H29 Changes in Receptor Expression of σ-1R in the Pineal Gland Related to Different Causes of Death

Elvira Ventura Spagnolo, MD, University of Palermo, Palermo 90127, ITALY; Cristina Mondello, MD*, University of Messina, Messina 98123, ITALY; Gennaro Baldino, MD*, Palermo 90100, ITALY; Antonio Guajana, MD, Palermo 90149, ITALY; Letteria Minutoli, MD, University of Messina, Messina 98125, ITALY; Domenico Puzzolo, MD, University of Messina, Messina 98125, ITALY; Vincenzo Macaione, MD, University of Messina, Messina 98125, ITALY; Luigi Cardia, MD, University of Messina, Messina 98125 , ITALY; Antonina Argo, PhD, University of Palermo, Palermo 90100, ITALY; Stefania Zerbo, MD, Palermo 90100, ITALY; Alessio Asmundo, University of Messina, Messina 98125 , ITALY*

Learning Overview: After attending this presentation, attendees will understand the importance of improving knowledge regarding pineal gland involvement in response to stress related to the death process and their possible changes related to the different causes of death.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by highlighting: (1) whether the pineal gland undergoes structural changes in relation to different causes of death; (2) if these changes have significant differences; and (3) if it is possible to better demonstrate molecular changes in the gland.

N,N-Dimethyltryptamine (DMT) is a potent psychedelic substance produced in the human body, especially in the pineal gland. It has been proposed that DMT is secreted by the pineal gland in large quantities under extreme stress, such as during dying or for a certain period after death.1 The σ-1 Receptor (σ-1R), is particularly well-expressed in the pineal gland, is located in the endoplasmic reticulum, and plays an important role in regulating the mechanisms of calcium release through the receptor for Inositol Triphosphate (IP3). DMT is the only endogenous agonist ligand capable of activating this receptor: once activated, DMT binds to the receptor and regulates cellular ionic channels, in particular K+ channels.2 The goal of the present study was to demonstrate the impact of different causes of death on the expression of σ-1R with immunohistochemical techniques.

The pineal glands from 48 forensic autopsies were included. The specimens from the following causes of death were examined: hanging, stabbing, fire fatality, sudden cardiac death, hemorrhagic shock, and drowning. All autopsies were performed within 24 to 48 hours after death. Pineal glands obtained from the autopsies were fixed in 4% paraformaldehyde in 0.2M Phosphate Buffer Saline (PBS), dehydrated in graded ethanol, cleared in xylene, and embedded in paraffin. Histological sections (5µm) were processed for σ1-R immunohistochemistry according to the manufacturer's instruction; sections were deparaffinized in xylene and rehydrated in ethanol. Antigen retrieval was performed with pH 6.0 buffer citrate and endogenous peroxidase blocked with 0.3% Hydrogen Peroxide (H2O2) in PBS. Primary antibody (1/100 dilution) was incubated overnight at 4°C in a moisturized chamber. The day after, peroxidase-conjugated secondary antibody (1/50 dilution; Pierce anti-rabbit, anti-goat, and anti-mouse) was added and the reaction was visualized with 3,3'-Diaminobenzidine (DAB). Counterstaining was performed in Mayer's hematoxylin. Negative control slices were tested using PBS instead of the primary antibody. Overall, results of this study revealed a different expression of σ1-R immunopositivity in relation to the cause of death, being particularly evident in hanging, fire fatality, and sudden cardiac death. The results were then analyzed in relation to factors such as sex, age, and timing of the death process.

Reference(s):

1. Strassman R. DMT The Spirit Molecule. Rochester, VT. Park Street Press, 2001.
2. Wang J., Shammugam A., Markand S., Zorrilla E., Ganapathy V., Smith S.B. Sigma 1 receptor regulates the oxidative stress response in primary retinal Muller glial cells via NRF2 signaling and system xc-, the Na- -independent glutamate-cystine exchanger. Free Radic Biol Med. 2015; 86:25-36.

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