

Perinatal morbidity and mortality and the impact of neonatal resuscitation day-by-day calamity evidenced by a prospective descriptive study in Guinea-Conakry

Abdourahamane DIALLO

Clinic of Obstetrics, University Hospital Ignace Deen and Conakry University Gamal Abdel Nasser, Conakry, Guinea

Ibrahima Sory DIALLO

Institute for Nutrition and Child Health, University Hospital Donka and Conakry University Gamal Abdel Nasser, Conakry, Guinea

Ibrahima Koussy BAH

Clinic of Obstetrics, University Hospital Ignace Deen and Conakry University Gamal Abdel Nasser, Conakry Guinea

Mamadou Cellou DIALLO

Clinic of Obstetrics, University Hospital Ignace Deen and Conakry University Gamal Abdel Nasser, Conakry, Guinea

David DESSEAUVE

Clinic of Obstetrics, Department woman-mother-child, University Hospital and University of Lausanne, Lausanne, Switzerland

Telly SY

Clinic of Obstetrics, University Hospital Ignace Deen and Conakry University Gamal Abdel Nasser, Conakry, Guinea

Matthias ROTH-KLEINER (✉ matthias.roth@chuv.ch)

Clinic of Neonatology <https://orcid.org/0000-0003-1478-198X>

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Abstract

Background

Perinatal mortality represents a major health care problem in particular in low and middle-income countries, which account for 97% of all late fetal and 98% of all neonatal deaths. Our objective was to analyse perinatal morbidity and mortality at the largest maternity clinic of Guinea, in sub-Saharan Africa.

Patients & Methods:

Prospective observational evaluation of the perinatal morbidity and mortality between May 1st and June 30th 2019 at the Clinic of Obstetrics of the University Hospital Ignace Deen in Conakry, Guinea.

Results

Of the 1189 deliveries, 98 (82%) fetus were born dead, 58.1% of them with signs of maceration. 14.1% of all infants had low birth weight (< 2500 g) and 10.6% were macrosome (> 4000 g). The rate of preterm infants was 9.3% and 99 infants (8.3%) showed signs of post-maturity. At birth, 6.8% of all live born infants had asphyxia, 10.9% respiratory distress, 1.9% infection, 0.3% malformation, and nine infants died within the first postnatal minutes. Need for any resuscitation manoeuvres showed 304 infants (27.9%), 68.8% of them needed bag and mask ventilation and 27.0% chest compressions. Infants with bad Apgar score at 1 and 5 minutes did improve by 10 minutes thanks to respiratory support, but not due to chest compression. As there is no neonatal unit in the same hospital, 192 infants (17.6%) had to be transferred across Conakry to the only tertiary neonatal unit. Due to lack of any (para-)medical transport system for newborn infants, mortality of these neonates is very high and adds to the total perinatal mortality of 143.8 deaths/1000 deliveries.

Conclusions

Late pregnancy control is very poor in Conakry, leading to delayed referral of high-risk pregnancies to the university hospital. This goes along with high rates of stillbirths, post-term and macrosome infants with increased risk for delivery complications like postnatal adaptation problems and asphyxia. Resuscitation algorithm needs to be adapted to the local context. A hospital-based neonatal unit for primary stabilization and a medicalised neonatal transport system within Conakry needs to be implemented to decrease the high mortality rate.

Background

Stillbirths and neonatal mortality are major health care problems especially in low and middle-income countries (LMIC) where 98% of all neonatal and 97% of all late fetal deaths are reported (1–3). Although a lot of effort has been made worldwide to decrease under-5 mortality rate (U5MR) by 50% between 1990 and 2015, the millennium developmental goal number 4 (MDG 4) fell short to reach the planned 75% reduction, leading to the Every Newborn action plan (4, 5). An important reason for missing the goal is an ongoing high neonatal mortality representing death within the first 28 days after birth. Furthermore, neonatal and U5MR refer to live births and therefore do not include stillbirths. According to the WHO health report 2005, 21% of all death before 5 years of age concern fetal deaths, 21% occur within the first week of life (early neonatal deaths), 8% within second and fourth postnatal week (late neonatal deaths), 28% between postnatal month 2–12 (postneonatal deaths) and 28% during second to fifth year of age (6). It is estimated that about 2.5 million newborn infants die each year, almost three quarters of them within the first week of life. To focus on late pregnancy and delivery control, as well as early neonatal care, the term of perinatal mortality was defined, as the sum of stillbirths and early neonatal deaths (within the first seven postnatal days) per 1000 deliveries (7). Data about stillbirth rates are in many regions inexistent or underreported. Globally, the number of stillbirths is estimated at about 2.6 million deaths per year, similar to the number of newborn deaths. However, less reduction in stillbirth rates compared to neonatal mortality rates have been observed over the last decades (8). Scarce data are available about stillbirth and perinatal mortality rates from hospitals or urban regions in LMIC (9–11). Nationwide data are mostly estimates, based on demographic and health inquiries and multiple indicator cluster surveys (MICS). The latest data set for Guinea is the MICS 2018, estimating neonatal mortality rate as 32 per 1000 live births (LB), but no official data about stillbirths exist (12), meaning that no data are available about perinatal mortality. In order to fill this gap of knowledge, we performed a prospective analysis of all birth activities at the largest maternity of the Republic of Guinea. In particular, we focused on postnatal adaptation, neonatal morbidity and perinatal mortality.

Patients & Methods

This prospective and descriptive analysis of all deliveries during a two months period (May 1st – June 30th 2019) has been done at the clinic of obstetrics of the National University Hospital Ignace Deen in Conakry. With about 6'000 deliveries per year, it represents by far the largest maternity clinics of all Guinea. All deliveries of dead fetus with BW > 1000 g and live born infants were included in the study. Data collection comprised documentation of maternal health during pregnancy and delivery and data of the charts of the newborn infants regarding postnatal adaptation, need for resuscitation, body measurements (BW: birth weight, length, and head circumference), and need and the reason for transfer to the neonatal unit. Gestational age (GA) in weeks was defined as the interval between the first day of last menstruation and birth or the age determined by echography performed before 20 weeks of gestation. Degree of prematurity was defined as extremely preterm (< 28 weeks GA), very preterm (GA 28 0/7–31 6/7), moderately preterm (GA 32 0/7–33 6/7) and late preterm infants (GA 34 0/7–36 6/7). Descriptive statistical analysis consisted in calculation of means, standard deviation (SD) and median values with the respective range. We performed a subgroup analysis, focused on newborns with an Apgar < 4 at 1 minute and on newborns with poor prognosis, defined in our study with an Apgar score < 4 at 1 minute and/or Apgar score < 7 at 5 minutes. In these two subgroups, crude associations between primary resuscitation measures, and an improvement to Apgar score > 7 at 10 minutes were quantified by odds ratios and their 95% confidence intervals (Cis). Multivariate analysis followed in order to obtain a better estimate of the role of ventilatory support (including airway suctioning and bag and mask ventilation) and cardiac massage to obtain and Apgar > 7 at 10 minutes in the two subgroups. The data was analyzed with Stata (version 16IC; Stata corporation, College station, Texas, USA).

Results

During the two months study period, 1189 deliveries were registered. From these, 98 were stillbirths (8.2%), of which 57 (58.1%) showed macerations as sign of prolonged intrauterine death and 41 (41.8%) were without macerations, commonly defined as a surrogate for intrapartum stillbirths (Table 1). Prematurity rate was 9.3%, and 8.3% of infants were born post term. Figure 1 shows the distribution of the preterm infants according to the different gestational age groups. Mean birth weight (BW) of all newborns was 2938 g (+/- 736 g), with 14.1% being low BW (LBW, < 2500 g) and 10.6% macrosome infants with a BW of > 4000 g. There was a light female predominance with 624 girls (52.5%). Of the 1091 live births (LB), only 513 infants (47.0%) were born by vaginal delivery. The remaining 578 newborn infants (53.0%) were born by caesarian section (CS), of which 73.2% as an emergency and 26.8% during planned CS. Of the 110 preterm infants, 22 (20.0%) were born because of an induced anticipated delivery. Reasons for induced delivery were in nine situations retroplacental hematoma, in six cases haemorrhage with placenta previa, in five cases pre-eclampsia, and in two situations eclampsia.

After delivery, the following diagnoses were mentioned in the patient records within the 1091 live born infants: 74 (6.8%) asphyxia, 21 (1.9%) congenital infection, and three (0.3%) with malformations (1 hydrocephaly and 2 omphalocele).

Among the 1091 LB, 243 (22.3%) showed a bad postnatal adaptation with an Apgar score at 1 minute < 7, of which 75 with an Apgar score 0–3. At 5 minutes, 9 infants had an Apgar score of 0–3 which corresponds according to the International Classification of Diseases to the diagnosis of severe asphyxia, and 99 infants (9.1%) still had an Apgar score < 7 (13). By 10 minutes, 33 infants (3.0%) remained with an Apgar score < 7 (Fig. 2). Table 2 summarizes the resuscitation manoeuvres and postnatal procedures needed in the early postnatal period. Of the 1091 LB, 304 (27.9%) underwent some kind of resuscitation manoeuvres, 209 (19.2%) of them needed bag and mask ventilation, and 82 (7.5%) chest compression. A closer analysis showed that infants with a bad postnatal adaptation at 1 minute (Apgar score: 0–3) and/or at 5 minutes (< 7) who benefitted from 'ventilatory support' had a 5 times higher chance to have a Apgar score > 7 at ten minutes. Chest compression however did not show a beneficial effect (Table 3). According to the registry, nine infants died within the first postnatal hour despite resuscitation.

After this first stabilisation period, 192 (17.6%) of the live born infants were transferred for ongoing neonatal care to the only neonatal clinic in Conakry, the Institute for nutrition and child health (INSE). All neonatal transports have been performed by private measures or public taxi without any medical or therapeutical support.

Discussion

This study demonstrates the highly difficult and worrisome situation of perinatal medicine in the Republic of Guinea. In the most developed referral clinic of obstetrics of the whole country, to which the most complicated pregnancies and deliveries are referred to, a stillbirth rate of 82/1000 deliveries was measured. Almost 18% of all live born infants needed a higher degree of neonatal resuscitation, 8.2/1000 LB died under resuscitation and 17.5% of all LB had to be transferred to a neonatal clinic for ongoing care.

Stillbirths

The high rate of stillbirths is particularly important to highlight, as this specific death rate is often neglected in hospital or national statistics, in which neonatal mortality and U5MR are reported in relation to LB. Data from the regional hospital of Kindia in Guinea showed a stillbirth rate of 47.7 per 1000 deliveries (14). According to the 'Every newborn action plan', developed by UNICEF and WHO, the stillbirth rate should decrease in each country to ≤ 12 stillbirths/1000 total births by 2030 (4). Today, it is estimated that each year worldwide 2.6 million fetus are stillborn (2).

The few documented stillbirth rates in hospitals are usually higher than those estimated in the community (15). Nevertheless, the here reported stillbirth rate with 82 stillbirths /1000 total births is very high in comparison to other countries and hospital reports (15–17). A large meta-analysis about stillbirth reports from 50 countries showed a variety of causes. Data from low-income countries showed antepartal haemorrhage with 9.3%, hypoxia with 11.6% and infection with 15.8% as the most important identified causes, whereas in the vast majority of situations (63.3%) no clear causes have been described (18). Unfortunately, the data available in this study are too incomplete to identify the reasons for intrapartum stillbirths. It is also not possible to analyse, if improved intra-hospital care and/or an accelerated delivery could decrease the high intrapartum stillbirth rate, or if the problem is mainly due to a delayed arrival of the pregnant woman at the hospital. The latter reason is supported by the high rate of emergency caesarean section. A further indicator of insufficient late pregnancy control and delayed transfer to the hospital were the high rate of macerated stillbirths, the increased number of post mature infants and infants with a BW of > 4000 g.

Caesarean section rate

The here described hospital CS rate with > 50% is very high. In contrast to high-income countries with high elective CS rates, in this study it is mainly due to a high number of emergency CS (19). There is hardly any other emergency treatment available for life threatening situations, either for mothers, nor for foetuses, then to terminate pregnancy by CS. No vaginal deliveries with instrumentation (forceps or vacuum extraction) were performed. The lack of therapeutical options other than termination of pregnancy is also decipherable in the context of preterm births. Whereas the overall prematurity rate is comparable to international values (20), the distribution according to preterm age groups and the causes for prematurity are quite different. In only 20% prematurity was medically indicated and provoked, in particular because of maternal reasons like retroplacental haematoma or haemorrhage due to placenta praevia or in the context of pre- or eclampsia (21). The high rate of spontaneous preterm birth indicated that the pregnant women were referred to the hospital in situations where there was no time for preventable therapies like tocolysis or maternal antibiotic therapy in order to stabilize pregnancy to gain days or weeks. Such interventions to prevent prematurity would be even more important in countries like Guinea, in which very preterm and extremely preterm infants have almost no chances to survive.

Birth weight anomalies

Whereas the rate of LBW infants of 14% was similar to other African countries, macrosome infants were overrepresented with 10% compared to macrosome rates of 2–4% (22–25). LBW as well as macrosomia are both independent risk factors for hospitalization in a neonatal unit (26); LBW infants due to immaturity, risk for hypothermia, hypoglycaemia, and respiratory distress; infants with BW > 4000 g due to increased risk for birth trauma, asphyxia and metabolic problems (25).

Need for neonatal resuscitation

The rate of infants needing resuscitation manoeuvres is very high, compared to other settings (27). This might indicate that improved examination of fetal intrapartum wellbeing and delivery management would be required. Almost 30% of all newborn infants needed any kind of resuscitation manoeuvres (tactile stimulation and/or airway aspiration), 2/10 of all infants needed additional bag and mask ventilation, and 7.5% were treated with chest compressions. In a similar setting in Tanzania, spontaneous respiration initiated in 84% of all LB infants, in 8% respiration commenced after tactile stimulation and/or suctioning and only in 8% bag and mask ventilation was necessary to start spontaneous respiration (28). Comparable data from three Norwegian hospitals are even lower with 17.5% for any resuscitation manoeuvres, 4.9% needing bag and mask ventilation and 0.1% chest compression (27). Chest compressions do not take part in the “Helping Babies Breathe” training and resuscitation program, which was taught at two occasions two years before the study period at this hospital (29). Our data do not support the use of chest compressions, as they didn’t show a beneficial effect for improved postnatal adaptation. In contrary, respiratory support (airway cleaning and manual ventilation) had a beneficial affect on improved Apgar score at 10 minutes after suppressed and delayed postnatal cardiopulmonary adaptation. It would be important to re-analyse neonatal resuscitation according to the proven beneficial resuscitation program “Helping Babies Breathe” (30).

Although Apgar score at 1 minute is a bad predictor for outcome, 88% of the 75 newborns with a very low 1-min-Apgar-score (0–3) remained instable and needed a transfer to the neonatal unit for further neonatal care. Apgar score at 5 minutes, however, was shown to be a strong predictor for death and cerebral palsy. Compared to children with 5 min Apgar scores of 7–10, those with a score of 0–3 had an almost 400 times increased risk for death and a 50–100x higher risk for cerebral palsy (31, 32). Indeed, seven of the nine newborns with 5 min Apgar 0–3 died within the first postnatal hour. Casey et al found a 13x increased risk for neonatal death in preterm and 53x increased risk in term infants, respectively, if 5-minute Apgar was 4–6 compared to 7–10 (33). This group of children (Apgar at 5 min 4–6) representing almost 9% of the study population, fulfil also one of the clinical criteria for mild to moderate asphyxia. Unfortunately, no other clinical or laboratory criteria for the diagnosis of asphyxia were available in the study population. It would be very important to create a neonatal unit in close contact to the delivery room, in order to hospitalize, stabilize and better monitor by clinical and point of care laboratory measures all these newborn infants with adaptation problems for a longer time period, than just the first hour as it is use now.

Neonatal transport

Lacking a neonatal unit at the same location, 17.6% of all live born infants had to be transferred postnatally. Indication for referral were mainly prematurity (85%), respiratory distress (62%) and in 11% neonatal infection. The high rate of respiratory distress corresponds to data presented by McEvoy et al in Western Switzerland (34). However, whereas in Switzerland respiratory support is guaranteed during transportation in a fully equipped and medicalized ambulance, professional neonatal transport does not exist in Conakry. The emergency transports of suffering infants were all performed by private vehicles or public taxis, without medical or paramedical assistance and without any kind of respiratory support. This might lead to a serious deterioration of the respiratory status, with some infants arriving dead at their destination. A study performed in a similar neonatal referral context from Dakar described mortality during transport in 2.3%. Additional 4.6% of transferred newborns presented with cardiorespiratory arrest just at arrival (35). Such data strongly suggest the creation of a medicalized neonatal transport system for the Conakry area.

Perinatal morbidity and mortality

Despite resuscitation manoeuvres, nine of the 1091 live born infants did not survive the first minutes of postnatal life, representing a resuscitation mortality of 8.2/1000 LB. Unfortunately, no data are available about the short and long term outcome of the transferred newborns. However, in a retrospective study of the second university maternity existing in Conakry (Donka National Hospital), mortality rate of the transferred newborn infants to the same neonatal intensive care unit, was shown to be 41.7% (36). In a separate evaluation performed at the INSE during the same year as the presented study, a total mortality rate of 39.9% of all admitted newborn infants was measured. For the infants referred from the Ignace Deen University Hospital, a mortality rate within the first seven days after hospitalisation at the INSE was at 33% (unpublished data). Taken all this data together, the perinatal mortality accounts as follows: of the 1189 deliveries, there are 98 stillbirths and nine infants died during resuscitation. With an early neonatal mortality (within the seven first postnatal days) rate of 33%, of the 192 transferred infants additional 64 fatal outcomes would have to be added. Altogether, the number of stillbirths, of the direct postnatally deceased infants and of these neonatal deaths within the first week of life, the total perinatal death rate rises to 143.8/1000 total births, or one dead infant in seven births.

Limitations of this study

There were quite a number of limitations added to this study. Being limited to the data of this maternity hospital, information about the outcome of the newborn infants is lacking. The calculated mortality rates are not representative for the whole population of Guinea. However, the results of this study were meant to give some indicators for policy makers and health care providers how the regional perinatal network collaboration could be improved in order to reduce this very high perinatal mortality rate.

Conclusions

Perinatal mortality in the largest clinic of obstetrics in Guinea is very high with a fatal outcome in one out of seven deliveries. Potential factors involved were delayed referral, limited resources and therapeutical options for emergencies and a non-existing neonatal unit for newborns in need of postnatal intensive care. As emergency measures in this clinic, an efficient triage system for transferred women in labour should be established in order to avoid intrahospital delays. Furthermore, neonatal resuscitation needs to get standardized according to the HBB-program, a neonatal stabilization unit has to be created in proximity to the delivery room and the obstetric surgical theatre must be equipped with emergency respiratory support and staffed by trained personal for neonatal emergency care. The caseload of the Conakry area is big enough to install a neonatal transport system with ambulances supplied with oxygen and respiratory support in order not to interrupt life-saving neonatal care during transportation.

List Of Abbreviations

BW Birth weight

CS Caesarean section

GA Gestational age

HBB Helping Babies Breathe Program

INSE Institut de Nutrition et de Santé de l'Enfant; Institute for nutrition and child health

LBW Low birth weight (< 2500 g)

LMIC Low and middle-income countries

MICS Multiple indicator cluster survey

MDG 4 Millenium developmental goal number 4

U5MR Under-5-mortality rate

UNICEF United Nations Children's Fund

WHO World health organization

Declarations

Ethics approval

The study was approved by the bioethical Committee of the National University Hospital Ignace Deen in Conakry. The parents were informed about the goal of the study, and their right for non-acceptance. The individual data was used for scientific purposes only, according to the legal regulations on privacy applicable in Guinea. No written informed consent was required.

Availability of data

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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There was no funding for this study.

Author's contribution

AD initiated the study, wrote the protocol, analysed data and performed tables. Patient recruitment and data acquisition were performed by IKD and MCD. MRK, DD and AD wrote the manuscript. DD made statistical analyses. ISD and TS gave scientific advises, helped interpreting the data and revising the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1:

Epidemiological and clinical data of infants born during the study period:

Clinical data at birth	n	%
Viability (n =1189)		
Live births	1091	91.8
Stillbirths	98	8.2
Type of stillbirths (n= 98)		
Recent stillbirths	41	41.8
Stillbirths with signs of maceration	57	58.2
Maturity of newborn infants (n= 1189)		
Mature	980	82.4
Prematuré	110	9.3
Post term	99	8.3
Birth weight in grams (n =1189)		
<2500	167	14.0
2500-3999	896	75.4
≥4000	126	10.6
Mean birth weight: 2938g (Standard deviation : 736g);		
Range: 965g - 5200g		
Head circumference (n = 1189)		
Mean: 33 cm (SD: 3 cm)		
Range: 27 - 36 cm		
Birth length (n = 1189)		
Mean: 49 cm (SD: 4cm)		
Range: 44 - 56 cm		
Postnatal diagnoses of live born newborn infants (n= 1091)		
Asphyxia	74	6.8
Infection	21	1.9
Malformation	3	0.3
Type of malformation (n= 3)		
Hydrocephalus	2	66.7
Omphalocele	1	33.3

Table 2:

Postnatal adaptation and immediate outcome of the live births

Adaptation and immediate outcome	n	%
Any sort of resuscitation manoeuvres (n=1091)	304	27.9
Resuscitation manoeuvres (n = 304)		
Tactile stimulation	289	95.1
Upper airway aspiration	212	69.7
Bag and mask ventilation	209	68.8
Chest compressions	82	27.9
Immediate death despite resuscitation (n =304)	9	3.0
Transfer to neonatal unit (n =1091)	192	17.6
Transfer indications (n =192) (More than 1 indication possible)		
Prematurity	164	85.4
Respiratory distress	119	62.0
Malformation	2	1.0
Neonatal infection	21	10.9

Table 3:

Association between primary resuscitation measures after birth and Apgar-score at 10 minutes >7, according to Apgar-score at 1 minutes <4 and newborns with poor prognosis defined by Apgar-score <4 at 1 minute and <7 at 5 minutes.

	Crude OR [95%CI]	aOR [95%CI]
<i>Apgar at 1 minutes <4 (N=102)</i>		
Tactile stimulation	-	-
Ventilatory support	3.65 [1.4-9.5]	5.0 [1.8-14.6]
Cardiac massage	0.13 [0.02- 1.17]	0.3 [0.1-0.9]
<i>Poor prognosis (N=68)</i> <i>(Apgar at 1 minute <4 and Apgar at 5 minutes <7)</i>		
Tactile stimulation	-	-
Ventilatory support	6.4 [1.7-38.5]	9.4 [1.8-47.2]
Cardiac massage	0.3 [0.13-1.7]	0.4 [0.1-1.6]

Legend: CI: Confidence interval ; OR: Odds ratio ; aOR: adjusted Odds Ratio.

Figures

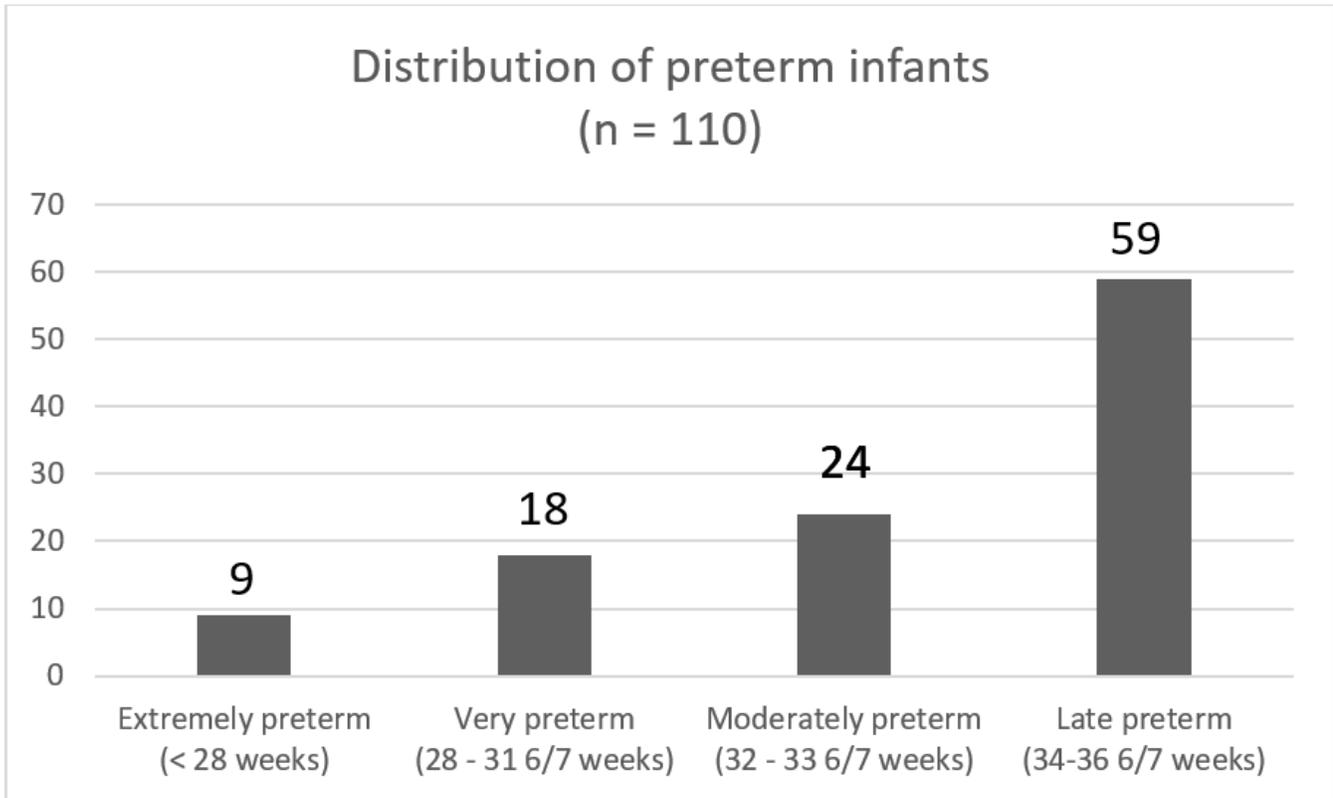


Figure 1

Distribution of preterm infants according to the different degrees of prematurity

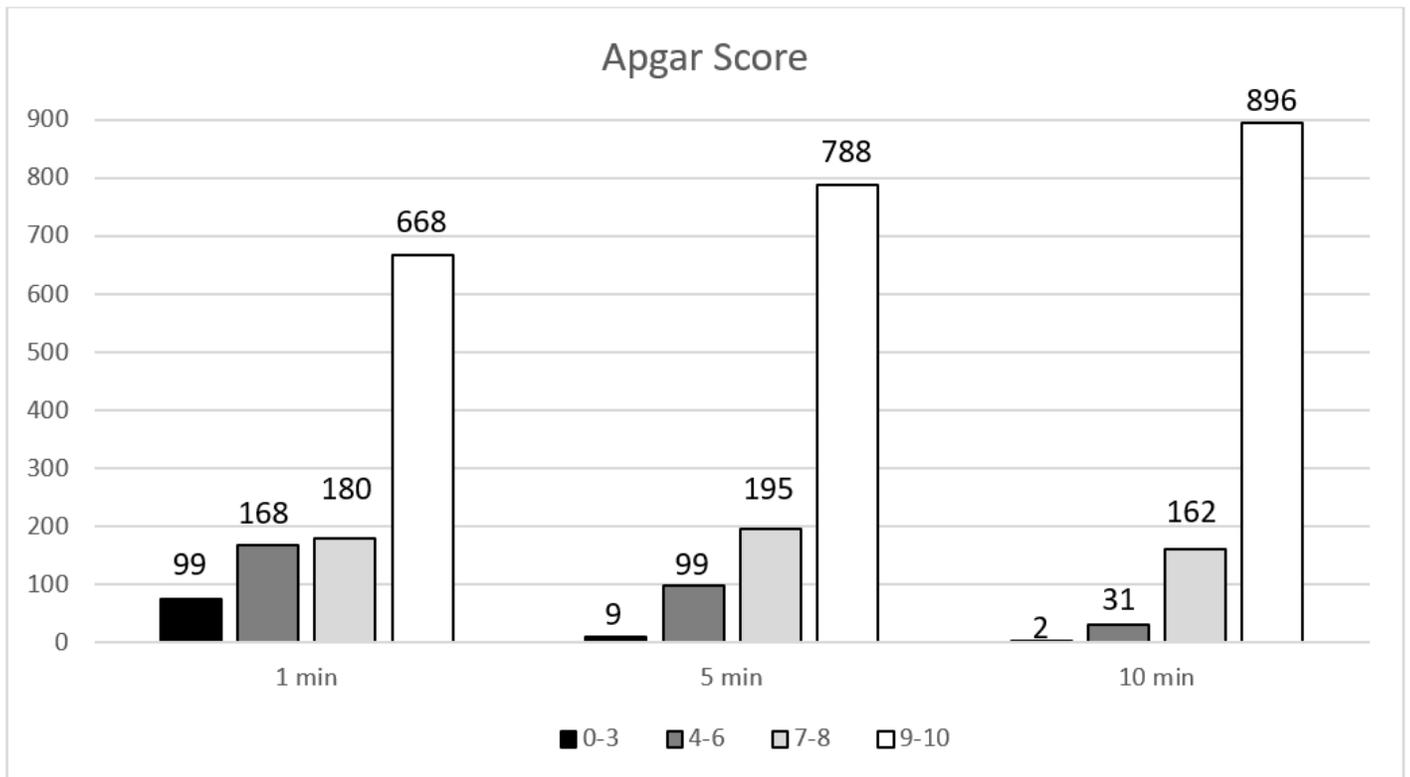


Figure 2

Number of patients within different Apgar score groups at 1, 5, and 10 minutes of postnatal life.