Open Access Library Journal
2023, Volume 10, e9855
ISSN Online: 2333-9721
ISSN Print: 2333-9705

Respiratory Distress in the Newborn: Experience of Pediatric Emergency Department

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How to cite this paper: Danaoui, K., Lahmini, W. and Bourrous, M. (2023) Respiratory Distress in the Newborn: Experience of Pediatric Emergency Department. *Open Access Library Journal*, **10**: e9855.
https://doi.org/10.4236/oalib.1109855

Received: February 8, 2023
Accepted: March 11, 2023
Published: March 14, 2023

Abstract

The transition from fetal life to extra-uterine life is accompanied by significant changes involving a need for adaptation. This leads to the admission of a large number of newborns in neonatal units. Currently, there is an increasing incidence of respiratory distress in all newborns admitted to Pediatric Emergency Departments. Through an analytical and descriptive retrospective study, carried out in the Pediatric Emergency department of the University Hospital Mohammed VI of Marrakesh, including newborns treated for respiratory distress over a period of one year; we have analyzed the epidemiological, clinical, paraclinical, and evolutionary aspects of neonatal respiratory distress. The total number of neonates hospitalized for respiratory distress was 381 cases with a sex ratio of 1.4. The average age of our patients was 4.68 ± 6.87 days with extremes ranging from 1 to 28 days. The prematurity rate was 33.1% and 41% of newborns had low birth weight. The majority of cases were of rural origin (49.4%). More than half (51.15%) of pregnancies were poorly monitored, medicalized deliveries represented 91.7% in our series, and 78.4% were by vaginal route against 21.6% by cesarean section. The infectious anamnesis was positive in 51.7%. Respiratory distress was the main reason for consultation in pediatric emergencies (52%). Nearly 19% of newborns had moderate respiratory distress. Rapid recognition of respiratory distress and initiation of appropriate treatment play a key role in the quality of care.

Subject Areas

Emergency & Critical Care, Pediatrics

Keywords

Newborns, Respiratory Distress, Extra-Uterine Life, Morocco

1. Introduction

In the early neonatal period, respiratory distress is common and affects up to 7% of infants. Newborns, especially premature babies [1] [2]. The transition from fetal life to extra-uterine life is accompanied by significant changes implying a need for adaptation. This leads to the admission of a large number of newborns in neonatal units. Currently, there is an increasing incidence of respiratory distress in all newborns admitted to Neonatal Units in Pediatric Emergency Departments, this is probably due to the increase in the number of extremely low birth weight infants, changes in admission policies, and the increase in the number of infants delivered by caesarean section [3].

Multiple conditions can cause respiratory distress in newborns such as meconium aspiration, hyaline membrane disease, perinatal asphyxia, respiratory distress transient, and early infection in the lungs [1] [4]. It is important to recognize respiratory distress early and initiate treatment appropriate to ensure optimal neonatal outcomes [5]. Complementary examinations should be hierarchical and oriented. The prevention and management of respiratory distress require the good organization of perinatal care in the form of integrated networks. This care involves a minimum technical platform and resuscitation skills, particularly in the various respiratory assistance techniques such as oxygen therapy and mechanical ventilation [6].

2. Patients and Methods

A retrospective analytical and descriptive study was carried out in the Pediatric Emergency Department of the University Hospital Mohammed VI of Marrakesh over a period of one year from January 2021 to 31 December 2021. We included in this study all newborns aged from the 1st hour of life up to 28 days hospitalized for respiratory distress of medical origin who received treatment in the Pediatric Emergency Department.

This study was based on the medical records of hospitalizations in the Pediatric Emergency Department, the reference forms of other hospitals (provincial hospitals, regional hospitals, university hospitals, and maternity homes, as well as the hospital management and information system, which makes it possible to verify the assessments and extract other information not included in the medical record. An exploitation form has been established for each patient allowing the evaluation of the different epidemiological, clinical, paraclinical (biological and radiological), etiological, and therapeutic data.

3. Results

During the year 2021 of the study, 381 newborns were hospitalized in the Pediatric Emergency Department of the Mohammed VI University Hospital in Marrakech following neonatal respiratory distress (52%) representing the first reason motivating the consultation. The month of December prevailed with a rate of 12.07%, or 46 newborns with respiratory distress.

In our study, the ages of admission of the patients varied between one and 28 days of life with an average age of 4.68 ± 6.87 days and a median corresponding to one day of life (Figure 1). The male sex was predominant (58.3%) representing 222 newborns with a sex ratio of 1.4. Note the presence of a newborn whose sex was undetermined.

With regard to social coverage, the study was only carried out on 163 newborns (42.8%) due to the absence of information in the files. Two-thirds of newborns had no social security coverage (68.7%). The majority of hospitalized newborns were referred from a health facility (Provincial Hospital Centers (CHP), Regional Hospital Centers (CHR), University Hospital Centers (CHU), birthing center, private sector, etc.). The Provincial Hospital Centers (CHP) prevailed with a total of 167 among 381 patients, or 45%. The average maternal age was 27.53 ± 6.32 years with extremities ranging from 17 to 46 years. Almost half of the mothers (46.7%) were between 26 and 35 years old; the mothers minor also existed in our series with a percentage of 4.9%. Almost two-thirds of neonates were full-term (65.7%) while 126 cases were preterm.

Transient respiratory distress is more likely to occur in neonates delivered by cesarean section, whereas NPA is more likely to occur in patients delivered by vaginal delivery with the use of an instrument (forceps or vacuum) or episiotomy (Figure 2). We found a statistically significant difference between the route of delivery and the diagnoses retained ($p = 0.036$).

Regarding the clinical course in our series: neonates from urban areas were more likely to have a favorable outcome, while those from rural areas were more likely to die.

We found a statistically significant difference between the gestational age of the neonates and their outcome ($p = 0.038$) and a statistically significant difference between gestational age of the newborns and their outcome ($p = 0.038$). Full-term newborns were more likely to have a favorable outcome while premature babies were more likely to have an unfavorable outcome.

We found a statistically significant difference between the diagnoses chosen and the outcome of the newborns ($p = 0.001$). Newborns diagnosed with perinatal asphyxia, hyaline membrane disease, or septic shock were more likely to have an unfavorable outcome.

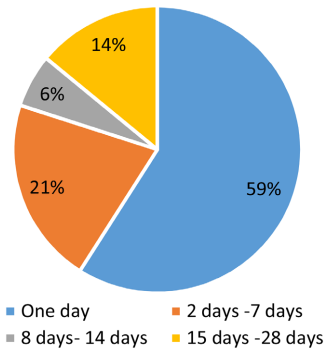

Figure 1. Hospitalizations by age group.

4. Discussion

The causes of respiratory distress in a newborn are diverse and multisystemic. Pulmonary causes may be related to alterations during normal lung development or transition to extrauterine life. Normal lung development occurs in 5 phases [7] (Table 1).

Respiratory disease may result from developmental abnormalities that occur before or after birth. Early developmental malformations include tracheoesophageal fistula, bronchopulmonary sequestration (abnormal mass of pulmonary tissue not connected to the tracheobronchial tree), and bronchogenic cysts (abnormal branching of the tracheobronchial tree). Later, in gestation, parenchymal lung malformations, including congenital cysticadenomatoid malformation or pulmonary hypoplasia from congenital diaphragmatic hernia or severe oligohydramnios,

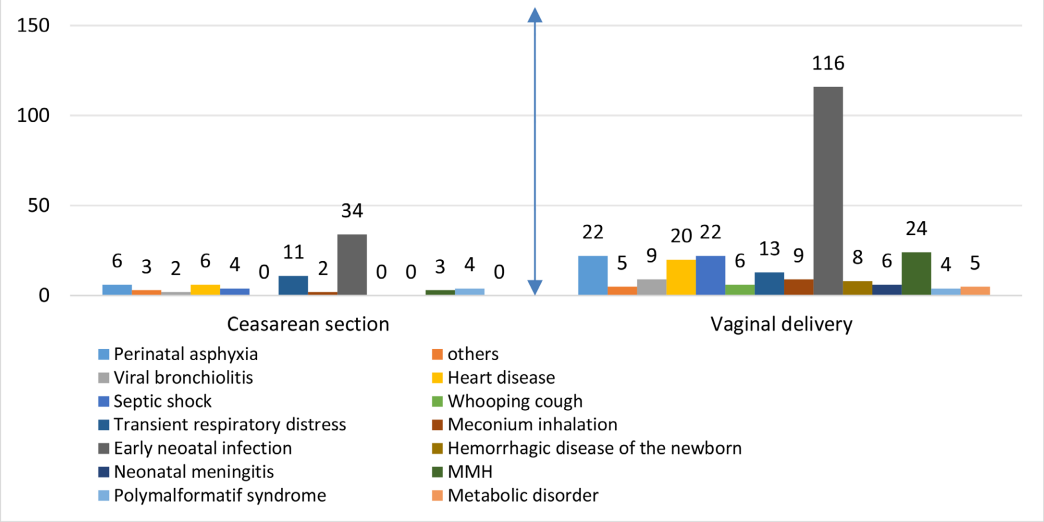

Figure 2. Distribution by etiology and route of delivery.

Table 1. Developmental stages of lung development and respiratory disease pathogenesis.

DEVELOPMENTAL STAGE	EMBRYONIC	PSEUDOGLANDULAR	CANALICULAR	TERMINAL SAC	ALVEOLAR
Gestation	0 - 6 weeks	7 - 16 weeks	17 - 24 weeks	25 - 36 weeks	>37 weeks
Structural morphogenesis	Trachea, bronchi	Bronchioles, terminal bronchioles, lung circulation	Respiratory bronchioles, primitive alveoli	Alveolar ducts, thin-walled alveolar sacs, increasing functional type 2 cells[a]	Definitive alveoli and mature type 2 cells[a]
Disease manifestation	Tracheoesophageal fistula, pulmonary sequestration	Bronchogenic cyst, congenital diaphragmatic hernia, congenital cystic adenomatoid malformation	Pulmonary hypoplasia, RDS, BPD, alveolar capillary dysplasia	RDS, BPD	TIN, MAS, neonatal pneumonia, PPHN

BPD = Bronchopulmonary Dysplasia; MAS = Meconium Aspiration Syndrome; PPHN = Persistent Pulmonary Hypertension of the Newborn; RDS = Respiratory Distress Syndrome; TTN = Transient Tachypnea of the Newborn; [a]Type 2 peneumocytes are surfactant-producing cells.

may develop. More common respiratory diseases, such as TTN, RDS, neonatal pneumonia, MAS, and Persistent Pulmonary Hypertension of the Newborn (PPHN), result from complications during the prenatal to postnatal transition period. Although mature alveoli are present at 36 weeks' gestation, a great deal of alveolar septation and microvascular maturation occur postnatally. The lungs are not fully developed until ages 2 to 5 years [7] [8]. Therefore, developmental lung disease can also occur after birth.

Bronchopulmonary Dysplasia (BPD), for example, is a significant lung disease that complicates prematurity due to arrested alveolarization in developing lungs exposed to mechanical ventilation, oxygen, and other inflammatory mediators before normal development is complete. As defined by an ongoing oxygen requirement at 36 weeks' adjusted gestational age, BPD affects up to 32% of premature infants and 50% of very low-birth-weight infants [9].

Respiratory Distress Syndrome (RDS), also known as hyaline membrane disease, is a common cause of respiratory disease in the premature infant. RDS is also seen in infants whose mothers have diabetes in pregnancy. RDS is caused by a deficiency of alveolar surfactant, which increases surface tension in alveoli, resulting in microatelectasis and low lung volumes. Surfactant deficiency appears as diffuse fine granular infiltrates on radiograph. Pulmonary edema plays a central role in the pathogenesis of RDS and contributes to the development of air bronchograms. Excess lung fluid is attributed to epithelial injury in the airways, decreased concentration of sodium-absorbing channels in the lung epithelium, and a relative oliguria in the first 2 days after birth in premature infants [10]. Infants typically improve on onset of diuresis by the fourth day after birth. Infants with RDS typically present within the first several hours of life, often immediately after delivery.

Meconium Aspiration Syndrome (MAS) occurs when the fetus passes meconium before birth. Infants born through MSAF are at risk for aspiration of meconium in utero or immediately after birth. Any infant who is born through MSAF and develops respiratory distress after delivery, which cannot be attributed to another cause, is diagnosed as having MAS. Meconium is composed of lanugo, bile, vernix, pancreatic enzymes, desquamated epithelia, amniotic fluid, and mucus. Meconium is present in the gastrointestinal tract as early as 16 weeks' gestation but is not present in the lower descending colon until 34 weeks' gestation; therefore, MSAF is seldom seen in infants younger than 37 weeks' gestation [11]. In the compromised fetus, hypoxia or acidosis may result in a peristaltic wave and relaxation of the anal sphincter, resulting in meconium passage in utero. Aspiration may occur in utero or immediately after birth as the compromised fetus gasps.

Meconium is toxic to the newborn lung, causing inflammation and epithelial injury as it migrates distally. The pH of meconium is 7.1 to 7.2. The acidity causes airway inflammation and a chemical pneumonitis with the release of cytokines [11]. As meconium reaches the small airways, partial obstruction occurs, which results in air trapping and hyperaeration. The typical chest radiograph initially appears streaky with diffuse parenchymal infiltrates. In time, lungs become hyper-

inflated with patchy areas of atelectasis and infiltrate amid alveolar distension. Surfactant is inactivated by the bile acids in meconium, resulting in localized atelectasis, so alternatively, radiographs may resemble those of RDS with low lung volumes.

5. Conclusion

We can conclude that respiratory distress in the newborn is a frequent reason for consultation and hospitalization in pediatric emergencies. A better knowledge of the risk factors of the disease allows improving management. Learning to easily recognize respiratory distress in the newborn and understanding the physiological abnormalities associated with each of the different causes will guide optimal management. Although the ideal is to decrease incidence through preventive measures, early recognition and treatment of common neonatal respiratory diseases will reduce short- and long-term complications and associated mortality in infants at risk.

Conflicts of Interest

The authors declare no conflicts of interest.

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