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Original Research Article

A prospective observational study of maternal outcomes in very high-risk pregnancies in a tertiary care centre of South Gujarat

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ABSTRACT

Background: Very high-risk pregnancy (VHRP) is associated with increased maternal morbidity and mortality. Early identification and appropriate management are essential to improve outcomes. This study aims to study maternal outcomes and complications in very high-risk pregnancies up to 7 days postpartum.
Methodology: This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at a tertiary care center in South Gujarat. A total of 150 pregnant women fulfilling VHRP criteria as per Government of Gujarat guidelines were included. Detailed history, clinical examination, and investigations were recorded. Maternal outcomes, complications, and OBICU admissions were analyzed.
Results: Majority of women belonged to the 18–25 years age group (52%). Common VHRP conditions included Low BMI (25.3%), Previous 2 caesarean sections (23.3%) and Severe PET (21.3%). OBICU admissions were noted in a significant proportion of patients. OBICU admissions were commonly seen in severe PET (40.8%), Sickle cell disease (25.9%) and prev 2 caesarean sections (11.1%) while no OBICU admissions in low BMI criteria. Maternal complications commonly included puerperal pyrexia (20%) and sepsis (8.7%). Mortality rates were higher in severe PET (62.5%) and sickle cell disease (37.5%), however reduction in rates after implementation of VHRP criteria were seen.
Conclusion: VHRP is associated with significant maternal morbidity. Early identification, timely referral, and management at tertiary care centres significantly improve outcomes and reduce mortality.

Keywords: Very high-risk pregnancy, Maternal outcome, OBICU

INTRODUCTION

The evolving paradigm of global and national maternal health

The landscape of maternal and fetal health has undergone a profound and highly necessary epidemiological transition over the past three decades. Historically, public health frameworks in developing nations were predominantly oriented toward the expansion of primary maternal care, aiming to provide basic access to childbirth facilities and rudimentary antenatal screening.[1] However, as the foundational metrics of maternal survival began to improve globally, it became increasingly evident that the residual burden of maternal morbidity and mortality was heavily concentrated within specific, highly vulnerable clinical subpopulations.[2] The modern obstetric challenge is no longer merely facilitating institutional deliveries, but rather the highly specialized interception and management of catastrophic pathophysiological complications that threaten the lives of pregnant women.

In the complex sociodemographic environment of India, this epidemiological transition has birthed a dual burden of disease that heavily taxes the healthcare infrastructure. The persistent, historical challenges of widespread maternal undernutrition, endemic infectious diseases, and chronic multiparity-associated anemia are now increasingly

superimposed with a rising incidence of modern obstetric complications. To systematically address these intersecting and often synergistic risks, the Government of India, operating through the National Health Mission (NHM), has continuously evolved its reproductive and maternal health strategies.[3]

The reproductive, maternal, newborn, child, adolescent health, and nutrition (RMNCAH+N) strategy represents a cornerstone of this evolution, shifting the focus from episodic care to a continuum of care approach.[3] Central to this targeted intervention strategy is the Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA). The PMSMA initiative was explicitly designed to guarantee that every pregnant woman receives at least one comprehensive antenatal checkup by a specialist during her second or third trimester.[4] The core operational objectives of PMSMA extend beyond routine screening; they mandate the meticulous identification and longitudinal line-listing of high-risk pregnancies based on a rigorous evaluation of obstetric history, existing medical comorbidities, and emerging clinical conditions.[4]

The efficacy of these sweeping national interventions is continuously monitored through the Registrar General of India's sample registration system (SRS). The SRS utilizes rigorous instruments to yield direct, nationally representative estimates of cause-specific mortality, including the maternal mortality ratio (MMR).[5] According to the SRS special bulletin on maternal mortality spanning the 2020-2022 period, India's national MMR has demonstrated a commendable decline, though vast regional disparities underscore the necessity for localized, state-specific interventions.[5] The state of Gujarat stands out as a highly successful model of intermediate epidemiological transition, achieving an MMR of 55 per 100,000 live births, which comfortably surpasses the United Nations Sustainable Development Goal (SDG) target.[5]

Defining the very high-risk pregnancy framework

While the broad categorization of "high-risk" pregnancies has been a staple of obstetric triage, the evolving complexity of maternal morbidity in states like Gujarat necessitated a more precise, granular approach. Recognizing that a subset of high-risk patients required significantly more aggressive surveillance and mandatory tertiary-level intervention, the Gujarat Health and Family Welfare Department conceptualized and implemented the "very high-risk pregnancy" (VHRP) framework.[6]

A very high-risk pregnancy is fundamentally defined as a state in which the mother, the developing fetus, or both are subjected to a substantially magnified risk of severe morbidity or mortality.[6] The state government recognized that subjective clinical gestalt was insufficient for identifying these extreme outliers. Consequently, a rigid, criteria-based triage system was established, designed to mandate early referral from peripheral primary health centers to advanced tertiary care facilities.[6]

To ensure uniform identification across sub-centers and minimize diagnostic latency, the state integrated these criteria into digital tracking infrastructure, notably the pregnancy, child tracking and health services management system (PCTS) application.[6] The formal inclusion criteria defining a VHRP in Gujarat are exhaustive and encompass a wide spectrum of physiological and anatomical derangements, specifically tracking parameters such as severe anemia (Hb ≤6.5 g/dl), severe hypertensive disorders (≥180/110 mmHg), severe undernutrition (BMI <17 kg/m²), multiple prior cesarean sections, and specific hematological pathologies like sickle cell disease.[6]

The pathophysiological burden of specific VHRP criteria

Nutritional extremes: the dual burden of low BMI and anemia

Despite rapid economic development, India continues to grapple with a profound crisis of maternal undernutrition. Data derived from the National Family Health Survey (NFHS-5) indicates that a significant proportion of Indian women remain underweight, creating a chronic metabolic deficit during pregnancy.[7]

This chronic malnutrition is intrinsically linked with severe maternal anemia. A massive prospective observational cohort study conducted by the Global Network's Maternal and Newborn Health Registry in eastern rural Maharashtra illuminated the catastrophic synergy of these two conditions.[8] The study demonstrated that moderate to severe anemia significantly increases the risk of stillbirths, neonatal deaths, and the delivery of low birth weight (LBW) babies, as an undernourished mother simply cannot sustain the transplacental demands of the third trimester.[8]

The apex killer: hypertensive disorders of pregnancy

While nutritional deficits cause chronic perinatal morbidity, hypertensive disorders of pregnancy—specifically severe pre-eclampsia and eclampsia—act as the apex acute killers in modern obstetrics.[9] Pre-eclampsia is a multi-systemic syndrome triggered by chronic placental ischemia, which releases a cascade of toxic anti-angiogenic factors into the maternal systemic circulation.[10]

These factors cause profound widespread maternal endothelial dysfunction.[10] The loss of endothelial control over vascular tone results in extreme, intractable vasoconstriction, driving blood pressures to dangerous heights. When this intense vasospasm affects the cerebral vasculature, it can precipitate eclamptic seizures, marking the transition to life-threatening emergencies that mandate immediate critical care and often iatrogenic preterm delivery.[9,10]

Hematological crises in the tribal belt: sickle cell disease

In specific geographic pockets of India, notably the tribal belts stretching across South Gujarat and Central India, inherited hematological disorders represent a massive obstetric crisis.[11] Sickle cell disease (SCD) fundamentally destabilizes the physiological balance of a pregnant woman. When the normal hypercoagulability of pregnancy is superimposed onto the baseline endothelial damage and sickling pathology of SCD, the risk of massive thromboembolic events and vaso-occlusive crises skyrockets.[11]

A comprehensive analysis from the Kasturba Maternity Hospital in the tribal Jhagadia block of Gujarat vividly illustrated this disparity: pregnancies complicated by SCD exhibited exponentially higher stillbirth and preterm birth rates compared to non-SCD pregnancies, primarily due to microvascular sickling and thrombosis within the placental bed.[12]

The critical role of the obstetric intensive care unit

The management of VHRPs frequently exhausts the capabilities of standard labor wards, necessitating the advanced life support infrastructure of an obstetric intensive care unit (OBICU).[13] Globally, obstetric patients represent a small fraction of total ICU admissions, generally ranging from 0.5% to 10.2%.[13]

However, mortality outcomes in these ICUs vary drastically based on regional healthcare infrastructure and referral timelines. A comparative study between King Edward Memorial Hospital (KEMH) in Mumbai and Ben Taub General Hospital in Houston highlighted stark disparities: Indian patients frequently presented to the ICU with higher severity scores and suffered a higher maternal mortality rate, primarily driven by delays in primary identification and late referral from peripheral centers.[14]

Rationale and objectives of the thesis study

Given the immense complexities of managing highly vulnerable obstetric populations, it is imperative to continuously validate the clinical parameters utilized by health authorities. The thesis research summarized herein, based on the prospective observational study by Verma et al. conducted at a tertiary care center in South Gujarat, aims to systematically evaluate the maternal outcomes and complication profiles of pregnancies categorized as very high risk according to the official Gujarat state guidelines.[15]

By analyzing a dedicated cohort of 150 VHRP women up to 7 days postpartum, the study aims to definitively map the distribution of risk factors, quantify the demand these patients place on the OBICU, and determine the mortality impact of early identification and specialized tertiary care management.[15]

METHODS

Study design and population

This prospective observational study was conducted in a Department of Obstetrics and Gynaecology at a tertiary care hospital in South Gujarat enrolling 150 subjects fulfilling inclusion criteria of very high-risk pregnant women over a period of 1 year from March 2025 to February 2026.

Inclusion criteria

Pregnant women fulfilling VHRP criteria as defined by the Gujarat health and family welfare department will be included in the study.

The inclusion criteria for a VHRP encompass a broad spectrum of severe obstetric, medical, and anatomical complications. Specifically, pregnant women were included if they presented with profound nutritional or hematological deficits, such as a BMI below 17 during any antenatal care (ANC) visit, a maternal weight under 42 kg after six months of gestation, or hemoglobin levels ≤6.5 g/dl detected across two ANC visits. Severe hypertensive disorders, defined as blood pressure ≥180/110 mmHg recorded three times with accompanying pedal edema or proteinuria, also warranted inclusion. Additionally, the criteria cover significant obstetric structural risks, including a history of two prior caesarean sections, pregnancies with three or more fetuses, or placenta previa detected at the time of delivery. Furthermore, women with severe systemic and cardiovascular comorbidities are classified as VHRP; this includes those diagnosed with inherited hematological disorders (sickle cell disease, thalassemia, or hemophilia), chronic multidrug-resistant tuberculosis, chronic kidney disease (grade 2 or above), a previous history of heart valve replacement or balloon valvotomy, and severe mitral valve stenosis or regurgitation complicated by pulmonary hypertension.

Exclusion criteria

Conversely, pregnant women were excluded from the study if they did not meet the predefined clinical parameters for a very high-risk pregnancy or if they declined to provide informed consent to participate.

Data collection procedure and tools

The study was done with a pre-designed proforma. For every case, information like age, residence, booking status, obstetric history, past history and sonography findings were recorded.

Physical and obstetric examination carried out on admission, mode of delivery, intraoperative findings and postnatal/postoperative complications were noted. All cases were followed up until discharge from the hospital.

Statistical analysis

Clinical data were coded and organized in Microsoft Excel before being exported for statistical analysis using software Jamovi version 2.7.31. Descriptive statistics summarized the cohort's demographics and clinical profiles, presenting categorical variables such as VHRP criteria, OBICU admission rates, and maternal mortality as absolute frequencies and percentages. The resulting data were then tabulated and graphed to clearly illustrate maternal morbidity and outcomes.

RESULTS

Among the various risk factors, low BMI was the most common, accounting for 25.3% of cases. This was followed by a history of previous two lower segment caesarean sections (23.3%) and severe pre- eclampsia (21.3%). Other contributors included sickle cell disease and severe anemia (hemoglobin <6.5 g/dl), each accounting for 8% of cases, while placenta previa (2.7%) and previous history of heart valve replacement (1.3%) were less common.

Out of the total VHRP cases, 27 required admissions to the OBICU. Severe pre-eclampsia emerged as the leading cause for OBICU admission, contributing to 40.8% of cases, followed by sickle cell disease (25.9%). Other indications included previous two LSCS (11.1%), severe anemia (7.4%), placenta previa (7.4%), and prior heart valve replacement (7.4%).

There was a total of 8 maternal deaths recorded in the study. Severe pre-eclampsia was the leading cause of mortality, responsible for 62.5% of deaths, while sickle cell disease accounted for the remaining 37.5%. This highlights the significant impact of hypertensive disorders and hematological conditions on maternal outcomes in very high-risk pregnancies.

Regarding the mode of delivery, vaginal delivery was the most common, observed in 57.4% of cases, followed by cesarean section in 41.3%, while instrumental delivery was rare (1.3%). Despite the high-risk nature of these pregnancies, the majority of women did not experience major complications, with 65.3% having no adverse maternal outcomes. Among those who developed complications, puerperal pyrexia was the most common (20%), followed by sepsis (8.7%) and other complications (6%) (Table 1).

A comparison of maternal mortality before and after the introduction of the VHRP identification system showed a reduction in deaths. Prior to its implementation, there were 37 maternal deaths out of 7900 deliveries, which decreased to 26 deaths out of 8500 deliveries after its introduction, indicating an improvement in maternal outcomes with early identification and management of high-risk cases. Overall, the findings suggest that although low BMI was the most common risk factor, severe pre- eclampsia and sickle cell disease were associated with higher morbidity and mortality. Early identification and management of VHRP cases contributed to improved maternal outcomes (Figure 1).

Table 1: Demographic characteristics, clinical profile, and outcomes of very high-risk pregnancies (n=150).

Variable	Category	No. of patients	%
Age (years)	18–25	78	52.0
	26–30	55	36.7
	>30	17	11.3
Area-wise distribution	Urban	72	48.0
	Rural	78	52.0
Obstetric history	Primigravida	61	40.7
	Multigravida	89	59.3
Types of very high-risk pregnancy	Low BMI	38	25.3
	Previous 2 CS	35	23.3
	Severe PET	32	21.3
	Sickle cell disease	12	8.0
	Hb <6.5 g/dl	12	8.0
	Placenta previa	4	2.7
	Previous history of heart valve replacement	2	1.3
OBICU admissions (n=27)	Severe PET	11	40.8
	Sickle cell disease	7	25.9
	Previous 2 CS	3	11.1
	Hb <6.5 g/dl	2	7.4
	Placenta previa	2	7.4
	Previous history of heart valve replacement	2	7.4
Maternal mortality (n=8)	Severe PET	5	62.5
	Sickle cell disease	3	37.5

Continued.

Variable	Category	No. of patients	%
Mode of delivery	Vaginal delivery	86	57.4
	LSCS	62	41.3
	Instrumental delivery	2	1.3
Maternal complications	No complications	98	65.3
	Puerperal pyrexia	30	20.0
	Sepsis	13	8.7
	Others	9	6.0

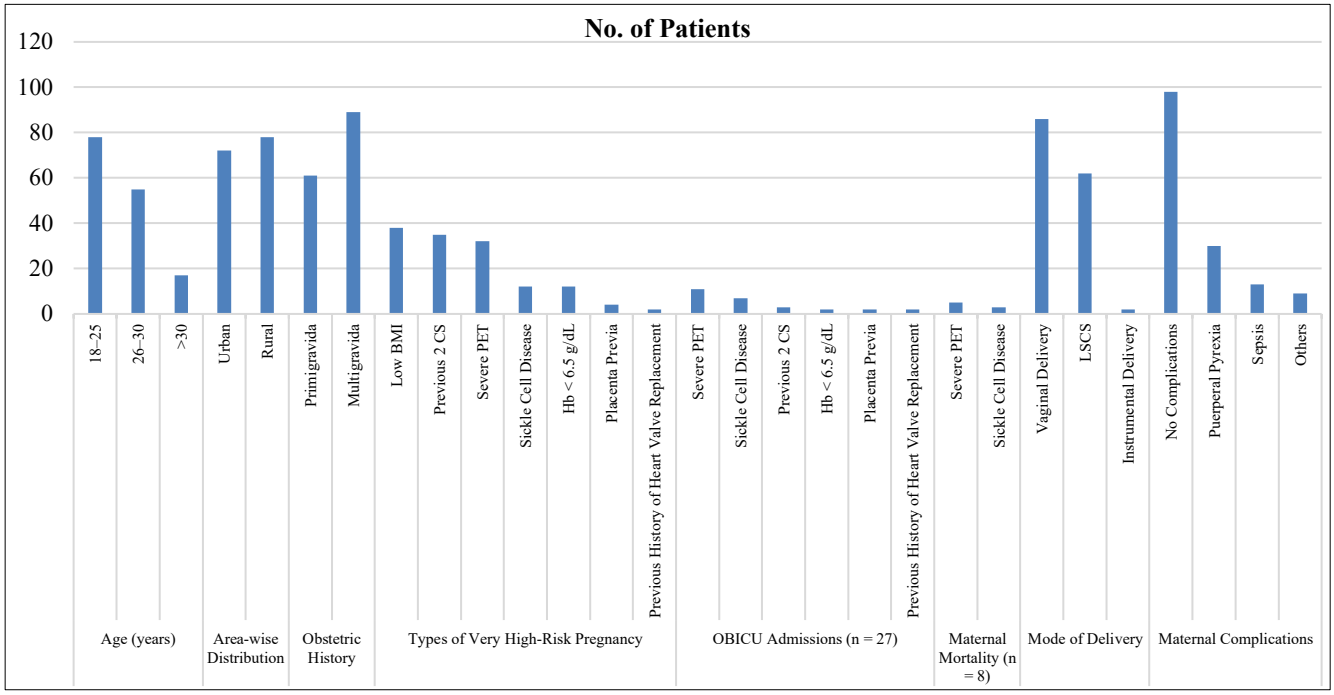

Figure 1: Distribution of types of very high-risk pregnancies, OBICU admissions mortality.

DISCUSSION

The prospective observational study evaluating 150 VHRPs in a South Gujarat tertiary care center yields a wealth of clinical data that both confirms established global epidemiological trends and exposes highly specific, localized clinical paradoxes.

Demographic and obstetric profiling: the concentration of risk

A rigorous analysis of the demographic foundation reveals exactly who bears the heaviest burden of extreme obstetric risk. The age distribution within the study was highly concentrated, with 52.0% of the VHRP cases falling within the narrow 18-25 years age bracket.[15] This perfectly aligns with the national mortality statistics published in the SRS bulletin, which confirms that the apex of maternal mortality occurs exactly within these young age bands.[5]

Geographically, the cohort was nearly evenly split, with 52.0% originating from rural areas and 48.0% from urban settings.[15] Rural populations frequently face multi-tiered disadvantages, including restricted access to care and significant logistical delays in reaching tertiary healthcare facilities during obstetric emergencies the classic "type 2" delay of the Three Delays model that frequently transforms a manageable complication into a fatal one.[16]

Regarding obstetric history, multigravida women constituted a dominant 59.3% of the VHRP cohort, reflecting the cumulative nature of obstetric risk such as multiparity-associated anemia and previous surgical history.[15]

The BMI paradox: high prevalence versus low acute lethality

Within the cohort, the single most prevalent criterion triggering a VHRP designation was a drastically low BMI (<17 kg/m²), accounting for 25.3% of all cases.[15] However, the clinical outcomes associated with this specific risk factor present a stark paradox. Despite being the most prevalent cause for a VHRP label, low BMI resulted in zero (0%) OBICU admissions and zero (0%) maternal deaths within the cohort.[15]

This highlights a crucial distinction in obstetric risk stratification: a severely low BMI acts as an insidious,

long-term state of metabolic deprivation rather than an acute, catastrophic physiological trigger.[8]

While it leaves the mother vulnerable, the true, devastating toll of maternal undernutrition is exacted upon the fetus, manifesting as severe intrauterine growth restriction (IUGR) and low birth weight, funneling the morbidity burden to the neonatal intensive care unit (NICU).[8]

Severe pre-eclampsia: the apex driver of OBICU utilization and mortality

In stark contrast to undernutrition, severe pre-eclampsia emerged as the undisputed, primary driver of catastrophic morbidity and mortality. In the South Gujarat cohort, severe pre-eclampsia accounted for an overwhelming 40.8% of all OBICU admissions and was directly responsible for 62.5% of all maternal deaths.[15]

The dominance of severe pre-eclampsia in intensive care settings is entirely dictated by its ferocious pathophysiology, which causes multi-systemic endothelial destruction.[10] The management of such patients requires highly invasive, resource-heavy interventions in the OBICU, including continuous mechanical ventilation, aggressive intravenous anti-hypertensive titrations, magnesium sulfate infusion for seizure prophylaxis, and emergent surgical termination of the pregnancy.[9,13,15]

The unique regional challenge: sickle cell disease in the tribal belt

A highly distinct component of the VHRP profile in the South Gujarat region is sickle cell disease (SCD).[11] In the cohort, SCD accounted for a modest 8.0% of the total cases, yet its clinical impact was violently disproportionate. SCD was responsible for 25.9% of all OBICU admissions and an alarming 37.5% of the total maternal mortality.[15]

This exponentially higher maternal mortality rate underscores the lethal synergy of pregnancy hypercoagulability and the mutated hemoglobin S, driving widespread microvascular occlusion and acute crises.[11,12,15] Management of these patients demands aggressive, multidisciplinary tertiary care.

The burden of surgical history and modes of delivery

A history of two prior lower segment cesarean sections (LSCS) was the second most common VHRP indication, present in 23.3% of the patients.[15] While this history accounted for 11.1% of OBICU admissions—often due to prophylactic monitoring or management of expected surgical hemorrhage—it did not result in any maternal mortalities within this study.[15] This suggests that the highly controlled environment of a tertiary center can effectively mitigate the immediate lethality of surgical history compared to unpredictable systemic disorders.[15] Despite the extreme severity of the cohort, vaginal delivery remained the predominant mode of delivery (57.4%), highlighting the efficacy of continuous fetal monitoring and specialized labor management.[15]

Systemic impact and strategic imperatives

The utilization of the OBICU in the South Gujarat study was exceptionally high at 18.0%, an expected artifact of isolating the most extreme subset of the obstetric population.[15] The ultimate validation of the VHRP criteria lies in its impact on maternal survival. Prior to the strict implementation of the VHRP system, maternal mortality at the observed facility stood at 37 deaths out of 7,900 deliveries; following its introduction, mortality dropped significantly to 26 deaths out of 8,500 deliveries.[15]

This tangible reduction confirms that the vast majority of maternal deaths are preventable through proactive identification, the eradication of referral delays, and the early centralization of complex cases in tertiary institutions equipped to provide OBICU-level care.[13,15,16]

Limitations

This study has several limitations. As a single-center observational study of 150 patients at a tertiary facility, it is subject to referral bias, limiting the generalizability of the findings to broader populations.

Furthermore, the short 7-day postpartum follow-up precludes the assessment of late maternal morbidities or mortalities that may occur later in the puerperal period. Finally, the study lacks a standard-risk control group and does not evaluate long-term neonatal outcomes.

CONCLUSION

The findings of this prospective observational study underscore that while VHRP account for profound maternal morbidity within tertiary frameworks, the implementation of systematic, criteria-based identification significantly enhances survival outcomes. Although severe maternal undernutrition (low BMI) is the most prevalent risk factor, it predominantly drives chronic morbidity rather than acute maternal lethality. In contrast, acute emergencies like severe pre-eclampsia and SCD are the primary drivers of catastrophic decompensation, necessitating aggressive OBICU intervention and accounting for all maternal mortality within the cohort. Ultimately, the marked reduction in institutional mortality rates following the enforcement of VHRP triage protocols proves that early risk stratification and rapid referral to equipped tertiary centers are essential for mitigating preventable maternal deaths.

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