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Research paper

Detecting presence of cardiovascular disease through mitochondria respiration as depicted through biophotonic emission

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ABSTRACT

Aims: Increased production of reactive oxygen species (ROS) in mitochondria, play an important role in the cardiovascular system. Furthermore, oxidative metabolism of mitochondria comprised of biophoton emissions, are linked to ROS and oxidative stress. In this review we investigated the association between the ability of ClearViewTM system (ClearView) to indicate the presence or absence of cardiovascular disease through mitochondria respiration as depicted through biophotonic emission.

Methods and results: One hundred and ninety-five out of the three hundred and fifty-three human subjects enrolled in this prospective, single site study had at least one cardiovascular related diagnosis. Measurements with ClearView consisted of scanning all 10 fingers twice. Images were captured through the ClearView software and analyzed to produce a scale that indicates the presence or absence of cardiovascular disease. The association of ClearView's ability to indicate the presence or absence of cardiovascular disease with a physician's diagnosis was assessed using odds ratios (OR) and area under ROC curve (AUC). Adjusting for age, OR of ClearView measurements conducted with capacitive barrier was 3.44 (95%CI: 2.13, 5.55) and the OR without the capacitive barrier was 2.15 (95%CI: 1.42, 3.23). The OR in men were 5.91 (95%CI: 2.35, 14.85) and 2.88 (95%CI: 1.38, 6.01), adjusting for age and corresponding to with and without capacitive barrier. The OR in women were 3.50 (95%CI: 1.86, 6.59) and 2.09 (95%CI: 1.20, 3.64) with and without capacitive barrier. AUCs for measurements with capacitive barrier were >0.90.

Conclusion: ClearView detected the presence or absence of cardiovascular disease independent of other conditions.

1. Introduction

Cardiovascular diseases (CVD), including hypertension, coronary artery disease (CAD), cardiomyopathy, heart failure, and stroke are the greatest cause of mortality, with over 17.3 million people dying annually [1],costing $863 billion in direct and indirect economic expenditures each year [2]. Cardiovascular disease is a common complex disorder, which can be caused by a single gene or multifactorial conditions resulting from interactions between environmental (modifiable) and inherited (immutable) risk factors [3]. While significant progress in understanding the development of CVD has been discovered, the mechanisms of individual CVD susceptibility are still not clearly understood. A considerable number of studies suggest that altered levels of oxidative stress within the cardiovascular environment are critical contributors in the development of cardiovascular disease [4] while others suggest CVD is a multifactorial disorder that involves several genetic determinants, including mitochondrial dysfunction [5]. Mitochondrial dysfunction has been associated with a wide range of cardiovascular disorders such as cardiomyopathy and hypertension [6]. In this regard, studies are beginning to illustrate that mitochondria not only appear susceptible to damage mediated by increased oxidative stress but also play a significant role in the regulation of cardiovascular cell function [4]. Furthermore, oxidative metabolism of the mitochondria via biophoton emission, is linked to increased production of reactive oxygen species (ROS) and overall oxidative stress. This has led to accumulating evidence that a commonality among cardiovascular disease development and cardiovascular disease risk factors is due to increased mitochondrial damage and dysfunction [4] which can be measured through biophotonic emission. In this manuscript we will introduce the utilization of the Clearview System (ClearView), which can detect cardiovascular disease through the measurement of mitochondria dysfunction through biophoton emission.

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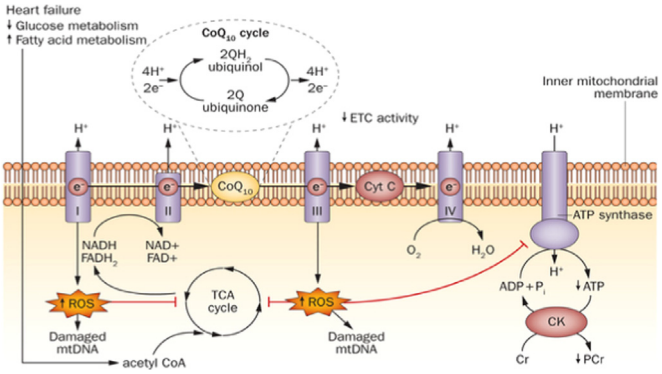

Fig. 1. Mitochondrial dysfunction and oxidative stress in heart failure [21].

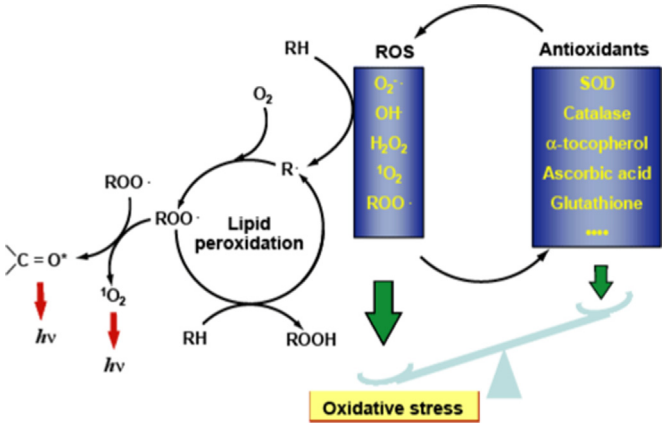

Fig. 2. Illustration of biophoton mechanism [22].

1.1. Mitochondrial dysfunction associated with CVD

Mitochondria, also referred to as the "powerhouses" of cells, are responsible for creating over 90% of energy needed by the body to sustain life and support growth [7]. Not only do they generate energy in the form of ATP, but they also regulate numerous cellular functions relevant to cell outcome, such as apoptosis, generation of oxidative free radicals, and calcium homeostasis. Mitochondria are a major source of reactive oxygen species (ROS). Oxidative stress occurs when excess ROS are generated and cannot be adequately countered by the antioxidant systems [8]. Oxidative stress has also been associated with loss of cells in heart failure, cardiomyopathy, and increased ROS associated with mitochondrial dysfunction in heart failure [8], suggesting there is a strong affiliation between CVD development, and mitochondrial damage and function [9] (Fig. 1).

Several factors can increase the risk of CVD; however, there is lack of clarity to whether the risk factors alter cellular function. Studies have demonstrated that several CVD risk factors such as hypercholesterolemia and age can alter mitochondrial damage and function [10] by increasing mitochondrial oxidative stress. It has also been thought that CVD risk factors may act on the cardiovasculature by inducing mitochondrial damage and dysfunction, thus facilitating a premature aging process [11]. Various studies are focused on identifying mitochondrial sources of ROS; however, these are limited to in vitro studies and lack the ability to detect possible disruption of cellular communication as a contributor. Through oxidative metabolism of the mitochondria exhibited by biophoton emissions, we will demonstrate the ClearView system's capability of detecting and measuring cell-to-cell communication in vivo.

1.2. Biophoton detection

Biophoton emission, the spontaneous emission of light (photons) emanating from all living systems including humans, is biochemically distinct from bioluminescence, which is generally visible and involves specialized enzymatic mechanisms. Although biophoton emission is described to be less than 1000 photons per second per cm and are not visible to the naked eye [12], recent advances in photo-detection make it possible to analyze biophoton emission. Biophoton emission is found in oxidative metabolism in mitochondria, free radical reactions with biomolecules, proteins, and DNA. Biophoton emission has been known to be related to the generation of ROS, and therefore could be used as a tool for the investigation of oxidative stress [13] (Fig. 2). Boveris and Cadenas [14] were the first to demonstrate the potential usefulness of biophoton detection for non-invasive monitoring of oxidative metabolism and oxidative damage in living tissue. Several studies repeatedly illustrate that the intensity of photon emission changes in a state of disease [15] and that disease cells emit significantly more biophotons than healthy cells. It has also been shown that changes in biophotonic activity are indicative of changes in mitochondrial ATP energy production manifested in physiological and pathological conditions [16]. Biophoton emission has also been found to be an expression of cell-to-cell communication reflective of the functional state of the living organism, and its measurement can be used to assess this state [17]. Over decades of research in this area, several studies have made progress in investigating human biophoton emission in both basic and applied research. Clinically relevant in vivo human biophoton detection is currently being studied; however, the numbers of studies and human subjects have been limited. Although the use of biophoton emission for diagnostic and treatment purposes is in its infancy, we have demonstrated the ability to detect several components of cardiovascular disease through biophoton emission as assessed by the ClearView system.

1.3. ClearView system

The ClearView system is a non-invasive, electrophysiological measurement tool that has the possibility to determine autonomic response and physical response indicators by measuring the electrophysiological signals associated with human body systems. It has been scientifically proven that every cell in the body emits more than 100,000 light impulses or photons per second. These light emissions, otherwise known as biophotons, have been found to be the steering mechanism behind all biochemical reactions. Unlike other bio-impedance devices, such as the electrocardiogram (ECG) and the electroencephalogram (EEG), that measures the electrophysiology of the heart and brain, the ClearView system measures electromagnetic energy at a smaller scale through amplification of biophotons. It has been demonstrated that biophoton emission is strongest in the hands [18]. It has also been demonstrated that if a disease is present, biophotonic imbalances are emitted between left and right hands, suggesting diagnostic potential [19]. The ClearView system taps into the global electromagnetic holographic communication system via the fingertips. The fingers are a highly refined component of the peripheral nervous system; therefore, due to the high energy expenditures of the nerves throughout the body, they require higher proportionate numbers of mitochondria. Through measuring mitochondrial respiration via biophoton detection, the ClearView system has the ability to quantify electrophysiological biophoton activity as it relates to the metabolic function of forty-nine (49) identified organ systems.

The ClearView system consists of a camera that lies under a glass electrode. When a finger is placed on the glass electrode of