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Commentary
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Serial Sitting Electrocardiograms for Early Cardiology Referral of Patients Undergoing Chemotherapy and/or Radiotherapy

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Abstract

Based on previous experience of the author in monitoring of patients with Heart Failure (HF) and other edematous states employing serial electrocardiograms, it is proposed to use such recordings for patients receiving chemotherapy and/or radiation in order to expedite referral to cardiology of patients with cancer earlier in their HF course. To facilitate work flows in the busy environment of chemotherapy stations and radiation suites, such electrocardiograms could be recorded in the sitting position, based on previous work of the author showing the equivalency of the electrocardiograms obtained in the sitting and supine positions. The electrocardiogram parameter to be serially followed will be the top-to-bottom amplitude of the QRS complexes, which is inversely proportional to the edematous state of the entire body and the heart during the development of HF, as per Ohm's physical law. Based on the above, patients treated for cancer who are developing HF, could be referred to cardiology earlier than currently done, relying on findings from the infrequently recorded echocardiograms revealing HF.

Keywords: Oncology; Cardio-oncology; Edematous states and electrocardiogram; Ohm's law; Heart failure; Chemotherapy; Echocardiography; Radiation therapy

Introduction

The objective of submitting this commentary to this journal, is to sensitize the profession about the disconcerting current "modus operandi" of referring patients undergoing chemotherapy and/or radiotherapy to cardiology in response to the patients' cardiovascular symptoms and/or echocardiography findings of compromised left ventricular systolic function. It is appalling that in 2026 we continue a practice mode that does not make any sense, and it would be an advancement if all concerned (physicians [cardio-oncologists, cardiologists, primary physicians, gynecologists, geriatricians, oncologists, radiotherapists, oncology surgeons], nurse practitioners, and physician assistants) consider rethinking our current approach to this matter. It is well appreciated that many chemotherapeutic drugs are cardiotoxic (e.g., doxorubicin, methotrexate, and trastuzumab), leading to either reversible heart failure or irreversible cardiomyopathy in some patients, while others escape unscathed their chemotherapy and/or radiotherapy regimen(s) (why this is the case has not as yet been convincingly determined). While chemotherapy scheduling varies depending on the type and stage of cancer, the specific chemotherapeutic administered, and whether such therapy is given before during or after surgery, nevertheless it is provided in multiple cycles over several months, while radiotherapy is administered sometimes daily. Since physical examination and history are not adequate for detection of insidiously emerging heart failure or cardiomyopathy, an echocardiogram is necessary to provide such diagnoses, although it will be cumbersome and not cost-effective to consider performing an echocardiogram before each chemotherapeutic or radiation session.

This author has previously proposed recording an electrocardiogram each time the patient receives chemotherapy or prior to every radiation session [1], specifically in a sitting position [2], which will expedite working flows in busy chemotherapy infusion clinics/stations, and radiology suites, based on previous work demonstrating that electrocardiograms performed in sitting and supine positions are equivalent [3]. However, these 2 previous reports [2,3] were published in subspecialty journals read only by a very selective subspecialty group of our colleagues.

The electrocardiogram parameter sought after during these serial electrocardiogram recordings is the amplitude in mm of the QRS complexes (top to bottom) mainly in the limb leads (since

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the amplitudes in the QRS complexes precordial electrocardiogram leads V1-V6 vary, depending on the different placement of the six chest lead recording electrodes, a frequent encounter, and a problem proven not to have a solution). Indeed, "eyeballing" the top to bottom amplitude of the QRS complex in limb lead AVR will be enough to provide evidence of amplitude reduction, well-known to occur in Heart Failure (HF) [4] and other edematous states (e.g., before hemodialysis). This author has used this insight on a daily basis and for 25 years in the management of his patients with HF, hemodialysis, and the whole other variety of edematous states.

The mechanism of reduction of the amplitude of QRS complexes in edematous states is based on the decrease in the electrical resistance, when the body volume conductor, as well as the edematous myocardium, are engorged with water as per Ohm's physical law (V = IR, where V = voltage, I = current, and R = resistance); (current [I] is fixed, and thus voltage [V] varies directly with the resistance [R], depending on the water content of the heart [i.e. myocardial edema] and/or the body volume conductor, enveloping the heart) [4-6].

The author has tried desperately over the past 25 years, since the original description of this phenomenon [4] *via* teaching of his cardiology trainees, other colleagues, and via national and international contacts with HF specialist's oncologists, cardio-oncologists, and cardiology guidelines writers, and has also proposed collaboration for carrying out a clinical trial based on existing data or as a denovo research endeavor.

It goes without saying that the above constitutes a research hypothesis, that needs to be explored by our Cardio-oncology and oncology colleagues in patients with cancer, undergoing chemotherapy and/or radiation therapy, and should be based on serial electrocardiograms and ancillary clinical and laboratory evidence of developing HF and/or cardiomyopathy. Considering the previous experience of the electrocardiograms' performance in research focusing on patients with heart or renal failure [4-6], it is conceivable that the proposed research has the potential to yield clinically relevant and beneficial information. Finally, it is hopeful that such an awakening role can be played uniquely by the currently existing and developing cardio-oncology programs.

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