

<sup>+</sup>  
**PROCEEDINGS of**  
**The First International Symposium**  
**ADVANCES IN LEGAL MEDICINE**

Edited by Taizo Nagano<sup>+</sup>

October 11-15, 1990  
Kanazawa, Japan

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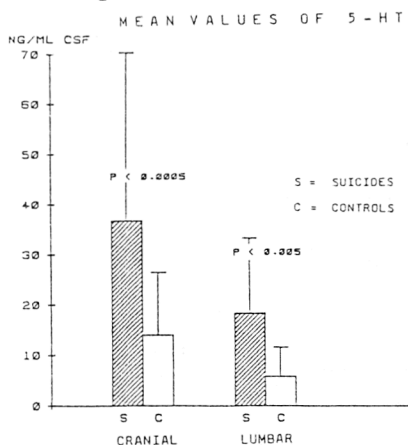
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# EXPERIENCES IN BIOCHEMICAL DIAGNOSIS OF SUICIDE BY ANALYZING SEROTONIN IN CEREBROSPINAL FLUID

G.Kauert and W. Eisenmenger

## Introduction:

Disturbances in serotonin (5-HT) metabolism are implicated in the pathogenesis of aggressive and autoaggressive behaviour of patients. This has been evidenced by numerous studies in the past.



In earlier and recent studies we found significant differences between the 5-HT concentrations analyzed in lumbar as well as cranial cerebrospinal fluid (CSF) of suicide and non-suicide victims (Fig.1) (KAUERT et al.,1986, 1990). These differences cannot be explained by agonal stress, post mortem delay or age and sex. The application of this method in Forensic medical routine work in order to differentiate between accident, homicide and suicide requires a high evidential value of a single result. Therefore, in a

Fig.1: from Kauert et al.1986

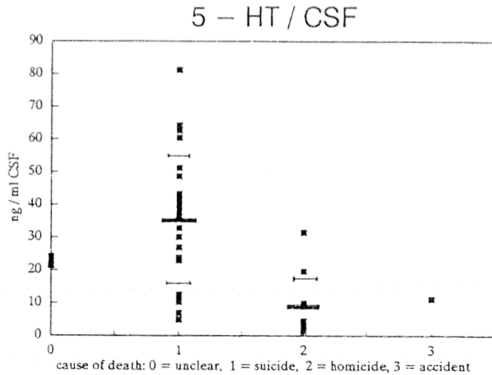
very recent study we blindly analyzed 5-HT in lumbar CSF of 38 randomly selected cases (without knowledge of the autopsy result) and from the 5-HT concentrations measured we assigned the cases to either suicide or non-suicide. Afterwards we compared the biochemical diagnosis with the autopsy results and analyzed the rate of correspondence. The data of this study are presented on the First International Symposium on Advances in Legal Medicine , Kanazawa, Japan, Oct.12th to 15th, 1990.

## Methods:

A) Sampling of CSF: Lumbar CSF is collected during autopsy by ventral perforation of the intravertebral disk L 3/4 or L 4/5 after removal of the intestinal tract. The first portion of 2 - 4 ml has to be taken for analysis. The samples have to be frozen deeply within of max. 2 hours. Only samples absolutely free of blood contamination are admitted.

B) Analyticals of 5-HT: 5-HT is isolated from CSF via an ion exchange resin and separated from other endogenous compounds by HPLC and detected by an electrochemical detector (WATERS) equipped with a glassy carbon working electrode and a Ag/AgCl reference electrode. The working potential is set on 0.7 V. The detection limit of the method is 0.1 ng/ml.





**Results and discussion:**

In fig.2 all cases the 5-HT values of the different groups are spotted. In 37 cases investigated there were 34 cases with unequivocal diagnoses of death by autopsies. 23 of these were suicides and 11 of them homicide and accident respectively. High 5-HT concentrations (20ng/ml) fitted in 17 of 23 cases of suicide, whereas low 5-HT concentrations (5ng/ml) were found in 9 of 11 cases. With the 4-fields chi square test we calculated a  $\chi^2$  value of 9.3745 (P = 0.00217).

Fig.2 In the 3 cases with code = 0 the situations are uncertain. From the 5-HT concentrations they could be suicide cases. Case No 1 is problematically in so far as this is a suicide committed together with his mother (aut-No 321090) on the one hand but this person was mentally disturbed on the other hand. Also a confusion of the CSF samples could not be excluded. Case No 2 might in fact be a possible suicide from the circumstances at the scene of crime. Case No 3 primary was diagnosed as a cardiovascular failure. A post investigation by toxicological analyses resulted in a toxic serum level of amitriptyline (428 ng/ml) suggesting an overdose!

In the group of suicide (code 1) there are some cases with striking low 5-HT concentrations. 2 of these exhibit a case history of heavy illness (cancer and paraplegia resp.) and were members of a german society which from one can get safe methods for committing suicide. It might be that the low concentrations of 5-HT resulted from a lacking autoaggression or from the illness itself. Case No.8 is the mother of above mentioned case of mentally disturbed man, who committed suicide together with her son by driving her car into a river. The remaining cases 26 all show a therapeutic serum level of tricyclic antidepressants like amitriptyline, some of which are well known to decrease the 5-HT synthesis after chronic uptake, however, not after acute dosage (VAN PRAAG, 1981).

The group of homicide and accident (codes 2 and 3) contains 2 cases with high 5-HT concentrations. Case No.31 exhibits a very interesting history from scientific point of view: The man was discovered and then killed by his son, while he maltreated his wife possibly with intention of killing her. This case might be an indicator that high concentrations of 5-HT are correlated with the rate of aggression.

The second case could not be elucidated. It is an alcoholic and tramp we are dealing with here, who was strangled by

another ramp. The reason for his relative high 5-HT concentration must remain unclear at present.

### **Conclusion:**

Our method analyzing the concentration of 5-HT in lumbar CSF provides the possibility of differentiation between suicide and non-suicide with a high evidential value. From our experiences, however, there are some factors to be considered as described above. Of particular criminalistic interest are suspected homicides which are pretended as suicide. From our homicide cases investigated we could evidence that agonal stress or panic reactions, which provably took place in a lot of cases, has no influence on the 5-HT concentration in CSF. This observation is in agreement with studies of LUNA et al. (1982), who investigated 5-HT in CSF after short and prolonged lethal agony.

From our results we suggest that the degree of aggression and autoaggression respectively is associated with the rate of 5-HT concentration in the CSF.

The crucial question of the central origin of this 5-HT has to be clarified. And as preliminary result we could state that the pineal organ may be involved, because in our studies we found a negative correlation between the pineal and lumbar CSF 5-HT concentrations (KAUERT et al. 1990). Should Descartes (1596-1650) be right with his assumption of the pineal being the seat of the soul?

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