G69 Experimental Evaluation of Rigor Mortis - The Influence of the Central Nervous System on the Evolution of the Intensity of Rigor Mortis

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The goal of this presentation is to present the development of the intensity of rigor mortis after the disconnection of different parts of the central nervous system.

This presentation will impact the forensic community and/or humanity by providing a better understanding of the development of rigor mortis under different conditions.

In 1811, the French physician and chemist P. H. Nysten published the first scientific description of rigor mortis. The law named after him states that "Cadaveric rigidity affects successively the masticatory muscles, those of the face and the neck, those of the trunk and arms and finally those of the lower limbs." It is often added that resolution occurs in the same order. The development of rigor mortis is thus descending, a finding thought to be related to the varying distances between the different muscles and the central nervous system. However, Nysten himself noticed that the destruction of the CNS did not affect the order of the development of rigidity.

In 1904, Fuchs described the brain as the initial site of death, followed by the proximal part of the spinal cord, and suggested that the process then progressed towards the caudal spinal cord: the presumed impulsions influencing the development of rigor mortis arose from catabolic changes in the nerve cells.

In 1819, Busch observed that the removal of the brain and spinal cord resulted in an early onset of rigidity; moreover, rigidity was more pronounced and lasted longer.

In experiments conducted on animals, Eiselberg (1881) demonstrated that when the sciatic nerve was sectioned on one side, in over 70% of cases rigidity developed later than on the contalateral side.

Gendre (1885) and Aust (1886) confirmed this finding. Aust, in particular, obtained this result in 12 out of a total of 13 experiments. Having conducted in vivo sectioning of the left side of the spinal cord in rabbits (underneath the pyramidal crossing), Bierfreund (1888) made the following statement: "I was very surprised to find that after a few hours following death, the right half of the body became very rigid, while the left half remained almost normally mobilisable." Bierfreund thought that the "accelerating" effect of the central nervous system on the appearance of cadaveric rigidity was the result of a weak excitation of the muscular system, and if this excitation really did exist, it was too weak to cause a visible contraction. To prove this hypothesis, Bierfreund conducted animal experiments that involved weak irritation by the sciatic nerve. The results were the very opposite of what he had hoped for.

The experimental results described above and some others are partially contradictory. Therefore, it remains unclear what role the nervous system may play in the development of cadaveric rigidity.

Some years ago, a method to increase understanding of rigor mortis through the objective measurement of the intensity of cadaveric rigidity in rats was developed. The principle of the method is to determine the force required to cause a movement of small amplitude (4 mm) in the limb under examination. Since the movement doesn't break rigor mortis, serial measurements can be conducted. The apparatus used measures the resistance caused by rigor mortis in the knee and hip joints of rats. This method has been used in the past to evaluate the influence of several pre-mortem and postmotrem factors (i.e., body weight, muscular mass, age, physical exercise, ambient temperature, various causes of death, electrocution) on the development of rigor mortis.

In present investigations, experiments are performed that at least partially clarifies the influence of the central nervous system on the development of rigor mortis.

Experimentation: Animals: male albino rats, weighing approx. 300 g. Measurement time points: 10 min, 1h, 2h, 3h, 4h, 5h, 6h, 8h, 12h, 16h, and 24h postmotrem.

Measurements were made on the hind limbs of the animals. Group N°1: control

Group N°2: medulla oblongata section

Group N°3: destruction of spinal chord with a needle introduced in the spinal canal

Group N°4: sciatic nerve section

Results: No significant difference was found in the development of the intensity of rigor mortis among the four groups.

Conclusion: In "normal" conditions, the central nervous system has no significant influence on the

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intensity or on the time course of the rigor mortis. These experiments do not exclude the possibility of the influence of the CNS on the development of cadaveric rigidity in some pathological conditions.

Rigor Mortis, Central Nervous System, Rats

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