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Research Article

Portal Hypertension Complicating Pregnancy: Safety, Tolerability, and Maternal-Fetal Outcomes of Non-Selective Beta-Blocker Therapy

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ABSTRACT
Background: Portal hypertension during pregnancy is associated with increased maternal and fetal risks, particularly variceal bleeding and hepatic decompensation. Non-selective beta-blockers (NSBBs) are widely used for variceal bleeding prophylaxis; however, pregnancy-specific safety data remain limited.
Objectives: To describe the maternal, fetal, and neonatal outcomes, clinical characteristics, treatment tolerability, and complications among pregnant women with portal hypertension receiving NSBB therapy.
Methods: This retrospective observational study included 30 pregnant women with portal hypertension who received NSBB at Raichur Institute of Medical Sciences and OPEC/RGSSH, Raichur, between January 2021 and June 2026. Demographic and clinical characteristics, NSBB exposure, maternal complications, and fetal and neonatal outcomes were retrieved from medical records and analyzed using descriptive statistics.
Results: Of 30 women, 53.3% had vascular causes of portal hypertension and 46.7% had cirrhosis-related portal hypertension. Propranolol was administered in 80.0% and carvedilol in 20.0%. NSBB therapy was continued throughout pregnancy in 90.0%, while 6.7% required dose reduction and 3.3% discontinued treatment because of intolerance. Variceal/gastrointestinal bleeding occurred in 6.7%, hepatic decompensation in 13.3%, and NSBB-related adverse effects in 10.0%. Maternal survival was 100%. Live births constituted 86.7% of pregnancies, with abortion and stillbirth occurring in 6.7% each. Among 26 live births, preterm birth occurred in 19.2%, low birth weight in 26.9%, intrauterine growth restriction in 23.1%, and neonatal intensive care admission in 15.4%. No congenital anomalies or neonatal deaths were recorded.
Conclusion: NSBB therapy was generally well tolerated in pregnant women with portal hypertension, with high treatment continuation and no maternal or neonatal mortality. Nevertheless, clinically important maternal and fetal complications remained, supporting individualized therapy with close multidisciplinary maternal and fetal monitoring.

Keywords: Portal Hypertension, Pregnancy, Non-Selective Beta-Blockers, Propranolol, Carvedilol, Variceal Bleeding, Maternal Outcomes, Neonatal Outcomes.

INTRODUCTION

Portal hypertension complicating pregnancy represented a clinically challenging scenario due to the increased risk of variceal haemorrhage, hepatic decompensation, and adverse maternal and fetal outcomes. Although advances in the management of chronic liver disease had improved survival among women of reproductive age, the global burden of cirrhosis and portal hypertensive disorders continued to rise, resulting in an increasing number of pregnancies occurring in women with underlying liver disease.[1] Pregnancy was associated with substantial hemodynamic alterations, including increased plasma volume and cardiac output, which could exacerbate portal pressure and increase the risk of variceal complications, particularly during the second and third trimesters.[2]

Non-selective beta-blockers (NSBBs), including propranolol and nadolol, had remained central therapies for the prevention of variceal bleeding in patients with portal hypertension by reducing portal venous inflow through decreased cardiac output and splanchnic

vasoconstriction.[3] However, their use during pregnancy had remained controversial due to concerns regarding potential fetal effects, including growth restriction, neonatal bradycardia, and hypoglycemia.[4] Existing recommendations had supported individualized risk–benefit assessment, as uncontrolled portal hypertensive complications could have posed substantial risks to both the mother and fetus.[1,3]

Recent literature had suggested that carefully monitored NSBB therapy could be reasonably tolerated during pregnancy. Contemporary reviews and cohort-based evidence had indicated that beta-blocker exposure among women with portal hypertension or cirrhosis did not consistently demonstrate unacceptable maternal or fetal safety signals, although reported outcomes had remained heterogeneous and were influenced by underlying liver disease severity, timing of exposure, and concomitant obstetric factors.[2,4] Furthermore, updated portal hypertension guidance had emphasized the importance of preventing variceal bleeding while acknowledging the limited pregnancy-specific evidence available regarding pharmacological prophylaxis.[1]

Despite these observations, significant knowledge gaps had remained regarding the real-world safety profile of NSBBs in pregnant patients with portal hypertension. Most available studies had involved small sample sizes, heterogeneous populations, or indirect evidence derived from cardiovascular indications rather than portal hypertension-specific cohorts. Data regarding maternal complications, fetal outcomes, treatment tolerability, and predictors of adverse events had remained insufficient, particularly from regional clinical settings.

Therefore, this retrospective study was conducted with the objectives to describe the maternal, fetal, and neonatal outcomes among pregnant women with portal hypertension who received non-selective beta-blocker therapy and to describe the clinical characteristics, treatment tolerability, and complications observed in pregnant women with portal hypertension treated with non-selective beta-blockers.

MATERIALS AND METHODS

This retrospective observational study was conducted in the Departments of Obstetrics and Gynecology and Medical Gastroenterology at Raichur Institute of Medical Sciences (RIMS), Raichur, and OPEC/RGSSH, Raichur. The study included pregnant women with portal hypertension who had received non-selective beta-blocker (NSBB) therapy during pregnancy between January 2021 and June 2026. All eligible cases were included based on the availability of documented clinical records during the study period. Patients were identified through hospital records, gastroenterology databases, obstetric case files, and pharmacy records. The study population comprised pregnant women diagnosed with portal hypertension secondary to chronic liver disease or other etiologies who had received NSBB therapy (propranolol or nadolol) for variceal bleeding prophylaxis or portal pressure reduction.

Patients with incomplete medical records, pregnancies without documented portal hypertension, or those who had received beta-blockers for indications unrelated to portal hypertension were excluded. Data regarding maternal demographics, etiology and severity of portal hypertension, liver disease status, variceal history, NSBB dosage and duration, obstetric complications, mode of delivery, and maternal and neonatal outcomes were collected using a structured data collection proforma. The safety profile of NSBB therapy was evaluated by assessing maternal complications, including variceal bleeding, hepatic decompensation, and obstetric outcomes, along with fetal and neonatal outcomes such as birth weight, preterm delivery, neonatal bradycardia, and neonatal hypoglycemia.

All eligible cases available during the defined study period wee included, considering the rarity of portal hypertension complicating pregnancy and the limited availability of pregnancy-specific NSBB exposure data. Ethical approval for the study was obtained from the Institutional Ethics Committee of Raichur Institute of Medical Sciences, Raichur, before commencement of data collection. As the study involved retrospective review of existing medical records, informed consent was obtained where required according to institutional guidelines. Patient confidentiality was strictly maintained by anonymizing all collected data. The study methodology followed established recommendations for observational studies, including the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[5]

The collected variables were entered into excel datasheet. Continuous variables were expressed as mean ± standard deviation or median with interquartile range depending on data distribution, while categorical variables were presented as frequencies and percentages. Statistical analysis was performed using Jamovi (Version 2.6.26.0), and a two-tailed p value <0.05 was considered statistically significant.

RESULTS

Among the 30 pregnant women with portal hypertension, the majority were aged 20–30 years (60.0%), followed by those aged >30 years (36.7%). Multigravida women constituted 60.0% of the study population, while 40.0% were primigravida. Vascular causes of portal hypertension, including extrahepatic portal vein obstruction and Budd–Chiari syndrome, were the predominant etiologies (53.3%), whereas cirrhosis-related portal hypertension accounted for 46.7% of cases. Portal hypertension was diagnosed before pregnancy in 70.0% of women, while 30.0% were diagnosed during pregnancy. A history of previous gastrointestinal/variceal bleeding was present in 33.3% of participants, and esophageal/gastric varices were identified in 66.7% of women. (Table 1)

All women received non-selective beta-blocker (NSBB) therapy during pregnancy, with propranolol being the most commonly used agent (80.0%), followed by carvedilol (20.0%). NSBB therapy was administered for secondary prophylaxis in 60.0% of women and for primary prophylaxis in 40.0%. Two-thirds of the women (66.7%) had initiated NSBB therapy before conception, whereas 33.3% started treatment during pregnancy, most commonly during the second trimester (20.0%). NSBB intolerance was uncommon, with only one woman (3.3%) requiring discontinuation and two women (6.7%) requiring dose reduction due to adverse effects. (Table 2)

During pregnancy and the postpartum period, hepatic decompensation occurred in 13.3% of women, including ascites in 10.0% and hepatic encephalopathy in 3.3%. Variceal or gastrointestinal bleeding was observed in 6.7% of cases, and 10.0% required endoscopic intervention during pregnancy. NSBB-related adverse effects were reported in 10.0% of women, with bradycardia or hypotension requiring monitoring in 6.7% and treatment discontinuation in 3.3%. Despite these complications, maternal survival was 100%, with no maternal deaths recorded. (Table 3)

Regarding fetal and neonatal outcomes, 86.7% of pregnancies resulted in live births, while abortion and stillbirth each occurred in 6.7% of cases. Among the 26 live births, preterm delivery occurred in 19.2%, low birth weight in 26.9%, and intrauterine growth restriction in 23.1% of neonates. Neonatal intensive care admission was required for 15.4% of newborns. No congenital anomalies or neonatal deaths were observed in the study population. (Table 4)

Overall, NSBB therapy was well tolerated during pregnancy, with 90.0% of women continuing treatment throughout pregnancy. Dose modification was required in 6.7% of cases, while permanent discontinuation due to intolerance occurred in only 3.3%. Maternal complications were observed in 23.3% of women, and adverse fetal/neonatal outcomes occurred in 26.7%; however, there were no maternal or neonatal deaths. These findings suggest that NSBB therapy can be continued during pregnancy in women with portal hypertension with careful maternal and fetal monitoring. (Table 5)

Table 1: Baseline Clinical Characteristics of Pregnant Women with Portal Hypertension (n = 30)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
<20 years	1	3.3
20–30 years	18	60
>30 years	11	36.7
Parity status		
Primigravida	12	40
Multigravida	18	60
Etiology of portal hypertension		
Vascular causes (e.g., extrahepatic portal vein obstruction/Budd-Chiari syndrome)	16	53.3
Cirrhosis-related portal hypertension	14	46.7
Timing of diagnosis of portal hypertension		
Diagnosed before pregnancy	21	70
Diagnosed during pregnancy	9	30
Previous history of gastrointestinal/variceal bleeding	10	33.3
Presence of esophageal/gastric varices	20	66.7

Table 2: Pattern of Non-Selective Beta-Blocker Exposure During Pregnancy (n = 30)

NSBB-related characteristics	Frequency (n)	Percentage (%)

Received NSBB therapy during pregnancy	30	100
Type of NSBB used		
Propranolol	24	80
Carvedilol	6	20
Indication for NSBB therapy		
Primary prophylaxis	12	40
Secondary prophylaxis (previous variceal/GI bleeding)	18	60
Timing of NSBB initiation		
Started before conception	20	66.7
Started during pregnancy	10	33.3
└ First trimester	2	6.7
└ Second trimester	6	20
└ Third trimester	2	6.7
NSBB intolerance/adverse effects requiring discontinuation	1	3.3
Dose reduction due to intolerance	2	6.7

Table 3: Maternal Outcomes and Portal Hypertension-Related Complications During Pregnancy and Postpartum (n = 30)

Maternal outcomes	Frequency (n)	Percentage (%)
Hepatic decompensation during pregnancy/postpartum	4	13.3
Ascites	3	10
Hepatic encephalopathy	1	3.3
Variceal/gastrointestinal bleeding during pregnancy	2	6.7
Need for endoscopic intervention during pregnancy	3	10
NSBB-related adverse effects	3	10
Bradycardia/hypotension requiring monitoring	2	6.7
NSBB discontinuation due to adverse effects	1	3.3
Maternal survival	30	100
Maternal mortality	0	0

Table 4: Fetal and Neonatal Outcomes Among Pregnant Women with Portal Hypertension Receiving NSBB Therapy (n = 30)

Fetal/neonatal outcomes	Frequency (n)	Percentage (%)
Pregnancy outcome		
Live birth	26	86.7
Abortion	2	6.7
Stillbirth	2	6.7
Neonatal outcomes (among live births, n = 26)		
Preterm birth	5	19.2
Low birth weight (<2.5 kg)	7	26.9
Intrauterine growth restriction	6	23.1
Neonatal intensive care admission	4	15.4
Neonatal death	0	0
Congenital anomalies observed	0	0

Table 5: Summary of NSBB Safety and Clinical Outcomes (n = 30)

Outcome parameter	Frequency (n)	Percentage (%)
Continued NSBB throughout pregnancy	27	90
NSBB dose modification required	2	6.7
NSBB discontinued due to intolerance	1	3.3
Maternal complications observed	7	23.3
Adverse fetal/neonatal outcome observed	8	26.7
Maternal mortality	0	0
Neonatal mortality	0	0

DISCUSSION

The present study investigated the clinical characteristics, treatment tolerability, and maternal-fetal outcomes of 30 pregnant

women with portal hypertension managed with non-selective beta-blockers (NSBBs), primarily propranolol (80.0%) and carvedilol (20.0%). Our findings demonstrate that NSBB therapy is remarkably well tolerated during pregnancy, with 90.0% of patients continuing treatment throughout gestation and a low permanent discontinuation rate of only 3.3% due to adverse effects. This is highly consistent with a recent retrospective study by Alexander et al. (2025)[6], which evaluated 134 pregnancies (51 with NSBB exposure) and concluded that NSBBs are safe and well tolerated, reporting no statistically significant differences in fetal outcomes, birth weight ($p = 0.12$), or intrauterine growth restriction (IUGR; 34% vs. 28%, $p = 0.40$) between exposed and unexposed groups. Both studies reinforce the clinical safety of maintaining active pharmacological prophylaxis during pregnancy, as maternal survival reached 100% in both cohorts.[6]

Importantly, our observed variceal bleeding rate of 6.7% (2 cases) is consistent with the protective efficacy of beta-blockers, representing a significant contrast (and a clinical improvement) compared to historical cohorts where systematic prophylaxis was underutilized. For instance, in a study of 50 pregnancies with non-cirrhotic portal hypertension (NCPH) by Aggarwal et al. (2001)[7], a much higher variceal bleeding rate of 34% was reported alongside significant fetal losses. Similarly, Aggarwal et al. (2011)[8] reported a 33.3% variceal bleeding rate among pregnancies complicated by extrahepatic portal vein obstruction (EHPVO). The low rate of hemorrhage in our cohort demonstrates the efficacy of NSBBs in reducing portal inflow and countering the profound physiological volume expansion of pregnancy, which peaks during the second and third trimesters and can otherwise catastrophically worsen portal hypertension.[9]

Our fetal safety outcomes are similarly encouraging. The live birth rate of 86.7% is consistent with the 91% live birth rate reported in stable, non-decompensated pregnancies by Alexander et al. (2025)[6], and closely aligns with Mandal et al. (2012)[10], who reported a 95.1% live birth rate (39/41) in patients with EHPVO. Furthermore, our abortion rate of 6.7% is consistent with the low abortion rate of 7% reported by Kochhar et al. (1999)[11] in patients with preserved liver function, representing a major advancement over historical estimates of untreated portal hypertension where fetal wastage ranged between 10% and 66%.[12]

However, portal hypertension in pregnancy still carries substantial risks. Hepatic decompensation occurred in 13.3% of our cohort (ascites 10.0%, encephalopathy 3.3%), which is highly consistent with Westbrook et al. (2011)[13]. Westbrook et al. demonstrated that pregnancy outcomes are tightly bound to the severity of underlying liver disease, with decompensation risk escalating in more advanced disease states. This underscores the critical need for a multidisciplinary maternal-fetal team approach to continuously monitor hemodynamics, optimize therapeutic dosages, and manage potential decompensation events early.[13]

CONCLUSION

This retrospective study demonstrates that non-selective beta-blocker therapy is a safe, highly tolerable, and effective treatment modality for preventing variceal hemorrhage in pregnant women with portal hypertension. Pharmacological management of portal pressure during gestation is associated with excellent maternal survival and a very low rate of permanent treatment discontinuation due to adverse drug effects. However, despite the low rate of variceal bleeding observed under this preventative regimen, maternal and fetal complications—such as hepatic decompensation, preterm delivery, low birth weight, and intrauterine growth restriction—remain substantial clinical challenges. Therefore, continuing active beta-blocker prophylaxis throughout pregnancy is justified, provided there is vigilant, continuous monitoring of both maternal hemodynamics and fetal development.

To optimize outcomes, we recommend that comprehensive pre-conceptional counseling and screening endoscopies be systematically integrated into the clinical care of reproductive-aged women with known portal hypertension. Non-selective beta-blockers should be initiated or maintained under the close supervision of a dedicated multidisciplinary maternal-fetal medicine team, incorporating obstetricians, hepatologists, anesthesiologists, and neonatologists. Vigilant serial assessments of liver function, hemodynamic stability, and fetal growth are essential to allow for timely drug dose adjustments and early management of complications. Lastly, prospective, multicenter collaborative studies are highly recommended to establish standardized clinical guidelines, determine optimal dosing thresholds during pregnancy, and track long-term neonatal health outcomes.

Acknowledgment: Nil
Conflict of Interest: Nil

Limitations

The study has several limitations that should be considered when interpreting the findings. Its retrospective design relies on historical medical databases and clinical records, which introduces the possibility of documentation bias, variability in record quality, and missing clinical data. Additionally, the small sample size of thirty women, reflecting the rarity of portal hypertension in pregnancy, reduces statistical power and limits the generalizability of the results to larger and more diverse populations. Furthermore, the single-center nature of the study, conducted at one regional tertiary care institution, may reflect specific patient characteristics and clinical practices that may not be representative of other healthcare settings or populations worldwide.

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