Original Article

Study the Clinical Profile of Acute Hepatic Dysfunction in Patients admitted in Intensive Care Unit

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Abstract

Background: To study the clinical profile of acute hepatic dysfunction in patients admitted in Intensive Care Unit. To study the outcome of patients with acute hepatic dysfunction in ICU in terms of Death and Discharge or Transfer out. **Material and Methods:** This study will evaluate the performance of Child-Turcotte-Pugh & MELD scores with the outcome of Acute Hepatic Dysfunction in critically ill patients. Approval from the Institution Ethics Committee of a tertiary care centre and teaching hospital was taken for cross sectional observational study of 50 cases developing ALF in ICU. Duration of study was from November 2017 to October 2019. **Results:** The age group having maximum deaths was 21-30 years (47.82%), with a female preponderance. The most common etiologies of ALF were Septic shock, Pregnancy associated Liver Complications, Zinc Phosphide associated FHF and Congestive Cardiac Failure. Morbidity and mortality due to pregnancy related liver diseases and zinc phosphide associated FHF can be prevented with early diagnosis and timely interventions. The role of General Examination and Systemic Examination of patients in predicting mortality is indispensable, with special emphasis on pallor, respiratory rate, presence of ascites and neurological assessment. **Conclusion:** The age group having maximum deaths was 21-30 years (47.82%), The most common etiologies of ALF were Septic shock. The role of General Examination and Systemic Examination of patients in predicting mortality is indispensable, with special emphasis on pallor, respiratory rate, presence of ascites and neurological assessment.

Keywords: Clinical profile, Acute Hepatic Dysfunction, Intensive Care Unit.

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Introduction

Liver impairment significantly contributes to the morbidity and mortality of patients in the Intensive Care Unit (ICU). Metabolic, haemodynamic, and inflammatory elements play a role in hepatic injury. Hemorrhagic shock, septic shock, multiple organ failure, acute respiratory failure, metabolic abnormalities, myocardial impairment, hepatitis virus infection, and interventions like blood transfusion, parenteral nutrition, immunosuppression, and pharmacotherapy are all acknowledged as potential clinical scenarios leading to liver dysfunction.[1]

The clinical manifestation typically encompasses hepatic impairment, irregular liver biochemical parameters, and coagulopathy; encephalopathy may arise, with multiorgan failure and mortality occurring in as many as fifty percent of instances.[2]

The diagnosis of hepatic dysfunction relies fundamentally on hyperbilirubinaemia, increased serum transaminases, alkaline phosphatase, lactate dehydrogenase, and gamma glutamyl-transpeptidase, as well as reduced albumin and coagulation factor levels. Despite the absence of sensitivity and specificity, these characteristics arise from damage to hepatocytes or bile ducts and thus are commonly utilised to identify hepatic injury.[1]

Interventions for hepatic impairment concentrate on averting underlying triggers. Timely resuscitation, conclusive management of sepsis, diligent supportive care, regulation of circulatory metrics and metabolic processes, along with careful oversight of interventions like intravenous nutrition, mechanical ventilation, and catecholamine therapy, mitigate the occurrence and intensity of hepatic impairment.[2]

Hence this study was conducted to study the clinical profile of acute hepatic dysfunction in patients admitted in Intensive Care Unit.

Materials and Methods

This study will evaluate the performance of Child-Turcotte-Pugh & MELD scores with the outcome of Acute Hepatic Dysfunction in critically ill patients. Approval from the Institution Ethics Committee of a tertiary care centre and teaching hospital was taken for cross sectional observational study of 50 cases

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developing ALF in ICU. Duration of study was from November 2017 to October 2019

Sample Size: Total number of cases (n) = 50

Inclusion Criteria:

A case will be defined to have Acute Hepatic Dysfunction when all the following alterations take place within 2 weeks of ICU admission and if any three out of five of the following laboratory criteria are met;

- Serum Bilirubin levels >2mg/dl
- Serum Albumin levels <3g/dl
- Prothrombin Time >16 secs and INR >2
- SGOT and SGPT >2 times the normal reference range of the particular laboratory
- Alkaline Phosphatase >2 times the normal reference range of the particular laboratory

Exclusion Criteria:

1. Patients with pre-existing Chronic Liver Disease will be excluded from the study.
2. Patients who are not willing to give informed written consent.
3. Patients with Altered Mental Sensorium (or) Patient's relatives are not willing or not available to give consent.

The determination of Acute Hepatic Dysfunction was made upon meeting the specified criteria and timescale. Every patient hospitalised to the Intensive Care Unit that fulfilled the selection criteria was examined and included.

A comprehensive medical history was obtained, and an extensive clinical examination was conducted in all instances following the acquisition of prior written informed permission. Data was gathered using a pre-established, pre-evaluated format. Each case was evaluated through a series of investigations including Haemoglobin (Hb), Total Leucocyte Count (TLC), Platelet Count, Differential Leucocyte Count (DLC), Haematocrit, Serum Bilirubin, Alanine Transaminase (ALP/SGPT), Aspartate Transaminase (AST/SGOT), Alkaline Phosphatase (ALP), Serum Albumin, Serum Globulin, Total Proteins, Prothrombin Time (PT/INR), Serum Creatinine, Blood Urea Nitrogen (BUN), Serum Sodium, Serum Potassium, Serum Uric Acid, Urine Microscopy, and biochemical tests for Bile Salts and Bile Pigments, in addition to Chest X-ray, abdominal Ultrasonography, ECG, and Contrast Enhanced Computed Tomography Scan (CECT) if required. All additional significant assessments concerning the fundamental cause were executed.

The management was executed in accordance with the standard of care and the fundamental cause. The patients' results were evaluated based on the enhancement and decline of several indicators. The designated outcome endpoints comprised mortality (adverse result) and discharge/transfer (beneficial outcome).

Statistical analysis: The data collected was entered in Microsoft Excel. Continuous variables were presented as mean ± SD; while Categorical variables were expressed in frequency and percentages.

Statistical analysis was done using SPSS software. The association between two discrete variables was studied using chi-square test whenever necessary; while comparison between two continuous variables was done using unpaired t-test. Univariate and Multivariate linear regression analysis were performed to evaluate prognostic value of various factors. Correlation test to compare the performances of CTP and MELD scores was performed. Tests were considered significant if p value was less than 0.05.

Results

During the study period 50 patients were evaluated for Acute Hepatic Dysfunction after admission in the ICU.

The number of males were 24 (48%) out of 50 and females were 26 (52%) out of 50. The number of patients in ≤ 20, 21-30, 31-40, 41-50 and >50 age groups were 9 (18%), 19 (38%), 7 (14%), 5 (10%) and 10 (20%) respectively. Hence, maximum numbers of cases were between 21 and 30 years of age.

Out of 50 cases in our study, wherein 5 (10%) were illiterate, 21 (42%) had senior secondary schooling, 21 (42%) had higher secondary schooling and 3 (6%) were graduates.

Table 1: Presenting Features of Patients with Acute Liver Failure

Signs/ Symptoms	Number of patients	Percentage (%)
Nausea/Vomiting	44	88.0
Abdominal Pain	32	64.0
Altered Sleep Pattern	29	58.0
Fever	24	48.0
Jaundice	23	46.0
Per Rectal Bleeding	18	36.0
Weight Loss	15	30.0
Skin Rashes	9	18.0
Seizures	5	10.0
Constipation	3	6.0
Old case or Newly Diagnosed CLD	3	6.0
Diarrhoea	2	4.0
Malena	2	4.0
Alcohol Intake	2	4.0
Itching	1	2.0

In descending order, out of 50 cases, 44 (88%) cases had Nausea/Vomiting, 32 (64%) cases had Abdominal pain, 29 (58%) cases reported Altered Sleep Pattern, 24 (48%) cases had Fever, only 23 (46%) cases reported Jaundice in their presentation, 18 (36%) cases had Per-rectal Bleeding, 15 (30%) had reported Weight Loss, 9 (18%) cases had Skin Rashes in the form of purpura, ecchymoses, etc., 5 (10%) people suffered seizures, 3 (6%) cases had constipation, 3

(6%) cases were newly diagnosed as chronic liver disease, 2 (4%) cases had diarrhoea, 2 (4%) cases reported malena and 1 (2%) patient complained of itching at the presentation. Occasional Alcohol Intake of less than approximately 40g/day was established in 2 (4%) cases. The history of weight loss was considered significant if the cases reported ≥5% of total body weight 1 month prior to admission or ≥10% of total body weight in the last 6 months.

We carried out measurements of vital parameters and other general physical examination of every study patient and results are as follows;

Vital Parameters: The relevant vital parameters studied were Temperature, Pulse Rate, Blood pressure and Mean Arterial Pressure at the time of inclusion of the case in our study

Table 2: Temperature at the time of inclusion in the study

Temperature	No. of patients	Percentage (%)
≤ 37.0 (Normal)	23	46.0
37.1 - 38.90	22	44.0
≥ 39.00	5	10.0
Total	50	100.0

Table 3: Pulse Rate at the time of Inclusion in our study

Pulse Rate	No. of patients	Percentage (%)
Normal (60-99 bpm)	20	40.0
Normal but Irregular	5	10.0
Tachycardia (≥100 bpm)	25	50.0
Total	50	100.0

Table 4: Respiratory Rate at the time of inclusion in our study

Respiratory Rate	No. of patients	Percentage (%)
Normal (12-19/min)	15	30.0
Tachypnoea (20-34/min)	34	68.0
Severe tachypnoea (≥35/min)	1	2.0
Total	50	100.0

The presence of Pallor, Icterus, Edema, Clubbing and Cyanosis were studied. The most common general examination finding was icterus, seen in 31 (62%) of all cases.

Table 5: General Examination Findings

Symptoms	Number of patients	Percentage (%)
Icterus	31	62.0
Edema	16	32.0
Pallor	14	28.0
Clubbing	1	2.0
Cyanosis	1	2.0

Abdominal Examination: Hepatomegaly and Splenomegaly were found in 20 (40%) and 8 (16%) of all cases. The presence of splenomegaly was stratified as Mild, Moderate and Severe when spleen was palpable 1-2cms, 3-7cms and >7cms respectively below the left costal margin.

Table 6: Presence of Hepatomegaly

Liver	Number of patients	Percentage (%)
Palpable	20	40.0
Not palpable	30	60.0
Total	50	100.0

Table 7: Presence of Splenomegaly

Spleen	Number of patients	Percentage (%)
Not palpable	42	84.0
Mild	6	12.0
Moderate	2	4.0
Total	50	100.0

Of the total 50 cases, 11 (22%) showed Mild to Moderate Ascites, 2 (4%) showed Gross Ascites, while 37 (74%) cases did not show any signs of free fluid in abdomen on abdominal examination.

Table 8: Presence of Free Fluid in Per-Abdomen Examination

Signs of Free Fluid	Number of patients	Percentage (%)
Absent	37	74.0
Mild to Moderate	11	22.0

Gross Ascites	2	4.0
Total	50	100.0

Only 3 (6%) cases were found to have sluggish-absent bowel sounds on abdominal auscultation, while 47 (94%) presented with normal bowel sounds.

Other Systemic Examinations: The Cardiovascular, Respiratory and Neurological System Examinations were also performed in depth in all at the time of inclusion in our study.

The Central Nervous System examination played a critical role in our study. The West Haven Hepatic Encephalopathy clinical criteria and the Glasgow Coma Score were correlated as seen in Table 14 and we found that 8 (16%), 4 (8%) and 7 (14%) exhibited Grade 1 to 2, Grade 3 and Grade 4 stages of hepatic encephalopathy respectively, while 31 (62%) cases exhibited no or absent signs of Encephalopathy at the time of inclusion in our study.

Table 9: Grading of encephalopathy, clinical features and comparable Glasgow Coma Score

West Haven Hepatic Encephalopathy Grade	Clinical Features	Glasgow Coma Score
0	Normal	15
1	Shortened attention span, minimal lack of awareness	15-14
2	Minimal temporo-spatial disorientation, inappropriate behaviour	13-11
3	Overt confusion, gross disorientation, somnolence but responsive to verbal stimuli	10-8
4	Unresponsive to verbal stimuli	<8
	Pupillary abnormalities	3

Traditionally, the evaluation of liver function in critically ill patients has relied on static assessments, including blood liver enzyme activity, hepatic protein synthesis (coagulation factors, albumin), and bilirubin levels. In our study, the performance of scoring systems relied highly upon laboratory parameters. Our study showed that the mean values of total WBC count, platelet count, total and direct bilirubin, serum albumin, serum creatinine, serum urea, prothrombin time and INR at the time of inclusion in the study were highly comparable. However, the serum transaminases (SGOT and SGPT) and serum sodium did not show much difference between the two groups based on outcome. Serum amylase values were abnormal in 6 (12%) cases and median value was 40 U/L.

the number of cases who survived ALF in our ICU were 27 (54%) of which 11 were females and 16 were males, while the incidence of mortality was 46% (23 cases) of which 15 were females and 8 males. We had a greater number of females with ALF than males and proportionate mortality remained higher than that in males.

Discussion

In this study, our aim was to study the clinical profile of 50 patients (n=50) developing ALF after being admitted in critical care unit, we studied 24 males and 26 female patients, satisfying the study criteria. Their epidemiological parameters, clinical presentations, examination findings, laboratory parameters. We included only ALF cases in critical care unit to exclude outcome bias. Chronic Liver Disease cases were excluded as majority of them admitted in the hospital have Alcoholic Liver Cirrhosis with recurrent admissions due to exacerbation of underlying disease.

Out of the 50 cases in the study, the number of cases who survived were 27 (54%), while those who died were 23 (46%), of which 15 dead (60.86%) were females. The number of females who died with pregnancy associated complications was 5 (33.3%). Hence, ALF was found to be more common in females. This discovery aligned with the research conducted by Dhiman RK et al,[3] and Khuroo MS et al,[4] which indicated that 51% and 61% of patients with ALF were female, respectively. Thanapirom et al,[5] investigated the prevalence, causes, consequences, and mortality predictors of acute liver failure in Thailand, revealing that males (59.6%) were more significantly impacted. Lehner et al,[6] reported a male preponderance (65.8%) in the population affected with ALF.

The age group having maximum deaths was 21-30, with 11 out of total 23 deaths (47.82%). Hence, mortality was higher in those with age >20years and <30years than those with age above 30.

Our results are at odds from those of one of the largest prospective studies to determine the incidence of acute hepatic dysfunction in ICU patients by Kramer et al,[7] wherein the most common age group was 62.9 ± 16.5. Similar results were found in Koch D et al,[8] (38 ± 10) and Acharya et al,[9] (31.4 ± 0.8).

The most common symptoms found in decreasing order were Nausea/Vomiting (88%), Abdominal Pain (64%), Altered Sleep Pattern (58%), Fever (48%), Jaundice (46%) and Per-Rectal Bleeding (36%). All the patients had non-haemorrhoidal per rectal bleeding, likely as a result of coagulopathy, which further influenced the clinical course due to complications like anaemia, shock and hemodynamic worsening. The primary symptoms observed in the research conducted by Shakil OA et al,[10] on the prognosis of acute liver failure included jaundice (49%), nausea and vomiting (47%), impaired mental status (42%), abdominal pain (34%), and fatigue (31%). Additional manifestations comprised fever (21%), dark urine (21%), malaise (17%), anorexia (16%), and myalgia or arthralgia (10%).[10]

Of all the clinical features, patients presenting with Per-Rectal Bleeding were found to have very high incidence of mortality ($p<0.001$), Our study showed that the age-old and time-tested general and systemic examination has meticulous role in assessing clinical status and played a great role in prognostication of the patient. The essential metrics, including Temperature, Pulse, and Respiratory Rate, indicate the present condition of liver failure at a specific moment and must be consistently assessed to accommodate the fluctuating clinical trajectory. Conditions that led to the alterations in respiratory rate were

presence of fever, pneumonia, sepsis, anaemia, orthodeoxia and hepatic hydrothorax.

Arterial hypoxaemia is recognised to occur in 10 to 70% of individuals suffering from severe liver disease. Karcz M et al,[11] examined the consequences of acute respiratory failure in the context of advanced liver disease and determined that individuals with hepatic impairment are particularly susceptible to respiratory inadequacy due to hepato-pulmonary syndrome, pulmonary haemorrhage, pleural effusions, porto-pulmonary hypertension, immunosuppression, and pulmonary infections. Moreover, tobacco use, chronic obstructive pulmonary disease, nutritional deficiencies, physical deconditioning, and muscular atrophy all elevate the likelihood of respiratory failure. The liver is pivotal in modulating cytokine dynamics associated with acute lung damage among extrapulmonary organs.

Apart from the vitals, we also studied impact of other general examination findings such as pallor, icterus and oedema in the outcome and prognosis of the patient. The utmost significant amongst the three in ALF, was the presence of pallor (p=0.031), and neither icterus (p=0.381) nor oedema (p=0.767). A study by Hadem et al,[12] to find the prognostic implications of various factors and etiologies to ALF showed that there was a significant difference (p=0.005) between the median haemoglobin levels amongst survivors [13.6 (8.0–19.9)] and non-survivors or transplanted cases [12.6 (5.2–17.2)]. A retrospective cross-sectional study by Yang J et al,[13] showed that anaemia was associated with the severity of liver impairment and might be a predictor for short-term mortality in patients with HBV-related decompensated cirrhosis. This finding, although done on chronic liver disease patients holds true for our study as well, as univariate analysis showed that presence of pallor (p=0.03) and anaemia (p=0.03) contributed to poorer prognosis. Of 14 patients who exhibited pallor on general examination, 10 died and only 4 survived.

The median haemoglobin level in 23 patients who died was 10.2 g/dl, while in those who survived was 12 g/dl which was statistically significant (p=0.046). Anaemia in individuals with liver illness can result from diminished erythropoietic function, haemorrhage, or haemolysis, making it challenging to determine which factor is more significant.[14]

The presence of ascites on clinical examination indicated bad prognosis (p=0.036). Of 13 (26%) patients who had clinical ascites, 8 (62% if n=13) died and only 5 (38% if n=13) survived. A study by Dhiman RK et al,[3] found that ascites was common in patients with ALF (32.3%) but the mere presence of ascites did not influence the outcome of patients with ALF. However, due to technical reasons and severe coagulopathy, ascitic fluid analyses of all these patients could not be performed to look for Spontaneous Bacterial Peritonitis (SBP). It is well known that patients with SBP are more likely to develop renal failure and have a significantly higher mortality than uninfected patients.[3]

Furthermore, our study showed that the systemic examination findings of Cardiovascular system and Respiratory System had no contribution to evaluating the prognosis of ALF. This result is contrary to the findings by Kramer et al,[7] where the impact of early hepatic dysfunction on cardiovascular and respiratory system was statistically significant (p<0.001).

The prominence of encephalopathy in every definition of adult acute liver failure highlights its crucial prognostic relevance, with its occurrence signifying substantially diminished liver function. The clinical characteristics include a variety of neurological impairments, extending from minor attention deficits to outright coma. Cerebral oedema, whether at the cellular level (cytotoxic oedema) or the interstitial level (vasogenic oedema), is a pathological characteristic of hepatic encephalopathy in acute liver failure. The deterioration of hepatic encephalopathy in acute liver failure is an imminent worry for the physician, which can solely be assessed through a thorough and precise neurological evaluation of the patients.

In our study, we found that mortality was significantly higher in those with poor neurological statuses and high peak stages of hepatic encephalopathy than those who were neurologically intact (p<0.001), The research conducted by Dhiman RK et al,[3] revealed that the emergence of encephalopathy seven days post-jaundice onset serves as an independent prognostic indicator; additionally, among those who developed grade 2 encephalopathy, survival rates ranged from 60-70%, in contrast to 40-50% for grade 3 and less than 20% for grade 4 encephalopathy. According to Trey et al,[15] survival in patients with HE grade 2 was 66% (43-81%), grade 3 was 42% (19-75%), and grade 4 was 18% (12-21%; p<0.0001). In a study by Nusinovici et al,[16] survival of 28 patients with less than grade 4 coma was 57% (37-76%), against 7% (3-14%) in 110 patients with this grade (p<0.0001).

Conclusion

The age group having maximum deaths was 21-30 years (47.82%), with a female preponderance. The most common etiologies of ALF were Septic shock, Pregnancy associated Liver Complications, Zinc Phosphide associated FHF and Congestive Cardiac Failure. Morbidity and mortality due to pregnancy related liver diseases and zinc phosphide associated FHF can be prevented with early diagnosis and timely interventions. The occurrence of per-rectal bleeding portends grave prognosis. The role of General Examination and Systemic Examination of patients in predicting mortality is indispensable, with special emphasis on pallor, respiratory rate, presence of ascites and neurological assessment. Mortality was significantly higher in those with high peak stages of hepatic encephalopathy.

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Conflicts of interest

There are no conflicts of interest.

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