

MIZAJ AND MOTOR NERVE CONDUCTION -A REVIEW**Saad Ahmed^{1*}, Lubna Fatima², Farah Naaz³ and Nazim Saifi⁴**

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ABSTRACT

Mizaj plays a pivotal role in determining the physiological, psychological and pathological status of an individual and is the basis of Unani therapeutics. Mizaj is one of the basic and distinguishing features of Unani system of medicine. It is one amongst the seven basic physiological principles i.e., Umoo-e-Tabai'ah. There are ten parameters which determine Mizaj of an individual, Afa'l-e-Aza (Functions of the body) is one of those and are considered as important in assessing the Mizaj of an individual as Ibn Nafis said 'quickness of the body in reaction to stimuli is the evidence of preponderance of heat state in the body, e.g. certain people are quickly affected by cold air and

winter season and cold things, while others do not get affected by them but they are affected by hot things'. In this paper, Unani classical literature on Mizaj & Afal-e-Aza and Modern Literature on Nerve Conduction are reviewed and compared.

KEYWORDS: *Mizaj, Afal-e-Aza, Motor Nerve Conduction velocity.*

INTRODUCTION

Mizaj is one of the basic and fundamental concepts of Unani system of medicine. Ancient Unani physicians were very much devoted towards the concept of Mizaj. It is one amongst the seven basic physiological principles i.e., Umoo-e-Tabai'ah. It forms the basis of pathology, diagnosis and treatment. Unani medicine's main advantage over western medicine lies in its ability to provide a holistic approach in prevention and management of diseases.

The concept of Mizaj is a major pillar of Tibb philosophy and is the amalgam of a person's physical characteristics and his/her psychological and emotional attributes. (Glynn & John, ynm). Unani physicians described various parameters or signs through which the state of Mizaj of any individual can be recognized. These parameters are related with the morphological, physiological and psychological conditions of the individual. These parameters or signs are known as determinants of Mizaj. These ten parameters (Ajnas-e-Ashra) are.

1. Malmas: (Palpation/ Touch)
2. Laham-wa- Shaham: (Muscles and Fat)
3. Sha'r: (Hair)
4. Laun-e-Badan: (Body Complexion)
5. Haiyat-e-Aza: (Physique)
6. Kaifiyat-e-infe'al: (Responsiveness of organs)
7. Naum-wa- Yaqzah: (Sleep and wakefulness)
8. Afa'l-e-Aza: (Functions of the body)
9. Fuzlat-e- Badan: (Excreta of the body)
10. Infialat-e-Nafsaniya(Psychic reactions)

Afa'l-e-Aza (Functions of the body) are considered important in assessing the Mizaj of an individual as 'quickness of the body in reaction to stimuli is the evidence of preponderance of heat state in the body, e.g. certain people are quickly affected by cold air and winter season and cold things, while others do not get affected by them but they are affected by hot things'. (Nafis, 1954)

Neurons

Neuron or nerve cell is defined as the structural and functional unit of nervous system. Neurons possess electrical excitability, the ability to respond to a stimulus and convert it into an action potential. A stimulus is any change in the environment that is strong enough to initiate an action potential. An action potential (nerve impulse) is an electrical signal that propagates (travels) along the surface of the membrane of a neuron. It begins and travels due to the movement of ions (such as sodium and potassium) between interstitial fluid and the inside of a neuron through specific ion channels in its plasma membrane. Once begun, a nerve impulse travels rapidly and at a constant strength. Some neurons are tiny and propagate impulses over a short distance (less than 1 mm) within the CNS. Others are the longest cells

in the body. The neurons that enable you to wiggle your toes, for example, extend from the lumbar region of your spinal cord (just above waist level) to the muscles in your foot. Some neurons are even longer. Those that allow you to feel a feather tickling your toes stretch all the way from your foot to the lower portion of your brain. Nerve impulses travel these great distances at speeds ranging from 0.5 to 130 meters per second (1 to 290 miles/hr). (Tortora & Derrickson, 2012). Although neurons vary considerably in size and shape, they generally have three principle regions.

1. Cell body is the enlarged portion that contains the nucleus; it is a nutritional centre of the neuron where macro-molecules are produced. The cell bodies within the CNS are frequently clustered into groups called nuclei. Cell bodies in the PNS usually occur in clusters called ganglia.
2. Dendrites are thin branched processes that extend from the cytoplasm of the cell body. Dendrites provide a receptive area that transmits electrical impulses to the cell body.
3. Axon is a longer process that conducts impulses away from the cell body. Axons vary in length from only a mm long to a meter or more (for those that extend from the CNS to the foot). The origin of the axon near the cell body is an expanded region called the axon hillock. It is here that nerve impulses originate. (Fox, 2011)

Classification of Nerve Fibers

Axons can be classified into three major groups based on the amount of myelination, diameters and their propagation speeds.

- **A fibers** are the largest-diameter axons and are myelinated. A fibers have a brief absolute refractory period and conduct nerve impulses (action potentials) at speeds of 12 to 130 m/sec (27–280 mi/hr). The axons of sensory neurons that propagate impulses associated with touch, pressure, position of joints, and some thermal and pain sensations are A fibers.
- **B fibers** are axons with diameters of 2–3 m. Like A fibers, B fibers are myelinated and exhibit saltatory conduction at speeds up to 15 m/sec (32 mi/hr). B fibers have a somewhat longer absolute refractory period than A fibers. B fibers conduct sensory nerve impulses from the viscera to the brain and spinal cord.
- **C fibers** are the smallest-diameter axons (0.5–1.5 m) and all are unmyelinated. Nerve impulse propagation along a C fiber ranges from 0.5 to 2 m/sec (1– 4 mi/hr). C fibers exhibit the longest absolute refractory periods. These unmyelinated axons conduct some sensory impulses for pain, touch, pressure, heat, and cold from the skin, and pain impulses from the viscera. Autonomic motor fibers that extend from autonomic ganglia to stimulate the heart,

smooth muscle, and glands are C fibers. Examples of motor functions of B and C fibers are constricting and dilating the pupils, increasing and decreasing the heart rate, and contracting and relaxing the urinary bladder (Stanfield, 2013)

Functional Classification

Functionally, neurons are classified according to the direction in which the nerve impulse (action potential) is conveyed with respect to the CNS.

- 1) Sensory or afferent neurons
- 2) Motor or efferent neurons
- 3) Interneurons or association neurons. (Tortora & Derrickson, 2012)

Neurilemma and Myelin Sheath

All axons in the PNS (myelinated and unmyelinated) are surrounded by a continuous living sheath of Schwann cells, known as the neurilemma, or sheath of Schwann. The axons of the CNS, by contrast, lack a neurilemma (Schwann cells are found only in the PNS). Some axons in the PNS and CNS are surrounded by a myelin sheath. In the PNS, this insulating covering is formed by successive wrappings of the cell membrane of Schwann cells; in the CNS, it is formed by oligodendrocytes. Unmyelinated axons are also surrounded by a neurilemma, but they differ from myelinated axons in that they lack the multiple wrappings of Schwann cell plasma membrane that compose the myelin sheath. Unlike a Schwann cell, each oligodendrocyte has extensions, like the tentacles of an octopus that form myelin sheaths around several axons. The myelin sheaths around axons of the CNS give this tissue a white color; areas of the CNS that contain a high concentration of axons thus form the white matter. The gray matter of the CNS is composed of high concentrations of cell bodies and dendrites which lack myelin sheaths. (Fox, 2011).

Synapses—Chemical and Electrical

There are two major types of synapses: (1) The chemical synapse and (2) The electrical synapse. Almost all the synapses used for signal transmission in the central nervous system of the human being are chemical synapses. More than 40 important transmitter substances have been discovered thus far. Some of the best known are acetylcholine, norepinephrine, epinephrine, histamine, gamma-aminobutyric acid (GABA), glycine, serotonin, and glutamate. Electrical synapses, in contrast, are characterized by direct open fluid channels that conduct electricity from one cell to the next. Most of these consist of small protein tubular structures called gap junctions that allow free movement of ions from the interior of

one cell to the interior of the next. Chemical synapses have one exceedingly important characteristic that makes them highly desirable for transmitting most nervous system signals: they always transmit the signals in one direction: that is, from presynaptic neuron to postsynaptic neuron. This is the principle of one-way conduction at chemical synapses, and it is quite different from conduction through electrical synapses, which often transmit signals in either direction (Guyton & Hall, 2006)

Electrical Signals in Neuron

Like muscle fibres, neurons are electrically excitable. They communicate with one another using two types of electrical signals: (1) Graded potentials are used for short distance communication only. (2) Action potentials allow communication over long distances within the body. Recall that an action potential in a muscle fiber is called a muscle action potential. The production of graded potentials and action potentials depends on two basic features of the plasma membrane of excitable cells: the existence of a resting membrane potential and the presence of specific types of ion channels. Like most other cells in the body, the plasma membrane of excitable cells exhibits a membrane potential, an electrical potential difference (voltage) across the membrane. In excitable cells, this voltage is termed the resting membrane potential. The membrane potential is like voltage stored in a battery. If you connect the positive and negative terminals of a battery with a piece of wire, electrons will flow along the wire. This flow of charged particles is called current. In living cells, the flow of ions (rather than electrons) constitutes the electrical current. Graded potentials and action potentials occur because the membranes of neurons contain many different kinds of ion channels that open or close in response to specific stimuli. Because the lipid bilayer of the plasma membrane is a good electrical insulator, the main paths for current to flow across the membrane are through the ion channels (Tortora & Derrickson, 2009). An increase in membrane permeability to a specific ion results in the diffusion of that ion down its electrochemical gradient (concentration and electrical gradients, considered together), either into or out of the cell. All cells have a resting membrane potential, but its magnitude can be different in different types of cells. Neurons maintain an average rmp of -70 mV, for example, whereas heart muscle cells may have an rmp of -85 mV. If appropriate stimulation causes positive charges to flow into the cell, the line will deflect upward. This change is called depolarization (or hypopolarization) because the potential difference between the two recording electrodes is reduced. A return to the resting membrane potential is known as repolarization. If stimulation causes the inside of the cell to become more negative than the resting membrane potential,

the line on the oscilloscope will deflect downward. This change is called hyperpolarization. (Fox, 2011)

Neurotransmission

Neurons communicate with other cells by the release of chemical neurotransmitters. The human nervous system has some 100 billion neurons, each of which communicates with postsynaptic targets via chemical neurotransmission. The first neurotransmitters described were acetylcholine (ACh) and norepinephrine (NE). These were identified at synapses in the PNS. Many others transmitters have been identified since then, but, even counting all the peptides known to act as transmitters, the number is well less than 50. The specific neuronal signaling that allows the enormous complexity of function in the nervous system is largely a result of the specificity of neuronal connections made during development and the distribution of specific classes of neurotransmitter receptors.

Nerve Conduction Study

In the past two decades, major advances have taken place in the field of peripheral nerves, especially, in relation to its ultra-structure, histo-chemistry, neuro-physiology and axonal transport system. These advances have not only contributed to a better understanding of normal peripheral nerve structure and function but also in relation to various diseases. (Misra, 2012). Nerve conduction study is done to assess whether a nerve which has suffered compression or injury is degenerating or not. The nerve is stimulated directly by a short duration stimulus along its course. When it is stimulated it conveys impulses to the muscles it supplies and the muscles contract (Downie, 1992). The principal use of nerve conduction studies is to identify damage to peripheral nerves, and to determine whether the pathological process is focal or diffuse and whether the damage is principally axonal or demyelinating. It is also possible to obtain some information about nerve roots by more sophisticated analysis of responses to impulses initially conducted antidromically to the spinal cord, and then orthodromically to the stimulation point (F wave). (Walker et al, 2013)

Nerve Conduction Velocity (NCV)

By stimulating a motor nerve at two different points along its course and by recording from an appropriate muscle the motor unit potentials so produced, it is possible to measure the stimulus contraction delay interval in each case and hence to calculate the rate of conduction of the impulse along the nerve. (Walton, 1979)

Principle of Motor Nerve Conduction Study

The motor or mixed nerve is stimulated at least at two points along its course. The pulse is adjusted to record a compound muscle action potential. It is important to ensure a supra-maximal stimulation keeping the cathode close to the active recording electrode. This prevents hyper polarization effect of anode and anodal conduction block. The surface recording electrodes are commonly used and placed in belly tendon montage keeping the active electrode close to the motor point and reference to the tendon. Ground electrode is placed between stimulating and recording electrodes. A biphasic action potential with initial negativity is thus recorded. Surface stimulation of healthy nerve requires a square wave pulse of 0.1 ms duration with an intensity of 5-40 mA. In a diseased nerve, however, the nerve excitability is reduced and the current requirement may be much higher than the normal. Filter setting for motor nerve conduction study is 5 Hz to 10 KHz and sweep speed 2-5ms/division. The measurement for motor nerve conduction study include the onset latency, duration, amplitude of compound muscle action potential (CMAP) and nerve conduction velocity. The onset latency is the time in milliseconds from the stimulus artifacts to the first negative deflection of CMAP. For better visualization of the take-off, the latency should be measured at a higher gain than the one used for CMAP amplitude measurement. The onset latency is a measure of conduction in the fastest conducting Motor fibers. It also includes neuromuscular transmission time and the propagation time along the muscle membrane which constitute the residual latency. The amplitude of CMAP is measured from baseline to the negative peak (base to peak) or between negative and positive peaks (peak to peak). The amplitude correlates with the number of nerve fibers. The duration of CMAP is measured from the onset to the negative or positive peak or the final return of wave form to the base line. Duration correlates with the density of small fibers. The area under the CMAP can also be measured. However, it needs computer analysis. Motor nerve conduction velocity is calculated measuring the distance between two points of stimulation in mm which is divided by the latency difference in millisecond. The nerve conduction velocity is expressed as m/s. Measurement of latency difference between the two points of stimulation eliminates the effect of residual latency.

$$\text{CONDUCTION VELOCITY} = \text{D} / (\text{PL}-\text{DL}) \text{ m/s}$$

PL= Proximal latency in ms

DL= Distal latency in ms

D= Distance between proximal and distal stimulation in mm.

For accurate motor nerve conduction velocity measurements, the distance between two points of stimulation should be at least 10cm. (Misra, 2012). So, by following measures, a person's Motor Nerve Conduction Velocity can be measured. For normal individuals, there is a physiological range of MNCV level as it can't be same in all persons. Some may be on the higher side and some on the lower side of that range. Accordingly, the motor response/movements will not be same in every person. 'When the functions are rapid such as rapid movements of organs and rapid growth of hair and eruption of teeth, they show excess of heat. If the functions are dull, weak and inactive or slow, they indicate coldness. Among powerful functions that denote hotness are - powerful and loud voice, rapid and continuous speech, short temper, brisk movements and frequent blinking'. (Ibn Sina, 1993) 'Since functions of an organ reflect its structural and functional integrity, they indicate that the organ is within physiological limits, and is having Taba'i Mizaj. Functions and actions when accelerated become indicative of hot temperament of the organs'. (Zaidi & Zulkifle, 1999) 'In healthy individuals, hyperactivity and increase responsiveness in motor functions are indicative of Haar Yabis Mizaj of brain while hypo activity and decrease responsiveness are indicative of Baarid Ratab Mizaj of brain'. (Kabiruddin, 1940) Hkm. S.I.Ahmed also stated in his book *Kulliyat-e-Asri* that 'swiftness in motor functions is indicative of hot temperament and hypo activity and sluggishness in motor functions are indicative of cold temperaments'. (Ahmed, 1983)

So, from the above quotations, it is assumed that Unani scholars considered that individuals having Haar Mizaj (Safrawi and Damvi) would be having faster motor functions as compared to individuals having Baarid Mizaj (Balghami and Saudawi). Further studies may be carried out to find out whether there is any relation between Motor Nerve Conduction Velocity and Mizaj of an Individual or not.

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