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CLINICAL PROFILE AND OUTCOME OF NEONATES ADMITTED TO NEONATAL INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL

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Abstract

Background: Neonatal Intensive Care Units (NICUs) play a vital role in managing critically ill and premature newborns. Evaluating the clinical profile and outcomes of neonates admitted to the NICU helps in identifying common health issues, planning effective interventions, and improving neonatal survival rates.

Methods: This prospective observational study was conducted in the Department of Paediatrics, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, during 2022 and 2024. A total of 262 neonates admitted to the NICU were enrolled after obtaining written informed consent from parents. Data on demographic details, clinical profile, mode and place of delivery, Apgar score, diagnosis, interventions (including ventilatory support, phototherapy, and antibiotics), and outcomes were collected using a structured proforma. Statistical analysis was performed using SPSS v17, with significance set at $p < 0.05$.

Results: This study included 262 neonates admitted to the NICU. Most were males (57.3%), admitted within 24 hours (70.2%), and born by cesarean section (58%). Low birth weight (54.6%) and prematurity (35.5%) were leading reasons for admission. Most stayed 4–7 days in NICU. Discharge rate was 90.5%, and mortality was 5.7%. Ventilated neonates had better outcomes than non-ventilated ones. Common infections were due to MRSA and Klebsiella. Main complications included pneumonia and ROP. Prematurity with low birth weight, sepsis, and RDS were major causes of death.

Conclusion: Prematurity, low birth weight, and infections were the leading causes of NICU admission and mortality. Early intervention, appropriate ventilation support, and infection control are essential to improving neonatal outcomes.

Keywords: Infant, Newborn Neonatal Intensive Care Units, Infant Mortality, Morbidity, Premature Birth

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3. Dr. Amit Ravindra Rudrakar: Writing original Draft, Conceptualization

INTRODUCTION

Neonatal deaths contribute to nearly two-thirds of the global infant mortality rate and 47% of under-five child mortality [1, 2]. In 2019 alone, approximately 2.4 million newborns died worldwide, corresponding to a neonatal mortality rate of 17 per 1,000 live births [1]. Between 1990 and 2019, the global neonatal mortality rate declined by 52%. However, nearly 80% of these deaths occurred in just two regions: Sub-Saharan Africa, which accounted for 42%, and Southern Asia, which contributed 37% of the total neonatal deaths in 2019 [1].

Neonatal Intensive Care Units (NICUs) play a vital role in reducing neonatal morbidity and mortality by providing specialized care for high-risk neonates, especially those born prematurely, with low birth weight, or with congenital anomalies. Globally, neonatal deaths account for nearly half of under-five child mortality, with the majority occurring within the first 28 days of life [3]. Understanding the clinical profile and outcomes of NICU-admitted neonates is critical for designing effective perinatal care interventions and optimizing resource allocation in tertiary care hospitals.

Recent studies across various geographic regions have highlighted significant variations in neonatal outcomes depending on gestational age, birth weight, mode of delivery, presence of sepsis, and need for respiratory support [4, 5]. For instance, respiratory distress syndrome and neonatal sepsis continue to be the leading causes of NICU admissions, particularly among preterm and low birth weight infants [6,7]. A multicenter Indian study also observed that outborn neonates, often transported from rural facilities, faced higher rates of morbidity and mortality compared to inborn neonates [5].

Moreover, regional disparities in NICU outcomes underscore the influence of maternal factors, quality of antenatal care, and institutional readiness. For example, neonates born via cesarean section or to mothers with gestational diabetes exhibited a greater likelihood of complications necessitating intensive care [8].

Despite advances in neonatal care technologies, challenges such as multidrug-resistant infections and lack of early diagnosis in peripheral centers remain pressing issues [9]. Therefore, profiling neonates based on their clinical presentations, sociodemographic characteristics, and outcomes is essential for evaluating NICU performance and guiding improvements in neonatal care. This study aims to systematically analyze the clinical characteristics, associated risk factors, and short-term outcomes of neonates admitted to the NICU of a tertiary care hospital. Through this analysis, we seek to identify critical areas for clinical and policy-level interventions to enhance neonatal survival and healthcare quality.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted in the Department of Paediatrics at Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, over a period of one year from October 2022 to September 2023. The study included all neonates admitted to the Neonatal Intensive Care Unit (NICU) during the study period.

In this study a total of 262 Neonates were enrolled after obtaining written informed consent from parents or caregivers. Data monitoring and analysis commenced after successful enrollment of all participants.

In this study all neonates admitted to the NICU whose parents provided informed consent were

included. The neonates not admitted to the NICU and those without parental consent were excluded from the study.

Data were collected using a predesigned proforma and included variables such as age, sex, birth weight, place and mode of delivery, maternal antenatal history, Apgar score, diagnosis, duration of stay, need for ventilatory support, and final outcomes.

The data were entered into SPSS version 17 for analysis. Continuous variables were analyzed using the t-test, and categorical variables were evaluated using the chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant. Results were presented using descriptive statistics, percentages, and appropriate graphical representations. Neonates were also assessed before discharge for risk of developmental delays using parameters such as otoacoustic emissions (OAE), tone, abnormal reflexes, and presence of seizures.

RESULTS

Descriptive statistical analysis to investigate differences in perfusion with PSR values and signal intensities across these patterns of enhancement revealed substantial differences in perfusion behaviour. The mean PSR value for all patients (N = 70) and all lesions was 23.94% ± 9.26, spanning a range of 8% to 46%. In ring lesions, PSR ranged from 11% to 46% with a mean PSR of 23.56% ± 9.91, and the signal intensities were markedly more heterogeneous. The signal intensity for the lesions had a mean baseline pre-contrast signal intensity of 1149.96, which decreased to a minimum of 826.70 upon passage of contrast and then returned to 1067.07 post-contrast. The heterogeneously enhancing lesions, most commonly found in the lung carcinoma group, had an average PSR of 24.67% ± 9.17. The pre-contrast mean signal intensity was 1262.30, with the lowest exit signal intensity mean of 942.89 upon contrast transit, and it returned to an average of 1182.11. In this category, the signal intensity had the greatest range, indicating increased vascular heterogeneity, and possibly as a necrotic or haemorrhagic etiology. Cystic patterns of enhancement, which are more typical of metastatic breast cancer, had a mean PSR of 24.86% ± 8.25, slightly above the mean. These cystic lesions had a signal intensity of 1231.86, which dropped significantly upon passage to 879.14, then returned to 1133.57. An atypical subset, yet showed a homogeneous nature for PSR behaviour and therefore indicated homogeneous perfusion in the cystic tumorous spaces. Homogeneous enhancement patterns had the lowest mean PSR of 22.22% ± 9.46; however, the lesions were less heterogeneous in terms of signal intensity. The mean pre-contrast signal intensity of 1152.11 also showed a range, from a minimum of 778.00 to a maximum of 1069.00 post-contrast. The pattern was seen in both tumours, but without correlation. This detransformative analysis is summarised in Table 1.

Table 1: Demographic and Clinical Profile of Neonates at Admission

Parameter	Categories	Number (%)
Sex distribution	Males	150 (57.3%)
	Females	112 (42.7%)
	Total	262
Age at Admission	< 24 hrs	184 (70.2%)
	24-72 hrs	28 (10.7%)
	> 72 hrs	50 (19.1%)
Mode of Delivery	LSCS	152 (58.0%)
	NVD	90 (34.4%)
	Vacuum/Forceps	20 (7.6%)
Birth Weight (grams)	< 999	8 (3.1%)
	1000 - 1499	25 (9.5%)
	1500 - 2499	114 (43.5%)
	2500 - 4000	110 (42.0%)
	> 4000	5 (1.9%)

Gestational Age (weeks)	< 28	2 (0.8%)
	28 - 33	33 (12.6%)
	34 - 36	64 (24.4%)
	> 37	163 (62.2%)

The study included 262 neonates, with a male predominance (57.3%). Most were admitted within 24 hours of birth (70.2%). The majority were delivered by lower segment cesarean section (58.0%), followed by normal vaginal delivery (34.4%). In terms of birth weight, 85.5% weighed between 1500 and 4000 grams, while only a small fraction had very low or high birth weights. Regarding gestational age, 62.2% were born at term (>37 weeks), with the remainder being preterm to varying degrees.

Table 2: Maternal and Perinatal Characteristics of the Study Population

Parameter	N, (%)(Out of 262)
Gravida Status	
Gravida 1	146 (55.7%)
Gravida 2	69 (26.3%)
Gravida 3 or more	47 (18.0%)
Type of Delivery	
Singleton	226 (86.3%)
Twins	33 (12.6%)
Triplets	3 (1.1%)
Place of Delivery	
Inside hospital	148 (56.5%)
Outside hospital	114 (43.5%)

Out of 262 cases, more than half of the mothers were primigravida (55.7%), while 26.3% were gravida 2 and 18.0% had a gravida status of three or more. Most deliveries involved singleton births (86.3%), with twins and triplets accounting for 12.6% and 1.1%, respectively. A slight majority of the deliveries occurred within the hospital (56.5%), whereas 43.5% took place outside the hospital setting.

Table 3: NICU Stay Duration and Clinical Outcomes of Neonates

Parameter	**Number (%)**
Duration of NICU stay	
1 day	10 (3.8%)
1-3 days	77 (29.4%)
4-7 days	97 (37.0%)
> 7 days	78 (29.8%)

Outcome	
Discharged	237 (90.5%)
LAMA (Left against medical advice)	4 (1.5%)
Referred	6 (2.1%)
Expired	15 (5.7%)

Among the 262 neonates, the majority had a NICU stay of 4–7 days (37.0%), followed by 1–3 days (29.4%) and more than 7 days (29.8%), while only 3.8% stayed for just one day. Regarding outcomes, 90.5% of the neonates were successfully discharged. A small proportion left against medical advice (1.5%), 2.1% were referred to other facilities, and 5.7% unfortunately expired during their NICU stay.

Table 4a: Outcome Comparison between Ventilated and Non-Ventilated Neonates

Parameter	**No Ventilator (n=194)**	**Ventilator (n=68)**	**Total (n=262)**
Discharged	191 (98.5%)	46 (67.6%)	237
LAMA	3 (1.5%)	1 (1.5%)	4
Referred	0 (0%)	6 (8.6%)	6
Expired	0 (0%)	15 (22.1%)	15

Among the 262 neonates, 68 required ventilator support, while 194 did not. Of those not on ventilators, 98.5% were discharged, and none expired. In contrast, only 67.6% of the ventilated group were discharged, and 22.1% expired. LAMA rates were equal in both groups at 1.5%, while all referrals (8.6%) occurred in the ventilated group. This suggests better outcomes among non-ventilated neonates, possibly reflecting differences in case severity, selection, or treatment response.

Table 4b: Modes of Ventilation and Associated Mortality in Neonates

Mode of Ventilation	**Number (%)**	**Mortality (%)**
P-SIMV	21 (30.9%)	11 (57.4%)
CPAP	9 (13.2%)	0 (0%)
P-SIMV + CPAP	37 (54.3%)	3 (8.1%)
P-SIMV + P-AC	1 (1.5%)	1 (100%)

Among the ventilated neonates, the most common mode used was a combination of P-SIMV and CPAP (54.3%), with a relatively low mortality rate of 8.1%. P-SIMV alone was used in 30.9% of cases, but it showed a high mortality rate of 57.4%. CPAP alone was used in 13.2% of cases and had no associated mortality. A single case required both P-SIMV and P-AC, which resulted in 100% mortality. These findings suggest that combined ventilation strategies may be associated with better outcomes compared to P-SIMV alone.

Table 5: Indications for NICU Admission among Neonates

Indication for Admission	**Number (%)**
Low Birth Weight (LBW)	143 (54.58%)

Preterm	93 (35.49%)
Neonatal Hyperbilirubinemia	63 (24.04%)
Respiratory Distress Syndrome (RDS)	62 (23.66%)
Birth Asphyxia (BA)	29 (11.06%)
Congenital Anomalies	28 (10.68%)
Sepsis	26 (9.92%)
Intrauterine Growth Retardation (IUGR)	25 (6.54%)
Meconium Stained Amniotic Fluid (MSAF)	25 (9.54%)
Infant of Diabetic Mother (IDM)	17 (6.40%)
Meconium Aspiration Syndrome (MAS)	10 (3.81%)
Transient Tachypnea of Newborn (TTN)	9 (3.43%)
Large for Gestational Age (LGA)	9 (3.43%)
Congenital Heart Disease	8 (3.05%)
Birth Trauma	7 (2.67%)
Other (Skin conditions, seizures, HDN etc.)	7 (2.67%)

The most common indication for NICU admission was low birth weight (54.58%), followed by prematurity (35.49%). Other frequent conditions included neonatal hyperbilirubinemia (24.04%) and respiratory distress syndrome (23.66%). Birth asphyxia and congenital anomalies accounted for 11.06% and 10.68% of admissions, respectively. Sepsis, intrauterine growth retardation (IUGR), and meconium-stained amniotic fluid (MSAF) were also notable contributors. Less common causes included infants of diabetic mothers (6.40%), meconium aspiration syndrome (3.81%), transient tachypnea of the newborn (3.43%), large for gestational age (3.43%), congenital heart disease (3.05%), and birth trauma (2.67%). Various other conditions such as skin disorders, seizures and HDN were (2.67%) also noted under miscellaneous causes.

Table 6: Distribution of Bacterial Isolates in Neonatal Infections

Organism	**Number (%)**
MRSA	13 (27.08%)
Klebsiella spp	11 (22.91%)
Acinetobacter baumanii	6 (12.5%)
Staphylococcus aureus	6 (12.5%)
Escherichia coli	5 (10.41%)
Serratia marcescens	3 (6.25%)
Streptococcus spp	2 (4.17%)
Pseudomonas aeruginosa	1 (2.08%)
Sphingomonas paucimobilus	1 (2.08%)
Total isolates	48

Out of 48 bacterial isolates identified from neonatal infections, MRSA was the most commonly detected organism (27.08%), followed by *Klebsiella* spp. (22.91%). *Acinetobacter baumannii* and *Staphylococcus aureus* were each responsible for 12.5% of infections. Other pathogens included *Escherichia coli* (10.41%), *Serratia marcescens* (6.25%), and *Streptococcus* spp. (4.17%). Less frequently isolated organisms were *Pseudomonas aeruginosa* and *Sphingomonas paucimobilus*, each accounting for 2.08% of the total. This distribution highlights the predominance of Gram-positive cocci and Gram-negative bacilli in neonatal sepsis.

Table 7Clinical Complications, Congenital Anomalies, and Interventions in Neonates

Parameter	**Number (%) / Count**
Complications	
Pneumonia	14 (58.33%)
Retinopathy of Prematurity (ROP)	8 (33.33%)
Convulsions	6 (25%)
Disseminated Intravascular Coagulation (DIC)	3 (12.5%)
Necrotizing Enterocolitis (NEC)	2 (8.3%)
Other complications (hypoglycemia, apnea, cerebral edema, etc.)	Various (≤4.16%)
Congenital Anomalies	
Tracheo-esophageal Fistula (TOF)	4 (14.28%)
Meningomyelocele (MMC)	3 (10.17%)
Congenital Talipes Equinus Varus (CTEV)	3 (10.17%)
Others (cleft palate, polydactyly, hydrocephalus, etc.)	Various (each ≤7.14%)
Congenital Heart Disease (CHD)	
Patent Ductus Arteriosus (PDA)	Most common CHD (exact count: 1)
Others (ASD, VSD, TGA, complex CHD)	Total 8 cases
Interventions	
Umbilical Venous Line (UV line)	37
Urinary Catheter	Not specified (among most common)
Laser for ROP	10
Exchange Transfusion	5

Among the reported complications, pneumonia was the most common (58.33%), followed by retinopathy of prematurity (33.33%) and convulsions (25%). Less frequent but serious conditions included disseminated intravascular coagulation (12.5%) and necrotizing enterocolitis (8.3%), along with various other complications such as hypoglycemia and apnea.

In terms of congenital anomalies, tracheo-esophageal fistula (14.28%) was the most frequently observed, followed by meningomyelocele and congenital talipes equinus varus, each at 10.17%. Other anomalies like cleft palate and polydactyly were also noted but were less common.

Regarding congenital heart disease, patent ductus arteriosus (PDA) was the most common, with additional cases involving ASD, VSD, TGA, and complex CHD (totaling 8 cases).

Key interventions included placement of umbilical venous lines (37 cases), laser therapy for ROP (10 cases), and exchange transfusions (5 cases), with urinary catheterization also noted as a frequent intervention, though exact numbers were not specified.

Cause of Death among the Study Population

During the study period, preterm birth associated with low birth weight (LBW) emerged as the most common cause of neonatal death, accounting for 10 cases. Among these, sepsis was present in 66.67% of the cases, followed by respiratory distress syndrome (RDS) in another 66.67%, and birth asphyxia (BA) in 53.33% of deaths. Congenital heart disease (CHD) was associated with 26.67% of deaths, while miscellaneous causes accounted for 20%. Other less frequent causes included LBW without prematurity (40%), congenital anomalies (13.33%), intrauterine growth restriction (IUGR, 6.67%), and hemorrhagic disease of the newborn (HDN, 6.67%). These findings highlight that preterm birth, sepsis, and RDS were the leading contributors to neonatal mortality in this NICU population.

DISCUSSION

In the present study, most neonates were born at term (62.2 percent) with normal birth weight (85.5 percent) and were predominantly delivered by cesarean section (58 percent). In contrast, the study by **Kolla et al. (2025)** reported a higher proportion of preterm births, with most neonates born between 28 and 32 weeks of gestation, and 95 percent weighing between 1.00 and 2.49 kilograms. Normal vaginal delivery was more common in their cohort. These findings highlight differing neonatal care challenges, with the present study focusing on term neonates with early complications and Kolla et al. addressing issues related to prematurity and low birth weight, emphasizing the need for tailored perinatal care approaches.

Among the 262 neonates included in the study, the majority (55.7%) were born to primigravida mothers (Gravida 1), followed by 26.3% to Gravida 2, and 18.0% to mothers with Gravida 3 or more. Most of the births were singleton deliveries (86.3%), while twins accounted for 12.6% and triplets for 1.1%. In terms of place of delivery, 56.5% of the neonates were delivered in a hospital setting, whereas a significant 43.5% were born outside the hospital, indicating a notable proportion of out-of-hospital deliveries.

In the present study, the most common indications for NICU admission were low birth weight (54.58%) and prematurity (35.49%), followed by neonatal hyperbilirubinemia (24.04%) and respiratory distress syndrome (RDS) (23.66%). These findings are comparable to the results of **Gupta et al.[4] (2024)**, they reported that among very low birth weight (VLBW) neonates, RDS (39.9%) and sepsis (34.9%) were the predominant morbidities, followed by transient tachypnea of the newborn (19.2%) and hyperbilirubinemia (15.8%). While both studies highlight respiratory and infectious conditions as leading causes of morbidity, the current study shows a relatively higher burden of low birth weight and prematurity as primary admission indicators. Despite differences in morbidity proportions, both studies underscore the critical need for early identification, respiratory support, and infection control measures to improve neonatal survival, especially in high-risk groups like VLBW infants.

In the present study, most neonates had a NICU stay of 4 to 7 days, with a high discharge rate (90.5%) and a moderate mortality rate (5.7%). Only small proportions were referred (2.1%) or left against medical advice (1.5%), suggesting generally favorable outcomes with appropriate care. In comparison, **Gebremariam H et al. [10] (2022)** reported that 39.3% of neonates also stayed for 4 to 7 days; however, a significant proportion of deaths (73%) occurred within the first 3 days of admission. This contrast highlights the importance of early critical care during the initial days of hospitalization, emphasizing that timely and intensive interventions in the early neonatal period can be crucial in improving survival outcomes.

In the present study, MRSA was the most frequently isolated pathogen (27.08%), followed by *Klebsiella spp.* (22.91%) and *Acinetobacter baumannii* (12.5%). The predominance of Gram-positive organisms, particularly MRSA, suggests a shift from the typically observed Gram-negative dominance in neonatal infections. In contrast, **Barkiya et al. [11] (2016)** reported Gram-negative

organisms as the predominant cause in both early-onset and late-onset neonatal sepsis, with favorable outcomes in 85% of term and preterm neonates with respiratory distress in a NICU in Kunnur, India. Similarly, **Panda PK et al. [12] (2019)** identified *Staphylococcus aureus* and *Acinetobacter* (19%) as major pathogens, highlighting a mixed pattern of both Gram-positive and Gram-negative organisms. Compared to previous studies, the current findings reflect a notable rise in Gram-positive infections, emphasizing the need for updated local antibiograms and infection control protocols.
Anurekha V et al. [13] (2018) concluded that preterm birth and low birth weight were the leading causes of NICU admissions, with sepsis and respiratory distress being the most common morbidities. **Yousuf et al. [14] (2017)** reported a neonatal survival rate of 72.6%, with major causes of admission including hyperbilirubinemia, perinatal asphyxia, and sepsis. The study emphasized that up to 85% of neonates can be effectively managed at secondary-level care facilities, reducing the load on tertiary centers. Mortality was notably higher in rural populations, underscoring the need for improved antenatal care and regional health equity. Strengthening secondary care units is a practical strategy to improve outcomes and reduce neonatal mortality.

CONCLUSION

From the results of the present study, we conclude that the most common reasons for NICU admissions were low birth weight and prematurity, followed by respiratory distress syndrome, neonatal jaundice, and birth asphyxia. The major causes of neonatal mortality were prematurity, low birth weight, respiratory distress syndrome, birth asphyxia, and sepsis.
These findings highlight that a significant proportion of neonatal morbidity and mortality is preventable. Strengthening public awareness, ensuring quality antenatal care, promoting institutional deliveries, early initiation of breastfeeding, and timely referral of high-risk pregnancies can greatly improve neonatal outcomes. Training of healthcare workers at the primary level, effective implementation of IMNCI protocols, and improved neonatal transport systems are also essential. Educating women and improving maternal nutrition and health during pregnancy play a critical role in reducing neonatal complications. Although neonatal tetanus was not observed in our study, community-based surveillance is necessary to assess its true prevalence.

References

1. United Nations Inter-agency Group for Child Mortality Estimation (UNIGME): 'Levels & Trends in Child Mortality: Report. Estimates developed by the United Nations Inter-agency Group for Child Mortality Estimation. New York: United Nations Children's Fund; 2020.
2. World health statistics: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO. 2020.
3. Jain K, Kumar V, Plakkal N, Chawla D, Jindal A, Bora R, Gupta N, Sastry A, Singla N, Bhargava A, Nath R. Multidrug-resistant sepsis in special newborn care units in five district hospitals in India: a prospective cohort study. The Lancet Global Health. 2025 May 1;13(5):e870-8.
4. Gupta P, Ingale S, Parab G, Pol P. Study of Neonatal Morbidity and Mortality in Very Low Birth Weight Neonates Admitted in Neonatal Intensive Care Unit in a Tertiary Care Centre: An Observational Study. SSR Inst Int J Life Sci., 2024; 10(5): 6304-6312.
5. Jaiswal R, Tanigasalam V, Gupta G. The Transport Profile and Outcomes of Sick Outborn Neonates Admitted to Tertiary Care Hospital in Uttar Pradesh: A Cross-sectional Study. Journal of Neonatology. 2025 Mar; 39(2):177-81.
6. Kolla S, Kumar AD, Songa NR, Kumar BR, Chandrakala M. A Study on Clinical Profile and Outcome of Indigenous CPAP on Preterm Babies with Respiratory Distress Syndrome Admitted in NICU at a Tertiary Care Hospital. European Journal of Cardiovascular Medicine. 2025; 15:715-21.
7. Zahoor F, Parvaiz H, Kalsum UE, Shah G. Bacteriological Profile And Resistance Pat-tern In Culture-Positive Septic Neonates Presenting To Tertiary Care Hospital, Peshawar. J Med Sci 2025;33(1):3-6
8. Ilyes SG, Chiriac VD, Gluhovschi A, Mihaela V, Dahma G, Mocanu AG, Neamtu R, Silaghi C,

Radu D, Bernad E, Craina M. The Influence of Maternal Factors on Neonatal Intensive Care Unit Admission and In-Hospital Mortality in Premature Newborns from Western Romania: A Population-Based Study. Medicina (Kaunas). 2022 May 26;58(6):709.
9. Prasath A, Kumar VHS. Special Issue: Advances in Healthcare for Neonates. Children (Basel). 2023 Jun 12;10(6):1048.
10. Gebremariam H, Tesfai B, Tewelde S, Abay S, Tekeste D, Kibreab F. Demographic, clinical profile and outcomes of neonates admitted to Neonatal Intensive Care Unit of Dekemhare Hospital, Eritrea. BMC pediatrics. 2022 Dec 15;22(1):716.
11. Barkiya SM, Venugopal N, Kumari V. Clinico-Etiological profile and outcome of neonatal respiratory distress. International Journal of Scientific Study. 2016 Feb 1;3(11):189-92.
12. Panda PK, Panda PK. Clinical profile and outcome of newborns admitted to a secondary-level neonatal intensive care unit in tribal region of Odisha. Journal of Clinical Neonatology. 2019 Jul 1;8(3):155-61.
13. Anurekha V, Kumaravel KS, Kumar P, Satheesh kumar D. Clinical profile of neonates admitted to a neonatal intensive care unit at a referral hospital in South India. Int J Pediatr Res. 2018;5(2):72-77.
14. Yousuf S, Tali SH, Hussain I. Clinical profile and Outcome of Neonates admitted to a Secondary-level Neonatal Intensive Care Unit in North India. Asian Journal of Pharmaceutical and Clinical Research. 2017 Sep 1:339-40.