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Original Article

Prevalence of Neonatal Hypoxia in District Buner, Pakistan

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ABSTRACT

Background: Neonatal hypoxia, or hypoxic ischemic encephalopathy (HIE), is a significant cause of neonatal morbidity and mortality, especially in developing countries. The condition arises from insufficient oxygen or blood flow to the neonate's brain, leading to various degrees of neurological impairment. This study aims to shed light on the prevalence and characteristics of neonatal hypoxia in District Buner, Khyber Pakhtunkhwa, Pakistan, a region where limited research has been conducted on this critical issue.

Objective: The primary objective of this study was to determine the prevalence of neonatal hypoxia in District Buner and to analyse the distribution of its severity across different tehsils within the district.

Methods: This retrospective study was conducted from August 2021 to August 2022. Data were collected from several government and private hospitals, including DHQ Daggar, Buner Medical Complex, and Hamdard Medical Center. A total of 753 neonatal hypoxia cases were identified and classified into three categories based on severity: mild (HIE I), moderate (HIE II), and severe (HIE III). The classification was based on Apgar scores and clinical symptoms. The data were statistically analysed using Microsoft Excel 2016 and SPSS software version 25.

Results: Out of the 753 neonatal hypoxia cases, 299 (39.7%) were classified as HIE I, 276 (36.6%) as HIE II, and 132 (17.5%) as HIE III. There were 46 fatalities (6.1%) reported. The study also revealed a gender disparity, with males (402 cases, 53.4%) more frequently affected than females (351 cases, 46.6%). The highest incidence of neonatal hypoxia was observed in Tehsil Daggar (25.9%), while Tehsil Khudokhail reported the lowest (6.2%).

Conclusion: The study highlights a significant prevalence of neonatal hypoxia in District Buner, with milder forms of HIE being more common. The findings underscore the need for improved obstetric and neonatal care, especially in areas with higher prevalence, to reduce neonatal morbidity and mortality associated with HIE.

Keywords: Neonatal Hypoxia, Hypoxic Ischemic Encephalopathy, Prevalence, District Buner, Neonatal Morbidity, Neonatal Mortality.

INTRODUCTION

Hypoxic ischemic encephalopathy (HIE) represents a significant clinical challenge, particularly in neonates. It is defined as a neurological syndrome characterized by impaired respiratory function, diminished reflexes, low muscle tone, a reduced heart rate, and seizures in newborns following birth. HIE results from a combination of reduced oxygen delivery (hypoxia) and diminished blood flow (ischemia) to the brain (1-3). This condition is categorized into mild, moderate, and severe forms, reflecting its clinical severity (4).

Globally, HIE is a primary contributor to neonatal morbidity and mortality, with variations in prevalence between developed and developing countries. Research indicates that perinatal hypoxia is responsible for approximately 23% of neonatal deaths, impacting

Journal of Health and Rehabilitation Research 2791-156X JHRR

2 per 1000 births in developed countries. This incidence markedly increases in resource-limited settings, reaching as high as 26 per 1000 births (5). The reported prevalence of HIE is between 0.5 to 1 per 1000 live births in developed nations, but this rate escalates to 100-250 per 1000 live births in developing countries. Consequently, HIE accounts for nearly one-quarter of the 3.6 million neonatal deaths each year worldwide (6).

In Pakistan, particularly in urban areas, the neonatal mortality rate stands at 47 per 1000 live births, with 26% of these deaths attributed solely to birth hypoxia. The country ranks third globally in terms of neonatal mortality, which is predominantly concentrated in ten countries, mostly in Asia (6). These countries account for two-thirds of global neonatal mortality (7-9). Annually, Pakistan experiences approximately 298,000 neonatal deaths, representing 7% of the global total. Factors contributing to HIE include inadequate oxygen supply from the placenta before or during labor, blockage in the baby's umbilical cord, a brain clot in the baby, shock, sudden blood loss, or infection (10).

The current study focuses on district Buner in Pakistan, aiming to investigate and determine the prevalence of Neonatal Hypoxia. The study specifically seeks to identify variations in the prevalence of Neonatal Hypoxia across different localities within the district, thereby understanding the geographical disparities in the occurrence of this condition (11-13). The objective is to highlight which localities within district Buner exhibit higher rates of Neonatal Hypoxia, thereby providing a foundation for targeted interventions and resource allocation to address this critical health issue.

MATERIAL AND METHODS

The study was conducted in District Buner, located in the Khyber Pakhtunkhwa province of Pakistan, between February and August 2022. This region, characterized by its high mountain ranges, streams, lakes, and numerous villages, is geographically delineated by several mountain ranges which separate it from neighboring districts. Historically part of the Swat Valley, District Buner is now an independent district, situated approximately 120 kilometers from the city of Peshawar (14, 15).

Data for this study were gathered using a direct questionnaire method. The questionnaires comprised open-ended questions designed to elicit detailed information from healthcare professionals. This approach was chosen to gain an in-depth understanding of neonatal hypoxia in the district. The data collection process involved visits to several government and private healthcare institutions across District Buner. The primary institutions included the District Headquarters Hospital (DHQ) in Daggar, Buner Medical Complex, Hamdard Medical Center, and Buner Children Care Center (16, 17).

Ethical considerations were paramount throughout the research process. Prior to conducting the interviews, ethical approval was sought and obtained from the relevant institutional review boards. Informed consent was obtained from all participants, ensuring confidentiality and adherence to ethical research standards.

The collected data were systematically organized and analyzed using Microsoft Excel 2016 and SPSS software version 25. The use of these tools facilitated a comprehensive statistical analysis, allowing for the exploration of patterns and trends within the data. This analytical approach provided insights into the prevalence and distribution of neonatal hypoxia across different localities within District Buner, thereby contributing to a better understanding of the condition in this specific geographical context. The results derived from this analysis aim to inform healthcare strategies and interventions targeted at reducing the incidence of neonatal hypoxia in the district (18, 19).

RESULTS

The study involved a comprehensive data collection from both private and government hospitals across the district, including prominent centers like DHQ Dagger, Buner Medical Complex, and Hamdard Medical Centre. A total of 753 neonatal hypoxia cases were recorded, encompassing various stages of HIE. Of these, 299 cases (approximately 39.7%) were classified as mild HIE (HIE I), characterized by symptoms like hyper-alertness, decreased muscle tone, and feeding difficulties, which typically resolve within 24 hours. Moderate HIE (HIE II) accounted for 276 cases (around 36.6%), presenting with lethargy, significant hypotonia, and seizures, necessitating close monitoring and treatment, especially during the critical first week. The severe HIE

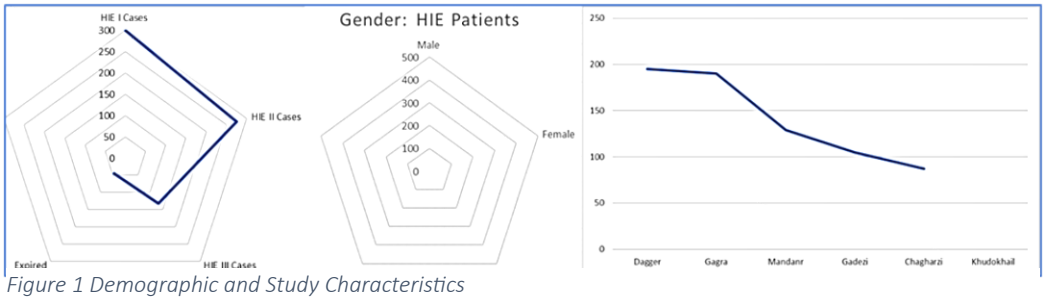

Figure 1 Demographic and Study Characteristics

(HIE III) cases, marked by coma-like unresponsiveness and severe neurological symptoms, were 132 (17.5%). Notably, there were 46 fatalities (6.1%) reported, underscoring the condition's severity.

Table 1 Symptomatology Across Different Stages of Neonatal Hypoxia

Feature	Mild HIE I	Moderate HIE II	Severe HIE III
Conscious Level	Hyper-alert	Lethargic	Stuporose
Muscle Tone	Normal	Mild hypotonia	Flaccid
Seizure	Absent	Present	Present
Moro Reflex	Strong	Weak	Absent
Sucking	Normal or Weak	Weak or Absent	Absent

The study also revealed a gender disparity in neonatal hypoxia incidence, with males (402 cases, 53.4%) being more frequently affected than females (351 cases, 46.6%). This gender-wise distribution highlights potential biological or environmental factors influencing the occurrence of HIE in newborns. An analysis of the tehsil-wise distribution of neonatal hypoxia cases in District Buner revealed varied prevalence across the region. The highest incidence was observed in Tehsil Daggar (25.9%), while Tehsil Khudokhail reported the lowest (6.2%). This geographical variation in case distribution suggests the influence of local healthcare infrastructure, environmental factors, or population dynamics on the prevalence of neonatal hypoxia in the district.

DISCUSSION

The study, conducted from August 2021 to August 2022 in District Buner, Khyber Pakhtunkhwa, Pakistan, aimed to investigate the prevalence of neonatal hypoxia, classified as hypoxic ischemic encephalopathy (HIE) (2, 20). The study encompassed 753 neonates diagnosed with HIE, drawing data from various hospitals and medical centres across the district, including DHQ Daggar, Buner Medical Complex, and Hamdard Medical Centre. Analysis revealed 299 cases of HIE I (39.7%), 276 of HIE II (36.6%), and 132 of HIE III (17.5%), with 46 neonates succumbing to the condition (6.1%).

Neonatal hypoxia originates from ischemia and hypoxia, often resulting from placental abruption, uterine rupture, or cord prolapse. These conditions trigger a cascade of events, including energy depletion, inflammation, excitotoxicity, oxidative stress, and apoptosis. Prolonged effects can include cell death, brain remodelling, astrogliosis, and epigenetic changes (21, 22). Comparatively, a study at Tanta University Hospital over 12 months in 2017 reported 60 neonates with HIE, showing a different distribution: 30% in Grade I, 30% in Grade II, and 40% in Grade III (8). This disparity may reflect regional differences in healthcare access, prenatal care, and delivery practices.

Our study's classification relied on the Apgar score, a critical indicator of neonatal health post-birth. Low scores suggest potential brain injuries like HIE, with higher scores indicating better neonatal condition. Neonatal encephalopathy, associated with seizures, altered consciousness, and respiratory difficulties, correlates with early mortality and long-term neurodevelopmental challenges. Maternal risk factors include hypertension, pre-eclampsia, diabetes, and prolonged labor, while neonatal factors range from hypoxic ischemia to infections and genetic disorders (23).

A study on newborns with birth asphyxia used the Sarnat and Sarnat score for HIE classification. Of 1752 deliveries, 11.5% had birth asphyxia, with 39.0% moderate and 10.2% severe HIE. Mortality was 9.1% among those with HIE, significantly higher in severe cases (84.2%) compared to moderate cases (1.4%). These findings underscore the global challenge of HIE, particularly in developing countries (19, 22).

In our study, the distribution of neonatal hypoxia varied across the tehsils of District Buner, with Tehsil Daggar reporting the highest incidence (25.9%). This geographical variation might reflect differences in healthcare resources, awareness, and maternal health services.

The study's strength lies in its comprehensive data collection and analysis across multiple healthcare settings, providing a detailed landscape of neonatal hypoxia in a specific region. However, it faces limitations, including potential biases in data collection and the challenge of generalizing findings to other regions. Recommendations for future research include a focus on improving prenatal and perinatal care, especially in high-risk areas, and exploring strategies for early detection and intervention in cases of neonatal hypoxia (14, 15, 23).

Journal of Health and Rehabilitation Research 2791-156X JHRR

CONCLUSION

In conclusion, this study highlights the significant prevalence of neonatal hypoxia in District Buner, with a higher incidence of milder forms of HIE. The findings emphasize the need for improved obstetric care and neonatal resuscitation to mitigate the risk of HIE. Additionally, the study points to the necessity of enhanced healthcare infrastructure and services, particularly in high-prevalence areas, to reduce the long-term impact of neonatal hypoxia on child development.

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Journal of Health and Rehabilitation Research 2791-156X JHRR

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