

Original article

Changes in thyroid function status of suicidal patients

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Abstract

Background: This study was carried out at Punjab Institute of Mental Health and Centre for Nuclear Medicine Mayo Hospital, Lahore. It is aimed at the possible association of thyroid malfunctioning with suicide attempts of patients. **Objective:** Determination of thyroid function status of suicidal psychiatric patients and their comparison with psychiatric patients without suicide attempt or ideation. **Methods:** Total 54 patients with either past history of suicide attempt or current suicidal ideation were selected for analysis of their thyroid function status (age 15-55 years). Age matched 50 non-suicide psychiatric patients were included for comparison. **Results:** Two patients with suicide attempt had overt thyroid dysfunction. Remaining patients had serum FT₄, FT₃ and TSH level within normal range. Suicide attempter patients had lower FT₄ but increased FT₃ and TSH levels compared to suicidal ideation patients. Serum FT₄ and TSH levels in suicidal patients were not different from psychiatric patients. Serum FT₃ in suicidal patients was lower than psychiatric patients (3.7 ± 0.8 vs. 4.3 ± 0.5; p < 0.05). Female suicidal patients had lower FT₃ levels compared to male patients (3.4 ± 0.6 vs. 3.9 ± 0.8 pmol/L; p < 0.05). **Discussion:** Local suicidal patients have higher incidence of overt thyroid disorder and lower FT₃ levels compared to non-suicidal psychiatric patients.

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Introduction

Death is a bitter reality of human life everyone is scared of. Mentally healthy persons never want to die. Still, there are present such individuals in our society who really want to leave this world by committing suicide. Such individuals are considered as mentally unhealthy and require immediate medical treatment. Suicide is a complex issue which involves a number of social, cultural, biological as well as psychological factors. In the last 45 years, the world has seen 60% increase in the suicide attempts with a prediction that global suicide figures will potentially reach to 1.5 million mark by the year 2020^{1,2}. This shocking act of uncivilized behavior is now attributed to the presence of a psychiatric disorder. This disorder is among the most consistently reported risk factors associated with the suicidal attempts. It is now known that more than 90% of people who either attempt a suicide or die as a result of attempting suicide are psychiatrically ill³. This fact is further supported by the recent studies which proves that the depressed individuals attempting suicide constitute a particular subgroup of depressed subjects with a higher severity of depressive disorder and higher social impairment⁴.

This psychiatric illness may arise as a result of abnormalities originating within the human body, particularly hormonal disturbances. The thyroid hormones are known to have profound effects on mood swings as well as human behavior. In the recent attempts to investigate the relationship between suicidal behavior and thyroid hormonal activity in depressed patients, it was reported that various degrees of hypothalamic-pituitary-thyroid (HPT) axis dysregulation are associated with the history of suicide^{5,6}.

The activity of thyroid is considerably regulated by iodine and, unfortunately, Pakistan is considered one of the severely iodine deficient countries in the region⁷. About 70% of Pakistani population is reported to be at risk of iodine deficiency disorder⁸. In this context, it is expected that a number of psychiatric patients may have underlying thyroid abnormalities which can lead towards suicide attempts. So far, the data from Pakistan, on prevalence of abnormal thyroid hormones among psychiatric patients, has not been reported^{9,10}. Therefore, present study is a part of a large study exploring the role of thyroid hormone in psychiatric patients. The

current study focuses on determination of serum levels of free thyroxin (FT₄), free triiodothyronine (FT₃) and thyroid stimulating hormone (TSH) in the patients who undergo suicide attempts (SA) as well as suicide ideation (SI) and the obtained results are compared with psychiatric patients without suicide attempts or ideation.

Material and methods

The details of patients for this study and the methods adopted has been provided.

Patients

Consecutive patients with past history of SA or SI were recruited from outpatient department of Institute of Mental Health, Lahore during June to September 2013. A careful Psychiatric history of each patient was taken and noted on a proforma by the qualified psychiatrist. For each patient, the physical examination of thyroid gland as well as signs and symptoms associated with thyroid dysfunction were also carried out. The patients already diagnosed with thyroid diseases and were either taking thyroid medications or underwent a thyroid surgery, the pregnant women and patients suffering from cardiac diseases and hepatitis were excluded from this study.

Methods

A 5.0 mL blood sample was taken from each patient in the study. The serum was separated from each sample by low-speed centrifugation (2000×g) for 5 minutes at room temperature and stored at minus 20 °C until analysis. All collected serum samples were analyzed for FT₄, FT₃ and TSH at CENUM, Mayo Hospital, Lahore. The serum FT₄ and FT₃ were determined by radioimmunoassay (RIA) and TSH was determined by IRMA techniques using commercial kits of Immunotech Inc. (Beckman, Czech Republic). The RIA & IRMA batches were tested with commercially derived control sera at low, medium and high concentrations. Measurement of radioactivity, fitting of the standard curve and analysis of samples was carried out using a computerized gamma counter (Cap-RIA 16, Capintec Inc.



USA). Assay reliability was determined by the use of commercially derived control sera of low, medium and high concentrations which were included in every test. All assays were carried out in duplicate. The RIA and IRMA results were expressed at less than 10% CV of imprecision profile. Normal ranges for FT₄, FT₃ and TSH, as standardized in CENUM RIA laboratory, are 11.0-22.0 pmol/L, 2.5-5.8 pmol/L and 0.3-5.0 mIU/L, respectively. The diagnosis of hyperthyroidism was marked as positive if serum TSH was found to be < 0.3 mIU/L and FT₄ > 22 pmol/L. Hypothyroidism was considered if serum TSH was > 5.0 mIU/L and FT₄ < 11.0 pmol/L.

The analysis of data was carried out using Microsoft Excel program on a personal computer. Mean values were compared by Student *t*-test in order to test the significance of difference between two arbitrary groups. A value of *p* < 0.05 was considered as significant.

Results

A total number of 54 consecutive psychiatric patients (21 females and 33 males) presenting with SA (*n* = 39) or SI (*n* = 15) were selected for this study. Their mean (± SD) age was 30.5 ± 10.1 years with age ranging from 15 to 55 years. Among them 24 (44.4%) were residents of Lahore city. As controls, age matched 50 patients (22 females and 28 males) with psychiatric disorder but no history of either past suicide attempts or current suicidal ideation were included in this study. Analysis of thyroid function tests showed that among 39 SA patients, one female and one male had severe hypothyroidism and hyperthyroidism, respectively (prevalence: 5.1%). The remaining 52 patients were found to have serum FT₄, FT₃ and TSH levels within the normal range. Among them a comparison of mean concentration of serum FT₄, FT₃ and TSH levels between SA and SI patients is shown in Table 1. The SA patients were found to have lower FT₄ and increased FT₃ and TSH levels as compared to those of SI patients. However, difference was slight and did not reach significant level. Thus, thyroid function tests were not different in patients who have attempted suicide compared to those who have current suicidal ideation.

Table 1. Mean concentration of FT₄, FT₃ and TSH in different groups of suicidal patients

Thyroid hormone (n = 37)	Suicidal attempter (n = 15)	Suicidal ideation	P-value
FT ₄ (pmol/L)	14.8 ± 3.2	16.0 ± 3.2	0.79
FT ₃ (pmol/L)	3.7 ± 0.8	3.6 ± 0.6	0.38
TSH (IU/L)	2.3 ± 1.0	1.7 ± 0.9	0.66

All control patients also had normal levels of thyroid related hormones. A comparison of mean concentration of serum FT₄, FT₃ and TSH in suicidal and control patients is shown in Table 2. Results showed that mean FT₄ and TSH levels in suicidal patients were not different from psychiatric patients. However, serum FT₃ in suicidal patients was significantly lower than psychiatric patients.

Table 2. Mean concentration of serum FT₄, FT₃ and TSH in different groups of patients

Thyroid hormone (n = 52)	Suicidal	Psychiatric (n = 50)	P-value
FT ₄ (pmol/L)	15.1 ± 3.2	15.0 ± 2.2	0.335
FT ₃ (pmol/L)	3.7 ± 0.8	4.3 ± 0.5	
TSH (IU/L)	2.1 ± 1.0	2.3 ± 1.1	

We further explored the effect of different patient's variables on serum FT₃ levels in suicidal patients; results are shown in Table 3. In female suicidal patients, the FT₃ levels were significantly reduced as compared to the male patients. However, patient's education level as well as place of residence has no effect on serum FT₃ levels in suicidal patients.

Table 3. Effect of different variables on mean serum FT₃ levels in suicidal patients

Variable	FT ₃ levels (pmol/L)	P-value
Gender		
Male	3.9 ± 0.8	0.01
Female	3.4 ± 0.6	
Educational level		
Matriculation and above	3.8 ± 0.7	0.69
Below matriculation	3.7 ± 0.8	
Place of residence		
Inside Lahore	3.5 ± 0.6	0.15
Outside Lahore	4.2 ± 0.9	

Discussion

The aim of this study was to determine thyroid function status of suicidal psychiatric patients and their comparison with those of non-suicidal psychiatric patients. The results of this study showed that the thyroid function tests were not significantly different among suicidal patients who had either attempted suicide in the past or were currently idealizing it. Compared to psychiatric patients without suicide history or idealization, suicidal patients had significantly decreased serum FT₃ levels. This decrease in FT₃ levels was comparatively more pronounced in female suicidal patients as compared to male suicidal patients. A noteworthy result was that more than 5.0% patients with past history of suicide attempt had severe thyroid dysfunction. This points towards the speculation that before a patient attempts suicide, his or her thyroid hormones may get dis regulated⁶.

Mann and Currier have reviewed the prospective studies of suicidal behavior and serotonergic, noradrenergic, dopaminergic and hypothalamic-pituitary adrenocortical (HPA) as well as HPT axis in mood disorders¹¹. The relationship between suicide and the HPT activity has been previously described in the literature^{6,12-15}. Most of these studies have focused on the change in serum TSH levels among the suicidal patients as compared to the depressive patients. These studies report conflicting results regarding serum TSH. Although most of the investigators have found that depressed patients with either a suicidal behavior or intent exhibited a reduced TSH response to morning administration of thyrotropin releasing hormone (TRH)^{6,12,13} while others did not agree to this generalization^{13,14}. In these reports, the serum FT₄ and FT₃ levels were not studied extensively in suicidal patients due to preoccupation with serum TSH. Recently, Duval *et al.*⁶ carried out a study on 95 medication-free DSM-IV euthyroid major depressed inpatients along with 44 healthy hospitalized controls; they found that control patients with a positive suicide history (*n* = 53) showed lower basal FT₄ (at 0800 h: *p* < 0.005; at 2300 h: *p* < 0.03) and normal FT₃ levels, whereas patients with a negative suicide history (*n* = 42) showed normal FT₄ and FT₃ levels⁶. In contrast to this finding, Pompili conducted a study on 439 patients suffering from major depression disorder, bipolar disorder and psychotic disorders (schizophrenia, schizoaffective disorder and psychosis not otherwise specified). They found that suicide attempters and non-attempters differ regarding their FT₃ values only. A multinomial logistic regression model revealed that suicidal attempters were 2.27 times (odds ratio = 0.44; 95% confidence interval: 0.23/0.82; *p* = 0.01) less likely to have higher FT₃ values than non-attempters. Earlier Jokinen *et al.* have shown that suicide patients' plasma T₃ had a negative correlation with the Beck Suicide Intent Scale and the Montgomery Asberg Depression rating scale¹⁶. Thus, these few studies on FT₄ and FT₃ are not consistent regarding serum FT₄ and FT₃ levels in suicidal patients. The results of this study are in accordance to Pompili showing that serum FT₃ levels were significantly lower in suicidal patients as compared to non-suicidal patients.

Disturbances in the serotonin (5-hydroxytryptamine, 5-HT) system constitute the most common biochemical abnormality

associated with suicide¹⁷. It is proposed that thyroid hormones are involved in a complex compensatory mechanism to correct reduced central 5-HT activity with existence of either of the two situations¹². The compensatory mechanisms are effective: in this situation decrease in 5-HT function leads to an increase in thyroid axis activity. This may be understood as a repairing process aiming to restore an efficient 5-HT functioning and the compensatory mechanisms are not effective: in this case the 5-HT deficiency remains. In depressed patients with a history of suicidal behavior, 5-HT dysfunction may be understood as a failure of the compensatory mechanisms. If thyroid hormones might be involved in a complex compensatory mechanism to correct reduced central serotonin activity, then the lower FT₃ levels in our patients mean the failure of thyroid compensation of serotonin secretion. In the past studies regarding TSH, the TRH hyper secretion has been considered a compensatory mechanism to maintain normal thyroid hormone secretion and to normalize serotonin activity in depressed patients^{12,13}.

The strength of the present study is the enrollment of consecutive suicidal patients constituting a measure of homogeneousness. Similarly, control group of patients was suffering from psychiatric disorders which made it suitable for differentiation between the effect of the psychiatric illness and the effect of suicidal behavior. However, there are some limitations to the generalization of the present results. First, the relatively small sample size may affect the replicability of results. Second, the sample of patients taken was not free of medication which might have affected thyroid hormone values.

Further, large studies should confirm this generated data regarding higher prevalence of overt thyroid diseases and lower FT₃ levels in local suicidal patients. Moreover, studies should be conducted to ascertain whether thyroid hormonal patterns found in suicide attempts can be ameliorated with T₃ supplementation before starting anti-depressive treatment. In the past, most of such acceleration studies have yielded favorable results before the use of tricyclic antidepressants¹⁸. Recently, it has been suggested that hyperactive HPT axis is associated with better antidepressant response and T₃ due to its short half-life may reduce the antidepressant response time¹⁹. This necessitates the trial of T₃ as acceleration agent before start of selective serotonin reuptake inhibitors (SSRIs). Such studies are of great importance because use of SSRIs alone have not completely eliminated the risk of future suicide attempt in admitted depressive patients²⁰, particularly the bipolar disorder patients²¹.

Conclusion

It has been observed from the present study that suicide attempting patients do not differ significantly in the levels of their FT₄, FT₃ and TSH when compared to those with suicidal ideation. Also, Serum FT₄ and TSH levels in suicidal and psychiatric patients were almost the same. However, serum FT₃ in suicidal patients was significantly lower than psychiatric patients as far as females are concerned. Female suicidal patients had lower FT₃ levels compared to male patients. It has also been noted that local suicidal patients have higher incidence of overt thyroid disorder as well as significantly lower FT₃ levels as compared to non-suicidal psychiatric patients.

Declaration of interest statement

The authors declare no conflict of interest in this article.

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