



## Clinical Predictors of Hepatic Encephalopathy Among Patients Admitted With Cirrhosis: A Retrospective Observational Study

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### Abstract

**Background:** Hepatic encephalopathy (HE) is a neuropsychiatric complication of cirrhosis that may occur in association with infection, gastrointestinal bleeding, electrolyte disturbances and renal dysfunction. Identifying clinical factors associated with HE is important for evaluating hospitalized patients and improving clinical monitoring.

**Objective:** To describe the clinical characteristics of patients admitted with cirrhosis and explore the relationship between recorded encephalopathy status and selected clinical variables.

**Methods:** This retrospective observational study was planned at Bir Hospital over eight months. Clinical records were intended to be reviewed for demographic characteristics, infection, gastrointestinal bleeding, electrolyte abnormalities, renal function and encephalopathy status. Descriptive analysis was performed on the 89 patient records supplied for preliminary assessment. The meanings of the numerical infection and gastrointestinal bleeding fields, as well as the coding of encephalopathy status, require verification before formal inferential analysis.

**Results:** The supplied dataset contained 89 records, with ages ranging from 19 to 92 years. The mean age was  $54.02 \pm 14.55$  years, and the median was 54 years (interquartile range, 44–63). Electrolyte abnormalities were marked “Yes” in 43 records (48.3%), while the renal-function field was marked “Yes” in 41 (46.1%). Encephalopathy-status codes were 0 in 19 records (21.3%), 1 in 26 (29.2%), 2 in 13 (14.6%), 3 in 18 (20.2%), 4 in 10 (11.2%) and 5 in three records (3.4%). Clinical interpretation of these codes requires confirmation. Cirrhosis severity scores, laboratory values and in-hospital outcomes were not included in the supplied dataset.

**Conclusion:** The available records provide preliminary descriptive information on age, electrolyte-abnormality flags, renal-function entries and encephalopathy-status codes. However, the incomplete dataset and ambiguous variable definitions prevent reliable conclusions about independent clinical predictors of HE. A verified dataset with defined exposure variables and outcome coding is required to complete the analysis.

**Keywords:** Hepatic encephalopathy; cirrhosis; infection; gastrointestinal bleeding; electrolyte abnormalities; renal dysfunction; retrospective study.

### INTRODUCTION

Cirrhosis is an advanced chronic liver disease associated with progressive impairment of hepatic function and changes in portal circulation. During the course of cirrhosis, patients may develop complications that require hospitalization and careful clinical assessment. Hepatic encephalopathy is one such complication and may manifest through changes in attention, behaviour, cognition, consciousness and neuromuscular function.

Hepatic encephalopathy is a clinical syndrome associated with liver insufficiency and portosystemic shunting. Its presentation ranges from subtle neurocognitive changes to overt disorientation, somnolence and severe impairment of

consciousness. Assessment requires consideration of alternative causes of altered mental status and standardized documentation of the type, grade and course of encephalopathy [1].

Several potentially reversible factors can precipitate or aggravate HE in patients with cirrhosis. These include infections, gastrointestinal bleeding, electrolyte disturbances, constipation, dehydration, renal dysfunction and certain medications. Identifying such factors is an important part of clinical evaluation because management may require treating the precipitating condition in addition to addressing encephalopathy itself [1].

Infection can contribute to systemic inflammation and physiological deterioration in patients with advanced liver disease. Gastrointestinal bleeding may increase the intestinal nitrogen load, while electrolyte abnormalities and renal impairment can further disturb cerebral function. These factors may coexist, making it necessary to record them separately when evaluating their association with HE.

Clinical studies seeking to identify predictors of HE should distinguish between variables recorded at admission, factors that develop during hospitalization and manifestations that are part of the outcome itself. A clearly defined outcome and accurately coded clinical variables are essential for valid statistical interpretation.

The present study was planned to review patients admitted with cirrhosis over an eight-month period and examine whether documented infection, gastrointestinal bleeding, electrolyte abnormalities and renal dysfunction were associated with hepatic encephalopathy.

## **AIM AND OBJECTIVES**

### **Aim**

To evaluate the clinical profile of patients admitted with cirrhosis and investigate factors associated with hepatic encephalopathy.

### **Objectives**

1. To describe the age distribution of patients admitted with cirrhosis.
2. To summarize the recorded electrolyte-abnormality and renal-function variables.
3. To describe the distribution of the recorded encephalopathy-status codes.
4. To examine the association between defined clinical factors and HE after verification of variable coding.
5. To evaluate the potential relationship between cirrhosis severity and HE, if validated severity scores and appropriate laboratory measurements are available.

## **MATERIALS AND METHODS**

### **Study design**

The study was planned as a retrospective observational investigation based on clinical records of patients admitted with cirrhosis.

### **Study setting and duration**

The study was conducted at Bir Hospital, in the Department of Gastroenterology, over eight months, from July 2020 to Feb 2021.

The final manuscript should use the actual dates covered by the medical-record review and should clarify whether the dataset contains unique patients or individual admissions.

### **Study population**

The planned sample comprised 90 patients admitted with cirrhosis during the study period. However, the supplied dataset contained 89 records. Preliminary descriptive analyses were therefore based on those 89 entries, pending reconciliation of the missing record.

The final study population should consist of patients who meet the eligibility criteria in the approved protocol. The number screened, excluded and included must be documented.

### **Eligibility criteria**

Suggested eligibility criteria for confirmation against the approved protocol are:

- Adult patients with a documented diagnosis of cirrhosis.
- Admission to the study hospital during the specified eight-month period.
- Clinical records containing sufficient information to establish study eligibility.
- Available documentation of encephalopathy status, where required for the primary analysis.

The final inclusion and exclusion criteria must reflect the actual research protocol and not be retrospectively modified to obtain particular results.

### **Data collection**

Clinical data were supplied in a tabular format containing age, a numeric field labelled “infection,” another numeric field labelled “gastrointestinal bleeding,” binary entries for electrolyte abnormalities and renal function, and an

encephalopathy-status code.

The age, binary fields and recorded encephalopathy codes were summarized descriptively. The infection and gastrointestinal bleeding fields were not interpreted clinically because their numeric values were not accompanied by definitions, units or a coding scheme.

### Outcome definition

The dataset contained encephalopathy-status codes ranging from 0 to 5. The meaning of each code was not provided. Before evaluating HE as a binary outcome or analysing its severity, the study codebook should establish whether 0 represents absence of HE and what each non-zero value represents. The codes should not automatically be treated as West Haven grades because the supplied scale has not been validated as such.

### Statistical analysis

Continuous age data were summarized using the mean, standard deviation, median, interquartile range and observed range. Categorical entries were reported as frequencies and percentages using the 89 supplied records as the denominator. Inferential analysis of clinical predictors was not undertaken because the infection and gastrointestinal bleeding variables were ambiguously coded, the HE outcome definition was unconfirmed, and cirrhosis severity scores and laboratory measurements were unavailable.

After verification, the association between clearly defined clinical predictors and HE may be assessed using appropriate categorical or continuous-variable methods. Multivariable analysis should only be undertaken if the number of outcome events and the completeness of the data support a reliable model.

### Ethical considerations

The study should report the name of the approving Institutional Ethics Committee, approval number, date and applicable consent or waiver procedure. These details must be obtained from the actual approval documentation.

Identifying patient information has been excluded from the manuscript. The research dataset used for analysis should likewise be de-identified and handled in accordance with institutional requirements.

## RESULTS

### Study population and age distribution

A total of 89 patient records were available for preliminary analysis, although the planned sample size was 90. Patient ages ranged from 19 to 92 years. The mean age was  $54.02 \pm 14.55$  years, and the median age was 54 years, with an interquartile range of 44–63 years.

**Table 1. Age distribution of the supplied patient records (n = 89)**

| Age characteristic                | Result                  |
|-----------------------------------|-------------------------|
| Number of records analysed        | 89                      |
| Mean age $\pm$ standard deviation | $54.02 \pm 14.55$ years |
| Median age                        | 54 years                |
| Interquartile range               | 44–63 years             |
| Minimum age                       | 19 years                |
| Maximum age                       | 92 years                |

### Age categories

Patients aged 40–59 years constituted the largest age group, accounting for 43 records (48.3%). Thirty-one patients (34.8%) were aged 60 years or older, while 15 (16.9%) were aged 39 years or younger.

**Table 2. Distribution of patients by age category**

| Age category        | Number (n) | Percentage (%) |
|---------------------|------------|----------------|
| 39 years or younger | 15         | 16.9           |
| 40–59 years         | 43         | 48.3           |
| 60 years or older   | 31         | 34.8           |
| <b>Total</b>        | <b>89</b>  | <b>100.0</b>   |

Percentages were calculated using the 89 supplied records. Age categories are descriptive and do not imply differences in HE risk.

### Electrolyte abnormalities and renal-function entries

The electrolyte-abnormality field was marked “Yes” in 43 records (48.3%) and “No” in 46 (51.7%). The field labelled “renal function” was marked “Yes” in 41 records (46.1%) and “No” in 48 (53.9%).

**Table 3. Distribution of recorded electrolyte and renal-function entries**

| Recorded variable         | Entry | Number (n) | Percentage (%) |
|---------------------------|-------|------------|----------------|
| Electrolyte abnormalities | Yes   | 43         | 48.3           |
| Electrolyte abnormalities | No    | 46         | 51.7           |
| Renal-function field      | Yes   | 41         | 46.1           |
| Renal-function field      | No    | 48         | 53.9           |

*The renal-function field has not been labelled as normal function or renal dysfunction because the meaning of “Yes” and “No” was not clarified. Its clinical interpretation requires confirmation.*

#### Distribution of encephalopathy-status codes

The recorded encephalopathy-status variable contained values from 0 to 5. Code 1 was the most frequent entry, appearing in 26 records (29.2%), followed by code 3 in 18 records (20.2%). Code 0 appeared in 19 records (21.3%), while code 5 was recorded in three (3.4%).

**Table 4. Distribution of recorded encephalopathy-status codes**

| Recorded code | Number (n) | Percentage (%) |
|---------------|------------|----------------|
| 0             | 19         | 21.3           |
| 1             | 26         | 29.2           |
| 2             | 13         | 14.6           |
| 3             | 18         | 20.2           |
| 4             | 10         | 11.2           |
| 5             | 3          | 3.4            |
| <b>Total</b>  | <b>89</b>  | <b>100.0</b>   |

*Note: The code definitions were not supplied. These values are presented as recorded and should not be interpreted as clinical grades until their coding system is verified.*

If the original data dictionary confirms that code 0 denotes absence of HE and codes 1–5 denote its presence, then 70 of 89 records (78.7%) would be classified as having a non-zero encephalopathy status. This is a conditional calculation and should not be reported as the confirmed prevalence of HE until the coding has been validated.

#### Infection and gastrointestinal bleeding fields

The field labelled “infection” contained numeric values ranging from 3 to 15, while the field labelled “gastrointestinal bleeding” contained values ranging from 5 to 85. No units or code definitions were supplied. Consequently, these fields could not be classified reliably as presence or absence of infection or gastrointestinal bleeding and were not used to estimate their association with HE.

#### Clinical predictors of hepatic encephalopathy

A reliable analysis of clinical predictors could not be completed from the supplied data. Although electrolyte-abnormality and renal-function entries were available, the coding of the HE outcome and the meaning of the renal-function field were not confirmed. In addition, the dataset did not contain clearly specified cirrhosis severity scores, the laboratory values required for prognostic assessment or in-hospital outcomes.

Accordingly, no independent predictors of HE are reported from this preliminary analysis.

## DISCUSSION

### Principal findings

The supplied records describe 89 patients, with a mean age of approximately 54 years and a broad age range. The electrolyte-abnormality field was marked “Yes” in 43 records, and the renal-function field was marked “Yes” in 41. The encephalopathy-status variable contained six numerical codes, with code 1 being the most frequent.

These findings provide an initial description of the available data but do not establish the clinical prevalence of HE or the predictive value of the recorded variables. The interpretation is constrained by incomplete coding information and the difference between the planned sample size and the number of records supplied.

### Hepatic encephalopathy and precipitating factors

In patients with cirrhosis, infection, gastrointestinal bleeding, renal dysfunction and electrolyte abnormalities are clinically important considerations when evaluating HE. Current guidance emphasizes identifying and correcting precipitating factors, alongside assessment of the type, grade and clinical course of encephalopathy [1].

The present dataset was intended to examine these factors. However, the numeric values entered under the infection and gastrointestinal bleeding columns cannot be interpreted as conventional binary indicators without additional documentation. Likewise, the renal-function field requires confirmation before its association with HE can be assessed.

A valid analysis would need to identify which patients had each precipitating factor at a defined time relative to HE

assessment. This would help distinguish factors present before the outcome from conditions documented after HE developed.

### Interpretation of encephalopathy status

A standardized clinical classification is essential for evaluating the presence and severity of HE. The European Association for the Study of the Liver recommends describing HE using a consistent approach to classification, grading, time course and precipitating factors [1].

The supplied status variable ranges from 0 to 5, but no codebook was included. This prevents the values from being mapped confidently to a standardized HE classification. The original medical records or data dictionary should be consulted before calculating HE prevalence, grouping patients by severity or evaluating predictors.

### Role of electrolyte abnormalities and renal dysfunction

Electrolyte disturbances and renal dysfunction are relevant clinical variables in cirrhosis and may coexist with encephalopathy. In the supplied dataset, 43 records were marked “Yes” for electrolyte abnormalities and 41 were marked “Yes” for renal function. However, the meaning and timing of the binary variables need clarification.

A useful predictor analysis would define electrolyte abnormalities based on actual laboratory measurements or documented diagnoses and define renal dysfunction using a prespecified clinical criterion. Associations could then be evaluated after confirming the HE outcome and accounting for relevant measures of cirrhosis severity.

### Limitations

The current analysis has several limitations. First, only 89 records were supplied despite a planned sample size of 90. Second, the numeric variables labelled infection and gastrointestinal bleeding lacked definitions and units. Third, the encephalopathy-status codes were not linked to a recognized grading system. Fourth, the dataset did not contain the actual cirrhosis severity measures, relevant laboratory values or in-hospital outcome data needed to assess prognostic relationships.

These issues preclude reliable claims about independent predictors. The findings should therefore be considered preliminary descriptive results rather than definitive clinical evidence.

### CONCLUSION

The preliminary analysis describes the age distribution, recorded electrolyte-abnormality and renal-function entries, and encephalopathy-status codes in 89 supplied patient records. The mean age was 54.02 years, and code 1 was the most frequent entry in the recorded encephalopathy-status variable.

The analysis cannot yet establish the prevalence of HE or identify clinical predictors. Reconciliation of the missing patient record, clarification of the variable definitions, and completion of the laboratory and cirrhosis-severity data are required before the study can support an interpretable predictor analysis.

### Recommendations

1. Reconcile the planned sample size of 90 with the 89 supplied records.
2. Define the numeric infection and gastrointestinal bleeding variables using the original data dictionary.
3. Confirm the meaning of all encephalopathy-status codes and document the grading method.
4. Clarify whether the renal-function field records normal function, abnormal function or a specific clinical diagnosis.
5. Obtain the relevant laboratory measurements and cirrhosis severity scores if these were part of the study.
6. Conduct predictor analysis only after the outcome and exposure variables have been validated.

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