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Short communication

Assessment of the potential iridology for diagnosing kidney disease using wavelet analysis and neural networks

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ABSTRACT

Alternative or complementary medicine emphasizes therapies that are claimed to improve quality of life, prevent disease, and address conditions that conventional medicine has limited success in curing. There are many techniques which are prevalent in many countries and these can cause harm if not scientifically evaluated. The objective of this paper is to validate the use of iridology to diagnose kidney abnormalities. Two subject groups were evaluated: one was 168 subjects free from kidney disease and the other was 172 subjects with chronic renal failure. The procedure to acquire, process and classify the iris images was designed in such a way that avoids any dependency on the iridologists by using wavelet analysis and Adaptive Neuro-Fuzzy Inference System. The results show a correct classification for both subjects with kidney problems and normal subjects of 82% and 93%, respectively. The proposed technique conducted on a systemic disease with ocular manifestations showed encouraging results. However, it is necessary to perform extensive studies with diseases that do not have ocular manifestations according to conventional medicine in order to validate iridology as a valid scientific technique.

1. Introduction

Complementary medicine is those therapies that are claimed to improve quality of life, prevent disease, and address conditions that conventional medicine has had limited success in curing, such as chronic back pain and certain cancers. Proponents of complementary medicine believe that these approaches to healing are safer and more natural and have been shown through experience to work. In certain countries, complementary medical practices are widely used methods of health care. However, many practitioners of modern conventional medicine believe these practices are unorthodox and unproven [1].

Although some medical schools have now begun offering complementary medicine, no standardized curriculum for medical students is available and there is still a debate about whether it should be offered at all. There is an argument that its inclusion in medical schools could be seen as an endorsement by conventional medicine, however if conventional medicine ignores it that will put patients at risk as complementary medicine use is so prevalent [2].

Complementary medicine regulation is a complicated and contentious issue. Currently only osteopaths and chiropractors have achieved statutory regulation in the UK. Theoretically anybody, regardless of insurance, skills or specialist knowledge, could set themselves up as a therapist. This leaves many clients with very little redress should they have a complaint. The UK government has been consulting on complementary medicine regulation since 2000 but progress has been slow. The main problem is achieving a consensus of the numerous therapy-specific regulatory organizations that already exist [3].

Iridology is a form of complementary medicine whose proponents believe patterns, colors, and other characteristics of the iris can be examined to determine information about a patient's systemic health. Practitioners match their observations to iris charts which divide the iris into zones corresponding to specific parts of the human body [4].

Peczely [5] and Liljequist [6] have independently noticed irises changes that correlate to different illnesses. They depicted in their publications very similar iris charts based on their own observations. Lane [7] carried out further surgical and autopsy correlations with iris markings which sparked the effort of Kritzer [8] and Jensen [4] to develop an updated iris charts that are widely used among iridologists as shown in Fig. 1. Typical charts divide the iris into approximately 80–90 zones. For example, the zone corresponding to the kidney is in the lower part of the iris, just beside 6 o'clock.

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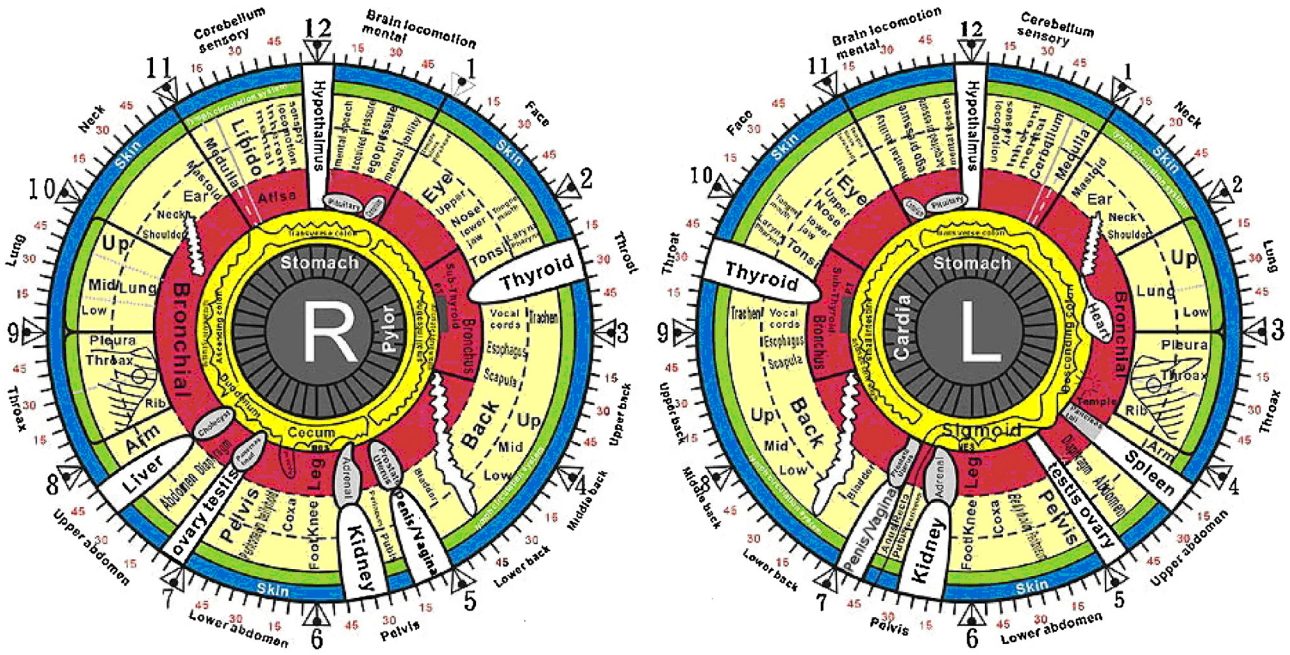

Fig. 1. The iridology chart for both the right and left irises.

However, there are minor variations between charts' associations of body parts and areas of the iris [9].

In an attempt to evaluate the diagnostic validity of iridology, many investigations have been conducted without a control group, and some (with or without a control group) were not evaluator blinded [10]. All of the uncontrolled studies and several of the unblinded experiments suggested that iridology was a valid diagnostic tool [11].

A number of researchers used blinded evaluations of the diagnostic validity of iridology. Simon et al. [12] studied patients suffering from kidney disease as defined by a creatinine level, and compared these to controls who were free of kidney disease. Photographs were taken of both irises of all 146 study participants, coded, and shown to 3 experienced iridologists and 3 ophthalmologists. The resulting frequency of false-positive and false-negative diagnoses was not significantly different from that expected by chance. Knipschild [13] conducted another investigator-masked case–control study. His 39 patients had inflamed gallbladder disease as confirmed by subsequent surgery. Patients with jaundice were excluded. Controls were matched for age and sex and had no signs or symptoms of gallbladder disease and shown to the iridologists. Validity, sensitivity, specificity, and consistency were not significantly different from that expected by pure chance.

Despite the lack of evidence for iridology, it is important to note that conventional medicine does not ignore the eyes as indicators of disease. There is a wide spectrum of systemic diseases that correlates with eye changes (the iris, the sclera, and the conjunctiva) [9]. For example, jaundice can indicate liver disease, dilated pupils can indicate brain malfunction, and even rings around the iris can indicate Wilson's disease (an abnormality of copper metabolism). Advanced kidney disease induces eye findings that signal the need for initiation or intensification of therapy. Conjunctival erythema, termed the red eyes of uremia, may be noted when high plasma phosphate levels induce corneal and conjunctival precipitation of calcium pyrophosphate. Metastatic calcification in the eyes may be associated with elevations of the serum concentration of calcium or calcium-phosphate product [14]. Profound uremia may rarely be complicated by transient cortical blindness; this is termed uremic amaurosis, which occurs in association with preserved pupillary contraction on light exposure and normal fundoscopic findings [15].

Some researchers have used iridology along with systematic and computerized approaches in medical applications. Ramlee and Ranjit used existing biometric identification methods to detect the presence of cholesterol in blood vessels. Based on the iris recognition methods, an iridology chart has been created to detect the presence of cholesterol in human body, however they did not evaluate their technique with a controlled study [16]. Shen et al. introduced the lacunae detection in iris images. As lacunae usually have poor local contrast, and the application of existing edge detection algorithms yields results which are not satisfactory, they proposed a lacunae detecting approach based on Gaussian filters that is robust to noise. The Gaussian filter in the vertical orientation was implemented to normalize iris image to reduce time complexity and again they failed to assess their findings with a controlled study or clarify how iridology was part of their technique [17].

Iridology, if proven correct, motivates healthy behavior and disease prevention throughout all stages of life which agrees with the objectives of pervasive healthcare technologies to offer new opportunities beyond traditional disease treatment that may play a major role in prevention. As indicated by Arnrich et al. [18], it was discussed the variability of health indicators between individuals and the manner in which relevant health indicators are provided to the users in order to maximize their motivation to mitigate or prevent unhealthy behaviors. From that perspective, iridology can pave the way for a pervasive, user-centered and preventive healthcare model. In this study, we evaluate the validity of iridology as a diagnostic tool. The case study in this research used iridology to detect abnormalities of the kidneys (chronic renal failure). We developed an automated technique based on image acquisition for the iris, pre-processing, normalization, segmentation, and feature extraction in regions corresponding to the kidneys in the iridology chart using the principles of iridology. The classification was based on those features and on the medical conditions of the patient.

2. Methodology

It has long been recognized that there is a lack of standardized procedures used in iridology and this research tries to overcome