International Journal of Cardiology 214 (2016) 107–112

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Review

Golden Ratio and the heart: A review of divine aesthetics

Kenan Yalta [a], Selcuk Ozturk [b], Ertan Yetkin [c,*]

[a] Trakya University, Faculty of Medicine, Department of Cardiology, Edirne, Turkey
[b] Abant Izzet Baysal University, Faculty of Medicine, Department of Cardiology, Bolu, Turkey
[c] Yenisehir Hospital, Division of Cardiology, Mersin, Turkey

ARTICLE INFO

Article history:
Received 8 March 2016
Accepted 20 March 2016
Available online 24 March 2016

Keywords:
Golden Ratio
Golden proportion
Golden Spiral
Golden geometric shapes
Golden Angle
Fibonacci Series
Greek letter Phi (φ)
Human body
Cardiovascular system
Divine aesthetics
Sahaja Yoga

ABSTRACT

In human history, certain mathematical figures or concepts had gained a significant reputation largely due to their occult and esoteric meanings. Among these, Golden Ratio and associated concepts, namely golden proportions, had elicited a tremendous breakthrough in our human awareness and perception regarding mundane and spiritual aspects of physical existence. Golden Ratio or Number (with a numerical value of 1.618) that is also referred to as the Greek letter Phi (φ), has been universally expressed on a line partitioned into two unequal lengths (L, the longer and S, the shorter) in such a manner that L / S = (L + S) / L. Besides, appearing in certain number sequences (Fibonacci Series, etc.), golden proportions, to the consternation of observers, appear to be strikingly prevalent across all levels of physical existence from the innermost structures to the colossal galaxies of the universe potentially labeling these concepts as the measures of divine aesthetics.

Accordingly, the human body also serves as an epitome of these mysterious concepts as exemplified by its outward appearance including general stature and extremities along with a variety of inner organ systems. Based on preliminary studies, the human cardiovascular system might also be suggested to serve as a major predilection site of divine aesthetics as measured with Golden Ratio and its allies. This appears to be completely in line with the ancient knowledge associating the human heart with the esoteric and spiritual components of human nature including human soul. Within this context, the present paper primarily aims to discuss human manifestations of divine aesthetics as measured with 'Golden Ratio' and associated indices with a particular and detailed emphasis on their potential link with the human cardiovascular system.

1. Introduction

Since ancient times, certain mathematical figures or symbols had been the focus of substantial interest around the globe probably due to their obscure and esoteric messages associated with basic and fundamental questions of physical existence. Leonardo of Pisa, the renowned medieval mathematician, also nicknamed as "Fibonacci," had described a number series (in his masterpiece known as Liber Abaci (1202)) that led to a significant upheaval in our understanding of mathematical aspects of nature [1–3]. This sequence, namely Fibonacci Series or Sequence, constitutes an infinite chain of numbers starting with '0' or '1' and following as 0, 1, 1, 2, 3, 5, 8, 13, 21… particularly implying that the sum of two consecutive integers equals the subsequent one [1–3]. As the '*Magnum Opus*' has been constantly attributed to Leonardo of Pisa (Fibonacci) worldwide, Pingala (the Indian Mathematician) who had actually recognized Fibonacci Series much earlier, and Edouard Lucas who also extensively studied on this series in the 19th century [1], have generally received far less reputation as compared with Fibonacci. Interestingly, this sequence potentially represents a concept that might be encountered in a variety of natural settings including design and branching of botanic structures etc. regarded as domains of phyllotaxis [1,4]. Furthermore, the usefulness of Fibonacci Series has also been reported in man-made settings including establishment of financial and biological models along with the design of electronics [5].

The most notable concept that might be drawn from the Fibonacci Sequence appears to be the Golden Ratio (also synonymous with Golden Number or Golden Mean) [1–3]. Principally, this phenomenon underscores the notion that the ratio of any two consecutive numbers in Fibonacci Sequence approximates to the numerical value of 1.618 that refers to the Greek letter Phi (φ) [1,3]. Moreover, as the numerical values of the sequential numbers in the ratio get higher, the approximation of 1.618 becomes more precise [1,3]. As described by Pythagoras and Euclid, the precise value of Golden Ratio may also be expressed on a line partitioned into two unequal lengths (shorter length (S) and longer length (L)) in such a manner that L / S = (L + S) / L = Golden Ratio (1.618) [6]. 'Golden Ratio' or 'Golden Number', has been the focus of interest not only for its apparent aesthetic pleasure in the domains of art, architecture and music but for its association with human structure and its functions as well [1,2,6–10]. Based on the latest evidence, and to the increasing consternation of observers, the concepts of 'Fibonacci

* Corresponding author.
E-mail addresses: ertanyetkin@hotmail.com, ertanyetkin@vasmolcardiol.org (E. Yetkin).

http://dx.doi.org/10.1016/j.ijcard.2016.03.166
0167-5273/

Sequence', 'Golden Ratio' and a variety of associated indices appear to be strikingly prevalent across all levels of physical existence (from human genome to galaxies) beyond a simple spontaneity or coincidence potentially suggesting a hand of all-pervading supreme intellect in their emergence. Therefore, one should render these predetermined and replicable measures as potential reflections of divine aesthetics within the universe. Accordingly, the present review primarily aims to focus on human manifestations of divine aesthetics as demonstrated with 'Golden Ratio' and associated indices with a particular emphasis and detailed information on their association with the human cardiovascular system.

1.1. Concepts and indices allied to Golden Ratio

There also exist a variety of indices primarily based on the concepts of Fibonacci Series and Golden Ratio that also merit particular attention in an effort to further outline the subtle features of the human body and components of the universe: for ins; sequential multiplication by 1.618 or division by 0.618 (starting from 1) gives rise to a cascade of numbers (1, 1.618, 2.618, 4.236, 6.854, 11.09…) termed as 'Fibonacci Cascade' that was previously proven to be associated with branching patterns of human coronary arteries and a variety of botanic structures in nature as well as the predilection site of atherosclerotic disease in human coronary arteries [3].

Certain geometric shapes primarily based on the rule of golden proportions are universally referred to as 'golden geometric shapes' [2]. Within this context, the term 'Golden Rectangle' signifies a specific golden geometric shape whose length to width ratio equals Golden Ratio [1], and is known to have high visual aesthetics. Interestingly, this rectangle might be split into a square and another golden rectangle that might subsequently be partitioned into another square and a golden rectangle as well primarily based on the order of the Fibonacci Sequence [1]. In other terms, sequential creation of squares within the consecutive golden rectangles (corresponding to the smaller numerical values of the Fibonacci Series) results in the complete occupation of the initial golden rectangle with squares (with diminishing sizes after each step) [1]. When the diagonals of each square are joined by an arc (quarter-circle), the final geometric shape approximates a 'Golden Spiral' [1]. True or approximate Golden Spirals are well known to manifest in sea shell, human ear [1] as well as in some galaxies. The rule of golden proportions might also apply to a variety of other geometric shapes including pentagrams and in certain settings, triangles [2].

'Golden Angle' (137.5°) emerges as another reference concept based on partitioning the circumference of a circle into smaller (S) and larger (L) arches in such a proportion that $L / S = (L + S) / L =$ Golden Ratio (1.618) [6]. The angles represented by these arches also conform to this equation with the angles of arches L and S measuring 222.5° and 137.5°, respectively. The latter is referred to as 'Golden Angle' exemplified, in nature, by a variety of botanic structures including leaves and branches of plant stems [6]. Even though, the term 'golden or divine proportion' is generally used as a synonym for 'Golden Ratio' in most references [1,6], we deem it more appropriate to suggest the concept of 'golden proportions' as a general umbrella term that encompasses both the concept of 'Golden Ratio' and all the abovementioned associated concepts including golden geometric shapes, spirals, and angle (Fig. 1).

1.2. Golden Ratio and its allies in human body: an overall perspective

Fibonacci Sequence and Golden Ratio might, to a large extent, be exemplified by a healthy human body and its organ systems in a proper manner: general stature, facial textures as well as phalangeal lengths of the digits even hands and forearm from the tips to the base, were previously suggested to be in complete harmony with Fibonacci values in an aesthetic human [3,6,10]. In contrast, a previous radiological study on cadaveric fingers failed to yield any evidence of Fibonacci Series (hence; Golden Ratio) through roentgenographic evaluation; yet still

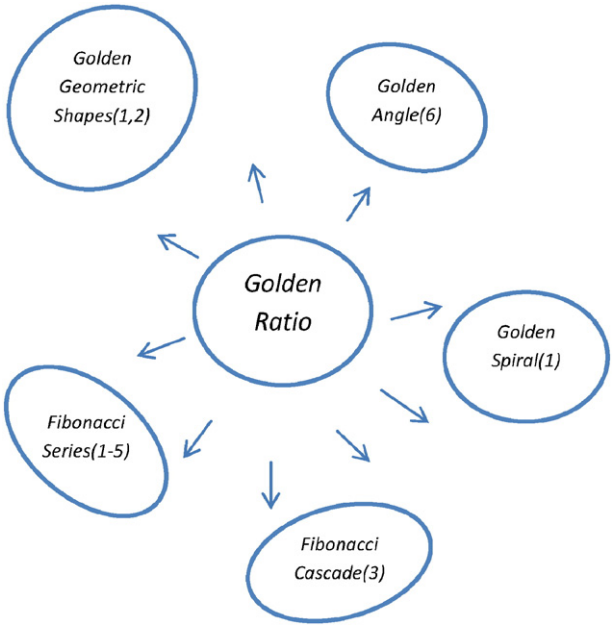

Fig. 1. Golden Ratio and associated concepts.

suggesting a variety of constant ratios other than Golden Ratio (1 and 1.3) among the phalangeal lengths [11]. On the other hand, a clenched hand superimposed on a Golden Rectangle along with the route of fingertips during hand extension and flexion as well as the gross appearance of inner ear structures in a human body might demonstrate a striking analogy to the Golden Spiral [1,8,12,13]. Regarding the general stature, the ratio of foot to belly to belly to head (top point) distances also equals golden ratio in a healthy and aesthetic human [3].

The potential components of anatomical beauty have been extensively investigated for many years ultimately suggesting that facial charm appears to be in close harmony with anatomical symmetry [9,14]. On the other hand, as far as the aesthetic nomenclature is concerned, it is widely accepted that the concept of physical beauty harbors an inherent subjectivity that is not amenable to standardization, and largely varies with time, place and sociocultural status [1]. Yet, there exists a myriad of paragons uniformly agreed upon their beauty around the globe who invariably manifest the concept of Golden Ratio in their physical appearance as a concrete evidence of their charm. Accordingly, investigations on facial beauty generally hover around the concept of golden proportions, and mostly focus on mouth and teeth that are primary textures of human face [1]: within this context, Rickets regarded the concept of golden proportions as a prerequisite in an aesthetic woman face [10], and accordingly investigated the potential impact of Golden Ratio and Fibonacci Series on the production of an aesthetic smile [1,15,16]. Moreover, he considered the concept of golden proportions as a part of management strategy in his patients [1,10,15,16].

In a more subtle manner, divine aesthetics might also manifest itself at the core of a variety of inner organ systems extending beyond gross perception: regarding central visual dynamics, Elliot and his friends demonstrated the potential link between aesthetic preference and Golden Ratio suggesting that golden sectioning in brain activities might have an impact on the efficiency of visual processing [17]. Golden Ratio has also been an area of interest in gynecology: in a retrospective study investigating ultrasonographic (USG) measurements of non-pregnant uteri, mean values of length/width ratio were reported to have an inverse correlation with age and number of gravidity [18]. More surprisingly, this ratio appeared to be 1.618 at peak fertility (at the age of 21) exactly concording with the Golden Ratio [18]. These findings [18] may suggest that divine aesthetics are more likely to manifest itself in organ systems at their peak function and capacity potentially implying that conforming to the measures of divine reflection including