



“CHRONIC LIVER DISEASE IN PREGNANCY: EFFECTS ON FETAL GROWTH AND LONG-TERM NEONATAL HEALTH”

Dr Paras^{1*}, Dr Gul Saba Taj², Dr Salma³, Dr Joshna Devraj⁴, Dr Hafiza Saira Gul⁵, Dr Beenish Hafiz⁶

^{1*}Demonstrator of Community Medicine, Department of Community Medicine, MBBS, MPH, HBS medical and dental Hospital Islamabad, Pakistan

²Gynaecologist, Department of Obstetrics & Gynecology, MBBS, FCPS, Pak Oman Hospital Pasni, Pakistan

³Consultant Obstetrics & Gynecology, Department of Obstetrics & Gynecology, FCPS, Dow University of Health Sciences/ Civil Hospital Karachi, Pakistan

⁴Postgraduate, Obstetrics & Gynecology, Department of Obstetrics & Gynecology, MBBS, Dow Medical College/ Civil Hospital Karachi, Pakistan

⁵Consultant Obstetrics & Gynecology, Department of Obstetrics & Gynecology, FCPS, MRCOG, Civil Hospital Karachi, Pakistan

⁶Assistant Professor of Community Medicine, Department of Community Medicine, MSPH, Hazrat Bari Sarkar Medical & Dental College Islamabad, Pakistan

***Corresponding Author:** Dr Paras,

Demonstrator of Community Medicine, Department of Community Medicine, MBBS, MPH, HBS medical and dental Hospital Islamabad, Pakistan Email: paras.sheikh08@gmail.com.

ABSTRACT

Background: Chronic liver disease (CLD) during pregnancy is evolving more commonly as a result of the increasing prevalence of viral hepatitis and metabolic liver disorders in women of reproductive age. Impaired maternal liver function can lead to disturbance of the energy metabolism, blood supply to the placenta, and immune system regulation, and fetal growth and neonatal health can be affected. Nevertheless, there is little data on the impact of hepatic dysfunction on the short- and early long-term outcomes of neonates.

Objective: To evaluate how chronic liver disease during pregnancy affects fetal growth patterns and to study its link with short-term and early long-term neonatal health outcomes.

Methods: This prospective observational study was carried out in a tertiary care hospital over the period of May, 2025 to August, 2025. In total, 180 pregnant women with chronic liver disease were included in the study. Their maternal clinical and laboratory data were registered, and fetal growth was checked by repeated ultrasonography. Neonatal results at birth and during the first postnatal follow-up period were recorded. Data were subjected to descriptive and inferential statistical methods.

Results: Fetal growth restriction occurred in 37.8% of the cases. Low birth weight was present in 40.6% of the neonates, while 33.9% were delivered preterm. NICU admission was necessary for 31.1% of the infants. At the early postnatal review, growth faltering was seen in 30.0% of the babies and early metabolic abnormalities in 16.1%, especially in those with antenatal growth restriction.

Conclusion: Pregnant women with chronic liver disease are at risk of delivering babies with growth retardation and experience increased morbidity in newborns, with the possibility of early long-term health effects. Proper and timely detection, detailed monitoring of the fetus, and a teamwork approach of different specialties are crucial ways to have positive maternal and neonatal outcomes.

Keywords: Chronic liver disease, pregnancy, fetal growth restriction, neonatal outcomes, long-term health

INTRODUCTION

Pregnancy is an exclusive physiological state when metabolic, cardiovascular, and hepatic systems of a mother experience changes which are vital to the development and growth of the fetus. In case these systems fail, both the baby and the mother may suffer repercussions of the system failure, more so when the mother already has chronic conditions. According to the new research, maternal diseases such as high blood pressure, diabetes, and metabolic disorders pose a tremendous influence on the placental activity and the supply of nutrients to the child and the future wellbeing of the child even in adulthood. In fact, since they are diseases that can be aptly managed, there is a possibility of the fetus developing not only limited growth but also such metabolic issues after birth. Chronic liver disease (CLD) during pregnancy is also a subject that has not attracted much attention and is a clinical dilemma of considerable significance due to its intercourse with the metabolic and vascular pathways that play a vital role during pregnancy (1). The rising prevalence of metabolic condition globally has also resulted in the liver-related issues becoming more widespread in women of child bearing age and CLD has become a more applicable subject matter in pregnancy management (2).

Fatty liver disease related to maternal metabolic dysfunction (MAFLD) and other chronic liver diseases are as risky as obesity, insulin resistance, and hormonal disorders, which also have an adverse influence on the development of the fetus. Liver inflammatory processes and unregulated lipids metabolism could decrease placental blood flow and fetal development, and predispose to intrauterine growth retardation or low birth weight. A similar sort of effects has been observed in complicated pregnancies those that were caused by systemic infections and chronic inflammatory diseases wherein the disease in the mother does not only dictate the immediate safety of the child but their future health (3). Recent findings on the hypertensive disorders during pregnancy indicate that one of the causes that the children suffer in the short term and in the long term is the blood vessel issues in the mother thus the importance of the mother having good organs during pregnancy (4). The state in the uterus certainly determines the well being of the baby. It has been proved that metabolic disorders of mother during pregnancy caused something to be left in trace in the child, increasing the chances of the child to develop obesity, insulin resistance and liver dysfunction later in life.

Thus, one of the causes of the abnormalities in fetal growth is gestational diabetes mellitus and babies are exposed to chronic metabolic issues (5). On the other hand, the administration of drugs during pregnancy in the treatment of diabetes might cause harm to the expectant baby by affecting the micro nutrient pathways which are important in growth and metabolic program of the baby (6). The findings are uncovering the intricate question of how far the morbidity of the mother can be cured, and the infant is continually growing well in the circumstance of pregnancy that is based on chronic hepatitis. In case of sick babies and the deaths of babies across the world, fetal growth limitation is always one of the leading causes. The global norms also place a lot of emphasis on determining the female impediment that, as a result of placental malfunction, the development of the fetus is impaired in the very initial stages of the pregnancy. Deviations in the maternal metabolic and liver conditions can lead to the inadequate supply of nutrients and oxygen, and thereupon, the lack of development of the fetus (7).

Recent studies that have examined maternal diseases on a systemic level including viral infections have found that chronic maternal illness may exacerbate fetal complications despite having cleared of the acute disease (8). In addition, these results are in agreement with chronic liver disease causing chronic metabolic and inflammatory alterations that may influence fetal development and newborn outcomes. Fetal growth that is compromised is not only harmful during the perinatal period, but health status would also affect the health of the fetus in the long term. Children that experienced poor conditions within the uterus are more likely to develop cardiovascular, metabolic, and liver diseases when they become older. Research studies of hypertensive disorders of pregnancy had never failed to provide evidence on the significant impacts of such disorders on both the mother and child health and

intergenerational effects of the pregnancy-related disease (9). Premature fetal growth retardation either singly or in combination with maternal comorbidities causes the development of organs to impair and an increased probability of chronic disease (10). Thus, the trends suggest that the cause of chronic liver disease in pregnancy could also be the cause of long-term risks by the conventional pathophysiological processes. The fact that metabolic liver disease is a hereditary disease between generations is a novel issue. Mother metabolic disorders during pregnancy have a correlation with the occurrence of non-alcoholic fatty liver disease in children. This demonstrates the fact that the vulnerability of the liver was even pre-programmable in the womb (11).

Chronic viral hepatitis during pregnancy creates not only a risk of vertical infection but also puts the safety of the fetus and its health in the long run at risk. The antiviral therapies are a two-sided sword because they assist in minimizing the maternal viral load, but their possible damage to the growth and development of the fetus should be carefully considered (12). These problems are the most relevant to the areas with high incidences of chronic hepatitis among women of reproductive age. Equally, the exposure to nutrition at the peak stages of growth would have a long-term effect on the liver of the young ones. Natural experiments have demonstrated that early-life nutritional deprivation or imbalance also plays a significant role in the development of the risk of metabolic-associated liver disease at the adult stage (13). The nutritional status of the mother and the hepatic performance can be considered in the future metabolic programming of the child in the case of the chronic liver disease during pregnancy. The antiviral treatment has resulted in a significant improvement in the outcomes of the mothers with chronic hepatitis B and the safety of the treatments in relation to the newborns or any long-term outcomes is closely being monitored by conducting studies (14). Following metabolic and viral liver diseases, investigation of maternal substance use conditions also throws light on the effects of chronic maternal illness on fetal and infant health.

One of the reasons the fetus develops poorly, the children develop neurodevelopmental and metabolic sequelae that they will carry their lives through is caused by maternal opioid use disorder (15). Equally, the problem of hypertensive disorders of pregnancy can be utilized to clarify how maternal systemic disease may alter the activity of the placenta and fetal development and hence the need to explore the multisystem interactions during pregnancy (16). Besides, recent worldwide epidemics like COVID-19 have demonstrated that maternal systemic illness may impact fetal and newborn outcomes by inflammatory and vascular pathways (17). The literature will highlight that the chronic maternal conditions have significant impacts on the growth of the fetus and long-term health of the neonatal condition when combined. A significant part of the work has been carried out during the past years on diabetes, hypertension, and infectious diseases. Nevertheless, pregnancy related chronic liver disease is a grossly unexplored field of research, although its incidence is rising, and it can carry considerable consequences. This paper is interested in discussing the effect that maternal CLD has on fetal growth patterns and long-term neonatal outcomes, and it may prove to be extremely helpful in enhancing antenatal care, risk stratification, and management methods. It is of great importance to learn more about CLD in pregnancy and this is most evident in tertiary care facilities where high-risk pregnancies are managed, and life time child health outcomes can be noticed and assessed in detail.

Objective: To evaluate how chronic liver disease in pregnancy affects fetal growth patterns and determine its relationship with immediate outcomes and long-term health consequences for the exposed infants.

MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Settings: The research was performed at the Department of Community Medicine, HBS Medical and Dental Hospital Islamabad.

Duration of Study: From May, 2025 to August, 2025.

Sample Size: A total of **180 pregnant women** diagnosed with chronic liver disease were enrolled by a non-probability consecutive sampling method.

Inclusion Criteria: Pregnant women aged 18–45 years old, diagnosed with chronic liver disease regardless of etiology, were included in the study. The women could be at any stage of pregnancy. The participants had to sign informed consent and commit to follow-up until delivery.

Exclusion Criteria: Women having acute liver failure and those with multiple pregnancies, significant congenital fetal anomalies, pre-existing renal or cardiac diseases, or incomplete clinical records were not included in the study.

Methods

After the patients were enrolled, a comprehensive maternal demographic profile and clinical characteristics were recorded that included a couple of things like the mother's age, whether she is a first-time mother, the gestational age at presentation, the cause of chronic liver disease, and the pertinent obstetric history. Routine baseline blood tests, such as liver function tests, coagulation profile, and viral hepatitis markers, were retrieved from the patient's prior medical documentation. The fetal growth was kept under observation by doing serial ultrasonography, which measured the estimated fetal weight, abdominal circumference, and amniotic fluid index. A fetus was considered to have growth restriction if it fell under standard gestational age-specific percentiles. Neonatal outcomes were recorded right after birth, which included birth weight, Apgar scores, gestational age at delivery, and whether the baby required admission to the neonatal intensive care unit. Where available, long-term neonatal health data were collected from follow-up records with a focus on growth parameters and early metabolic indicators. The data was input and statistically analyzed using software. Descriptive statistics were generated, and the relationships between maternal liver disease and fetal or neonatal outcomes were determined using proper inferential tests with the significance level set at $p < 0.05$.

Results

The analysis included 180 pregnant women with a diagnosis of chronic liver disease. The average age of the mothers was 29.6 ± 5.1 years, with most of the participants in the age range of 26–35 years. Most of the women were multiparous, and the liver disease caused by viral hepatitis was the most common etiology. A large number of patients came in the second trimester, and there was enough time for the follow-up of fetal growth. The maternal baseline characteristics are shown in Table 1.

Table 1: Baseline Maternal Characteristics (n = 180)

Variable	Frequency (%)
Age 18–25 years	42 (23.3)
Age 26–35 years	96 (53.3)
Age >35 years	42 (23.3)
Primigravida	58 (32.2)
Multigravida	122 (67.8)
Viral hepatitis–related CLD	98 (54.4)
Non-viral CLD	82 (45.6)

Evaluation of fetal growth showed that there were many growth problems in the cases of chronic liver disease in pregnancy. More than one-third of the cases showed fetal growth restriction (FGR). Ultrasound detected small abdominal circumference and low fetal weight as the most common

findings. These problems were more common in women who had severe liver disease and abnormal liver function test results. A comprehensive account of fetal growth outcomes is given in Table 2.

Table 2: Fetal Growth Outcomes

Outcome	Frequency (%)
Normal fetal growth	112 (62.2)
Fetal growth restriction	68 (37.8)
Low abdominal circumference	74 (41.1)
Reduced amniotic fluid index	39 (21.7)

Delivery was characterized by neonatal outcomes of increased rates of low birth weight and preterm birth. Around 1/3 of babies were delivered earlier than 37 weeks of pregnancy. Low Apgar scores at 5 minutes were largely seen in neonates with fetal growth restriction. Most of the newborns that had to be admitted to NICU were those who suffered from prematurity and low birth weight. Neonatal outcome data can be seen in Table 3.

Table 3: Neonatal Outcomes at Birth

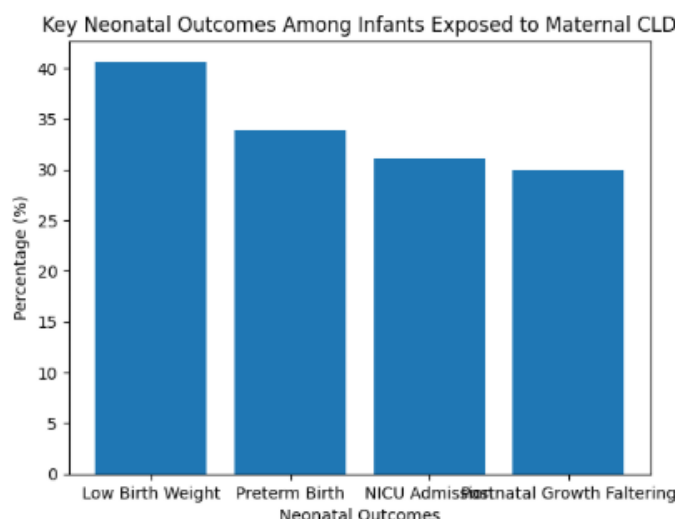
Outcome	Frequency (%)
Preterm birth	61 (33.9)
Low birth weight (<2.5 kg)	73 (40.6)
Apgar score <7 at 5 min	38 (21.1)
NICU admission	56 (31.1)

Neonatal follow-up data extending to long-term, which were only partially available, showed that infants continued to experience growth and health problems. Babies who were exposed to their mothers' chronic liver disease in utero had more postnatal growth failures and early metabolic disturbances than those who had normal fetal growth. Children with fetal growth restriction have been observed to have developmental delays more often. These results are presented in Table 4.

Table 4: Early Long-Term Neonatal Outcomes

Outcome	Frequency (%)
Normal postnatal growth	97 (53.9)
Postnatal growth faltering	54 (30.0)
Early metabolic abnormalities	29 (16.1)

Graph 1: Comparison of Key Neonatal Outcomes



A bar graph shows the percentage of infants with normal and low birth weight, those admitted to the NICU, and postnatal growth faltering. According to the chart, the cases of low birth weight and NICU admission were significantly higher in the babies whose mothers had fetal growth restriction. This points out how chronic liver disease negatively affects neonatal health not only at birth but also in the short term.

Discussion

This study shows that liver disease in pregnancy negatively affects fetal growth and also leads to immediate and later adverse neonatal outcomes. The considerable rate of fetal growth restriction and low birth weight seen in this group underlines how delicate the fetus's environment is when the mother's liver functions are impaired. Pregnancies with chronic metabolic and vascular diseases have also been found to be affected, due to changes in the mother's physiology, which reduce the blood supply and nutrients reaching the fetus (1). The data here support the idea that diseases in the mother, including those that are stable, always have a profound influence on fetal growth (2).

The main reason for viral hepatitis-related chronic liver disease among study participants is the regional epidemiologic situation, and this corresponds to the pattern of publications from low- and middle-income countries. Chronic inflammation of the liver and changes in its metabolism may lead to placental dysfunction through systemic inflammatory responses and excessive production of free radicals. Residual mechanisms have been observed in pregnancies complicated by chronic infections, where maternal immune activation results in fetal jeopardy and later child developmental issues (3). Similarly, one can identify parallels with hypertensive disorders of pregnancy, which also lead to poor uteroplacental blood flow and intrauterine growth restriction (4).

Fetal growth restriction was diagnosed in more than one-third of the pregnancies in this investigation, a figure way above that typically seen in low-risk obstetric populations. This observation aligns well with data associating maternal metabolic disturbances with fetal growth abnormalities. Research in gestational diabetes mellitus reveals that changes in maternal glucose and lipid metabolism can cause the fetus to evolve either too large or too small, depending on how severe the disease is and the degree of placental adaptation (5). In addition, it has been noted in diabetic pregnancies that medication and dietary components that interact with maternal metabolism can have a further effect on fetal growth patterns (6).

Various international guidelines stress the importance of spotting and tracking pregnancies where the baby may not be growing properly, even before birth. Findings from this research that picked up anomalies in the fetal weight estimation and fetal abdominal measurement indirectly indicate the requirement for specific pre-birth monitoring of liver disease-affected women. Leading practice guidelines underline that any maternal disease that impacts vascular and metabolic physiology should be a reason for conducting repeated fetal evaluations so as to lessen the chance of experiencing harmful outcomes (7). Data from more recent studies on maternal illness, such as research into the

long-term impacts of systemic infections, imply that exposure to chronic disease in pregnancy can affect the child beyond just the immediate perinatal period (8).

Neonatal outcomes of this study add to the evidence that chronic liver disease during pregnancy is very harmful clinically. The rise in preterm birth, low Apgar scores, and NICU admissions parallels the results of pregnancies complicated by hypertensive disorders and placental insufficiency. Similarly, long-term follow-up studies of offspring exposed to preeclampsia have shown that such offspring are at higher risk of metabolic and cardiovascular diseases. This suggests that early neonatal compromise may lead to health problems throughout the entire life (9). Early fetal growth restriction, especially when maternal comorbidities are present, has always been associated with poor neonatal adaptation and higher morbidity (10).

The ramifications of neonatal outcomes over the long term, such as the catch-up growth after birth and the first signs of metabolic irregularities, are, in fact, quite alarming. Developmental programming is a concept emerging from the evidence that a fetus exposed in-utero to a mother suffering from metabolic and hepatic dysfunction is more likely to develop chronic liver disease and metabolic disorders as an adult. Gestational metabolic disorders have been shown through systematic reviews to be a cause of the intergenerational transmission of non-alcoholic fatty liver disease (11). Treatment strategies for chronic viral hepatitis aim at reducing the vertical transmission from mother to child while at the same time keeping the fetus safe (12), and slight long-term impacts on the metabolism of the offspring are always being studied.

Prenatal nutrition and one's surroundings can have an additional impact on the results. Research on human early development following nutritional deprivation has shown that a change in the nutrients available to mother and fetus can result in an increased risk of metabolic-associated liver disease later in life (13). In the case of liver diseases, nutritional deficiencies of the mother together with hepatic metabolism disturbances may, through their cumulative effects, alter fetal programming. Even if antiviral drugs like tenofovir have been demonstrated to be relatively safe for mothers and newborns (14), the effects of maternal chronic liver disease on the offspring's growth and metabolism are issues that need to be continually re-evaluated.

Comparisons with other chronic maternal conditions give a useful background to understand these results. For example, maternal substance use disorders have been linked to poor fetal growth and long-term child health problems through parallel mechanisms of inflammation, endocrine disruption, and placental dysfunction (15). Likewise, pregnancy-related hypertension is an example of how maternal chronic diseases can affect fetal growth and neonatal adjustment through the vascular system (16). Latest information on COVID-19-affected pregnancies also gives an insight into how systemic maternal disease can lead to both immediate and delayed neonatal consequences (17).

The results of this study broadly add to the accumulating evidence that chronic liver disease during pregnancy is definitely not a harmless condition for the health of the fetus and the newborn (15). It is crucial that women affected by this condition receive antenatal care from a multidisciplinary team due to the association of fetal growth restriction, neonatal complications, and early long-term health problems with the disease. Awareness of the condition at the earliest stage, constant fetal monitoring, and a well-coordinated obstetric-hepatology approach can lead to lessening of the risks and better results for both the mother and the baby. More long-term studies on children are necessary to completely understand pediatric outcomes, which will help in the development of evidence-based guidelines specifically addressed to pregnancies complicated by chronic liver disease.

Conclusion

This research shows that chronic liver disease in pregnancy leads to serious negative impacts on fetal growth and neonatal health at birth. A large number of the pregnancies developed complications such as fetal growth restriction, preterm delivery, and low birth weight, all symptoms of poor intrauterine development. These negative results led to an increase in neonatal illness as seen in the higher frequency of NICU admissions and early postnatal growth failure. The study proposes that the dysfunction of the maternal liver might decrease placental performance and alter fetal metabolic programming, raising the risk of both immediate and long-term neonatal health problems. There is a

continual increase in the number of women of reproductive age suffering from chronic liver diseases. These findings shed light on the urgency of early diagnosis and close monitoring during pregnancy of patients with such conditions. The combination of the obstetric, hepatology, and neonatology specialists' management is necessary to ensure the best possible maternal and fetal outcomes, while also lowering the offspring's long-term risk.

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