Original Research Article

Correlation of serum ammonia with grades of hepatic encephalopathy

Rajpreet Brar*, P. K. Gupta, S. K. Virmani, Gautam Sarkar

Department of Medicine, Subharti Medical College, Meerut, Uttar Pradesh, India

*Correspondence:
Dr. Rajpreet Brar,
E-mail: rajpreetsingh811@gmail.com

ABSTRACT

Background: Affected patients exhibit alterations in psychomotor, intellectual, cognitive, emotional, behavioural and fine motor functions. Hepatic encephalopathy occurs as a complication of advance liver disease, either chronic or acute.

Methods: 58 patients of hepatic encephalopathy was enrolled in our study which was done in Chhatrapati Shivagi Subharti hospital for the duration of 2 years to look for the correlation of grades of hepatic encephalopathy with serum ammonia levels.

Results: In this study, the correlation of serum ammonia was significant with the grade of encephalopathy hence, the serum ammonia correlated well with the grade of encephalopathy for the patients during their hospital stay, suggesting that the serum ammonia level was an indicator of the clinical outcome of the patients during their hospital stay.

Conclusions: In this study, we found that there is a strong correlation between serum ammonia level and severity of liver disease. Higher serum ammonia was found in severe liver disease. We found that High grade i.e. grade III and IV patients were having significantly raised ammonia level.

Keywords: CLD, HE, MHE, OHE, Serum ammonia level

INTRODUCTION

Hepatic encephalopathy (HE) is a serious neuropsychiatric complication of both acute and chronic liver disease.[1] This disease encompasses a broad range of neuro psychiatric abnormalities of varying severity. Affected patients exhibit alterations in psychomotor, intellectual, cognitive, emotional, behavioural and fine motor functions.

Hepatic encephalopathy occurs as a complication of advance liver disease, either chronic or acute.[2] It is difficult to accurately assess the disease burden of chronic liver disease (CLD) since liver disease frequently has an insidious onset and a long latency period. Most patients, therefore, do not seek medical attention until late in the clinical course of the disease when complications develop. The prevalence of CLD in the United States is approximately between 7 and 11 million cases.[3] Approximately, 150000 individuals are newly diagnosed with CLD each year by gastroenterologists, and of these, approximately 30000 (20%) present with cirrhosis.[4]

METHODS

Inclusion criteria

All patients with a diagnosis of chronic liver disease, with clinical evidence of hepatic encephalopathy.

Exclusion criteria

Patients less than 18 years of age.

Patients with other causes of encephalopathy such as:

- Uremia
- Hypertensive encephalopathy
- Carbon dioxide narcosis
- Hypoglycemic encephalopathy
- Hypoxic ischemic encephalopathy.

Investigations

- Liver functions tests
- Ultrasonography abdomen
- Coagulation profile
- Venous blood ammonia
- Serology for HBV, HCV
- Complete hemogram
- Renal function test
- Random blood sugar
- Serum Electrolytes.

Statistical analysis

The data was compiled by SAS-6.50 version. Regression analysis was employed to find the significance of the relationship between encephalopathy grades and various clinical parameters of encephalopathy patients. Independent variable X and dependent variable (predictor) are taken in to consideration; regression line was made fit to least square analysis method. The following formula was used for regression for regression analysis.

$Y = a + bX$
x = Mean of independent variable
y = Mean of dependent variable
A = Intercept
B= Slope of regression line

The association relation between encephalopathy and clinical parameters were analysed by 2X2 Contingency Chi square analysis.

Table 1: Regression analysis.

|		Before treatment		Total
		Yes	No	
After treatment	Yes	A	B	A+B
	No	C	D	C+D
	Total	**A+C**	**B+D**	**N = 9 (A+B)+ (C+D)+(A+C)+ (B+D)**

Expected cell = Row total X column total/N
Chi Square = (Observed - expected)^2 / expected value
Degrees of freedom = (C - 1)*(R - 1)

RESULTS

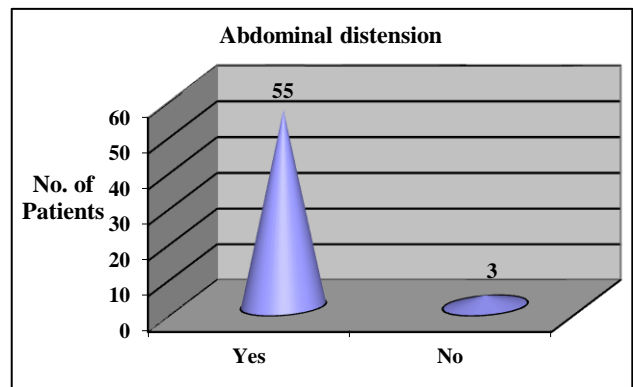Our study was done on 58 patients, in this group 38% of the patients were in the 48-58 age group, 28% in the 37-47 age group, 22% in 59-63 and 12%in 26-36age group.
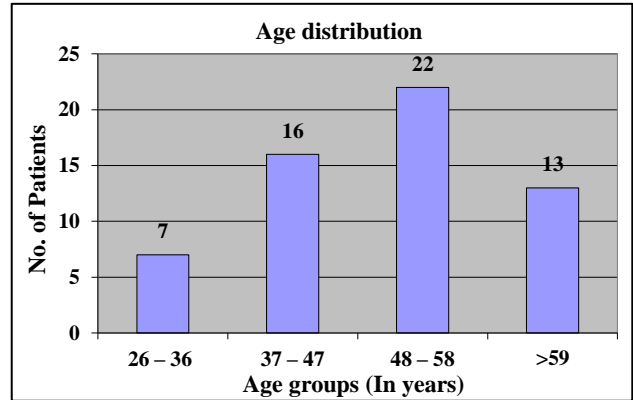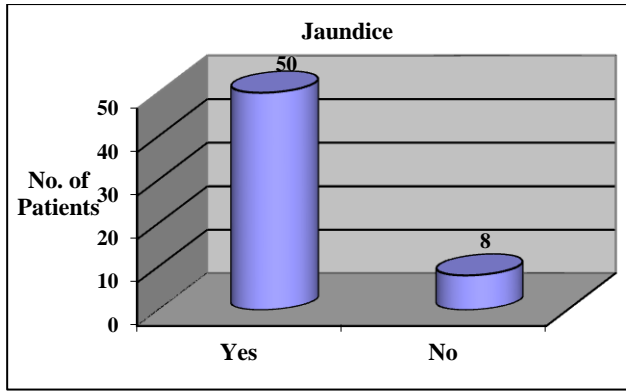

Figure 1: Age distribution.
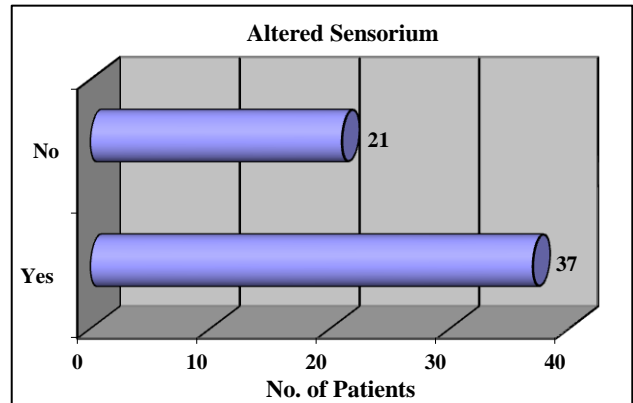
Figure 2: Out of 58 no of patients 37 (63.79%) patients presented in altered state of sensorium and 21 (36.21%) patient without altered sensorium.

Figure 3: Abdominal distension was present in 55 (96.55%) patients and 3 (3.44%) did not have distended abdomen.

Figure 4: Total of 50 (86.21) patients had presented with jaundice and 8 (13.79%) patients without jaundice.

In the present study, 58 patients were studied in C. S. S. hospital over a period of one year in which 8 patient had grade 1 (13.79%), 14 (24.14%) patients in grade 2, 2 patients in grade 3 (3.45%) and 34 (58.62%) in grade 4 encephalopathy.

Table 2: Grades of Ammonia- as per graded of HE.

Serum ammonia level	Grades of HE			
	G1	G2	G3	G4
23-43	6	4	0	0
44-64	1	4	1	0
65-85	0	5	1	3
86-106	1	1	0	14
107-127	0	0	0	7
128-148	0	0	0	10

Table 3: Grades of encephalopathy of patients of study group.

Grades	No. of Patients	%age
Grade I	8	13.79%
Grade II	14	24.14%
Grade III	2	3.45%
Grade IV	34	58.62%

DISCUSSION

This study was done on patients of Hepatic Encephalopathy, admitted to C. S. S. hospital, Subharti medical college, Meerut. Total duration of study was 2 years and total of 58 patients of hepatic encephalopathy were taken in the study.

Along with the routine investigations, the clinical grade of encephalopathy and the serum ammonia level was recorded. An estimation of the serum ammonia level and the grades of encephalopathy (West Haven) were recorded in the hospital. The correlation of the grades of encephalopathy and the serum ammonia in the patient population was studied using the chi square and the ANOVA test.

Several studies have shown a correlation of serum ammonia with complications related to liver failure such as cerebral hermination, hepatic encephalopathy, and prevalence of portosystemic collaterals.

A study done by Ong JP, Aggarwal A et al done on 121 patients of hepatic encephalopathy in which 27 patients were in grade 1, 23 were in grade 2, 28 were in grade 3 and 13 in grade 4 encephalopathy (West Haven), concluded that ammonia levels correlate with the severity of hepatic encephalopathy, and that venous sampling is adequate for ammonia measurement.[5]

A study done by Clemmenson JO et al on 22 patients of liver failure retrospectively and 22 patients prospectively concluded that vast amounts of ammonia escape hepatic metabolism in liver failure leading to high ammonia concentrations in blood, which in turn is associated with increased cerebral ammonia uptake and cerebral herniation.[6]

A study done by Tarantino G et al on 153 consecutive patients of liver failure concluded that identifying patients with high blood ammonia concentrations could be clinically useful, as high levels would lead to suspicion of being in presence of portosystemic collaterals and its complications.[7]

Of the study group 13.79% presented with grade 1 encephalopathy, 24.14% presented with grade 2, 3.45% presented with grade 3 and 58.62% presented with grade 4 encephalopathy.

In our study, the correlation of serum ammonia was significant with the grade of encephalopathy hence, the serum ammonia correlated well with the grade of encephalopathy for the patients during their hospital stay, suggesting that the serum ammonia level was an indicator of the clinical outcome of the patients during their hospital stay.

In our study, serum ammonia level was 23-64 in grade I and II, while serum ammonia level was 65-148 in grade III and IV, which clearly shows that serum ammonia level increases with high grade of hepatic encephalopathy.

CONCLUSION

In our study, we found that there is a strong correlation between serum ammonia level and severity of liver disease. Higher serum ammonia was found in severe liver disease. We found that High grade i.e. grade III and IV patients were having significantly raised ammonia level. So, serum ammonia can be used to assess severity of hepatic encephalopathy and can also be an important

predicator of clinical outcome in severe liver disease patients.

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