Section: Miscellaneous

Original Research Article

MATERNAL AND NEONATAL OUTCOMES ASSOCIATED WITH VIRAL HEPATITIS: A RETROSPECTIVE COHORT STUDY

Sharad Kumar Jha[1], Mandira Kumari[2], Meenakshi Singh[3]

[1]Assistant Professor, Department of Gastroenterology, Darbhanga Medical College and Hospital, Laheriasarai, Bihar
[2]Assistant Professor, Department of Obstetrics and Gynaecology, Madhubani Medical College and Hospital, Madhubani, Bihar
[3]Professor, Department of Obstetrics and Gynaecology, Lady Hardinge Medical College, Delhi

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Corresponding Author:
Dr. Mandira Kumari,
Email: jhamandira7@gmail.com

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ABSTRACT

Background: Viral hepatitis, including HBV, HCV, HDV, and HEV, poses a significant global health challenge, with HBV and HCV affecting over 325 million people worldwide. HBV, prevalent in regions like sub-Saharan Africa and East Asia, and HCV, affecting 71 million globally, are linked to serious liver complications. These infections, especially during pregnancy, can lead to adverse outcomes such as gestational diabetes, preterm birth, and vertical transmission. The study aimed to evaluate the impact of these infections on maternal and fetal health, aiming to enhance management strategies and improve clinical outcomes. **Materials and Methods:** This retrospective cohort study, conducted at a tertiary care center from January 2021 to December 2023, assessed pregnancy outcomes among women with HBV, HCV, HDV, or HEV. Inclusion criteria were women aged 18-45 with confirmed viral hepatitis diagnoses and who delivered at the study site. Blood samples were tested using ELISA, PCR, and RT-PCR to confirm viral infections and measure viral load. Data on demographics, comorbidities, and pregnancy outcomes were collected from electronic medical records. Statistical analyses included descriptive statistics, chi-square tests, t-tests, and multivariable logistic regression to identify factors associated with adverse outcomes, using SPSS version 20.0. **Result:** The mean age, parity, and BMI were similar across the HBV, HCV, and HEV groups. Antiviral treatment rates were highest in the HCV group (100%) and lowest in the HEV group (69.6%). Median viral loads and liver enzyme levels were comparable among the groups. Outcomes such as gestational age, mode of delivery, and neonatal Apgar scores showed no significant differences. The multivariable analysis revealed that age, parity, ALT, AST, and antiviral treatment, were not significantly associated with adverse outcomes. **Conclusion:** Our study demonstrates that pregnant women with HBV, HCV, and HEV infections have similar pregnancy and neonatal outcomes when managed appropriately. Key predictors of adverse outcomes were higher BMI and hypertension, emphasizing the importance of addressing these comorbidities during pregnancy.

INTRODUCTION

Viral hepatitis, encompassing hepatitis A (HAV), hepatitis B (HBV), hepatitis C (HCV), hepatitis D (HDV), and hepatitis E (HEV), is a significant global health issue. The World Health Organization (WHO) estimates that 325 million people are living with chronic HBV and HCV infections worldwide, which are major contributors to liver cirrhosis and liver cancer.[1] Among these, HBV and HCV are the most prevalent and pose considerable risks during pregnancy, potentially affecting both maternal and fetal outcomes.[2]

HBV is highly endemic in many regions, particularly in sub-Saharan Africa and East Asia. Approximately 257 million people were living with chronic HBV infection in 2015, and the disease results in around 887,000 deaths annually due to liver-related complications.[3] HBV infection during pregnancy can lead to adverse outcomes such as gestational diabetes, preterm birth, low birth weight, and a higher likelihood of neonatal HBV transmission if not adequately managed.[4]

HCV affects an estimated 71 million people globally, with a significant number of new infections occurring each year.[5] In pregnant women, HCV infection is

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associated with a higher risk of intrahepatic cholestasis of pregnancy, preterm birth, and vertical transmission to the newborn, though this occurs less frequently than with HBV. The introduction of direct-acting antivirals (DAAs) has revolutionized HCV treatment, but their use during pregnancy remains limited due to safety concerns.[6]

HDV infection occurs only in conjunction with HBV, exacerbating the disease's severity. It is estimated that about 15-20 million people globally are coinfected with HDV and HBV. During pregnancy, HDV coinfection can lead to severe liver disease and increased maternal and fetal mortality rates.[7]

HEV, particularly prevalent in developing countries with poor sanitation, can cause severe outbreaks. Pregnant women, especially those in their third trimester, are at an increased risk of developing fulminant hepatitis, leading to high maternal and fetal mortality rates. The WHO reports that pregnant women have a mortality rate of 15-25% when infected with HEV.[8]

Pregnancy itself induces significant physiological changes that can alter the course of viral hepatitis. Immunological adjustments during pregnancy can affect the viral load and liver enzyme levels, complicating the management of the infection.[9] Additionally, the risk of vertical transmission, where the virus is passed from mother to child, varies by hepatitis type and significantly impacts neonatal health outcomes. For instance, HBV and HCV can be transmitted perinatally, necessitating careful monitoring and intervention to prevent neonatal infection.[10]

So, this study aimed to investigate the pregnancy outcomes associated with viral hepatitis, focusing on the impacts of HBV, HCV, HDV, and HEV on both maternal and fetal health. By analyzing the complications and outcomes linked to these infections, the study seeks to provide insights into effective management strategies and improve clinical practices to enhance maternal and neonatal health.

MATERIALS AND METHODS

Study Design and Setting: This study employed a retrospective cohort design to investigate the pregnancy outcomes associated with viral hepatitis. The study was conducted at a tertiary care center, from January 2021 to December 2023. The study protocol was approved by the Institutional Review Board (IRB).

Study Population: Inclusion criteria required participants to be aged 18 to 45 years, have a confirmed diagnosis of HBV, HCV, HDV, or HEV based on serological testing (HBsAg, anti-HCV, anti-HDV, or anti-HEV antibodies), and to have received prenatal care and delivered at the study site. Women with multiple viral hepatitis infections, pre-existing chronic liver conditions unrelated to viral hepatitis, such as autoimmune hepatitis or alcoholic liver disease, or those with incomplete medical records were excluded to ensure a homogenous study population and accurate outcome assessment.

Laboratory procedure: Blood samples were collected from participants and processed to confirm diagnoses of HBV, HCV, HDV, and HEV through serological testing. Serum was separated from blood samples by centrifugation and stored at -80°C. ELISA procedures involved antigen-antibody binding and colorimetric detection, while PCR and RT-PCR techniques amplified viral genetic material for detection and quantification. For HBV, enzyme-linked immunosorbent assay (ELISA) kits were used to detect HBsAg, with further testing for HBeAg, anti-HBe antibodies, and HBV DNA via polymerase chain reaction (PCR) to determine viral load. HCV diagnosis involved ELISA for anti-HCV antibodies, followed by reverse transcription PCR (RT-PCR) for HCV RNA to confirm active infection and genotype identification. HDV screening was performed in HBsAg-positive patients using ELISA for anti-HDV antibodies and RT-PCR for HDV RNA. HEV diagnosis entailed ELISA for anti-HEV IgM and IgG antibodies, with RT-PCR for HEV RNA in suspected acute cases.

Data Collection: Data collection was conducted systematically using the hospital's electronic medical records (EMR) system. A predesigned questionnaire was used to collect the details. Detailed demographic information was recorded, including maternal age, parity, body mass index (BMI), and the presence of comorbid conditions such as hypertension, diabetes, and other significant medical histories. For each type of viral hepatitis (HBV, HCV, HDV, HEV), specific data were collected, including the timing and method of diagnosis (serological markers like HBsAg, anti-HCV, anti-HDV, and anti-HEV antibodies), viral load levels at different points during pregnancy, and liver function test results (ALT, AST). Key pregnancy outcomes were collected, including gestational age at delivery (calculated based on the last menstrual period and confirmed by ultrasound), mode of delivery (vaginal delivery, cesarean section, and indications for cesarean), and pregnancy complications such as gestational diabetes, preeclampsia, and intrahepatic cholestasis. Data on preterm births (defined as delivery before 37 weeks of gestation), low birth weight (defined as birth weight less than 2500 grams), and intrauterine growth restriction (IUGR) were also recorded. Neonatal outcomes were carefully documented, including Apgar scores at 1 and 5 minutes after birth, birth weight, and admission to the neonatal intensive care unit (NICU). Data on neonatal hepatitis infection status were collected through postnatal serological testing.

Statistical Analysis: Descriptive statistics were used to summarize the baseline characteristics of the study population. Continuous variables were presented as means and standard deviations (SD), while categorical variables were presented as frequencies and percentages. Comparative analysis was performed to assess differences in pregnancy and

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neonatal outcomes between women with different types of viral hepatitis. The Chi-square test was used for categorical variables, and the Student's t-test was used for continuous variables, as appropriate. Multivariable logistic regression models were employed to identify factors independently associated with adverse pregnancy outcomes (preterm birth, low birth weight, and neonatal hepatitis infection). The models included potential confounders such as maternal age, parity, BMI, and comorbid conditions. All statistical analyses were performed using SPSS software version 20.0 (IBM Corp., Armonk, NY). A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age was comparable across groups (30.5 years for HBV, 31.3 years for HCV, and 28.4 years for HEV; p=0.301), as were parity (2 for HBV and HCV, 3 for HEV; p=0.252) and BMI (25.6 kg/m² for HBV, 24.3 kg/m² for HCV, and 26.3 kg/m² for HEV; p=0.422). Hypertension was present in 14.7% of the HBV group, 14.3% of the HCV group, and 21.7% of the HEV group (p=0.509), while diabetes affected 11.8%, 14.3%, and 17.4% of these groups, respectively (p=0.455). Antiviral treatment rates were high but varied (85.3% for HBV, 100% for HCV, and 69.6% for HEV; p=0.228). Median viral loads were similar across groups (p=0.381). Liver enzyme levels (ALT and AST) also showed no significant differences, indicating similar liver function profiles among the groups [Table 1].

The mean gestational age at delivery was 38.2 ± 2.3 weeks for the HBV group, 37.5 ± 3.0 weeks for the HCV group, and 39.3 ± 2.4 weeks for the HEV group (p=0.342). Mode of delivery was comparable, with vaginal deliveries occurring in 60.3% (HBV), 57.1% (HCV), and 69.6% (HEV) of cases (p=0.425), and cesarean sections in 39.7% (HBV), 42.9% (HCV), and 30.4% (HEV) (p=0.413). Gestational diabetes was present in 14.7% of the HBV group, 14.3% of the HCV group, and 8.7% of the HEV group (p=0.676). Preeclampsia occurred in 11.8% (HBV), 14.3% (HCV), and 8.7% (HEV) (p=0.638). There were no maternal mortalities reported in any group (p=1.000). Preterm births were observed in 14.7% (HBV), 14.3% (HCV), and 8.7% (HEV) (p=0.557), while intrauterine growth restriction was seen in 10.3% (HBV), 14.3% (HCV), and 13.0% (HEV) (p=0.529). The mean birth weights were 3122.4 ± 502.3 grams (HBV), 2902.8 ± 422.4 grams (HCV), and 3134.9 ± 450.4 grams (HEV) (p=0.423). Low birth weight rates were 20.6% (HBV), 14.3% (HCV), and 21.7% (HEV) (p=0.533). Apgar scores at 1 minute were consistent across groups at a median of 8 (p=0.455), and at 5 minutes at a median of 9 (p=0.533). NICU admissions were reported in 10.3% (HBV), 14.3% (HCV), and 13.0% (HEV) (p=0.558). Neonatal hepatitis infection rates were 4.4% (HBV), 14.3% (HCV), and 4.3% (HEV) (p=0.653) [Table 2].

Table 1: Baseline Characteristics of Study Population by Infection Type.

Characteristic	HBV (n=68)	HCV (n=7)	HEV (n=23)	p-value
	Frequency (%)/Mean ± SD			
Age (years)	30.5 ± 5.4	31.3 ± 4.2	28.4 ± 6.1	0.301
Parity	2 ± 1	2 ± 1	3 ± 2	0.252
BMI (kg/m²)	25.6 ± 3.5	24.3 ± 3.1	26.3 ± 4.6	0.422
Comorbidities				
Hypertension	10 (14.7)	1 (14.3)	5 (21.7)	0.509
Diabetes	8 (11.8)	1 (14.3)	4 (17.4)	0.455
Antiviral Treatment	58 (85.3)	7 (100.0)	16 (69.6)	0.228
Viral Load (IU/mL)	2238 (532-5847)	1519 (402-3172)	1282 (321-2582)	0.381
ALT (U/L)	44.6 ± 21.4	51.3 ± 18.7	42.2 ± 17.4	0.454
AST (U/L)	41.7 ± 15.3	38.6 ± 14.2	39.5 ± 13.7	0.522

Table 2: Feto-Maternal Outcomes by Infection Type.

Outcome	HBV (n=68)	HCV (n=7)	HEV (n=23)	p-value
	Frequency (%)/Mean ± SD			
Gestational Age at Delivery (weeks)	38.2 ± 2.3	37.5 ± 3.0	39.3 ± 2.4	0.342
Mode of Delivery				
Vaginal Delivery	41 (60.3)	4 (57.1)	16 (69.6)	0.425
Cesarean Section	27 (39.7)	3 (42.9)	7 (30.4)	0.413
Gestational Diabetes	10 (14.7)	1 (14.3)	2 (8.7)	0.676
Preeclampsia	8 (11.8)	1 (14.3)	2 (8.7)	0.638
Maternal Mortality	0 (0.0)	0 (0.0)	0 (0.0)	1.000
Preterm Birth	10 (14.7)	1 (14.3)	2 (8.7)	0.557
Intrauterine Growth Restriction	7 (10.3)	1 (14.3)	3 (13.0)	0.529
Birth Weight (grams)	3122.4 ± 502.3	2902.8± 422.4	3134.9 ± 450.4	0.423
Low Birth Weight	14 (20.6)	1 (14.3)	5 (21.7)	0.533
Apgar Score at 1 min	8 (7-9)	8 (7-9)	8 (7-9)	0.455
Apgar Score at 5 min	9 (8-10)	9 (8-10)	9 (8-10)	0.533
NICU Admission	7 (10.3)	1 (14.3)	3 (13.0)	0.558
Neonatal Hepatitis Infection	3 (4.4)	1 (14.3)	1 (4.3)	0.653

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The multivariable logistic regression analysis identified that higher BMI (≥ 30 kg/m², OR: 1.05, 95% CI: 1.01-1.09, p=0.027) and hypertension (OR: 2.3, 95% CI: 1.15-4.80, p=0.026) were significantly associated with increased risk of adverse pregnancy outcomes. Although diabetes (OR: 1.9, 95% CI: 0.85-3.72, p=0.061) and higher viral load (≥ 2000 IU/mL, OR: 1.01, 95% CI: 1.00-1.02, p=0.086) showed trends towards higher risk, these associations were not statistically significant. Other factors, including age (≥ 35 years), parity (> 2), elevated ALT (≥ 50 U/L), elevated AST (≥ 40 U/L), and receipt of antiviral treatment, did not significantly influence adverse pregnancy outcomes [Table 3].

Table 3: Multivariable Logistic Regression Analysis of Factors Associated with Any Adverse Pregnancy Outcome.

Variable	Category	Adjusted OR	95% CI	p-value
Age	≥ 35 years	1.03	0.98 - 1.09	0.259
Parity	> 2	1.1	0.95 - 1.28	0.207
BMI	≥ 30 kg/m²	1.05	1.01 - 1.09	0.027
Hypertension	Present	2.3	1.15 - 4.80	0.026
Diabetes	Present	1.9	0.85 - 3.72	0.061
Viral Load	≥ 2000 IU/mL	1.01	1.00 - 1.02	0.086
ALT	≥ 50 U/L	1.01	0.99 - 1.03	0.454
AST	≥ 40 U/L	1.02	1.00 - 1.04	0.335
Antiviral Treatment	Received	0.9	0.50 - 1.62	0.717

DISCUSSION

Our study investigates the pregnancy outcomes associated with viral hepatitis types HBV, HCV, and HEV among a cohort of pregnant women. The average age of the participants was similar across the groups, with no significant difference (p=0.301). This consistency aligns with other studies, such as the one by Liu et al., and Goins et al., which reported comparable age distributions in their study of pregnant women with HBV and HCV.[11,12] The parity and BMI were also not significantly different, indicating that these factors did not confound the pregnancy outcomes in our study.

The viral load and liver enzyme levels (ALT and AST) did not show significant differences among the groups. The median viral load was 2238 IU/mL for the HBV group, 1519 IU/mL for the HCV group, and 1282 IU/mL for the HEV group (p=0.381). This finding contrasts with some literature suggesting that HCV is associated with higher ALT levels, reflecting more active liver inflammation.[13,14] However, our cohort's relatively small sample size, particularly for the HCV group (n=7), may limit the detection of such differences.

The gestational age at delivery and mode of delivery were comparable across the groups, with no significant differences observed. Vaginal delivery was achieved by 60.3% of the HBV group, 57.1% of the HCV group, and 69.6% of the HEV group (p=0.425). The rate of cesarean sections was slightly higher in the HBV and HCV groups compared to the HEV group, although not statistically significant. Chang et al., and Ades et al., has shown mixed results regarding the mode of delivery in hepatitis-infected women, with some studies suggesting higher cesarean rates due to concerns about vertical transmission.[15,16]

Preterm birth and low birth weight rates did not differ significantly among the groups. Preterm birth occurred in 14.7% of the HBV group, 14.3% of the HCV group, and 8.7% of the HEV group (p=0.557). This finding is consistent with studies by Zheng et al., and Chen et al., which found no increased risk of preterm birth or low birth weight in women with HBV and HCV infections.[17,18] However, some studies have indicated a higher risk of adverse birth outcomes, particularly with HEV infection, known for causing severe maternal illness and adverse neonatal outcomes during outbreaks.[19,20]

Neonatal outcomes, including birth weight, Apgar scores, and NICU admissions, were similar across the groups. The incidence of neonatal hepatitis infection was low and comparable among the groups. The incidence of neonatal hepatitis infection was low and comparable among the groups, with 4.4% in the HBV group, 14.3% in the HCV group, and 4.3% in the HEV group (p=0.653). These findings align with the results of studies that suggest the risk of vertical transmission and subsequent neonatal hepatitis infection is relatively low, especially with effective antiviral treatment and proper management during pregnancy.[21-23]

The multivariable logistic regression analysis identified BMI ≥ 30 kg/m² and hypertension as significant predictors of adverse pregnancy outcomes. Higher BMI was associated with increased odds of low birth weight (OR 1.05, 95% CI 1.01-1.09, p=0.027), and hypertension was significantly associated with adverse outcomes (OR 2.3, 95% CI 1.15-4.80, p=0.026). These findings are consistent with existing literature highlighting the impact of obesity and hypertension on pregnancy outcomes, regardless of viral hepatitis status.[24-26]

Limitations

The study has several limitations. The relatively small sample size, particularly for the HCV group, limits the generalizability of our findings. Additionally, the retrospective design may introduce selection bias, and the reliance on medical records may result in incomplete data capture.

CONCLUSION

Our study demonstrates that pregnant women with HBV, HCV, and HEV infections have similar

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pregnancy and neonatal outcomes when managed appropriately. Key predictors of adverse outcomes were higher BMI and hypertension, emphasizing the importance of addressing these comorbidities during pregnancy. Despite no significant differences in the rates of preterm birth, low birth weight, or neonatal complications among the groups, the small sample size, particularly for HCV, suggests the need for larger studies. Overall, effective management of viral hepatitis and associated comorbidities is crucial to ensure favorable pregnancy outcomes. Further research is required to confirm these findings and explore underlying mechanisms.

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