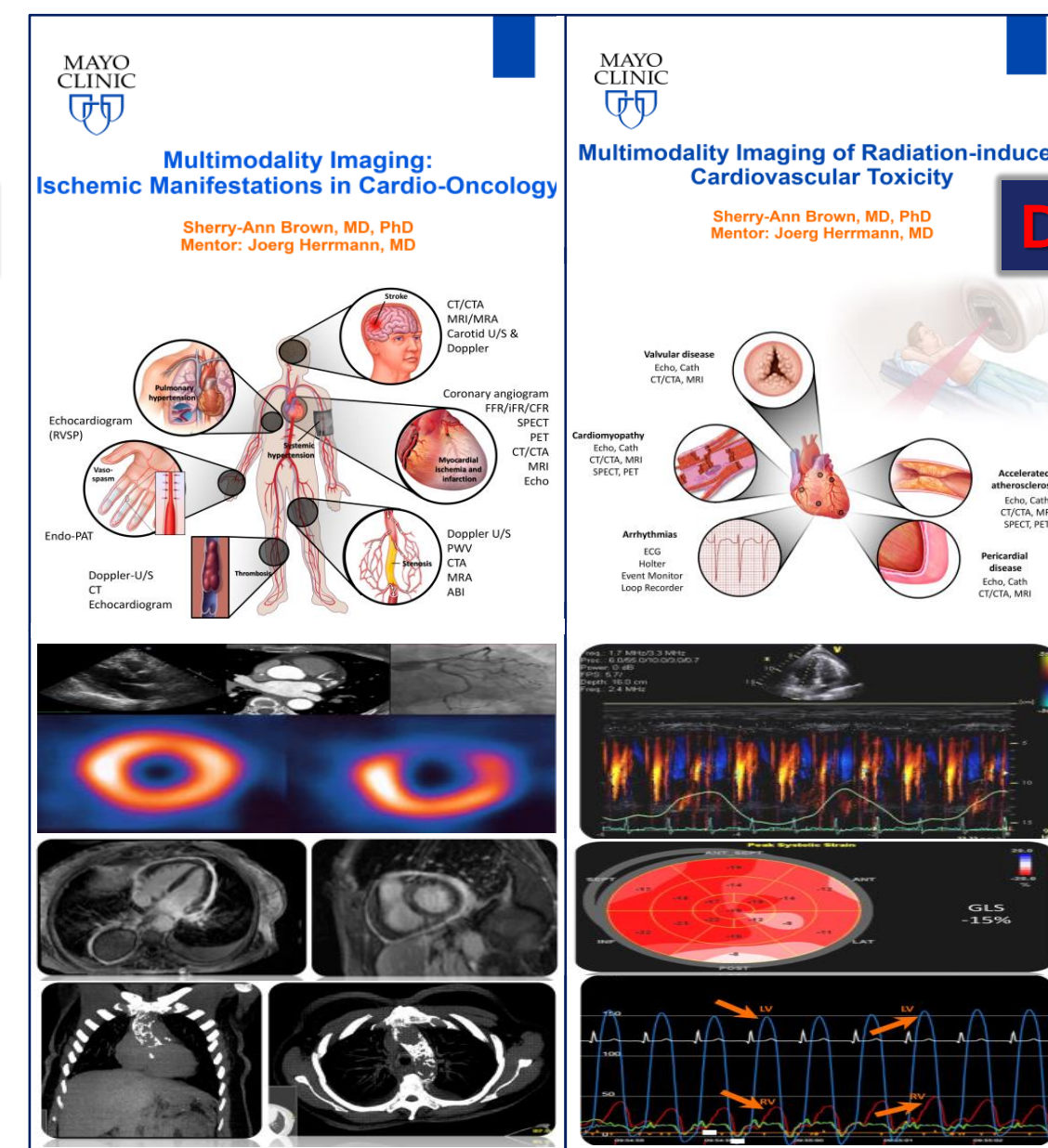
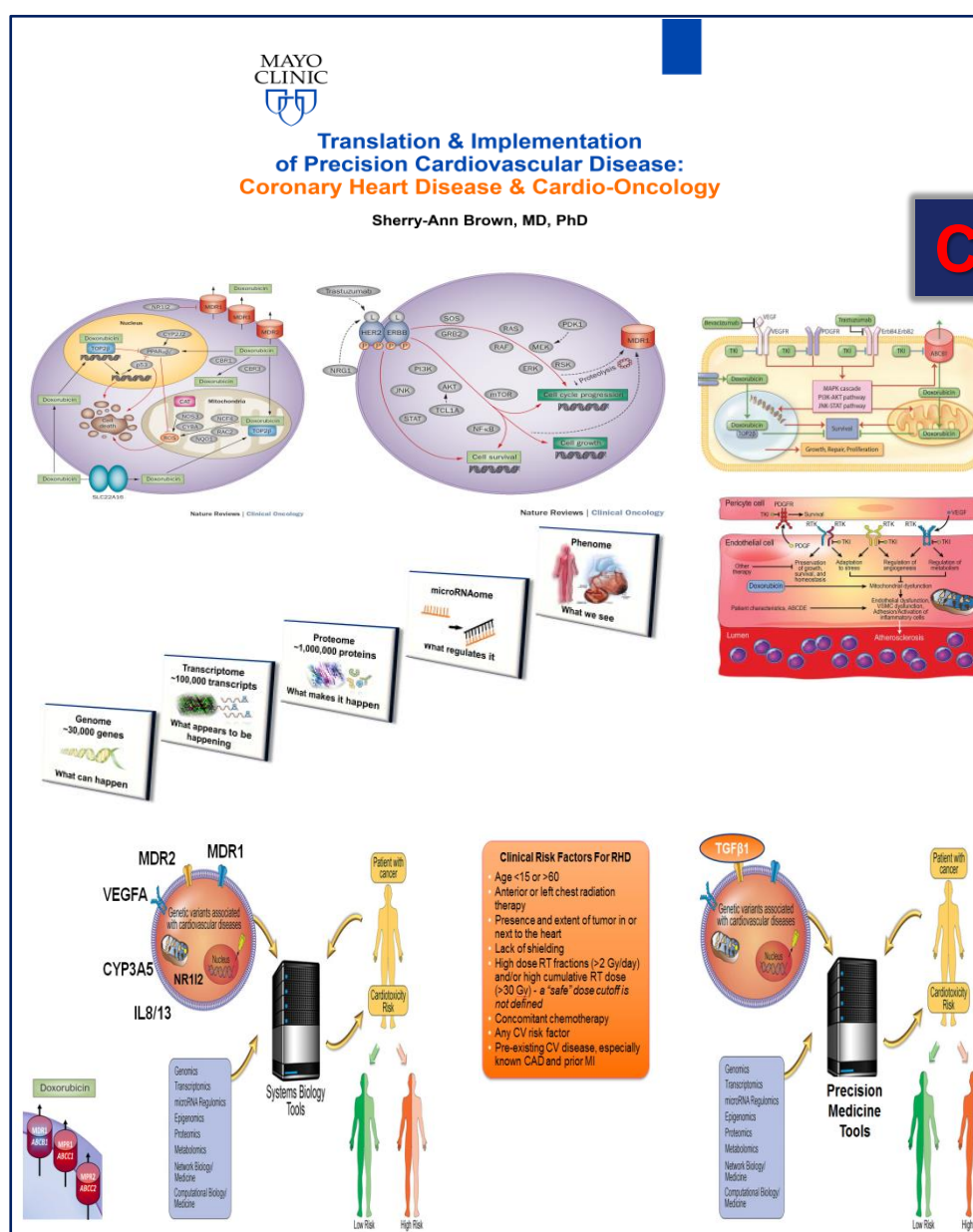


Figure 2. Output of Practical Applications in Cardio-Oncology as a Cardiology Fellowship Training Emphasis . **A.** Distribution of Patients by Setting. **B.** National Cardio-Oncology Involvement. **C.** Teaching Presentation at Cardiovascular Grand Rounds. **D.** Teaching Presentations at Cardiovascular Imaging Grand Rounds. **E.** Cardio-Oncology First Author Publications [2-5]. **F.** Cardio-Oncology Education on Social Media – Interviewing Cardiology-Oncology Leaders. **G.** Future Direction of Cardio-Oncology Subspecialty Training Program at Mayo Clinic.

CONCLUSION

Cardio-oncology was incorporated as a cardiology fellowship training emphasis, by including the essence of key learning objectives proposed by ICOS. This training emphasis model may provide a feasible and replicable option for training and education in programs that have not yet established a formal cardio-oncology fellowship.

DISCLOSURES

Disclosure of Faculty Relationships: Nothing to disclose.