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RESEARCH ARTICLE

Impact on the hematopoietic system by alcoholism and the influence of duration of consumption

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ABSTRACT

Background: The abuse of alcohol brings with it untold misery in the form of health-related problems as well as social issues. Chronic misuse of alcohol affects literally every aspect of bodily functions and organ systems functioning. **Aims and Objectives:** This study's aim was to observe the effect of alcoholism on select blood parameters. **Materials and Methods:** A total of 50 subjects who met the criteria for alcoholism and other prescribed inclusion criteria, and 50 age- and sex-matched controls formed the study population. Random blood samples obtained from patients as well as controls were used to estimate complete blood count (hemoglobin [Hb], red blood corpuscle (RBC) count, total leukocyte count (TLC), packed cell volume (PCV), mean corpuscular volume (MCV), and platelet count). Duration of alcohol consumption was also noted. Correlational analysis and *t*-test were the statistical tests adopted. **Results:** There were significantly reduced values for Hb, RBC count, PCV, and platelet count in alcoholics, and a significant increase in MCV in the same group compared to controls. TLC numbers were similar in both groups, and except for PCV, no other parameters showed any significant correlation with the duration of alcohol consumption. **Conclusion:** Excessive alcohol consumption affects the erythrocytes and thrombocytes while showing no effect on the leukocytes. In general, duration of alcohol consumption does not seem to influence the severity of these changes.

KEY WORDS: Alcoholism; Hemoglobin; Leukocytes; Mean Corpuscular Volume; Platelets

INTRODUCTION

Alcohol consumption in various forms has been associated with the evolution of humans (from frugivorous primates to modern humans through the hominids).[1] In fact, it is considered as the most frequently used drug worldwide.[2]

According to the World Health Organization, alcohol is responsible for about 6% of deaths worldwide. In the United States, about 88,000 (majority males) deaths are directly attributable to alcohol consumption, this apart an additional number of deaths due to violence and accidents due to alcohol use are also prevalent, all these leading to an ever-increasing economic burden (as much as 249 billion US dollars per year).[3]

Closer at home, there has been a very large increase in per capita alcohol consumption over a period of two decades starting from 1970 to 1972 onwards, and as of 2005, the estimated users being around 62.5 million, with about 17% of them being dependent on alcohol and thereby contributing to 20–30% of hospital admissions. Among the various states, the prevalence was least in the state of Gujarat (about 7%), while the highest was recorded in Arunachal Pradesh (75.0%).

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In Southern India, the prevalence of current alcohol use over the years was between 33% and 50%.[4] The concept of alcoholism was proposed in the year 1960, and despite its social and economic costs, very little attention has been shown towards it.[5] The culmination of this abuse can reduce the lifespan of an individual by about a decade irrespective of gender, cultural variations, or socioeconomic stratifications.[6]

Alcohol has been directly implicated in about 30 pathological conditions and has a contributory role in many other conditions. These range from infectious diseases, cancer, diabetes, neuropsychiatric diseases (including alcohol use disorders), cardiovascular disease, liver and pancreatic disease, and unintentional/intentional injury.[7] The purpose of the present study was to identify the effects of alcoholism on the various blood parameters and also to observe if these changes (if any) are affected by the duration of alcohol consumption.

MATERIALS AND METHODS

The present study's target population (i.e., those with alcoholic liver disease [ALD]) was sourced from those admitted in the institute's department of medicine and meeting the proposed inclusion criteria in all aspects. Fifty subjects were thus recruited and an equal number of controls were obtained from the institute's teaching and non-teaching staff. The study had the ethical clearance obtained from the institute's ethical clearance committee.

All the participants in this study had given their written informed consent for their participation. The inclusion criteria that were adopted are – male subjects who consumed more than 80 g of alcohol per day and aged between 30 and 60 years. The criteria that lead to exclusion were – females, those with a history of other forms of liver injury/diseases, history of hepatobiliary surgery and/or interventions, history of psychiatric illness, history of any malignancies (primary/metastatic), and the use of hepatotoxic drugs.

The selection of subjects was based on random sampling technique. Diagnosis of ALD was based on the following aspects – thorough history including alcohol consumption history, detailed physical examination, and searching for signs and symptoms of chronic liver disease such as fatigue, anorexia, nausea, vomiting, upper abdominal discomfort or pain, tender hepatomegaly, jaundice, abdominal distension due to ascites, pedal edema, hematemesis, melena, bruises, purpura, epistaxis, splenomegaly, digital clubbing, hair loss, gynecomastia and spider nevi, liver chemistry profile (including serum albumin, serum bilirubin, and serum transaminases), and prothrombin time.

The following aspects regarding alcohol consumption were collected – what type of drinks, how much they consume per day, and since how long, it is then converted to grams of alcohol per day, assuming that one standard drink of each drink type contains 10 g of alcohol. A thorough clinical examination was also done. Anthropometric measurements such as height and weight were measured by standard methods and body mass index was calculated using Quetelet's index. Random blood samples were collected from patients admitted with ALD to estimate complete blood count (hemoglobin [Hb], red blood corpuscle [RBC] count, total leukocyte count [TLC], packed cell volume [PCV], mean corpuscular volume [MCV], and platelet count).

Same tests were also done on the controls. The whole blood was processed in LabLifeD5 Supreme, 5-part differential instrument, manufactured by MinDray in China. Independent *t*-test was used for comparing the blood parameters between cases and controls, whereas Pearson's correlation analysis was performed to assess relationship between duration of alcohol consumption and blood parameters. The statistical tests were done using SPSS for Windows, version 17. Statistical significance was taken if $P < 0.05$.

RESULTS

The age-wise distribution of the cases and controls in this study was as follows: Of the 50 cases, 18 (36%), 14 (28%), and 18 (36%) subjects, and among the controls, 33 (66%), 13 (26%), and 4 (8%) persons belonged to the age groups of 30–40, 41–50, and 51–60 years, respectively. The average age of the cases was 45.68 ± 9.923 years and that of the controls was 38.76 ± 7.561 years. Among the cases of ALD, examination of the duration of alcohol consumption revealed the following distribution: 20 (40%), 23 (46%), and 7 (14%) cases consumed alcohol for 1–15 years, 16–30 years, and 31–45 years, respectively.

The occurrence of abnormal values for blood parameters among the cases was as follows: 29 cases (58%) had Hb <14g/dl, 29 cases (58%) had RBC count <4.5 million cells/mm^3, 5 cases (10%) had TLC count <4000 cells/mm^3, 12 cases (24%) had platelet count <1.5 lakhs/mm^3, 15 cases (30%) had PCV <40%, and 14 cases (28%) had MCV more than 98 fl. The different blood parameters (mean and standard deviation) in the subjects and controls are depicted in Table 1, along with the results of the unpaired *t*-test.

The impact of the duration of alcohol consumption on the blood parameters is showcased in Table 2, as demonstrated by the correlational analysis using Pearson's correlation coefficient.

DISCUSSION

In the present study, RBC parameters – Hb, RBC count, as well as PCV were significantly lower in cases compared

Table 1: Blood parameters among ALD cases and controls

Parameter	Cases (*n*-50) mean±SD	Controls (*n*-50) mean±SD	*t*-value
Hb (g%)	13.34±2.20	15.24±0.76	5.763**
RBC count (millions/mm^3)	4.26±0.67	5.08±0.44	7.191**
MCV (fl)	95.46±6.05	90.19±3.75	5.233**
PCV (%)	40.30±5.02	43.32±1.99	3.947**
Platelet count (lakhs/mm^3)	2.14±0.96	3.32±0.79	6.718**
TLC (per mm^3)	7830.00±3235.60	7490.80±1901.44	0.639*

**P<0.001, *P>0.05, ALD: Alcoholic liver disease, Hb: Hemoglobin, RBC: Red blood corpuscle, MCV: Mean corpuscular volume, PCV: Packed cell volume, TLC: Total leukocyte count, SD: Standard deviation

Table 2: Correlation between blood parameters and duration of alcohol consumption

Parameter	R	*t*-value	*P*-value
Hb (g%)	−0.183	−1.290	0.204*
RBC count	−0.194	−1.370	0.177*
MCV	0.007	0.048	0.960*
PCV	−0.339	−2.496	0.016**
Platelet count	−0.009	−0.062	0.952*
TLC	0.271	1.951	0.057*

*P>0.05 (Not significant), **P<0.05 (Significant), Hb: Hemoglobin, RBC: Red blood corpuscle, MCV: Mean corpuscular volume, PCV: Packed cell volume, TLC: Total leukocyte count

to the controls. While no significant correlation was found between duration of alcohol consumption and changes in Hb or RBC count, in case of PCV, there was a significant negative correlation. Anemia in alcoholics has been attributed to several causes such as dietary deficiency of folic acid or antifolate action (though a weak one) of ethanol itself or a direct toxic effect of alcohol on the erythrocyte precursors.[8] A similar negative correlation of PCV to the duration of alcohol consumption has been demonstrated in a study done in Tirana (Albania).[9]

Our study subjects (i.e., alcoholics) demonstrated significantly higher MCV values in comparison to non-alcoholics (though still within the normal range). Elevated MCV is considered as characteristic of excessive alcohol consumption and may be seen even without frank anemia. Its levels increase after 6 weeks of alcohol misuse and could remain so for up to 3 months after abstinence.[10]

The TLC in this study was within the normal range both in controls and alcoholic subjects and was also similar (not significant) and neither was there any significant correlation to the duration of alcohol consumption. Leukocytosis has been observed only when there is alcoholic hepatitis and it also correlates with the severity of the injury sustained by the liver.[11]

The platelet count in the alcoholics in our study was significantly lower than in the non-alcoholics. Thrombocytopenia in alcoholics is not severe enough to warrant intervention, and the probable mechanism may be either due to shortened lifespan of the thrombocytes or hindrance in the developmental process (thrombopoiesis), and the results of platelet variations are also not consistent (there are interindividual variations).[12] The limitations of the present study are – smaller sample size and non-adoption of additional tests such as bone marrow biopsy, which would have thrown more light on the developmental aspects of various blood elements.

CONCLUSION

The consequences of long-term abuse of alcohol affect erythrocyte development as exemplified by reduction in Hb, RBC count, and PCV, as well as increased MCV, and also a reduction in the platelet counts.

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