

A Review on Traditional Practices and Recent Advances in Nadi Pariksha

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ABSTRACT: *The importance of Nadi Pariksha is widely recognized by Ayurvedic practitioners, who utilize it to evaluate Tridoshas and different physiological and psychological states of patients. In a short series of slokas, the ancient books Sarangadhara Samhita, Yoga Ratnakara, Basavarajeeyam, and Bhavaprakasha explain the specifics of Nadi Pariksha. Ayurveda has thousands of years of expertise in Nadi Pariksha, with extensive literature to back it up, but it is subjective in nature, and the necessity for a scientific method to researching nadi is widely recognized. Pulse wave velocity has recently attracted a lot of study attention since it is thought to be a good predictor of cardiovascular illness; nevertheless, the applicability of pulse wave analysis to Nadi Pariksha has not been investigated. Traditional Nadi Pariksha techniques as described in Ayurveda classics are addressed in this review, as well as contemporary advancements in pulse wave analysis. According to classical texts, qualities or properties of the pulse such as pulse movement (gati), pulse speed (vega), pulse stability (sthiratva), and artery hardness (kathinya) play a major role in Nadi Pariksha, and these properties were analyzed and compared with modern pulse parameters such as pulse wave velocity, pulse rate variability, and arterial stiffness in the current review. The importance of pulse wave velocity in cardiovascular research is addressed, as well as the necessity to expand these studies to include Ayurveda.*

KEYWORDS: *Gati Kathinya, Pulse wave velocity.*

1. INTRODUCTION

Nadi Pariksha is well-known in Ayurveda, and ancient literature have highlighted its importance in determining the Tridoshas, which are the foundation for illness diagnosis and prediction. There is a precise description of dosha predominance in the texts that can be sensed from specific locations on the radial artery, and accordingly, vata dosha is felt at the root of the thumb with the index finger, pitta dosha is felt with the middle finger, and kapha dosha is sensed with the ring finger. According to Ayurveda, balanced Tridoshas indicate good health, whereas vitiated doshas indicate illness. According to Yoga Ratnakara, Nadi can detect all illnesses, and it has been likened to strings of veena playing all the ragas, indicating the significance of Nadi Pariksha. The aggravated doshas change the pace, stability, and gati of the pulse, and evaluating these changes using Nadi Pariksha is an art and science in and of itself. Traditional ayurveda practitioners were skilled in pulse-based diagnosis and could accurately identify illnesses by just placing their fingers on the radial artery [1].

Ayurveda has a lot of experience with pulse-based diagnosis, but it's subjective and largely reliant on the physician's competence. In recent years, there has been a rising interest in obtaining the pulse from Tridosha sites and scientifically studying the pulse wave patterns in the context of ayurveda. Upadhyaya examined the pulse patterns of the vata, pitta, and kapha doshas in depth as part of his clinical and experimental research on Nadi Pariksha utilizing the Dudgeon Sphygmograph. It was a comprehensive research that included a systematic review of ayurvedic literature, hemodynamics, and statistical analysis of vata, pitta, and kapha dosha pulse patterns in healthy and sick people. The significance of pulse parameters rate, rhythm, volume, force, tension, character, and hardness of the artery were analyzed in the context of ayurveda, and the significance of pulse parameters rate, rhythm, volume, force, tension, character, and hardness of the artery were studied across vata, pitta, and kapha doshas. Vasant has looked at the physiological importance of the pulse metrics gati (movement), vega (rate), tala (rhythm), bala (force), tapamana (temperature), akruti (volume and tension), and kathinya (vessel wall consistency) across the vata, pitta, and kapha doshas in a similar way [2], [3].

In contrast to qualitative analysis, these early research highlighted the significance of pulse parameters in evaluating Tridoshas in a more scientific manner. The pulse measurement sites utilized in Tridosha

analysis were emphasized in this review, as were the characteristics or features of Nadi as described in ayurvedic classics. The physiological relevance of Nadi characteristics was investigated, and they were compared to contemporary pulse measures such as pulse wave velocity, arterial stiffness, and pulse rate variability. The importance of pulse wave analysis methods to Nadi Pariksha was emphasized, as were recent advancements in pulse wave analysis. Various pulse measurement devices utilized in current research and their application to Tridosha analysis were addressed as part of the review. Traditional Nadi Pariksha methods were manual, and no equipment for detecting the pulse were accessible, while contemporary pulse wave analysis uses devices in both clinical and research purposes. The significance of contemporary equipment in analyzing traditional pulse parameters was addressed in this review.

In the study of Nadi Pariksha, ancient ayurvedic literature were incorporated. Sarangadhara Samhita, Yoga Ratnakara, Basavarajeeyam, and Bhavaprakasha were among the ayurvedic books featured. The study of ancient techniques of Nadi Pariksha also includes Upadhyaya's Nadi Vijnana and Vasant's Secrets of the Pulse. Pubmed, Google Scholar, Science Direct, and Google were used to conduct a thorough search using the key terms Nadi, Nadi Pariksha. Only six articles were found that addressed Nadi Pariksha as it is described in classical literature, and none that examined the significance of current advancements in pulse wave analysis to Nadi Pariksha, highlighting the need for a thorough study of Nadi Pariksha.

2. PULSE PARAMETERS

Traditionally, Nadi Pariksha was performed by feeling the pulse at three points along the radial artery and determining doshas based on the pulse's palpation. As part of Nadi Pariksha, the characteristics or properties of the Nadi are critical in evaluating doshas. The importance of gati, a distinct characteristic of the pulse, as part of Nadi Pariksha has been stressed in ancient literature, and according to scriptures, gati plays a vital role in illness diagnosis. In contemporary medicine, there is no comparable word for gati; nevertheless, pulse movement is a similarly related phrase that may be linked to gati. Apart from gati (pulse movement), there are many other characteristics of pulse that authors have emphasized, and the gati and other attributes of pulse were explored in depth in this review.

According to Ashtanga Hridayam, guru (heavy), manda (slow), hima (cold), snigdha (unctuous), slakshna (smooth), sandra (solid), mridu (soft), sthira (stability), sukshma (subtle), visada (non slimy) and their polar opposites laghu (light), tik (roughness) Twenty characteristics or gunas, such as drava (liquid), kathina (hard), cala (moving), sthula (large), and picchila (slimy), play a significant role in illness diagnosis and particularly in evaluating doshas. The characteristics of pulse must also be understood, and a study of ancient literature showed that the words manda (slow), vega (rapid), sthira (stable), capala (unstable), kathina (hard), sukshma (subtle), and picchila (slimy) were used to describe the attributes of pulse. The importance of pulse characteristics has been described in the literature, but in a qualitative, subjective way, and the necessity for a quantitative explanation of these features is widely recognized in light of evidence-based research. This requires a study of pulse characteristics described in classical literature in order to comprehend the physiological importance of the pulse and to find contemporary pulse parameters that may be linked to conventional pulse features [4], [5].

Manda (slow), vega (rapid), sthira (stable), capala (unstable), and kathina (hard) are research-relevant characteristics or features because they are quantifiable and may be linked to contemporary pulse measurements. The words manda (slow) and vega (rapid) refer to the pulse's pace or velocity, and in Sarangadhara Samitha's explanation of Nadi Pariksha vidhi, the term vega is used for increased pulse rate, while ksheena and manda are used for reduced pulse rate. The word vega is directly related to the pulse's speed and velocity, as well as contemporary pulse characteristics like pulse rate and pulse wave velocity.

The stability of the pulse has been discussed in depth in the scriptures when discussing Nadi Pariksha, with words such as sthir (stable) and capal (unstable) being used to describe the pulse's stability. In Ashtanga Hridayam's doshadi vijnaniya adhyaha (sutrasthana), the steadiness is referred to as sthiratva while discussing prakruta dosha karma. Although the word sthiratva is not used in the scriptures to describe Nadi Pariksha, it may be used to indicate pulse stability and is closely related to the contemporary parameter pulse rate variability. Because a steady pulse is more rhythmic in nature, the word tala, which means rhythm, may also be used to describe pulse stability, as Vasant used in Secrets of the Pulse. The word sthiratva has been employed in this study to describe the pulse's stability, as it is in most ancient literature.

2.1. *Gati (pulse movement):*

The dosha predominance may be accurately evaluated using gati, an ayurvedic diagnostic technique that compares the movement of the pulse to that of animals, birds, and reptiles. The movement of the vata pulse, also known as sarpa gati, would be curled, similar to that of a snake (sarpa) or a leech, according to the scriptures (jaluka). The importance of vata pulse is the curved and zigzag character of movement, and in Basavarajeeyam, the vata pulse is described to be of vakra and kutil in nature, which indicates the curved movement. The gati is not likened to the movement of animals or birds by Bhavaprakasha, but it is described to be of vakra in nature by Basavarajeeyam. The movement of the pitta pulse, also known as manduka gati, was likened to the hopping and leaping of a frog in nature, and was described using the terms capal and utplutya, which mean jumping nature. The importance of the kapha pulse, also known as hamsa gati, is its leisurely movement (manda gati), which has been likened to the movement of a swan. When more than one dosha is present, the ayurvedic texts explain that the gati of the pulse will be of sarpa and manduka nature if both vata and pitta doshas are aggravation, sarpa and hamsa nature if vata and kapha doshas are aggravation, and manduka and hamsa nature if pitta and kapha doshas are aggra. The scriptures make it clear that gati is important in determining dosha dominance, and ancient ayurvedic physicians were skilled at distinguishing gati from nadi [6], [7].

2.1.1. *Pulse movement:*

Traditional methods of evaluating gati have been used for thousands of years, but they are very subjective. In today's world of evidence-based research, it is critical to evaluate the nature of gati in a scientific way with a clear knowledge of its physiological importance. Upadhyaya discussed the physiological significance of gati from rate, volume, and character of the pulse as part of his clinical and experimental studies on Nadi Pariksha, and according to him, vata pulse signifies the rate of the pulse to be fast, volume to be small, and character to be curvilinear resembling sarpa gati, and if the rate is slow, volume is high, and character is jumping in nature it resembles s Vega (n.d) (speed of the pulse)

The pace of one's pulse is another factor that ayurveda considers important in determining a person's physiological, psychological, and pathological states. According to Sarangadhara and Bhavaprakasha, an increase in desire and wrath causes a rapid nadi, whereas an increase in sadness and dread causes a sluggish nadi. The speed of the nadi is linked to the digestive fire, according to Sarangadhara, and the nadi will be rapid when the digestive fire is active and sluggish when the digestive fire is weak. Traditionally, ayurvedic physicians measured pulse speed from the nadi, but with the introduction of biomedical equipment, detecting pulse speed has become both easy and complex. The pulse rate is a well-known measure of pulse speed that has been extensively utilized in clinical practice to provide an initial evaluation of health status while also indicating the need for further investigations to identify the illness. Another metric of great interest in research is pulse wave velocity, which may be linked to vega, and there is a need to investigate this parameter in the context of ayurveda.

2.2.1. *Velocity of pulse waves:*

In the aorta, blood flows faster than in the peripheral network, with speeds ranging from meters per second in the aorta to millimeters per second in the peripheral network. Pulse wave velocity (PWV) is the speed at which a pulse wave travels and typically varies from 5 to 15 m/s. Pulse wave velocity (PWV) has recently become popular as a predictor of cardiovascular risk and has sparked a lot of study. Aortic PWV is a significant predictor of future cardiovascular events and all-cause mortality, according to longitudinal studies. The European Society of Hypertension and the European Society of Cardiology proposed a 12 m/s threshold as a conservative estimate of significant alterations in aortic function in hypertensive patients, which was later reduced to 10 m/s when the true anatomical distance traveled by the pulse wave was taken into account.

2.3. *Sthiratva (cardiac stability):*

The ayurvedic classics go into great depth on the pulse's stability, including a reference of intermittent nadi, which may be slow, rapid, or halt in between. When describing the characteristics of sannipatha nadi, Basavarajeeyam used the word sthitva sthitva to describe the intermittent pulse. According to the scriptures, nadi that is intermittent in nature and felt in places other than the designated spot is deadly and

may result in the patient's early death. It's known as asadhya nadi in Basavarajeeyam and Yoga Ratnakara, and it's also known as mrityu nadi in Basavarajeeyam. The pulse's steadiness is also influenced by the person's physiological and psychological condition. According to the Sarangadhara Samhita, a healthy person's nadi would be strong and constant, while a hungry person's nadi will be erratic when compared to a person who has just eaten.

2.3.1. Variability in pulse rate

The rhythm of the pulse is traditionally felt via palpation, which is more qualitative in nature, but with equipment, it is now feasible to collect the pulse as a time series, allowing the rhythm to be studied quantitatively. There has been a surge in interest in using pulse rate variability (PRV) as a surrogate measure for heart rate variability in recent years (HRV). There are no equivalent terms in traditional texts that can be compared to PRV, but intermittent nadi can be closely associated with PRV because the nature of intermittent nadi can be well understood by looking into pulse rate variability and missing peaks, as well as beat to beat alterations in pulse interval. The Nadi Tarangini-acquired beat-to-beat changes of the pulse wave revealed substantial differences across age groups and diseases. Kathinya (Kathinya) (Kathinya) (hardness of artery)

The artery's hardness is intimately linked to kathinya, and only Basavarajeeyam has gone into depth about the nature of the kathin nadi. The hardness of the artery has been described using the terms kathor and kathin in Basavarajeeyam, but the hardness of the artery owing to pitta and kapha doshas has not been addressed. According to Ayurveda, the hardness (kathin) and roughness (khara) of the arteries correlate to the vata dosha, and Basavarajeeyam likened the vata nadi to a string of veena, which represents the vata nadi's hardness. In comparison to normal arteries, blood flow in hardened arteries would be faster, implying a faster vata pulse, which is consistent with ayurvedic theory. According to Basavarajeeyam, if the nadi is kathin, or extremely slow moving in a curved way, and is moved from its original location, it is mrityu nadi, and is an indication of the patient's early death.

2.4.1. Arterial stiffness:

The arteries stiffen with age and atherosclerosis, and arterial stiffness measured by pulse wave velocity (PWV) has recently gained significant research importance as a strong predictor of cardio-vascular events, according to Alberto et al., who have discussed the role of arterial pulse wave analysis in cardiovascular risk assessment in detail. Boutouyrie's longitudinal study is the first to show that aortic stiffness is an independent predictor of primary coronary events in hypertensive patients, and Laurent's independent study confirms that aortic stiffness is an independent predictor of all-cause and cardiovascular mortality in hypertensive patients. The description of mrityu nadi roughly correlates to the pulse wave velocity, a surrogate measure of arterial stiffness [8].

3. PULSE LOCATIONS

Ayurveda places a lot of emphasis on feeling the pulse at the radial artery for the purpose of determining doshas, but it does not restrict the pulse location to only the radial artery; it specifies that the pulse may be felt from eight other sites. Two at the radial artery, two at the ankle, two at the neck area, and two at the nose region are listed in the ancient book Basavarajeeyam as places to feel nadi. It is also stated that the radial artery may be used to learn about the vata, pitta, and kapha doshas, and that Nadi Pariksha based on the radial artery is extensively used since it is essential to evaluate Tridoshas for any illness diagnosis and therapy. Though the radial artery is essential in illness diagnosis and treatment, the nadi in the neck and nasal areas are equally important in disease diagnosis and prognosis. Fear, sadness, rage, desire, and fever are some of the symptoms that may be detected by the nadi in the neck, while illnesses of the head, eyes, and ears can also be identified by the nadi in the nose. The nadi at the ankle senses life and health, as well as fever and its alleviation. According to Ayurvedic literature, nadi pariksha plays a significant part in illness diagnosis and is not restricted to the radial artery but also includes other arteries.

Pulse is palpated at the radial, carotid, femoral, brachial, and ankle arteries in modern physiology, which is similar to the description in ayurveda except that the femoral artery is not mentioned in ayurveda and arteries in the nose area are not emphasized in modern physiology. In Ayurveda, the importance of radial artery-based pulse diagnosis is well known and extensively performed, but the nadi at other sites is not

thoroughly studied. The radial artery, on the other hand, has a very limited function in contemporary medicine, restricted to just detecting the pulse rate, while the carotid, femoral, brachial, and ankle arteries, which were extensively employed in measuring the pulse wave velocity, have received a lot of attention [9], [10].

4. DISCUSSIONS

In both ayurveda and contemporary medicine, pulse parameters and their study play an important role in illness diagnosis. Pulse measuring methods and the equipment used for such measurements are very important in evidence-based research. For evaluating arterial stiffness in central and peripheral arteries, a variety of pulse measurement methods are available. The pulse wave velocity and stiffness index are both indicators of arterial stiffness, and methods have been developed to use them to evaluate arterial stiffness. The carotid femoral pulse wave velocity (cfPWV) and brachial ankle pulse wave velocity are the two most used pulse wave velocity measuring methods (baPWV). In the carotid femoral pulse wave velocity (cfPWV) method, the carotid and femoral arteries are used to measure pulse wave velocity, while the brachial and ankle arteries are employed in the brachial ankle pulse wave velocity (baPWV) approach. The radial artery is used to calculate the Stiffness Index (SI). The methods and equipment used to measure pulses were covered in this section.

4.1. Carotid femoral pulse wave velocity (cfPWV):

The usual approach for evaluating arterial stiffness is to measure pulse wave velocity utilizing carotid femoral pulse wave velocity. This method is noninvasive, robust, and repeatable. The carotid femoral pulse wave velocity (cfPWV) method has attracted a lot of study attention recently, and the pulse wave velocity measured using it is regarded the gold standard. The carotid and femoral arteries will be studied using the cfPWV method, and the distance between them will be measured. The ratio of the distance between the carotid and femoral arteries to the time it takes for the pulse to move from the carotid to the femoral arteries is considered the pulse wave velocity, a proxy measure of arterial stiffness.

4.2. Instruments for detecting carotid femoral pulse wave velocity (cfPWV):

Today, a variety of instruments that use the cfPWV method to detect pulse wave velocity are available. Some of the devices used to measure the pulse wave velocity are Alam Medical's Complior, Atcor Medical's SphygmoCor, Dia Tecne's PulsePen, Fucuda Denshi Co Ltd's Vasera, and Skidmore Medical Ltd's Vicorder. The method pulse transit time and distance between arteries are calculated differs between Complior and SphygmoCor, which are frequently utilized in PWV-based research.

4.3. Brachial ankle pulse wave velocity (baPWV):

The brachial ankle pulse wave velocity (baPWV) is another method for measuring the pulse wave velocity from the brachial and ankle arteries that was established in Japan in 2000. In baPWV, the difficulties of measuring arterial stiffness using the cfPWV method have been addressed. By attaching volume plethysmographic sensors to cuffs attached to the brachial and ankle sites, the pulse wave velocity is recorded in baPWV. The ratio of virtual arterial length between these two arteries to the pulse transit time from brachial to ankle arteries is used to calculate pulse wave velocity. Because the virtual artery length is calculated based on the subject's height, there is no need to physically measure the distance between arteries.

4.4. Instruments for detecting brachial ankle pulse wave velocity (baPWV):

There are few devices available for measuring pulse wave velocity using the baPWV method, and the AT-form PWV/ABI (Colin, Kamaki, Japan) and VP-2000 (Colin, Kamaki, Japan) are the most often utilized by researchers. Volume plethysmographic and oscillometric sensors, ECG, and phonocardiogram are among the baPWV measuring instruments. Blood pressure is monitored using oscillometric sensors, the volume pulse is detected with volume plethysmographic sensors, the ECG is used to synchronize the pulse at the brachial and ankle arteries, and the phonocardiogram is utilized to detect the heart sound. Pulse wave velocity is determined in baPWV by attaching volume plethysmographic sensors to cuffs attached to the brachial and ankle arteries.

5. CONCLUSION

Nadi Pariksha has been practiced in Ayurveda for thousands of years, and ancient literature have highlighted the importance of Nadi in illness diagnosis and prediction. Using the traditional criteria gati, vega, sthira, capala, and kathinya, the texts have described the nature of nadi and its variations in a highly qualitative way. Traditional criteria like pulse wave velocity, pulse rate variability, and artery hardness are strongly linked to contemporary parameters like pulse wave velocity, pulse rate variability, and artery hardness, all of which were extensively addressed in this study. To bring the hidden mysteries of Nadi Pariksha to light, it is essential to examine these contemporary criteria in the context of ayurveda. Extending recent advances in pulse measuring methods and equipment to create the framework for Nadi Pariksha and introduce the scientific approach to pulse-based diagnosis, which is the need of the day, is urgently needed.

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