Int. J. Curr. Res. Med. Sci. (2020). 6(10): 37-42

International Journal of Current Research in Medical Sciences

ISSN: 2454-5716

P-ISJN: A4372-3064, E -ISJN: A4372-3061

www.ijcrims.com

Original Research Article

Volume 6, Issue 10 -2020

DOI: http://dx.doi.org/10.22192/ijcrms.2020.06.10.004

CT Changes in Chronic Alcoholism

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Abstract

Background: Chronic alcoholism causes brain damage. Our aim is to determine computed tomography (CT) changes in the brain of chronic alcoholics. **Methods:** This prospective cross-sectional study was done on chronic alcoholic patients referred from deaddiction center over a period of 2 years. Nonalcoholic controls with same age group were included and Student's t -test and chi-square test comparison was done. Correlation coefficient was obtained by Pearson's correlation coefficient. Patients and the controls were studied in two age groups: 30 to 45 and 46 to 60 years. CT scan of head was done in each case and CT indices of brain damage were measured. **Results:** The study included 110 alcoholics out of which 60 were in the age group of 30-45 years and 50 in the age group of 46-60 years. One hundred age-matched, nonalcoholic controls were taken. Mean values of alcohol were higher in the age group of 46-60 years than in the younger age group of 30-45 years. As compared with controls, various CT scan indices of ventricular changes, cortical changes, and subcortical changes were significantly higher in both age groups. There was a significant increase in the mean values of indices of brain damage with increase in the grade of alcoholism. **Conclusion:** The results of this prospective epidemiological study showed marked alterations in all CT indices of brain atrophy and were correlated to the duration and amount of alcohol consumption. This study highlights that chronic alcoholism is a significant risk factor for brain atrophy.

Keywords: Atrophy, Computed Tomography (CT) scan, brain, alcoholism,

Introduction

Chronic alcoholism is a pathologic condition due to excessive and habitual intake of alcohol. [1] Alcoholism can affect and damage the brain in several ways and this depends on various factors such as age, sex, history of intake, diet, and vulnerability of specific brain regions. [2] Multiple methods have been used to study the etiopathogenesis of alcohol-induced brain injury in different subgroups. Chronic alcoholism has major alcohol-related effects resulting in various degenerative changes in the brain including cerebral atrophy, dilatations of ventricles, and cerebellar atrophy. [3- 4]

There have been several reports of brain damage in chronic alcoholics based on analysis of computerized tomographic (CT) images of the brain. The data suggest an association between chronic alcohol use and loss of brain tissue and are consistent with long-standing observations of deficits in performance of certain cognitive tasks among alcoholics. However, there is a surprising lack of evidence demonstrating a clear association between actual alcohol consumption and CT assessment of brain atrophy on the one hand or neuropsychological impairment on the other. [5-6]

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reason for this situation is the complex and multifactorial nature of the relationship between chronic alcohol consumption and observed changes in brain structure or function.[7] Among the many brain alterations promoted by chronic Alcohol consumption, brain shrinkage due to cortical atrophyis the most striking one. It is related to alcoholic dementia and to atrophy of the corpus callosum [8], and although clearly dependent on age [9], brain shrinkage is more intense among heavy drinkers. [10] Its pathogenesis is obscure, and probably, multifactorial [11], but it is at least partially reversible with alcohol abstinence [12].

CT studies of the alcoholic brain have been quite consistent in reporting cerebral atrophy. While early applications of CT to study the alcoholic brain were retrospective, and used “normal” CT scans drawn from hospital files as controls,[13] more recently there have been several prospective studies in which alcoholics have been compared with community controls.[14-15] While some studies may report higher incidences of atrophy than others, or note greater change at sulci than ventricles, [16] the general direction of the data is quite consistent and corroborates autopsy data on reduced brain weight[17] and increased pericerebral space in alcoholics[18]. On the basis of these facts, in the present study we investigate computerized tomography (CT) assessed brain alterations in alcoholics.

Materials and Methods

This hospital-based cross-sectional prospective study was conducted in our tertiary care center consisting of rural population. The study was conducted on 110 subjects. Most of the subjects were referred from the deaddiction clinic. Chronic alcoholic subjects in the age group of 30 to 60 years were included in the study. Exclusion criteria for the study were diagnosed cases of systemic medical illness such as hypertension or diabetes mellitus, history of any other drug abuse, history of head injury, intellectually disabled patients, and patients of cerebrovascular, infective, degenerative disease, and tumors of brain.

For comparison, 100 nonalcoholic of same age group were included as controls. Controls were nonalcoholic patients presenting with headache or dizziness, with no history of systemic illness, drug intake, and trauma and had normal CT scan. Controls were used to compare changes with brain of alcoholics over and above the normal age related changes. The patients and controls were grouped into two age groups: 30 to 45 and 46 to 60 years. After taking an informed written consent in each case, history of duration of alcohol, amount, type of alcohol intake, and symptoms were recorded in a proforma. CT of the patient was performed. Non enhanced head CT scan was done in each case, from base of head to vertex in supine position, arms by side of the body. CT scan was used to assess the ventricular size, cerebral and cerebellar changes, and signs of atrophy using different indices including bicaudate index, ventricular index, and Evan’s index, and maximum transverse diameter of third ventricle. Some of the terms used are described as:

Bicaudate index: Minimum width of the lateral ventricles in relation to the inner skull at the same level.

Evan’s index: Maximum width of the anterior horns of the lateral ventricles in relation to maximum width of inner skull diameter.

Ventricular index: Minimum width of lateral ventricle in relation to maximum width of anterior horns of lateral ventricle.

Cortical atrophy: Sum of the width of the four widest sulci at the two highest scanning levels/maximum inner skull diameters.

Statistical Analysis

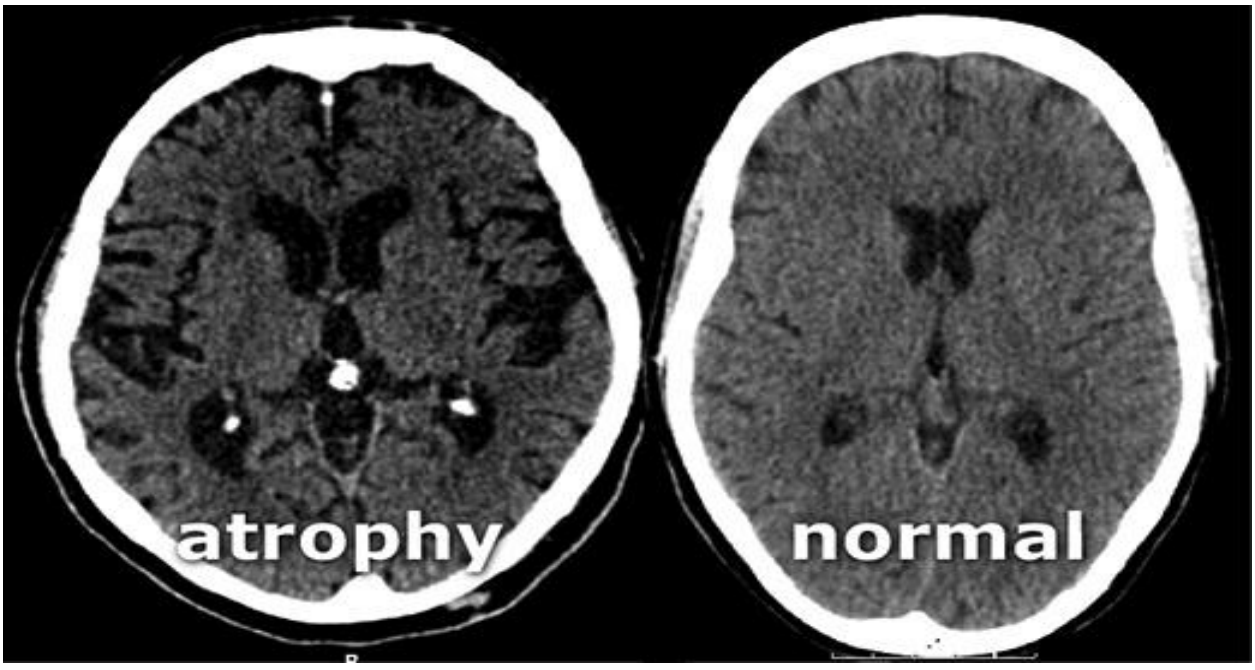
Results were expressed as mean ± standard deviation for continuous variables and percentages for categorical data. Various indices values were calculated for alcoholics in age group of 30 to 45 and 46 to 60 years separately and these were compared with age-matched controls using Student’s t -test and chi-square test. Correlation coefficient was obtained by Pearson’s correlation coefficient. The p -value of < 0.05 was considered as significant.

Results

Table 1: Patient characteristics

Variable	30–45 years N (%)	46–60 years N (%)
Group of cases		
Patients	60 (54.5)	50(45.5)
Controls	50 (50)	50 (50)
Symptomatology		
CNS	40 (66.6)	30 (60.0)
GIT	20 (33.3)	20 (40.0)
Grade of alcoholics		
Mild	35 (58.3)	12 (24.0)
Moderate	17 (28.3)	20(40.0)
Heavy	08 (13.3)	18 (36.0)
Amount of alcohol (g)		
50–75	35 (58.3)	27 (54.0)
76–100	12 (20.0)	10 (20.0)
101–150	08 (13.3)	08 (16.0)
>150	05(8.3)	05 (10.0)
Duration of alcohol (y)		
2–5	39 (65.0)	12 (24.0)
6–10	14 (23.3)	12 (24.0)
11–15	03 (5.0)	18 (36.0)
16–20	03 (5.0)	07 (14.0)
>20	01 (1.6)	01 (2.0)
Haemoglobin(g)		
8–10	5 (8.3)	9 (18.0)
10–12	29 (48.3)	28(56.0)
12–14	26 (43.3)	13 (26.0)

Figure 1: showing CT images differentiating normal from atrophic brain in alcoholism



Discussion

CT scan is a widely available, reliable, and economical imaging technique that can detect gross neuropathological changes in the brain such as cortical atrophy, ventricular enlargement, and other intracranial changes. [19-20] CT head scan in alcoholics in our study showed marked changes in all the CT indices of cortical, ventricular, and subcortical changes.

These indices were significantly altered when compared with controls of same age group and were related to the years of alcohol consumption and the daily amount of alcohol consumed.

The values obtained for the CT variables of our control population are in agreement with those reported for normal individuals.[21-23]From our data, it is clear that alcoholics show highly significantly different CT values than the controls. This result is in agreement with others reported in the medical literature. Nutritional status in the form of hemoglobin is suggested by our data, but a more detailed account of this variable is needed.

As also reported by other authors, [24-25] we observed diffuse and fairly symmetrical cerebral cortical atrophy, dilated lateral and third ventricles, and shrinkage of the cerebellar hemisphere and vermis. As reported by Whitehead et al, [26] we also observed a significant reduction in hemoglobin levels with increase in grades of alcoholics in both age groups.

The pathophysiology of alcohol effects on the brain has been studied and numerous hypotheses proposed. Alcohol and its metabolite directly cause neurotoxic effect resulting in demyelination and degeneration of the nervous tissue [27] and indirectly by decreasing the blood flow to certain areas of cerebrum and cerebellum due to reduced flow rates in vessels, stasis, and aggregation of blood cells. The above effects are proportional to the amount of alcohol in blood. [28]

Pathological and neuroimaging studies show that chronic alcoholism leads to diffuse white matter volume loss with relative sparing of the gray matter. [29]

Conclusion

We conclude from our epidemiological study that chronic alcoholism is a risk factor for brain atrophy. There is more or less symmetrical shrinkage of the cortex of the cerebral hemispheres with dilation of the lateral and third ventricles. Alcoholics had a greater degree of central and frontal brain atrophy as compared with controls.

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How to cite this article:
Anju Yadav, Bir Singh Yadav, Vishal Goyal. (2020). CT Changes in Chronic Alcoholism. Int. J. Curr. Res. Med. Sci. 6(10): 37-42.
DOI: http://dx.doi.org/10.22192/ijcrms.2020.06.10.004