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MANAGEMENT AND FETAL OUTCOMES OF SECOND STAGE FETAL COMPROMISE: A CROSS-SECTIONAL ANALYSIS AT THE GYNECOLOGY DEPARTMENT.

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ABSTRACT

BACKGROUND: Second-stage fetal compromise is a critical obstetric emergency that requires prompt intervention to prevent adverse neonatal outcomes. Prolonged second-stage labor, fetal distress, and maternal exhaustion contribute to fetal hypoxia, leading to increased morbidity and mortality. Effective management strategies, including operative vaginal delivery and emergency cesarean section, play a crucial role in optimizing fetal outcomes.

OBJECTIVES: This study aims to evaluate the management approaches and fetal outcomes in cases of second-stage fetal compromise. Specific objectives include identifying risk factors, assessing different intervention strategies, and analyzing neonatal outcomes such as Apgar scores, NICU admissions, and perinatal mortality. **METHODS:** A cross-sectional study was conducted at the Gynecology Department, analyzing 220 cases of second-stage fetal compromise. Data were collected from medical records, including maternal demographics, fetal heart rate monitoring, mode of delivery, and neonatal outcomes. Statistical analysis was performed using SPSS, applying chi-square and logistic regression tests to determine associations between management strategies and fetal outcomes.

RESULTS: Among the 220 cases, 60% underwent emergency cesarean section, 30% required instrumental delivery forceps/vacuum, and 10% had spontaneous vaginal delivery. Neonatal outcomes showed that Apgar scores ≤ 7 at 5 minutes were observed in 25% of cases, while NICU admission was required in 18%. Perinatal mortality was 4%, primarily associated with prolonged fetal distress. Emergency cesarean section was significantly associated with improved neonatal outcomes $p < 0.05$. **CONCLUSION:** Timely identification and appropriate management of second-stage fetal compromise significantly improve neonatal outcomes. Emergency cesarean section remains the most effective intervention in severe cases. Strengthening intrapartum monitoring and decision-making can further enhance fetal survival rates.

KEYWORDS: Second-stage labor, fetal compromise, emergency cesarean section, neonatal outcomes, instrumental delivery, perinatal mortality.

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INTRODUCTION

Second-stage fetal compromise is an urgent obstetric emergency necessitating immediate intervention to avoid neonatal and maternal complications. The fetus sustains more mechanical and physiologic stress during the second stage of labor, which is the time from full cervical dilation through delivery. Prolonged labor, umbilical cord compression, and uteroplacental insufficiency are all major contributors to fetal distress. Unless treated, these conditions cause hypoxia, metabolic acidosis, and chronic neurological insults like cerebral palsy and hypoxic-ischemic encephalopathy HIE¹. Advances in the field of fetal monitoring, cardiotocography CTG, and fetal scalp blood sampling have made an early detection of distress possible and have allowed prompt interventions like operative vaginal delivery or emergency cesarean section².

Worldwide, second-stage fetal distress continues to be a leading cause of perinatal mortality and morbidity and its outcomes are largely determined by access to healthcare. The World Health Organization WHO predicts that 30% of neonatal deaths are due to complications occurring during pregnancy and most of these occur in settings with limited resources³. According to epidemiological studies, 5–10% of all deliveries include second-stage fetal distress and require immediate medical attention⁴. In developed countries, neonatal mortality from fetal distress is between 1 and 3 per 1,000 live births owing to sophisticated monitoring and expert obstetric care. In LMICs, the perinatal mortality rate is more than 10 per 1,000 live births due to late

diagnosis and poor availability of emergency facilities⁵.

The pathophysiology of second-stage fetal compromise is recurrent uterine contractions temporarily decreasing uteroplacental perfusion and oxygenation. Whereas an appropriate fetus can accommodate intermittent hypoxia by shunting blood to life-sustaining organs like the brain, heart, and adrenal glands, extended labor or intrinsic fetal compromise can overburden these adaptive processes to cause metabolic acidosis and resulting hypoxic injury⁶. Compression of the umbilical cord also increases the risk, leading to variable decelerations in fetal heart rate and limiting oxygen and nutrient delivery⁷. Maternal illnesses such as hypertension, gestational diabetes, and anemia also compromise placental function, making fetal hypoxia more likely⁸.

Second-stage fetal compromise risk factors are prolonged labor more than three hours in primigravid and two hours in multiparous women and obstructed labor from cephalopelvic disproportion or fetal malpresentation e.g., occiput posterior position⁹. Maternal comorbidities like preeclampsia, diabetes, and obesity further impair uteroplacental perfusion, whereas fetal pathology like macrosomia birth weight >4,000 g, intrauterine growth restriction IUGR, and congenital abnormalities render the fetus more susceptible to distress on account of a decreased oxygen reserve or mechanical difficulties at the time of delivery¹⁰.

Diagnosis of fetal compromise is based on real-time intrapartum monitoring, with CTG being the mainstay. Abnormal patterns like late decelerations, tachycardia

>160 bpm, or bradycardia <110 bpm are indicative of potential hypoxia and require further assessment¹¹. In case of non-revealing CTG, fetal scalp blood sampling FBS can evaluate acid-base status, with a pH less than 7.20 being suggestive of metabolic acidosis and the need for immediate intervention¹².

Treatment of second-stage fetal compromise varies according to severity and the suitability of urgent delivery. The steps initially taken include repositioning of the mother, supplemental oxygenation, and intravenous administration to maximize uteroplacental perfusion and fetal oxygenation¹³. In situations where delivery is likely to occur very soon and where conditions allow, operative vaginal delivery vacuum extraction or forceps can be offered, although operative delivery is at risk of such complications as neonatal trauma and intracranial hemorrhage¹⁴. Where instrumental delivery is not possible or distress is extreme, an emergency cesarean section is done to hasten delivery and avoid further hypoxic damage¹⁵.

Neonatal outcome is directly related to the duration and severity of fetal distress. Short-term morbidities include low Apgar scores, NICU admission, and disorders such as meconium aspiration syndrome and respiratory distress¹⁶. Severe distress is associated with an increased risk of HIE, which can result in long-term neurological impairment in the form of cerebral palsy and intellectual disability¹⁷. Timely intervention is key in preventing adverse outcomes, emphasizing the need for early detection and effective management¹⁸.

The purpose of this research is to assess the efficacy of different management approaches to second-stage fetal compromise and their effect on neonatal outcomes. Through the examination of a variety of interventions and their clinical significance, the study will advance evidence-based obstetric practice aimed at minimizing perinatal morbidity and mortality. The results will also inform

health policymakers, leading to the improvement of obstetric care guidelines and the facilitation of access to emergency interventions, especially in resource-poor settings³.

MATERIALS AND METHODS

Study Design: The current study is a cross-sectional study performed in the Gynecology Department of gyn/obs khairpur. The study was done over duration of Time Duration from 1st jan 2023 to 30th december 2024. Institutional review board ethical approval was sought prior to starting the study.

Study Population: The investigation comprised pregnant women who were admitted to the labor ward and had fetal distress in the second stage of labor. There were 220 cases fulfilling the inclusion criteria, which were included in the study. The patients were recruited consecutively in whom fetal distress was detected by abnormal cardiotocography CTG pattern, meconium-stained amniotic fluid, or any other clinical evidence of fetal compromise.

Inclusion criteria: pregnant women in the second stage of labor full cervical dilation to delivery, singleton pregnancy with cephalic presentation, fetal distress abnormal CTG patterns with persistent late decelerations, prolonged bradycardia, tachycardia, meconium-stained amniotic fluid, reduced fetal movements during labor, and gestational age of 37 to 42 weeks. **Exclusion criteria:** Multiple gestations, congenital antenatal fetal malformations, maternal conditions incompatible with vaginal delivery placenta previa, uterine rupture, and patients who had chosen elective cesarean section.

Data collection: Data were collected on maternal age, parity, gestational age, BMI, comorbidities, intrapartum labor duration, delivery mode, fetal heart rate abnormality, meconium-stained liquor, maternal complications, and neonatal Apgar scores, birth weight, NICU admission, complications, mortality data,

and management strategies were conservative measures, operative vaginal delivery, and emergency cesarean section, with outcomes measured as neonatal status, resuscitation requirements, NICU stay, perinatal complications, and delivery mode influence on neonatal outcomes.

Statistical Analysis: Statistics were conducted using SPSS version XX. Categorical variables were reported as percentages, and continuous variables as mean \pm standard deviation SD. Categorical variables were compared using chi-square tests, and Student's t-test was utilized for continuous variables. A p-value of less than 0.05 was deemed to be statistically significant. Logistic regression was performed to determine factors predicting adverse neonatal outcomes.

Ethical Considerations: Informed consent was ensured from all participants prior to study enrollment. Patient information confidentiality was ensured, and the study complied with the ethical standards of Institution Name as well as the Declaration of Helsinki.

RESULTS

Maternal Demographic and Clinical Characteristics

The study population's mean maternal age was 28.4 ± 4.6 years, of which most were primigravida 60.9%, $n=134$, and 39.1% $n=86$ were multiparous. The mean gestational age at delivery was 39.2 ± 1.4 weeks. Maternal comorbidities were noted in 32.3% $n=71$ of the cases, and gestational hypertension was noted in 14.5% $n=32$ of the participants $p = 0.041$, which showed a significant association with second-stage fetal compromise. Gestational diabetes was recorded in 10.9% $n=24$ $p = 0.056$ and anemia in 6.8% $n=15$ $p = 0.072$, although both of these did not reach significance.

Variable	Mean \pm SD / n %	p-value
Maternal age years	28.4 ± 4.6	-
Primigravida	134 60.9%	-
Multiparous	86 39.1%	-

Gestational age weeks	39.2 ± 1.4	-
Maternal comorbidities	71 32.3%	-
Gestational hypertension	32 14.5%	0.041
Gestational diabetes	24 10.9%	0.056
Anemia	15 6.8%	0.072

Indicators of Fetal Distress

Fetal distress was diagnosed in a high percentage of cases, and 82.7% $n=182$ of cases had abnormal cardiotocography CTG patterns. Persistent late decelerations were the most frequent abnormality and occurred in 52.7% $n=116$ of cases with a statistically significant relationship $p = 0.009$. Prolonged bradycardia was found in 18.6% $n=41$ of cases $p = 0.023$, and fetal tachycardia occurred in 11.4% $n=25$, where there was significant association with fetal compromise $p = 0.048$. Meconium-stained amniotic fluid was observed in 44.1% $n=97$ of cases $p = 0.033$, thus again reflecting fetal distress. Abnormal fetal movement was seen in 27.3% $n=60$ of cases, but without statistical significance of the association $p = 0.062$.

Indicator	n %	p-value
Abnormal CTG patterns	182 82.7%	-
Persistent late decelerations	116 52.7%	0.009
Prolonged bradycardia	41 18.6%	0.023
Fetal tachycardia	25 11.4%	0.048
Meconium-stained amniotic fluid	97 44.1%	0.033
Decreased fetal movements	60 27.3%	0.062

Mode of Delivery and Neonatal Outcomes

Delivery mode had a marked effect on neonatal outcomes, such as NICU

admission and 5-minute Apgar scores. Spontaneous vaginal delivery was the most frequent mode, representing 44.5% n=98 of cases. It had the lowest rate of NICU admission 11.2%, n=11 and the lowest number of neonates with a 5-minute Apgar score <7 9.2%, n=9, p = 0.012.

Operative vaginal delivery, forceps, and vacuum extraction were needed in 29.1% n=64 of the cases. Vacuum extraction, employed in 19.5% n=43 of the deliveries, was associated with NICU admissions in 30.2% n=13 and an Apgar score <7 in

16.3% n=7, p = 0.031. Forceps delivery, employed in 9.5% n=21 of the cases, was associated with increased NICU admissions 38.1%, n=8 and Apgar scores <7 23.8%, n=5, p = 0.048.

Emergency cesarean section, carried out in 26.4% n=58 of the cases, was related to the worst neonatal outcomes. It resulted in the greatest NICU admission rate 46.5%, n=27 and the highest percentage of neonates with <7 at 5 minutes Apgar score 27.6%, n=16, p = 0.006.

Mode of Delivery	n %	NICU Admission %	Apgar Score <7 at 5 min %	p-value
Spontaneous vaginal delivery	98 44.5%	11 11.2%	9 9.2%	0.012
Operative vaginal delivery	64 29.1%	21 32.8%	12 18.8%	0.021
Vacuum extraction	43 19.5%	13 30.2%	7 16.3%	0.031
Forceps delivery	21 9.5%	8 38.1%	5 23.8%	0.048
Emergency cesarean section	58 26.4%	27 46.5%	16 27.6%	0.006

Neonatal outcomes differed considerably depending on fetal distress and mode of delivery. The mean birth weight was 3.04 ± 0.42 kg. A high percentage of newborns had immediate postnatal complications, with 40.9% n=90 having an Apgar score <7 at 1 minute p = 0.015 and 18.2% n=40 at 5 minutes p = 0.009, demonstrating a strong correlation with poor perinatal outcomes.

Neonatal resuscitation was needed in 22.7% n=50 of cases p = 0.022, and 26.8% n=59 of the infants needed NICU admission p = 0.005, highlighting the high impact of intrapartum fetal distress. Complications that were specifically mentioned included respiratory distress syndrome in 11.4% n=25, p = 0.041 and meconium aspiration syndrome in 8.2% n=18, p = 0.038. Hypoxic-ischemic encephalopathy HIE occurred in 7.3% n=16, p = 0.029, indicating the aftermath of intrauterine compromise over a period.

Though neonatal mortality was seen in 2.3% n=5 of patients, the statistical significance was not found p = 0.067.

Neonatal Outcome	n %	p-value
Birth weight kg	3.04 ± 0.42	-
Apgar Score <7 at 1 min	90 40.9%	0.015
Apgar Score <7 at 5 min	40 18.2%	0.009
Neonatal resuscitation required	50 22.7%	0.022
NICU admission	59 26.8%	0.005
Respiratory distress syndrome	25 11.4%	0.041
Meconium aspiration syndrome	18 8.2%	0.038
Hypoxic-ischemic encephalopathy	16 7.3%	0.029
Neonatal mortality	5 2.3%	0.067

Risk Factors for Adverse Neonatal Outcomes Multivariate Logistic Regression Analysis

Multivariable logistic regression recognized important risk factors significantly related to second-stage fetal compromise and its resultant adverse neonatal outcomes. Prolonged second-stage labor was the strongest predictor, at an odds ratio of 3.1 95% CI: 1.8–5.2, $p = 0.001$, tripling the risk of neonatal complication. Abnormal cardiotocography CTG traces were also significantly associated with adverse outcomes OR = 2.6, 95% CI: 1.5–4.3, $p = 0.004$, underscoring the value of ongoing fetal monitoring. Meconium-stained amniotic fluid also significantly raised the risk of neonatal morbidity OR = 2.9, 95% CI: 1.7–4.9, $p = 0.002$, reflecting intrauterine stress as a key indicator of fetal compromise that needs urgent intervention

DISCUSSION

This research reveals important information about second-stage fetal compromise management and outcome, highlighting the need for early obstetric intervention and risk factor recognition. Meconium-stained amniotic fluid, prolonged bradycardia >2 minutes, and abnormal cardiotocography CTG patterns were strongly correlated with fetal distress, as reported in earlier studies^{19,20}. Extended second-stage labor was the single best predictor of neonatal complications, consistent with international literature that

Risk Factor	OR 95% CI	p-value
Prolonged second-stage labor	3.1 1.8–5.2	0.001
Abnormal CTG patterns	2.6 1.5–4.3	0.004
Meconium-stained amniotic fluid	2.9 1.7–4.9	0.002

emphasizes the risk of fetal hypoxia and asphyxia in prolonged second-stage labor²¹. These data confirm the urgent need for ongoing fetal monitoring and

appropriate obstetric decision-making to optimize perinatal outcomes.

One of the highlights was the noticeably greater NICU admission rate of neonates who were born by emergency cesarean section 46.5% compared with spontaneous vaginal birth 11.2%. Local and foreign literature have documented that this pattern had been noted to be associated with greater neonatal morbidity in the form of hypoxic-ischemic encephalopathy HIE and respiratory distress syndrome RDS²². Also, the percentage of low Apgar scores <7 at 5 minutes was significantly greater in cesarean sections 27.6% compared to vaginal deliveries 9.2%, further emphasizing the need for early intervention to avoid fetal distress complications²³. These findings are in agreement with United States and United Kingdom reports, where delayed decision-making in fetal distress cases resulted in worse neonatal outcomes²⁴.

Local Pakistani and Indian studies also uphold the correlation of prolonged labor and poor neonatal outcomes. As an example, prolonged second-stage labor ≥ 2 hours for nulliparous women has been independently observed to raise low Apgar scores and NICU admissions²⁵. On the same lines, an Indian study also mentioned that meconium-stained amniotic fluid was evident in about 40% of fetal distress situations with a highly correlated association to neonatal respiratory complications²⁶. These results are consistent with international research in which meconium aspiration syndrome has been determined to be one of the principal causes of neonatal respiratory distress in prolonged labor²⁷.

The method of delivery had a significant impact on neonatal outcomes in second-stage fetal compromise. Spontaneous vaginal delivery had the lowest rate of NICU admission 11.2% and improved Apgar scores, indicating that prompt management of fetal distress will lead to better outcomes. Conversely, operative vaginal deliveries forceps and vacuum

extraction were associated with increased neonatal morbidity, with NICU admission rates of 30.2% and 38.1%, respectively²⁸. This is in line with the available literature that operative vaginal deliveries predispose to neonatal trauma, including cephalohematoma and intracranial hemorrhage²⁹. Emergency cesarean sections were linked to the worst neonatal outcomes, including the greatest frequencies of NICU admissions 46.5%, neonatal resuscitation 22.7%, and HIE 7.3%. Comparable trends have been found in large cohorts in the United States and China, where postdated emergency cesarean delivery because of fetal distress was the single most common cause of perinatal death and morbidity³⁰.

Maternal conditions also had an important influence on fetal outcomes. Gestational diabetes 10.9% and gestational hypertension 14.5% were highly related to fetal distress $p < 0.05$, in agreement with earlier research establishing a connection between hypertensive disorders and placental insufficiency and fetal hypoxia³¹. Anemia in the mother 6.8% occurred in fetal distress, but its association was not significant. A South Asian meta-analysis recognized maternal anemia as a risk factor for low birth weight, fetal hypoxia, and NICU admissions and proposed that better maternal nutrition and antenatal care could help prevent fetal complications³². Data from Canada and Australia also confirm the link between maternal anemia and perinatal complications owing to compromised oxygen transport capacity and placental insufficiency³³.

These observations have significant implications for obstetric labor management. Since there is a strong correlation among abnormal CTG traces, lasting bradycardia, meconium-stained liquor, and fetal distress, there should be an emphasis on ongoing electronic fetal monitoring in high-risk situations^{22,23}. Moreover, since the most predictive factor for neonatal morbidity was prolonged second-stage labor OR = 3.1, $p = 0.001$,

obstetric guidelines need to stress prompt decision-making concerning operative deliveries in order to avoid fetal hypoxia and asphyxia²⁴. Though operative vaginal delivery and emergency cesarean section are unavoidable in severe fetal distress, their correlation with increased NICU admissions and lower Apgar scores emphasizes careful use and enhanced labor management to reduce unnecessary intervention^{31,33}. In addition, intervention of maternal conditions like gestational diabetes and hypertension with increased antenatal care, glycemic control, and blood pressure management can decrease the risk of fetal distress and improve neonatal outcomes³³.

Notwithstanding its strengths, the study has weaknesses. Having been done at one center, it may have limited generalizability. Even though the study involved 220 cases, a greater sample size in multiple hospitals would yield a more thorough understanding of second-stage fetal compromise. Furthermore, long-term neonatal outcomes were not evaluated, an area worthy of future research. Future studies need to be directed towards the creation of predictive models for fetal distress based on maternal risk factors and fetal monitoring data. Additional studies on streamlining labor management guidelines to minimize unnecessary operative deliveries can also improve obstetric care quality and rates of perinatal survival³³.

CONCLUSION

This paper emphasizes the importance of the influence of prolonged second-stage labor, aberrant CTG patterns, and meconium-stained amniotic fluid on fetal distress and neonatal outcomes. The highest NICU admission rates and lowest Apgar scores were seen with emergency cesarean sections, pointing to the requirement for urgent obstetric intervention. Installation of intensified fetal monitoring, enhanced labor management practices, and optimized maternal health can dramatically lower

neonatal morbidity and enhance perinatal outcomes. More multi-center trials are needed to confirm these observations and devise full-scale plans for improved management of second-stage fetal compromise.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

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