

# Arterial vs Venous Ammonia Levels in Correlation with severity of Hepatic Encephalopathy

Sricharan K.N.<sup>1</sup>, Shifali Prabhaker<sup>2</sup>

## ABSTRACT

**Introduction:** To compare between arterial versus venous ammonia levels in correlation with the severity of hepatic encephalopathy and to correlate between ammonia levels and clinical severity of hepatic encephalopathy.

**Material and methods:** After informed consent from the patient or their relatives, 50 patients in hepatic encephalopathy due to advanced liver disease were taken into the study after clinical assessment of their grading of encephalopathy using West Haven Criteria. Arterial and Venous ammonia levels were assessed at the same time during admission using Enzymatic UV method.

**Results:** 88% of the subjects (n=44) were males and 12% of the subjects (n=6) were females. The highest incidence of hepatic encephalopathy was seen in the age group of 50 to 70 years (54%), 30 to 50 years (30%) and >70 years was 16%. While correlating the arterial and venous ammonia levels with clinical grading of hepatic encephalopathy, there was moderate correlation between hepatic encephalopathy and arterial ammonia and venous ammonia levels, however statistically very high significant correlation with an  $r=0.569$  and  $r=0.504$  respectively.

**Conclusion:** Despite significant correlation of arterial and venous ammonia with hepatic encephalopathy neither is more useful than the other for the determination of the severity of hepatic encephalopathy.

**Keywords:** Arterial Ammonia, Venous Ammonia, Hepatic Encephalopathy

## INTRODUCTION

Hepatic encephalopathy is a serious complication of chronic liver disease and is defined as an alteration in mental status and cognitive function occurring in the presence of liver failure. Gut derived neurotoxins that are not cleared by the liver because of vascular shunting and decreased hepatic mass get to the brain and cause symptoms. Furthermore, cognitive impairment associated with cirrhosis results in utilization of more health care services in adults than other manifestations of liver disease.<sup>1</sup>

Ammonia levels are typically elevated in patients in hepatic encephalopathy although the correlation between plasma ammonia levels and the severity of hepatic encephalopathy is not consistent. Diagnosis of hepatic encephalopathy can be done by West Haven criteria which is a grading based on clinical findings.<sup>2</sup>

Correlation between ammonia levels and hepatic encephalopathy in Cirrhosis is not consistent, but is used widely for the diagnosis of Hepatic Encephalopathy. This study was planned to find the correlation between arterial

and venous ammonia levels and its significance in Hepatic encephalopathy.

Study aimed to compare between arterial versus venous ammonia levels in correlation with the severity of hepatic encephalopathy, To correlate between ammonia levels and clinical severity of hepatic encephalopathy.

## MATERIAL AND METHODS

It was a prospective and comparative study which included all patients diagnosed with hepatic encephalopathy admitted to A J Institute of Medical Sciences and Research Centre, Mangalore. Informed consent was taken from the patient/relatives who were included in the study. Patients were selected based on a detailed history, clinical examination along with laboratory and radiological investigations through a performance designed for this study which included haemoglobin, total leukocyte count, differential leukocyte count, serum electrolytes, prothrombin time, activated partial prothrombin time, serum albumin, liver function test, renal function test, blood sugar, abdominal ultrasonography and arterial blood has levels. Selected patients who met the inclusion criteria were clinically graded for hepatic encephalopathy according to West Haven Criteria within 24 hours of admission to the hospital. Arterial and venous blood samples of these patients for ammonia levels were collected in Heparinised vacutainer tubes. Samples were immediately centrifuged and sent to lab with ice pack within 30 minutes of collection. Total ammonia levels were calculated using Enzymatic UV method.

### Inclusion criteria

Patients of chronic liver disease who are in hepatic encephalopathy based on West Haven grading

### Exclusion criteria

Patients with altered sensorium due to causes other than hepatic encephalopathy.

## STATISTICAL ANALYSIS

All collected data was analysed using SPSS softies using the

<sup>1</sup>Associate Professor, Department of General Medicine, <sup>2</sup>Junior Resident, Department of General Medicine, A.J. Institute of Medical Sciences, Mangalore, India

**Corresponding author:** Dr. Shifali Prabhaker, Nethaji A Yellappa Memorial Hospital, Thokkottu, Mangalore 575020, India

**How to cite this article:** Sricharan K.N., Shifali Prabhaker. Arterial vs venous ammonia levels in correlation with severity of hepatic encephalopathy. International Journal of Contemporary Medical Research 2019;6(9):156-158.

**DOI:** <http://dx.doi.org/10.21276/ijcmr.2019.6.9.51>

Pearson's coefficient to find the strongest association factor with clinical grades of hepatic encephalopathy. P value of less than 0.05 was considered statistically significant.

## RESULTS

A prospective clinical study consisting of 50 patients in hepatic encephalopathy was undertaken to study the correlation of between arterial and venous ammonia levels and severity of hepatic encephalopathy.

### Age and sex distribution

88% of the subjects (n=44) were males and 12% of the

Age in years	Male	Female	All cases
30 – 50	15(34.09%)	0	15(30%)
50 – 70	21(47.72%)	6(100.0%)	27(54%)
>70	8(18.18%)	0	8(16%)
Total	44(100.0%)	6(100.0%)	50

**Table-1:**

Sex	Number (N=50)	%
Male	44	88.00
Female	6	12.00

**Table-2:**

West Haven grade	Arterial ammonia Range	Mean±SD
Grade I	48-86	62.22±12.38
Grade II	48-132	81.1±22.03
Grade III	50-111	90.07±23.98
Grade IV	72-166	110.25±29.71

**Table-3:**

West Haven Grade	Venous ammonia Range	Mean±SD
Grade I	32-85	56.22±15.18
Grade II	42-102	69.2±21.41
Grade III	44-102	71.461±16.94
Grade IV	32-142	108±32.46

**Table-4:**

subjects (n=6) were females. The highest incidence of hepatic encephalopathy was seen in the age group of 50 to 70 years (54%), 30 to 50 years (30%) and >70 years was 16%. The youngest subject being 32 years and the oldest being 78 years (Table no 1 and 2).

### Etiology

82% of the subjects (n=41) were alcoholic, 12% of the subjects (n=6) had chronic hepatitis B, 2% of the subjects (n=1) had cryptogenic cirrhosis and 4% of the subjects (n=2) had hepatocellular carcinoma. (Chart No.1)

There was moderate correlation between hepatic encephalopathy and arterial ammonia however statistically very high significant correlation. Observed p value was < 0.001 with an r=0.569 (Table No-3).

### Correlation of venous ammonia levels with clinical grading of hepatic encephalopathy and its severity.

There was moderate correlation between hepatic encephalopathy and venous ammonia however statistically very high significant correlation. Observed p value was < 0.001 with an r=0.504. (Table No.4)

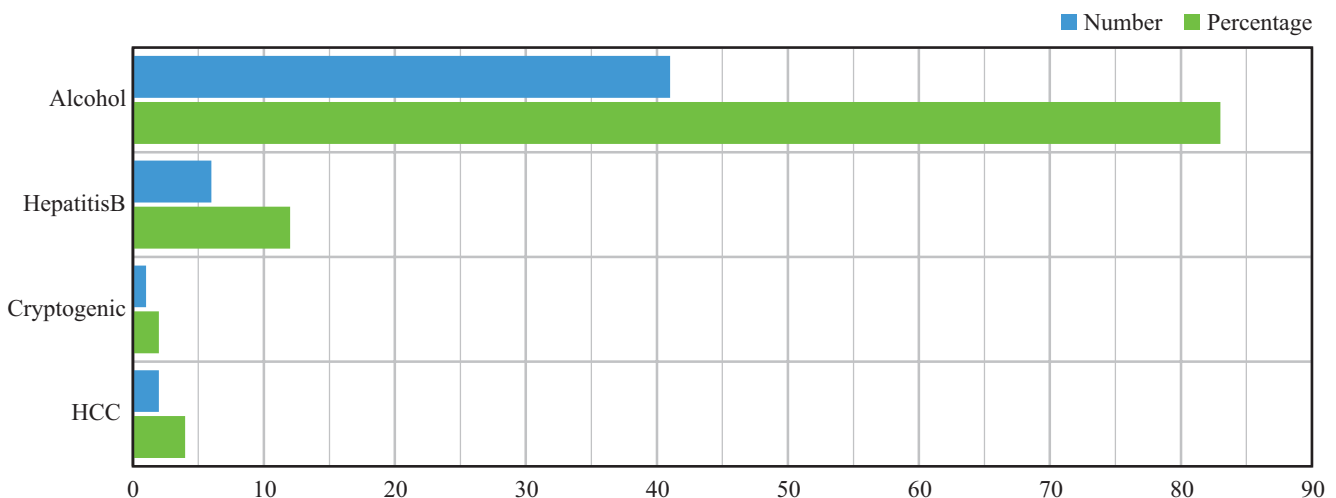
The correlation of both arterial and venous ammonia was found to be moderate. However arterial ammonia was found to have a better correlation than venous ammonia levels. Therefore there is a need for arterial ammonia levels to find the severity of Hepatic encephalopathy.

## DISCUSSION

In this study it was observed that highest incidence of hepatic encephalopathy was seen with age group 50-70 years, 21 were males and 6 females. These results were in correlation with study done by Janus P Ong et al<sup>3</sup> where the mean age group was 54 +/- 10 years.

In our study 88% (n=44) were males and 12% (n=8) were females. Similar trends in sex distribution were found by other studies conducted by Nanda Kumar et al<sup>4</sup> in Bombay and Tarun Kumar<sup>5</sup> in Bihar.

In a study done by Ong JP et al<sup>6</sup>, correlation between ammonia levels and partial pressure of ammonia levels with the clinical severity of hepatic encephalopathy were done in 121 patients, which showed ammonia levels correlating with



**Chart-1:**

the severity and venous sampling was sufficient for ammonia measurement. Our study showed moderate but significant correlation of both arterial and venous ammonia levels with the severity of hepatic encephalopathy and neither showed any added benefit over the other.

In a study done by Nicalao F et al<sup>7</sup> they determined the arterial, venous and partial pressure of ammonia levels in cirrhotic patients with and without hepatic encephalopathy. They found a significant correlation between  $pNH_3$  and hepatic encephalopathy. Neither  $PNH_3$  nor arterial ammonia levels from a clinical point of view, were more useful than arterial ammonia levels. It was also seen that highest ammonia levels were seen in Grade 3 and 4 groups.

Our study compared arterial and venous ammonia levels and found similar results with highest ammonia levels being in Grade 3 and 4.

R Manjunath, Nagesh H N, Vaishali Bharadwaj<sup>8</sup> did a study on clinical correlation between arterial and venous ammonia levels in hepatic encephalopathy in cirrhosis of liver and concluded that arterial ammonia levels correlated better with the severity of hepatic encephalopathy as compared to venous ammonia levels. Venous total ammonia levels did not correlate with the severity of hepatic encephalopathy and with arterial ammonia levels.

Our study showed significant moderate correlation with both arterial and venous ammonia levels with clinically graded hepatic encephalopathy.

A study done by Mohammed Asif Mehmood et al<sup>9</sup> concluded that total arterial ammonia, total venous ammonia, partial pressure of arterial ammonia and partial pressure of venous ammonia are all positively and significantly correlated with worsening clinical grades of hepatic encephalopathy.

Our study included only two parameters of ammonia levels that is total arterial and total venous ammonia levels which also showed positive and significant correlation with clinical grades of Hepatic encephalopathy. But the shortcoming of our study was the paucity of the subjects in our study group, which makes it difficult to generalise the results of this study to all patients with hepatic encephalopathy.

On the basis of the results of our study, we suggest that both arterial and venous ammonia levels

## CONCLUSION

The incidence of hepatic encephalopathy was more in males than females, with the majority of the patients having Grade III Encephalopathy assessed by West Haven Grading. The correlation with the severity of hepatic encephalopathy was found to be similar for arterial ammonia ( $r=0.569$ ) and venous ammonia ( $r=0.504$ ) with moderate correlation however significant. Despite significant correlation of arterial and venous ammonia with hepatic encephalopathy neither is more useful than the other for the determination of the severity of hepatic encephalopathy.

## REFERENCES

1. Rakoski MO, Mc Cammon RJ, Piette JD, Iwashyna TJ, Marrero JA, Lok AS, et al. Burden of cirrhosis on older

Americans and their families: analysis of the health and retirement study. *Hepatology* 2012;55:184-191.

2. Ferenci P, Lockwood A, Mullen K, Tarter R, Weissenborn K, Blei AT. Hepatic encephalopathy definition, nomenclature, diagnosis, and quantification: Final report of the working party at the 11<sup>th</sup> World Congresses of Gastroenterology, Vienna, 1998. *Hepatology*.2002;35:716-21.
3. Janus P Ong, Anjana Agarwal, Derk Kreiger. Correlation between ammonia levels and severity of hepatic encephalopathy. *American Journal of Medicine*. 2003;114:188-1933.
4. Nanda Kumar R, Amitabh S Nai et al. Effect of Helicobacter pylori eradication in serum ammonia levels in patients with chronic liver disease. *Indian journal of Gastroenterology* 2003;22:221-223.
5. Tarun Kumar. Incidence of cirrhosis caused by hepatitis B virus in different sex and age groups in Bihar. *JMGMS* 2006;11:52-54.
6. Ong JP Aggarwal A, Krieger D, Easley KA, Karafa MT, Van Lente F, Arrolifa AC, Mullen KD. Correlation between arterial ammonia levels and the severity of hepatic encephalopathy. *Am J Med* 2003;114:188-193.
7. Nicolao F, Efrati C, Maisini A, Merli M, Attili AF, Riggio O. Role of determination of partial pressure of ammonia in cirrhotic patients with and without hepatic encephalopathy. *J Hepatol* 2003;38:441-446.
8. R Manjunath, Nagesh H N, Vaishali Bharadwaj. Clinical correlation between arterial and venous ammonia levels in hepatic encephalopathy in cirrhosis of liver. *Journal of evolution of medical and Dental Sciences* 2014;3; 5322-5333.
9. Mehmood MA, Waseem T, Ahmad FZ, Malik AH. Measuring Partial Pressure of Ammonia in Arterial or Venous Blood Vs total Ammonia levels in Hepatic Encephalopathy. *Journal of Gastroenterology and Hepatology Research* 2013;2:602-606.

**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 12-08-2019; **Accepted:** 27-08-2019; **Published:** 30-09-2019