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Evaluation of Biochemical Parameters in Pediatric Patients with Acute Viral Hepatitis: A Cross Sectional Study

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Abstract
Hepatitis A is a transient liver ailment that can lead to significant morbidity, especially in pediatric populations from economically disadvantaged backgrounds in certain regions of the world. This disease is known to induce notable changes in liver function parameters. The primary goal of this study was to investigate the biochemical alterations observed in viral hepatitis A among pediatric patients upon admission to healthcare facilities. This observational study, of a cross-sectional nature enrolled 123 newly diagnosed hepatitis A patients. Blood samples were collected to measure serum levels of total and direct bilirubin, alanine aminotransferase (ALT), aspartame aminotransferase (AST), alkaline phosphatase, total protein and albumin. The collected data underwent statistical analysis using appropriate methods. Majority patients were male. Notably, majority of patients exhibited serum direct bilirubin levels ranging from 0.45 and 2.1 mg/dl with only five patients exceeding 4.2 mg/dl. A significant increase (more than 5-fold) in ALT and AST levels was observed in majority of cases. Elevated ALT and AST levels exceeding 1000 U/L were also recorded in few cases. Alkaline phosphatase levels were elevated in 24.39% of cases, while 13.82% of patients displayed hypoproteinemia. Additionally, 11 cases presented with elevated blood urea levels and 1 case showed an elevated creatinine level. The hepatitis A virus caused significant alterations in various body parameters, contributing to a substantial burden of mortality and morbidity. Given its heightened prevalence in underdeveloped communities, preventing the disease could potentially save numerous lives globally.

INTRODUCTION

Hepatitis A is typically a self-limiting illness, with only a small fraction of patients experiencing fulminant hepatitis or fatal outcomes. However, it poses a significant burden in terms of morbidity and economic impact in many countries. The causative agent, Hepatitis A virus (HAV), is a non-enveloped, single-stranded RNA virus belonging to the Picornaviridae family and Hepatovirus genus. It spreads primarily through the fecal-oral route and is closely linked to poor sanitation and hygiene. Despite the availability of a highly effective and safe hepatitis A vaccine, HAV remains a notable cause of acute viral hepatitis globally[1-3].

In India, HAV infections are prevalent during childhood, with a considerable proportion of children (85% below 2 years and around 50% aged 2-5 years) being affected[4]. A study conducted by Rakesh *et al*. highlighted an outbreak of acute viral hepatitis (AVH) in Kerala, attributed to HAV contamination in pipe water from a borewell. The study reported a high attack rate among age groups 15-24 years (4.6%) and 5-14 years (3.1%)[5]. Clinical presentation varies with age, with less than 30% of infected young children showing symptomatic hepatitis compared to about 80% of infected adults who present with severe acute hepatitis and elevated serum aminotransferase. Due to the indistinguishable clinical and biochemical features of acute hepatitis caused by HAV and other hepatitis viruses, serological tests are crucial for specific diagnosis[4,5]. Diagnosis typically involves assessing liver function through laboratory tests including urine and serum bilirubin, ALT and/or AST levels, alkaline phosphatase, total protein and serum albumin[6-10]. Despite this knowledge, there is a lack of studies on HAV infections among pediatric population. Therefore, our study aims to investigate the biochemical changes associated with viral hepatitis A in pediatric patients upon admission, prior to treatment initiation.

MATERIALS AND METHODS

This cross-sectional observational study was conducted over a year. It included a total of 123 newly diagnosed hepatitis A pediatric patients confirmed by serological tests. The study's inclusion criteria encompassed patients within the age range of 0-12 years, including both male and female subjects selected for convenience. Additionally, participants were required to be newly diagnosed with hepatitis A and had not yet undergone any treatment for this condition. Conversely, exclusion criteria were defined to exclude patients with diabetes mellitus, existing renal failure indicated by serum creatinine levels exceeding 3 mg/dL, any hematological or other malignancy, jaundice, known active infections, severely malnourished individuals and those with known chronic illnesses such as chronic kidney disease or chronic liver disease. These criteria were essential for ensuring a specific patient population and maintaining the study's focus on hepatitis A and its early treatment stages.

Blood samples were collected from the patients after obtaining written consent. Parameters related to liver functions (total and direct bilirubin, AST, ALT, alkaline phosphatase) and renal function (urea and creatinine) were analyzed using an AutoAnalyzer. The data were compiled and analyzed using appropriate software.

RESULTS AND DISCUSSIONS

In our study, we included 123 patients with acute viral hepatitis A, with majority being boys (Fig. 1). The average total bilirubin level was 9.76±3.53 mg/dL, while the average direct bilirubin level was 1.75±0.91 mg/dL. Among these patients, majority had serum direct bilirubin levels between 0.45 and 2.1 mg/dL, with only five patients exceeding 4 mg/dL (Table 1). The mean values for ALT and AST were 366.16±237.25 U/L and 311.42±200.62 U/L, respectively. Within the cohort, majority of patients exhibited more than a 5-fold increase in ALT levels, while majority also showed a similar rise in AST levels. Elevated ALT and AST levels exceeding 1050 U/L were observed in 4% and 1% of cases, respectively (Table 3). Regarding other parameters, the mean alkaline phosphatase, total protein, albumin and globulin levels were 382.17±173.66 U/L, 6.78±0.64 g/dL, 3.31±0.4 g/L and 2.79±0.4 g/L, respectively. Alkaline phosphatase levels were elevated in 24.39% of cases and 13.82% exhibited hypoproteinemia. Additionally, 11 patients had raised blood urea levels and 1 patient had elevated creatinine levels among the acute viral hepatitis A cases studied (Table 2).

HAV infection is a prevalent global health concern, with approximately 1.4 million cases reported annually worldwide[11]. Studies by Horvat *et al*.[12] and others[13-15] have indicated a higher incidence among males due to occupational hazards and outdoor activities. However, conflicting findings from Tong *et al*.[3] and Yapicioglu *et al*.[16] suggest an equal susceptibility among both sexes. In our study, 53% of

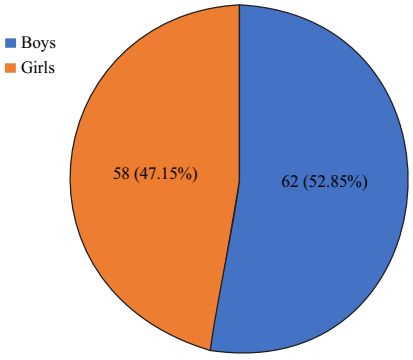

Fig. 1: Gender distribution of study population

Table 1: Serum bilirubin parameters in paediatric acute viral hepatitis

Parameter	n	Percentage
Serum Total bilirubin		
2-10 mg/dL	88	71.54
10.1-20 mg/dL	33	26.83
>20 mg/dL	2	1.63
Serum direct bilirubin		
0.5-2.0 mg/dL	87	70.73
2.1-4.0 mg/dL	31	25.20
>4.0 mg/dL	5	4.07

Table 2: Changes in Serum enzyme levels in paediatric acute viral hepatitis

Parameter	n	Percentage
Increased alkaline phosphatase level	30	24.39
Decreased serum protein level	17	13.82
Decreased serum albumin level	53	43.09
Increased serum globulin level	6	4.88
Increased urea level	11	8.94
Increased serum creatinine	1	0.81

Table 3: Magnitude of enzyme changes in paediatric acute viral hepatitis

Parameter	n	Percentage
Up to 5-fold rise	31	25.20
5-10-fold rise	66	53.66
More than 10-fold rise	26	21.14

cases were boys and 47% were girls, aligning with previous research. The mean age of our study population (7.1±2.35 years) was consistent with findings by Goyal *et al*.[17], ranging from 2-12 years old, with a higher seroprevalence observed with increasing age.

Liver function tests (LFTs) play a crucial role in diagnosing and assessing the severity of hepatitis. In acute hepatitis, elevated ALT levels may exceed AST levels[18]. Our study found that 71% of cases had serum total bilirubin levels within the range of 2-10 mg/dL, with only two cases showing levels above 20 mg/dL, indicating disease severity. Similar results were reported by Kumar *et al*.[19]. Additionally, 71% of cases had serum direct bilirubin levels within 0.5-2.0 mg/dL, with elevated ALT and AST levels observed in 75% and 82% of cases, respectively and alkaline phosphatase elevation noted in 24% of cases with hypoproteinemia in 14% of cases. Despite these findings, our study had limitations, including its cross-sectional design, which precluded follow-up assessments and limitations related to time and manpower constraints.

CONCLUSION

Hepatitis A, a viral infection, induces substantial changes in a multitude of physiological parameters within the body, thereby imposing a significant burden of both mortality and morbidity. The impact of this virus is particularly pronounced in underdeveloped communities, where its prevalence is heightened, leading to a greater number of affected individuals. Consequently, implementing effective preventive measures against hepatitis A could potentially result in saving countless lives on a global scale. This underscores the urgent need for robust public health strategies aimed at reducing the transmission and impact of this infectious disease, especially in vulnerable populations and resource-limited settings.

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