IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 5 Ver. II (May. 2016), PP 60-63
www.iosrjournals.org

Cholesterol Levels and Suicidal Behavior: A Case Control Study in A Tertiary Care Rural Health Centre in Central India

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Abstract:
Background: *In modern psychiatry, there is a movement to understand mental health, not solely based on behaviors and subjective report, but also based on objective markers of illness. Several studies have focused on a relationship between serum cholesterol levels and aggressive behaviors including suicide.*
Aim: *To identify a potential link between cholesterol and suicidal behavior.*
Material and methods: 150 patients with psychiatry diagnosis were divided into three equal groups (50 each): those who had a recent suicidal attempt, those who had suicidal ideations but no attempts and those with psychiatry diagnosis but no suicidal ideations and attempts. Blood sample for total cholesterol level was on IPD or OPD basis. The study was started after taking approval from institute ethical committee. Analysis was done using Chi square test.
Observations And Results: *It was found that maximum patients who attempted suicide belonged to major depression and schizophrenia followed by substance dependence and bipolar affective disorder (BPAD) with major depression and there was statistical difference in cholesterol levels of patients with suicide attempt, with suicidal ideations and control group. 42% and 44% of major depression and schizophrenia cases respectively had low total serum cholesterol levels (below 160 mg %).*
Conclusion: *There is a potential link between serum total cholesterol levels and suicidal behavior. Taking the literature as a whole there is substantial evidence that low cholesterol levels are found in suicidal behaviors of various psychiatric illnesses especially major depressive disorder, schizophrenia, substance dependence and bipolar depressive disorder.*
Keywords: *Suicide, depression, schizophrenia, cholesterol, alcohol use*

I. Introduction

In psychiatry a psychiatrist has the responsibility of assessing dangerousness. Many a times patients are hospitalized involuntarily, based on an evaluation of the patient's risk of attempting suicide, committing homicide. Demographic indicators identify various levels of risk but the prediction of dangerous behavior continues to generate a large number of false positive and negative results.

In modern psychiatry, there is a movement to understand mental health, not solely based on behaviors and subjective report, but also based on objective markers of illness. These markers can be in the form of functional imaging, genetic analysis and measurements of neurotransmitter levels. It is not surprising, therefore, that researchers are examining the correlation between behavioral manifestations of mental illness and objective laboratory values.

In particular, several studies have focused on a relationship between serum cholesterol levels and aggressive behaviors including suicide (7). Cholesterol is richly present in central nervous system of the brain and is important in mainly cellular structure and function. Cholesterol changes the fluidity of cell membranes, membrane permeability, exchange processes, and may influence serotonergic function (16). Cholesterol depletion may impair function of 5-HT1A and 5-HT7 receptors and serotonin receptor activity (6,16). Over time, lower cholesterol levels may further decrease the expression of serotonin receptors and cause a reduction in serotonergic activity. A correlation between low levels of 5-hydroxyindoleacetic acid in cerebrospinal fluid and cholesterol has been shown in suicide attempters (2). In our country there is paucity of studies regarding this matter. Considering the magnitude of problem, such studies can be of vital importance regarding diet and other behavioral modifications.With the growing evidence of a correlation between low cholesterol levels and increased rates of suicide, there is an attempt to identify a potential link between cholesterol & suicidal behavior.

II. Material And Methods

Sample selection: The study was conducted in the psychiatry outpatient and inpatient settings of AVBR Hospital. A total of 150 patients with a psychiatry diagnosis were included in the study. 50 were those who had a recent suicide attempt and have been admitted in the psychiatry ward. 50 were those who had suicidal ideations but no attempts in the past or present .50 patients were included as a control group with a psychiatry diagnosis without suicidal ideation or attempts.

The inclusion criteria were patients of either sex and those patients or accompanying relatives willing to give written informed consent for participation in study.The exclusion criteria were patients having co-morbid physical disorders Written informed consent was not given by patient or family members.

Study design: Crosssectional study.

Data collection: Over a period of one year (from February 2013 to January2014) patients attending psychiatry OPD or being admitted in psychiatry ward were interviewed. Patients were interviewed during the period of partial remission and complete remission. Blood sample for total cholesterol level was taken immediately after admission in psychiatry ward or on OPD basis. Normal levels of cholesterol: cholesterol levels increase with age and are slightly higher in males than females. Typical results at age 40-44 are 160-200mg% (4.1-5.2mmol/l).A Semi structured proforma was used to collect socio-demographic details of the patients. It includes Name, age, sex, marital status, details of informant, brief present and past illness, diagnosis and total serum cholesterol levels.

Ethical Considerations: The study was started after taking approval from Institute Ethics Committee for Research on Human Subjects. Throughout the study, ethical considerations were followed strictly. Confidentiality was ensured.

Statistical analysis: The data was collected and entries were done using SPSS version 17 software. Analysis was studied using Chi square test. Statistically significant p value of less than 0.05 was considered statistically significant.

III. Results

We took blood samples for serum total cholesterol levels of 150 patients with a psychiatric diagnosis, 50 were those who had attempted a recent suicide while another 50 were patients having suicidal ideations and remaining 50 were controls without suicide attempt or ideations.

Table 1: Socio demographic profile

Variables		**Cases**		**Control**	**p value**
		Patients with suicidal attempt	**Patients with suicidal ideations only**		
Age	< 35 years	20(40%)	11(22%)	16(32%)	0.40 NS, p>0.05
	35-60 years	25(50%)	31(62%)	28(56%)	
	> 60 years	5(10%)	8(16%)	6(12%)	
Sex	Male	27(54%)	26(52%)	27(54%)	0.97 NS, p>0.05
	Female	23(46%)	24(48%)	23(46%)	
Marital status	Single	8(16%)	6(12%)	6(12%)	0.36 NS, p>0.05
	Married	4(8%)	4(8%)	32(64%)	
	Widowed	10(20%)	13(26%)	4(8%)	
	Divorced	13(26%)	10(20%)	4(8%)	
	Separated	15(30%)	17(34%)	4(8%)	
	Others	0(0%)	0(0%)	0(0%)	

Table 1 shows the data of the brief socio demographic characteristics viz. Age, sex and marital status of cases and controls. Out of these there are no significant differences in the results.

Table 2: Clinical profile of the cases & controls

Variables		**Cases (n=100)**		**Controls (n=50)**	**p value**
		With suicide attempt n=50	**With suicidal ideations only n=50**		
Serum Total cholesterol levels	160-200mg%	25(50%)	32(64%)	47(94%)	0.001 **S**, p<0.05
	145-159mg%	10(20%)	16(32%)	0(0%)	
	< 145mg%	15(30%)	0(0%)	0(0%)	
	>200mg%	0(0%)	2(4%)	3(6%)	
Diagnosis	Major Depression	16(32%)	10(20%)	7(14%)	0.001 **S**, p<0.05
	Mild and moderate depression	-	3(6%)	8(16%)	
	Schizophrenia	15(30%)	9(18%)	8(16%)	

	Substance dependence	10(20%)	6(12%)	7(14%)	
	BPAD with mania	-	-	1(2%)	
	BPAD with major depression	9(18%)	7(14%)	4(8%)	
	Anxiety disorders	-	11(22%)	8(16%)	
	Others	-	4(8%)	7(14%)	

Table 2 shows the clinical profile of cases and controls viz. serum cholesterol levels and diagnosis. There are differences in cholesterol levels of patients with suicide attempt, with suicidal ideations and control group.

In the study maximum patients who attempted suicide belonged to major depression and schizophrenia followed by substance dependence and bipolar affective disorder (BPAD) with major depression. However maximum suicidal ideations were seen in anxiety disorder group, major depression, schizophrenia, BPAD with major depression and substance dependence. Few cases (Others) such as patients with somatoform disorder also reported suicidal ideations without any active plans.

Table 3: Association of various diagnosis and serum total cholesterol levels

Variables		**Serum total cholesterol levels (mg%) n=150**				**Total (as per diagnosis)**
		160-200	**145-159**	**<145**	**>200**	
Diagnosis	Major Depression	19 (57.57%)	10 (30.3%)	4 (12.13%)	-	33
	Mild and moderate depression	11 (100%)	-	-	-	11
	Schizophrenia	18 (56.25%)	9 (28.12%)	5 (15.62%)	-	32
	Substance dependence	13 (59.1%)	2 (9.1%)	3 (13.64%)	4 (18.18%)	22
	BPAD with mania	1 (100%)	-	-	-	1
	BPAD with depression	12 (60%)	5 (25%)	3 (15%)	-	20
	Anxiety disorders	19 (100%)	-	-	-	19
	Others	11 (100%)	-	-	-	11
Total(as per serum total cholesterol levels)		104(69.33%)	26(17.33%)	15(10%)	4(2.67%)	

This table illustrates that out of 33 cases of depression and 32 of schizophrenia 14 cases had serum total cholesterol levels below normal (160 mg% - 200 mg%). Almost similar percentage of cases of BPAD with major depression (40%) had low serum total cholesterol levels.

IV. Discussion

There are not many studies in this area. In this study we tried to find out a potential link between cholesterol levels and suicidal behavior (includes ideations and recent attempt) along with association of most common psychiatric diagnosis, cholesterol levels and suicidal behavior. 50 cases of each with recent suicidal attempt and with suicidal ideations only were taken and 50 patients of without suicidal ideations and attempt were taken as control. Serum total cholesterol levels were carried out on OPD or IPD basis. All the subjects enrolled in the study were fulfilling the different psychiatric diagnosis criteria.

In the study first an attempt was made to assess the demographic characteristics of the subjects under study. In cases 62% and 50% patients with suicidal ideations and attempts respectively belonged from an age group of 35-60 years. However when age criteria was less than 35 years, suicidal attempt cases predominates with 40% with respect to 22% and 32% of suicidal ideations and control group respectively. Few patients i.e. 10%, 16% and 12% belonged to more than 60 years age group of suicidal attempts, suicidal ideations and control group respectively. The three groups did not differ significantly with respect to age.

Males predominated in all groups. Overall suicide attempt are 3-5 times more common in females as compared to males. But the number of completed suicide is higher in males. There was no significant difference in gender distribution between the three groups.

In comparison of marital status predominant status was ‘separated’ for suicidal attempts and suicidal ideations only group with 30% and 34% of patients respectively belonging to this group. For suicidal attempt group the descending order of marital status for number of patients was ‘separated (30%)’, ‘divorced (26%)’, ‘widowed (20%)’, ‘single (8%)’ and least was ‘married (8%)’. Same order was there for suicidal ideations group with slight changes in widowed and divorced group. These findings are in synchronous with supposed risk factors of suicide (11).

When levels of serum total cholesterol were compared for these three groups it was found that 32% of patients with suicidal ideation had low serum total cholesterol levels i.e. 145mg%-159mg% and 50% of patients with suicidal attempts had cholesterol levels below 159mg%. Out of these 50% patients 30% had levels below 145mg% and remaining patients (20%) were between 145mg%-159mg%. In a study conducted by Sullivan et al

(17) in 90 patients with major depressive episode it was found that suicidal ideations or attempt was 5 times more likely in lowest serum cholesterol group (≤ 4.1mmol/l or ≤ 159mg%) than in the highest (≥ 6.2mmol/l or 240mg%). Another study conducted by Takei et al (18) in patients admitted following a suicidal attempt in psychiatry ward it was seen that parasuicide cases had significantly lower cholesterol levels than both psychiatric controls and normal controls. Modai et al (12) and Golier et al (9) conducted a study on consecutive psychiatric admissions and took a large sample (584 and 650 respectively) and found that low serum cholesterol levels in parasuicide cases and male patients with cholesterol levels at or below the lowest quartile were twice as likely to have made a serious suicide attempt as those with higher levels. A Polish study conducted by Ainiyet et al in 1996 (1) showed that low concentration level of total serum cholesterol is a risk factor for suicidal and aggressive behavior. Another study conducted by Diaz-Sastre et al (5) to test whether cholesterol levels in suicide attempters are lower than in controls without suicide attempt history matched by gender, age, and body mass index (BMI). Their sample size was 177 patients of suicide attempters. They reported that with similar findings that serum cholesterol levels were significantly lower in suicide attempters than in controls. In a recent study by Picot et al in 2011 (13) over 3207 subjects in which 510 patients had history of suicidal attempts, 275 patients with no history of suicidal attempts, and 2422 controls. This case-control study was undertaken to assess the association between serum cholesterol level and suicide attempts in both genders. Their results showed that after adjustment for age, cholesterol level was significantly lower ($p<0.01$) in suicide attempters than in non-attempters and controls for both genders. The results of the above mentioned studies are in congruence with our study. However one the study in 1995 (14) on 216 parasuicide patients and 286 healthy volunteers showed that parasuicide patients had higher mean cholesterol levels (220mg%) than controls (208mg%).

Cholesterol levels and psychiatric illnesses: In our study it was found that patients with major depression, schizophrenia, substance dependence and bipolar depressive disorder with suicidal ideations and suicide attempts have low cholesterol levels. Literature has also supported our findings (3,4,7,8,10,12).

The limitations of the study were small sample size, decreased appetite and weight loss is seen in depression which could have lead to decreased cholesterol levels and confounding factors including medical illness, medications taken by study subjects and dietary factors.

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