

A study of AST: ALT ratio in alcoholic and nonalcoholic liver diseases

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Abstract: High alcohol consumption is one of the most common causes of liver disease. Several markers have been studied for alcohol consumption such as carbohydrate deficient transferrin (CDT), gamma glutamyl transferase, alanine aminotransferase (ALT), aspartate aminotransferase (AST). An elevated serum AST in relation to serum ALT (alanine transaminase) has been proposed as an indicator that alcohol has induced organ damage. Thus when AST:ALT ratio is greater than 2, this is considered as highly suggestive that alcohol is the cause of the patient's liver injury. The aim of this study was to assess the clinical utility of AST:ALT ratio in alcoholic and nonalcoholic liver disease. This study involved 148 subjects, out of which 74 were diagnosed cases of alcoholic liver disease (ALD) and remaining 74 were age and sex matched diagnosed cases of nonalcoholic liver disease (NALD). Blood samples were collected and plasma AST and ALT activity were determined in both groups (ALD & NALD) by colorimetric method using standard curve. Then the ratio of AST:ALT was calculated and compared in both groups. The plasma activity of AST and ALT was high in both alcoholic and nonalcoholic liver disease patients. Plasma AST, ALT activity and their ratio (AST:ALT ratio) were found to be significantly different in both groups ($p < 0.05$). AST:ALT ratio less than 2 was found in 95.94% and 29.72% of non-alcoholic liver disease and alcoholic liver disease respectively. The ratio was more than 2 in 4.05% of nonalcoholic liver disease and 70.27% of alcoholic liver disease cases. The ratio of AST:ALT was significantly increased in alcoholic liver disease as compared to nonalcoholic liver disease. Hence, the ratio of AST:ALT can be used as a parameter for the diagnosis of alcoholic liver disease and for the differentiation of alcoholic liver disease from nonalcoholic liver disease.

Keywords: AST, ALT, AST:ALT ratio, Alcohol, Alcoholic liver disease, Nonalcoholic liver disease.

INTRODUCTION

Alcohol misuse is associated with poor health, disease and societal dysfunction[1,2]. There is an obvious relationship between chronic alcohol consumption and prevalence of alcoholic liver disease[3,4]. High alcohol consumption is one of the most common causes of liver disease. It includes alcoholic fatty liver disease, alcoholic hepatitis and alcoholic cirrhosis. Alcoholic liver disease represents a spectrum of clinical illness and morphological changes that range from fatty liver to hepatic inflammation and necrosis to progressive fibrosis[5].

Several markers have been studied for alcohol consumption such as carbohydrate deficient transferrin (CDT), gamma glutamyl transferase, alanine transaminase (ALT), aspartate aminotransferase (AST). An elevated serum AST in relation to serum ALT (alanine transaminase) activity has been proposed as an indicator that alcohol has induced organ damage[6].

This study aims to detect the presence of alcohol induced liver damage by using simple, economical and reliable tests. The estimation of serum AST, ALT activity doesn't require specialized technology, therefore they can be estimated in clinical laboratories which do not have automated system. This is in favor of the patients who get their diseases diagnosed in low cost. The present study was planned to assess the effectiveness of serum AST, ALT activity and their ratio (AST:ALT ratio) which could be employed for the welfare of mankind.

Previous studies have shown that AST:ALT ratio is greater than two in several cases of alcoholic liver disease as compared to nonalcoholic liver diseases[7]. More recent papers quote the AST:ALT ratio over 2 as being strongly suggestive of alcohol induced liver damage[8,9]. The AST:ALT ratio is more sensitive at any phase of the disease. The

determination of serum AST, ALT activity are commonly requested as a part of ‘Liver Function Test’, but rather than assessing the functions of liver, the release of AST & ALT from liver cells to bloodstream represents the damage or death of hepatocytes. With the hepatic AST:ALT ratio of 2.5:1, we might expect that hepatocyte turnover should always result in a much higher amount of AST in plasma compared to ALT. However, because AST is removed from plasma by the liver sinusoids[10] twice as quickly compared to ALT, the resulting plasma levels of AST and ALT are fairly similar in healthy individuals. Furthermore, in healthy individuals, circulating AST in plasma constitutes mainly cytosolic AST (cAST) but not mitochondrial AST. When hepatocellular damage occurs, the plasma levels of AST compared to ALT will tend to reflect the cellular proportions where AST is over twice as prevalent than ALT [11].

EXPERIMENTAL SECTION

The present study involved 148 subjects, out of which 74 were diagnosed cases of alcoholic liver disease and the rest 74 were diagnosed cases of nonalcoholic liver disease. The subjects of alcoholic liver disease and nonalcoholic liver disease having skeletal muscle injury, cardiac muscle injury, kidney disease were excluded from the study. The study was carried out in Medico home polyclinic situated in Kathmandu, Nepal from January 2011 to March 2016 and the laboratory tests were done in the clinical laboratory of the same polyclinic. Informed consent was taken from both alcoholic and nonalcoholic liver disease patients. The subjects with alcoholic and nonalcoholic liver diseases voluntarily participated in the study. About 5 ml venous blood was collected in a clean and dry test tube applying all aseptic techniques and serum was separated from collected blood. Serum AST and ALT activity were determined by colorimetric procedure using standard curve method and then the ratio of AST:ALT (De Ritis ratio) was calculated in both alcoholic and nonalcoholic liver disease patients. Statistical analysis was done by using SPSS.

RESULTS

The total number of patients selected for the study was 148, out of them 74 patients were the diagnosed cases of alcoholic liver diseases and remaining 74 patients were diagnosed cases of liver diseases which was not due to alcohol consumption (Nonalcoholic liver disease). As shown in table1, the mean age of patients in year was 49.26±11.332 and 46.49±12.586 in alcoholic liver disease (ALD) and nonalcoholic liver disease (NALD) patients respectively. The mean AST activity in ALD & NALD was 201.43±71.024 IU/L & 190.04±86.552 IU/L respectively and the mean ALT activity was 104.95±24.690 IU/L & 205.32±79.090 IU/L in ALD & NALD respectively. The value of AST activity was greater than ALT in ALD but such relation was not found in NALD patients..

Table-1: Showing mean values of AST, ALT & AST: ALT ratio in ALD & NALD

Group	No. of subjects studied	Age (year)(mean±SD)	Mean AST (IU/L)(mean±SD)	Mean ALT (IU/L) (mean±SD)	AST:ALT ratio (mean±SD)
Alcoholic liver disease	74	49.26±11.332	201.43±71.024	104.95±24.690	1.9061±0.44236
Non-alcoholic liver disease	74	46.49±12.586	190.04±86.552	205.32±79.090	0.9222±0.26529
p-value		<0.05	<0.05	<0.05	<0.05

As shown in Table 2, 70.27% (52) of ALD and 4.05% (3) of NALD patients showed AST:ALT ratio more than 2. This indicated the usefulness of AST:ALT ratio determination in alcoholic liver diseases.

Table 2 showing the frequency of cases with AST:ALT ratio more or less than 2

Group	Total number of Nonalcoholic liver disease	% of nonalcoholic liver disease	Total number of alcoholic liver disease	% of alcoholic liver disease
AST:ALT ratio less than 2	71	95.94	22	29.72
AST:ALT ratio greater than 2	3	4.05	52	70.27

Table 3: Showing the number of ALD and NALD in different intervals of AST, ALT activity

Group	Intervals of AST & ALT activity	Alcoholic liver disease(ALD)		Nonalcoholic liver disease(NALD)	
		Number of cases	%	Number of cases	%
AST	0-300	72	97.29	67	90.54
	> 300	2	2.70	7	9.45
ALT	0- 300	70	94.59	65	87.83
	> 300	4	5.40	9	12.16

DISCUSSION

Alcohol consumption is the most common cause of liver disease in community. For most people, the risk dose is about 80 gm alcohol (200 ml whiskey or equivalent) per day [12]. The diagnosis of alcoholic liver disease is based on clinical and biochemical evidence of liver damage in the setting of chronic alcohol ingestion history. A large number of biochemical markers have been proposed for the detection of excessive alcohol consumption and associated liver disease[13,14]. Among the several biochemical alteration seen in alcoholic liver disease, the AST:ALT ratio has been found to be more reliable marker for the diagnosis[15,16].

In our study, there was marked increase in the activity of AST & ALT in both alcoholic and nonalcoholic liver disease. The activity of AST & ALT rarely exceeded 300 IU/L in alcoholic liver disease. This is because alcohol depletes vitamin B6 dependent PLP (pyridoxal phosphate) which acts as coenzyme for aminotransferases (AST, ALT). In nonalcoholic liver disease patients, the activity of AST & ALT exceeded 300 IU/L in some patients. The elevation of ALT was not as high as AST in alcoholic liver disease making De Ritis ratio (AST:ALT ratio) greater than two in 52 (70.27%) patients. This is in agreement with Nyblom H et al who found 69% of patients with alcoholic liver cirrhosis had AST:ALT ratio greater than or equal to two[17]. The high AST activity is due to increased cell membrane permeability, cellular necrosis and leakage of mitochondrial AST (mtAST) into plasma[18]. In nonalcoholic liver disease, plasma ALT activity is typically greater than AST. This has been attributed to the release of only the cytoplasmic isoenzyme of AST into the circulation from damaged hepatocytes and also due to longer half life of ALT compared to AST, making the ratio less than 2 in 71 (95.94%) patients which is consistent with the results of De Ritis et al. (1965) and Hasan et al. (2013)[19,20].

In the present study, AST:ALT ratio in alcoholic liver disease (ALD) is 1.9061 ± 0.44236 and in nonalcoholic liver disease (NALD) is 0.9222 ± 0.26529 which shows significant rise in ratio in ALD in comparison to NALD. This is in agreement with Pujar et al who found high AST:ALT ratio in ALD in comparison to control[18]. Gurung et al.(2013) studied upon the correlation of AST:ALT ratio and

severity of ALD and suggested that AST:ALT ratio is also an indicator of severity of alcohol induced liver damage[21].

CONCLUSION

The determination of AST:ALT ratio can be used as a marker in differentiating alcoholic and nonalcoholic liver diseases. The ratio is greater than two in several cases of ALD and is less than two in the most of the cases of NALD. Therefore, the activity of AST, ALT along with AST:ALT ratio can be useful biochemical parameters for the diagnosis of liver diseases which is economic for the people of underdeveloped region where they can not afford the cost of liver function tests and Ultrasonography(USG). However, further studies with adequate sample size and comparison with other parameters are necessary to finally accept the concept as diagnostic marker.

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