AMMAR YASEEN MANSOUR

The Nerve Conduction Study (NCS),
The Wrong Hypothesis is the Origin of the Misinterpretations

To evaluate the nerve integrity, we used to study the nerve conduction velocity (NCV) and/or the electrical activity of the nerve-dependent muscles (EMG). For this purpose, we must often utilize the famous electromyography.

Surely, the electromyography can detect many nerve pathologies. However, many other pathologies could unperceptibly pass. Nevertheless, we are sometimes confronted by some contradictory data. The nerve, for example, could be quite endamaged and the EMG is quite consistent with, whereas the NCV is normal or unremarkably decreased.

The reason of such contradiction actually is the conventional scientific base on which the detective device (electromyography) works. Actually, in their pursuit to detect the nerve integrity , the designers of such electrical device exploit the current conception concerning the neural conduction.

The conventional conception regarding the electrical nerve study and the electromyography device itself, as well as my personal vis-à-vis view would be the subject of my following research.

The tow conceptions come too close to each other in certain point. However, they go too far from each other in the rest. One could get more details of my conception of the neural conduction in the neural fibers in reading my article titled " The Neural Conduction, The Personal View vs. The International View"

1. The Conventional Mechanism of the Neural Conduction

The supporters of this hypothesis claim the neural conduction to be an electrical current that runs on the external surface of the neural fiber. Moreover, they insist on the exchange of positive ions between the external and the internal spaces of the neural fiber to be the progenitor of the neural electrical current.

Since it has the exact pathway, the external galvanic current could be a good substitute for the physiological neural electrical current, and does produce its same physiological action. This coception becomes the standard, on which many other practical applications are based.

Among them is the electromyography device that detects the integrity of the nerve. Its method of function is very simple. A superficial electrode is used to apply a feeble electrical current onto the skin, while another electrode is used to receive the electrical current after a certain distance from the precedent. We finally obtain a number of curves and a set of measurements, which could together exteriorize the nerve suffering. If the second electrode is applied on the nerve-dependent skin, we get the NCV. If the second electrode is inserted deep in the nerve-dependent muscle , we get the EMG.

The EMG will not be a controversial case. Since it records the electrical activities of the related muscle itself, no matter if the stimulating electrical current would be natural or artificial, internal or external, takes this trajectory or that one . However, the NCV would be the case.

2. My Personal vis-à-vis View of the Neural Conduction

Personally, I do believe the neural conduction to be a pressure wave impulse that flows in the lumen of the neural fiber. The action pressure wave builds up its physiological electrical current. The both, i.e. the action pressure wave and the neural electrical current, run inside the neural fiber in the center of the fiber precisely.

Regardless of the process of building of a such pressure impulse and a such electrical current, the trajectory of both that counts here. The trajectory of the both is the internal space of the neural fiber. This point of view makes all the difference vis-à-vis the universally accepted conception of the neural conduction.

Consequently, we cannot apply an external galvanic current and claim it as a perfect substitute for the physiological electrical current. Obviously, in their course to reach the terminal neural synapses, the two electrical currents take different pathways. The galvanic current will utilize the external surface of the neural fiber sheath, while the physiological electrical current will utilize the central portion of the internal cytoplasm of the neural fiber.

2.1 The Converging Point

However, there still is a common converging point between the two trajectory. It is the neural fiber sheath. The galvanic current ride on its external surface. The physiological current needs the same fiber sheath in order to contain the components of its trajectory, i.e. the cytoplasm and its molecules.

Thus, the integrity of the neural fiber sheath is essential for a good electrical conduction of both the artificial and physiological currents. In another sense, the lesions of the neural fiber sheath have serious negative impact on the velocity of the electrical conduction of the both.

For that reason, the electromyography device could detect the lesions of the myelin sheath, and records it as decrease in the NCV. Which is the reality.

2.2 The Diverging Point

The lesions of the internal cytoplasm of the neural fiber (axon degeneration) will negatively impact the electrical conduction of the physiological current only. The EMG will then record abnormal activities of the nerve-dependent muscle(s). While, the NCV could be normal or unremarkably decreased.

Actually, in the nerve electrical study, the electrical conduction of the artificial galvanic current is only influence by the external space of the neural fiber and by the lesions of the fiber sheath. In the axon degeneration, since the sheath of the neural fiber is supposed to be

intact, the conduction velocity of the electrical current remains intact. Consequently, the NCV remains within normal limits.

3. A Dilemma or a Mere Deficiency?

In the early stage of the nerve compression syndromes, the patient is quite suffering and the clinical examination is strongly suggestive of the nerve compression syndrome. However, the electromyography could still record a normal EMG and a normal NCV as well.

Herein, both the sheath and the internal cytoplasm of most the sensitive and the motor neural fibers are still intact. Therefore, the electromyography cannot detect whatever abnormalities. Even so, the patient is quite suffering?!

In fact, the neural fibers that conduct the pain are more fragile and more vulnerable than the other fibers. Some of these fibers are myelinated, and the other some are unmyelinated (fibers group C). Since these neural fibers are of a smaller diameter, of a thinner sheath, and of a lower internal osmotic pressure than those of the other fibers, the least compression on the nerve could hurt them firstly. Therefore, the pain most often comes first in the nerve compression syndromes. Actually, a considerable period of time might pass before one could detect the nerve suffering electrically.

4. Conclusion

It is not up to the device deficiency, may it is up to the concept deficiency of the device. The electromyography is designed according to a certain view of the neural conduction. The designers thought the trajectory of the physiological electrical current to be superficial on the external side of the neural fiber sheath. Thus, an external electrical current could be a perfect substitute for the physiological electrical current, and could produce its same physiological effects on the effector organs as well as on the electromyography.

However, this is not my conception of the neural conduction. I do believe the physiological electrical current to run in the lumen of the neural fiber. It has a parallel but quite different trajectory. Thus, the factors that block the physiological current are not identical to those blocking the external galvanic current.

Actually, the only common factor between them is the sheath of the neural fiber. The lesion of the neural fiber sheath could have a negative influence on the both. In contrast, the degradation of the internal cytoplasm of the neural fiber (axon degeneration) will only blocks the physiological electrical current, whereas the conduction velocity of the galvanic external current (i.e. NCV) could be normal.

Finally, I have nothing to do with the EMG. This test registers the electrical activity of the muscle in response to an electrical stimulation. The ultimate results on EMG are the same whatever is the source of the electrical current; physiological or artificial. In fact, the last just-mentioned phenomenon has for a long time saved the electromyography, and gave the illusion of its justification.

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In the same context, one could read:

- **The Neural Conduction (Innovated Conception)**
- **The Sensory Receptors, The Genius of Creation and the Beauty of Creature (Innovated Conception)**
- **The Neural Conduction in the Synapses (Innovated Conception)**
- **The Node of Ranvier, the Equalizer (Innovated Conception)**
- **The Philosophy of Pain, Pain Comes First (Innovated Conception)**
- **The Philosophy of Form, (Innovated Conception)**
- **The Spinal Injury, the Pathology of the Spinal Shock, the Pathology of the Hyperreflexia (Innovated Conception)**
- **The Wallerian Degeneration, Attacks the Motor Axons of Peripheral Nerve, while Conserves its Sensory Axons(Innovated Conception)**

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