Olaf Rilke
Christian Safar
Matthias Israel
Thomas Barth
Werner Felber
Jochen Oehler

Department of Psychiatry, Carl Gustav
Carus Hospital, Technical University of
Dresden, Germany

Differences in Whole Blood Serotonin Levels Based on a Typology of Parasuicide

Key Words

Parasuicide
Serotonin
Tryptophan
HVA
Typology

Abstract

Suicidal behavior has to be considered as a multifactorial phenomenon, which can be analyzed in a classifying-phenomenological manner. We have examined the relation of parasuicide typology to whole blood concentrations of serotonin, HVA, and tryptophan in 58 patients classified into 4 groups of parasuicide typology compared to 22 nonsuicidal depressed patients and 20 healthy subjects. Suicidal patients classified as impetuous, desperate and ambivalent types had significantly reduced whole blood 5-HT levels in comparison with the appealing type as well as nonsuicidal subjects. No differences were detected in the HVA content, but whole blood tryptophan concentrations were significantly reduced in impetuous suicidal patients and depressed patients compared to healthy subjects. This study provides evidence for reduced whole blood serotonin content based on different types of parasuicide.

Introduction

There is growing evidence linking serotonin (5-hydroxytryptamine – 5-HT) abnormalities with suicide. This evidence is based mainly on CSF studies showing a correlation between suicide and low levels of 5-hydroxyindoleacetic acid (5-HIAA) in the cerebrospinal fluid [1]. Tryptophan, an amino acid precursor of serotonin, has a role in neuropathological research, and reduced plasma tryptophan levels have been observed in depressed patients [2]. Evidence has pointed to the involvement of the linked serotonin-dopamine systems in affective disorders [3]. Thus our study is aimed at investigating whole blood concentrations of serotonin, tryptophan and homovanillic acid (HVA) with regard to suicidal behavior. However,

suicidal behavior has to be considered as a multifactorial phenomenon, which can be analyzed in a classifying-phenomenological manner using a suicidality questionnaire according to Felber [4]. We examined what types of suicidal patients are related to different biological markers (5-HT, HVA, tryptophan) compared to nonsuicidal depressed patients and healthy subjects.

Subjects and Methods

Subjects

Fifty-eight suicidal patients (38 female, 20 male, mean age $\pm$ SD: 37 ± 13), admitted into the Psychiatric Clinic of Dresden University because of suicide attempt, were studied and classified into four groups according to a suicidality questionnaire [4]: impetuous type

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0302-282X/98/0382-0070\$15.00/0

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Dr. Olaf Rilke
AG Neurobiologie, Klinik und Poliklinik für Psychiatrie und Psychotherapie
Universitätsklinikum Carl Gustav Carus der TUD
Fetscherstr. 74, D-01307 Dresden (Germany)
Tel. +49 351 458 5489, Fax +49 351 458 5350, E-Mail Olaf.Rilke@mailbox.tu-dresden.de

(n = 16), desperate type (n = 10), ambivalent type (n = 14) and appealing type (n = 14). Parasuicides of the patients were committed 2 days up to 3 weeks before the biological examination. Depressed patients were 22 consecutively admitted inpatients (15 female, 7 male, mean age $\pm$ SD: 36 $\pm$ 13) who met DSM-III-R criteria for depression and who had never attempted suicide. The control group contained 20 healthy subjects (11 female, 9 male, mean age $\pm$ SD: 33 $\pm$ 10).

HPLC Analyses

5-HT, HVA and tryptophan were assayed in whole blood samples by HPLC with electrochemical detection by modifications of the methods of Korpi [5] and Saito et al. [6]. Aliquots of whole blood were mixed with precipitation solution (Chromsystems, GmbH, Munich, Germany) as well as N-methylserotonin used as internal standard and then ultrasonically homogenized. Following centrifugation at 14,000 g for 15 min, the supernatant was directly injected into the HPLC column (C18 Ultrasphere, 75 $\times$ 4.6 mm, 3- μ m particle size). The mobile phase consisted of 0.02 M sodium acetate/0.0125 M citric acid buffer, pH 3.7, containing 15% (v/v) methanol, 0.042% heptanesulfonic acid and 0.1 mM Na₂ EDTA. The flow rate was set to 1 ml/min and the temperature maintained at 20°C. The working potential was 740 mV for 5-HT/HVA measurements and 1,000 mV for tryptophan. Interassay variability was estimated to be 2.5–6.6%.

Statistics

Data were analyzed by analysis of variance (ANOVA). Post-hoc comparisons were performed by Student's t test when appropriate. Statistics were carried out using the SPSS 6.1.2 computer package. The level of significance was set at $p < 0.05$. Means $\pm$ SEM are reported.

Results

ANOVA analyses of whole blood 5-HT content revealed significant differences between studied groups ($F(5, 94) = 3.9$, $p < 0.01$). According to figure 1 parasuicidal patients classified as impetuous, desperate and ambivalent types have significantly reduced whole blood 5-HT levels compared to appealing parasuicides as well as nonsuicidal subjects (depressed and healthy subjects).

No differences were detected in the HVA content ($F(5, 89) = 0.8$; $p = 0.5$; table 1), but whole blood tryptophan concentrations were significantly reduced in impetuous parasuicidal patients as well as in depressed patients in comparison to healthy subjects ($F(5, 94) = 3.0$; $p < 0.05$).

Discussion

This study provides evidence for reduced whole blood serotonin content based on various types of parasuicide. In patients whose parasuicide was classified as impetu-

Fig. 1. Whole blood 5-HT content of parasuicidal patients classified as impetuous, desperate, ambivalent and appealing as well as nonsuicidal depressed patients and healthy subjects; * $p < 0.05$, Student's t test. Error bars indicate SEM. Number of patients in parentheses.

Table 1. Whole blood tryptophan and HVA content of parasuicidal patients classified as impetuous, desperate, ambivalent and appealing type as well as nonsuicidal depressed patients and healthy subjects (mean $\pm$ SEM)

Subjects	Tryptophan, μ g/ml	HVA, ng/ml
<i>Parasuicidal patients</i>		
Impetuous type	6.1 $\pm$ 0.4* (n = 16)	20.9 $\pm$ 3.9 (n = 13)
Desperate type	7.4 $\pm$ 0.6 (n = 10)	16.7 $\pm$ 2.0 (n = 10)
Ambivalent type	6.8 $\pm$ 0.3 (n = 14)	17.9 $\pm$ 2.4 (n = 14)
Appealing type	7.5 $\pm$ 0.4 (n = 18)	15.7 $\pm$ 1.9 (n = 18)
<i>Nonsuicidal</i>		
Depressed patients	6.5 $\pm$ 0.2* (n = 22)	16.8 $\pm$ 1.8 (n = 20)
Healthy subjects	7.5 $\pm$ 0.3 (n = 20)	14.9 $\pm$ 1.6 (n = 20)

* $p < 0.05$, Student's t test vs. healthy subjects.

ous, desperate and ambivalent a significantly reduced level of whole blood serotonin content was found in comparison to nonsuicidal depressed and healthy subjects. Parasuicidal patients with appealing parasuicide did not show these differences. These data are in line with reports showing a correlation of low CSF 5-HIAA with the severity of suicide intent [7] as well as with planned and more medically damaging suicide attempts [1]. But our findings show the potential usefulness of whole blood serotonin concentration as a biological marker for differentiation of suicidal behavior. The results concerning reduced trypto-

phan concentration in depressed patients confirm previous reports [2]. However, we found no correlation between serotonin and tryptophan concentrations indicating that the availability of tryptophan does not account for lowered whole blood serotonin concentrations. Other mechanisms might explain a reduced serotonin content, such as reduced platelet serotonin uptake or a defect of storage in dense granules of platelets.

The importance of these results lies primarily in the existence of a relationship between whole blood serotonin

content and type of parasuicidal behavior. Further longitudinal studies are necessary to elucidate the nature of reduced whole blood serotonin concentration as a trait or a state marker in specific parasuicidal patients.

Acknowledgment

The authors are indebted to Heidi Jakob for expert technical assistance.

References

- 1 Mann JJ, Malone KM, Sweeney JA, Brown RP, Linnoila M, Stanley B, Stanley M: Attempted suicide characteristics and cerebrospinal fluid amine metabolites in depressed inpatients. *Neuropsychopharmacology* 1996;15:576–586.
- 2 Russ MJ, Ackerman SH, Banay-Schwartz M, Shindeldecker RD, Smith GP: Plasma tryptophan to large neutral amino acid ratio in depressed and normal subjects. *J Affect Disord* 1989;19:9–14.
- 3 Kapur S, Mann JJ: Role of the dopaminergic system in depression. *Biol Psychiatry* 1992;32:1–17.
- 4 Felber W: Typologie des Parasuizids. Suizidale Gefährdung, taxonomische Auswirkung, katamnästisches Ergebnis. Regensburg, Roderer, 1993.
- 5 Korpi ER: Serotonin determined in whole blood by liquid chromatography with electrochemical detection. *Clin Chem* 1984;30:487–488.
- 6 Saito H, Murai S, Abe E, Masuda Y, Itoh T: Rapid and simultaneous assay of monoamine neurotransmitters and their metabolites in discrete brain areas of mice by HPLC with coulometric detection. *Pharmacol Biochem Behav* 1992;42:351–356.
- 7 Plutchik R, van Praag HM, Picard S, Conte HR, Korn M: Is there a relation between seriousness of suicide intent and the lethality of the suicide attempt? *Psychiatry Res* 1990;27:71–79.