



## Perinatal Morbidity and Mortality at Souissi Maternity Hospital, Rabat, Morocco

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### Authors' contributions

This work was carried out in collaboration between all authors. All authors took participation in the design of the study. Authors MEB, MK and AB wrote the protocol. Author MEB managed the literature searches, performed the statistical analysis and wrote the first draft of the manuscript. Author AB revised the manuscript. All authors read and approved the final manuscript.

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## ABSTRACT

**Background:** Perinatal morbidity and mortality rates are indicators of the level of perinatal care.  
**Aims:** To study perinatal morbidity and mortality at Souissi maternity hospital, Rabat, Morocco.  
**Material and Methods:** Prospective study of all cases of perinatal morbidity and mortality during the months of January and February 2014.  
**Results:** A total of 3297 births were included in the study. Sex-ratio was 0.96. Birth weight ranged from 600 to 5400 g with an average of 3202 g. The total of perinatal morbidity and mortality cases was 792. Perinatal morbidity rate was 233 per 1000 births and perinatal mortality rate was 7 per

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1000 births. Perinatal morbidity consisted of: suspected perinatal sepsis (5.62%), prenatal exposure to maternal infections (0.21%), macrosomia at term (1.64%), low birth weight without prematurity (2.49%), post-term delivery (1.00%), prematurity (1.36%), perinatal asphyxia (3.97%), respiratory morbidity (2.12%), congenital malformation (0.64%) and birth trauma (0.12%). The perinatal mortality was 23, consisting of 20 stillbirths (8 macerated and 12 fresh stillbirths) and 3 cases of early neonatal mortality related to perinatal anoxia in 2 cases and to an anencephaly in 1 case. Higher risk of perinatal morbidity was associated with maternal age  $\leq 40$  years ( $P=0.002$ ), primiparous mother ( $P<0.001$ ), multiple pregnancy ( $P<0.001$ ), malpresentation ( $P<0.001$ ) and emergency cesarean delivery ( $P<0.001$ ).

**Conclusion:** Perinatal morbidity and mortality remains a public health concern in Morocco and identification of risk factors enables optimal targeting of prevention efforts. Given the high number of morbidities and mortalities observed during the period of the study, the permanent presence of a pediatrician at the labor ward of Souissi maternity hospital for immediate and optimal management of the newborns is crucial.

*Keywords: Perinatal morbidity; perinatal mortality; Souissi maternity hospital; Morocco.*

## 1. INTRODUCTION

Perinatal morbidity and mortality remains a challenge worldwide and particularly for developing countries. Its ranking is used to determine the relative safety of maternity care systems in different countries. The lack of epidemiological data on perinatal morbidity and mortality in Morocco led us to conduct this study. The purpose was to establish the rates of perinatal morbidity and mortality at Souissi maternity hospital of Rabat, Morocco, a tertiary maternity hospital, and to examine the perinatal morbidity and mortality causes, to establish its risk factors and to make recommendations adapted to the technical platform available that may improve on this.

## 2. MATERIALS AND METHODS

### 2.1 Location and Material

We conducted a cross-sectional prospective study during the months of January and February 2014 at the labor ward of Souissi maternity hospital of Rabat, Morocco. All participants provided informed consent and ethical approval for the study was granted by the ethics committee of the faculty of medicine and pharmacy of Rabat. The collection of data was anonymous using the inpatient registration number and it was made with the agreement of the department head. For each birth, these parameters were prospectively collected by the attending pediatric resident who provided initial care to all newborns: inpatient registration number, maternal age and blood type, maternal weight and height, gravidity and parity, prenatal

care (number of prenatal visits and obstetric ultrasonography), history of miscarriage or perinatal death, maternal chronic disease (chronic hypertension, diabetes or other), pregnancy complications (gestational hypertension, gestational diabetes, third-trimester bleeding, threat of premature labor, preeclampsia, eclampsia, HELLP syndrome, premature detachment of the placenta, placenta previa, intrapartum fever, documented urinary tract infection, premature rupture of membranes), presentation of the fetus, prolonged rupture of membranes greater than 12 hours, mode of delivery (vaginal, elective cesarean section or emergency cesarean section), vaginal delivery assistance (ventouse or forceps), cesarean section indication, date and time of birth, newborn's sex and weight, gestational age, Apgar score, physical examination and initial care to the newborn. Simple initial investigations were conducted in newborns to confirm suspected congenital malformations such as thoracoabdominal radiograph, abdominal ultrasonography, transfontanelar ultrasonography and echocardiography.

### 2.2 Inclusion and Exclusion Criteria

Eligibility criteria for this study were based on the WHO definition of viability, that is, birth weight of at least 500 g and gestational age of at least of 22 weeks [1]. During the study period, all newborns from childbirth or cesarean section performed at the Souissi maternity hospital meeting the WHO definition of viability were included. Newborns that weighed less than 500 g or had gestational age of less than 22 weeks at delivery were excluded.

## 2.3 Terms Definition

A woman was considered to have received prenatal care when she had 3 or more visits for prenatal care during her pregnancy and prenatal care was considered insufficient if there were less than 3 visits for prenatal care. Parity was the number of previous pregnancies ending after 20 completed weeks of gestation including stillbirth. Live birth was defined as a neonate that breathed or showed any other signs of life such as beating of the heart or definite movement of voluntary muscles. Stillborn was a neonate with no respiratory or circulatory signs of life at birth. Fresh stillbirth was defined as the intrauterine death of a fetus during labor or delivery. Macerated stillbirth was defined as the intrauterine death of a fetus sometime before the onset of labor, where the fetus showed degenerative changes. Early neonatal mortality included any death that occurred within the first 7 days of life. Perinatal mortality was defined as the sum of all stillbirths and early neonatal deaths. Prematurity was defined as a birth occurring before 37 completed weeks of gestation. Post-term was defined as 42 or more weeks of gestation. Birth weight was defined as the first measurement of body weight, usually in the first hour of life. Low birth weight was defined as birth weight below the 10th percentile of the Leroy and Lefort curve. Macrosomia was defined as birth weight above the 90th percentile of the Leroy and Lefort curve. Gestational age was calculated using the first day of last maternal menstrual period if it was known, or estimated by obstetric sonography, or with the Dubowitz score [2]. Perinatal asphyxia was defined as a low Apgar score of less than 7 at 5 minutes [3]. Respiratory morbidity was defined by the presence of tachypnea or chest retractions regardless of the etiology. Congenital malformation was defined as a physical defect present at birth. Major congenital malformation was defined as a life-threatening congenital malformation. Minor congenital malformation was defined as a congenital malformation that does not affect the chances of survival of the newborn. Birth trauma was defined as peripheral plexus or nerve injury, fracture or laceration. Perinatal sepsis was suspected in case of maternal chorioamnionitis or in case of premature or prolonged rupture of membranes of 12 hours or more.

## 2.4 Statistical Analysis

The statistical analysis was performed with Pearson's chi-square test. A p-value of less than 0.05 was considered statistically significant.

## 3. RESULTS

### 3.1 General Data

Overall, 3297 births were included in the study (Table 1): 3274 live births (99.30%), 20 stillbirths (6 per 1000 births) and 3 early neonatal mortalities (1 per 1000 births). There were 1619 males (49.11%) and 1678 females (50.89%), giving a male to female ratio of 0.96. Birth weight ranged from 600 to 5400 g with an average of  $3202 \pm 598$  g. Age of mothers ranged from 16 to 51 years with a mean age at delivery of  $28.7 \pm 6.27$  years. Mothers were aged over 40 years in 2.52%. There was prenatal care in 84.44%. The fetal presentation was vertex in 3180 cases (96.41%) and there was fetal malpresentation in 117 cases (3.59%). About 82.17% of mothers delivered vaginally and 17.83% had cesarean delivery of which 24.15% were elective and 75.85% were emergency cesareans. Among mothers who had vaginal delivery, 9.52% required some form of instrumentation during delivery. There were 3167 singletons (96.06%), 130 newborns from twin deliveries (3.94%) and no triplet or other multiple pregnancies. About 35.24% of mothers were primiparous and 64.76% were multiparous. There were a total of 770 perinatal morbidity cases (23.35%). The total of perinatal morbidity and mortality cases was 792 (24.02%) as described in Table 2.

Of those 792 neonates, 347 were males (43.81%) and 445 were females (56.19%), giving a male to female ratio of 0.78. Birth weight ranged from 600 to 5400 g with an average of  $3098 \pm 632$  g. Age of mothers ranged from 16 to 50 years with a mean age at delivery of  $29.2 \pm 6.41$  years. Mothers were aged over 40 years in 1.01%. There was prenatal care in 83.33%. The fetal presentation was vertex in 742 cases (93.69%) and there was fetal malpresentation in 50 cases (6.31%). About 74.87% of mothers delivered vaginally and 25.13% had cesarean delivery of which 27.64% were elective and 72.36% were emergency cesareans. Among mothers who had vaginal delivery, 8.77% had some form of instrumentation during delivery. There were 745 singletons (94.07%) and 47 newborns from twin deliveries (5.93%). About

47.97% of mothers were primiparous and 53.03% were multiparous.

### 3.2 Perinatal Morbidity

There were 445 cases (13.50%) of suspected perinatal sepsis due in 5.62% to chorioamnionitis and in 94.38% to premature or prolonged rupture of membranes greater than 12 h. Other perinatal morbidity cases were represented by 7 cases (0.21%) of prenatal exposure to maternal infections (1 case of toxoplasmosis, 1 case of syphilis, 1 case of HIV, 3 cases of hepatitis B and 1 case of hepatitis C), 54 cases (1.64%) of macrosomia at term with a mean weight of 4544 ± 225 g and extremes from 4100 to 5400 g, 82 cases (2.49%) of low birth weight without prematurity that ranged from 1300 to 2500 g with a mean weight of 2143 ± 241 g, 33 cases (1.00%) of post-term delivery with a mean gestational age of 42 weeks and half day ± 0,17 and extremes ranging from 42 to 42 weeks and 5 days, 45 cases (1.36%) of prematurity with a mean gestational age of 33.0 ± 2,67 weeks and extremes ranging from 28 and 36 weeks, 131 cases (3.97%) of perinatal anoxia and 70 cases (2.12%) of respiratory morbidity. We found 15 cases (0.45%) of major congenital malformation: 7 cases of dysmorphic facies, 2 cases of multiple malformations, 1 case of macrocrania, 1 case of esophageal atresia, 1 case of bilateral choanal atresia, 1 case of anencephaly, 1 case of

myelomeningocele and 1 case of abnormal sex differentiation. We also found 6 cases of minor congenital malformations. There were 4 cases (0.12%) of birth trauma: 2 cases of facial nerve injury associated with the use of forceps, 1 fetal laceration during cesarean section and 1 brachial plexus injury. Hospitalization concerned 62.53% of perinatal morbidity cases and an expert advice of a pediatric surgeon, an ENT specialist or a neurosurgeon was sought in 3.60%.

### 3.3 Perinatal Mortality

Perinatal mortality consisted of 20 cases of stillbirth (40% were macerated and 60% were fresh) and 3 cases of early neonatal mortality related to perinatal anoxia in 2 cases and to an anencephaly in 1 case (Table 3).

### 3.4 Risk Factors Analysis

A mother aged less than or equal to 40 years ( $P=0.002$ ), multiple pregnancy ( $P<0.001$ ), primiparous mother ( $P<0.001$ ), malpresentation ( $P<0.001$ ) and emergency cesarean delivery ( $P<0.001$ ) were statistically significant factors of higher risk of perinatal morbidity and mortality (Table 4). Vaginal delivery with assistance ( $P=0.48$ ) and insufficient perinatal care ( $P=0.32$ ) were not statistically significant factors of increased perinatal morbidity and mortality.

**Table 1. Maternal, obstetric and neonatal characteristics\***

Characteristics	Births (n = 3297)	Perinatal morbidity or mortality (n = 792)
Maternal age (year)	28.7±6.27	29.2±6.41
Parity		
Primiparous	1162 (35.24)	372 (47.97)
Multiparous	2135 (64.76)	420 (53.03)
Prenatal care		
Sufficient	2784 (84.44)	660 (83.33)
Insufficient	513 (15.56)	132 (16.67)
Pregnancy		
Single	3167 (96.06)	745 (94.07)
Multiple	130 (3.94)	47 (5.93)
Presentation of the fetus		
Vertex	3180 (96.41)	742 (93.69)
Malpresentation	117 (3.59)	50 (6.31)
Mode of delivery		
Vaginal	2709 (82.17)	593 (74.87)
Cesarean	588 (17.83)	199 (25.13)
Neonatal sex		
Male	1619 (49.11)	347 (43.81)
Female	1678 (50.89)	445 (56.19)
Mean birth weight (gram)	3202±598	3098±632

\*Values are given as mean ± standard deviation and number (percentage)

**Table 2. Perinatal morbidity\***

<b>Morbidity</b>	<b>Total (n = 770)</b>
Perinatal sepsis suspicion	455 (59.09)
Prenatal exposure to maternal infections	7 (0.91)
Macrosomia at term	54 (7.01)
Low birth weight without prematurity	82 (10.65)
Post-term	33 (4.29)
Prematurity	45 (5.84)
Perinatal asphyxia	131 (17.01)
Respiratory morbidity	70 (9.09)
Congenital malformation	21 (2.72)
Birth trauma	4 (0.52)

\*Values are given as number (percentage)

**Table 3. Perinatal mortality\***

<b>Perinatal deaths</b>	<b>Total (n = 23)</b>
Stillbirth	20 (86.96)
Early neonatal mortality	3 (13.04)

\*Values are given as number (percentage)

**Table 4. Factors associated with morbidity and mortality\***

<b>Risk factors</b>	<b>Births (n = 3297)</b>	<b>Perinatal morbidity or mortality (n = 792)</b>	<b>P-value</b>
Maternal age ≤ 40 years	3214 (97.48)	784 (98.99)	0.002
Primiparous mother	1162 (35.24)	372 (47.97)	< 0.001
Multiple pregnancy	130 (3.94)	47 (5.93)	< 0.001
Malpresentation	117 (3.55)	50 (6.31)	< 0.001
Emergency cesarean delivery	446 (13.53)	144 (18.18)	< 0.001

\*Values are given as number (percentage)

#### 4. DISCUSSION

Perinatal morbidity and mortality rates are useful indicators of the standard of a country's educational, social and community health system, the nutritional status of the population and the national medical programs in perinatal care [4]. During the last decades there has been a sustained decline in child and infant morbidity and mortality in the developing countries, however perinatal and neonatal morbidity and mortality rates have reduced more slowly [5]. Being no exception to this, Morocco needs scientific evidence regarding perinatal practices to understand contributory factors and identify areas for improvement in the local context for addressing appropriate resolutions. Although many advances in perinatal care are costly and require technology not always available, a significant proportion of perinatal morbidities and mortalities could be potentially addressed through appropriate adaptations and applications of inexpensive, relatively simple methods of perinatal care. It has also been stated that a

significant proportion of the perinatal morbidities and mortalities could be prevented by scaling up evidence-based available interventions such as skilled care at delivery and newborn resuscitation [6]. Also, the Millennium Declaration has set 2015 as the target date for achieving most of the goals including maternal and child health care (the Millennium Development Goals 4 and 5). The mid-point assessment in 2007 has shown that the results are, predictably, uneven [7]. The equity gap in maternal and child health did not only reflect the global disparity in wealth but it also showed a disparity in the political commitment and investment in the right strategies at the national level [8].

This pilot study was unique in the sense that there was no previous similar study locally for comparison to make. It was also one of the few studies that characterized the risk factors for perinatal morbidity and mortality in the Moroccan population. Among the characteristics of the study population, there were slightly more female than male births and the proportion of females

was even greater among cases of perinatal morbidity or mortality. This finding was also observed in a previous study conducted at the Souissi maternity hospital which aimed to identify the risk factors for perinatal mortality [9]. Perinatal morbidity was largely attributable to a suspected perinatal sepsis in this study and some cases were related to maternal chorioamnionitis. This indicates that there is poor-quality management of maternal infections during pregnancy in our context, especially the treatment of urinary tract infections, although 84.44% of mothers had received prenatal care. Lack of prenatal care is a risk factor for perinatal morbidity and mortality, whereas a good prenatal care is usually associated with a fewer perinatal morbidities and mortalities [10–12]. Similarly, prenatal care from a skilled provider 4 times during pregnancy is recommended by WHO since 1994 [13] and is shown to be associated with improved perinatal morbidity and mortality [14,15]. However, poor prenatal care was not associated with a significant increase risk of perinatal morbidity and mortality in this study. This could be related to the fact that some women that had poor prenatal care still did seek prenatal care, but they did not do it for the required frequency.

In this study, maternal attributes such as primiparity, maternal age less than or equal to 40 years had negative influence on the perinatal morbidity and mortality. This finding is consistent with a study conducted in another developing country [16] but disagrees with other authors who showed that higher maternal age was common in perinatal mortality [17]. Multiple pregnancy entails a high degree of risk [18,19] and it was a significant risk factor for higher risk of perinatal morbidity and mortality in this study. Preterm delivery and its complications, mainly low birth weight, are the main causes of perinatal morbidity and mortality in multiple pregnancies. Malpresentation was also significantly associated with higher risk of perinatal morbidity and mortality in this study. Others have also shown this to be true [20]. Emergency cesarean delivery was associated with increased risk of perinatal morbidity and mortality in this study. This has been shown by some researchers to hold true [21] and it could be explained by the fact that it is conceivable that factors leading to perinatal morbidity and mortality may cause mothers to have emergency cesarean section. Finally, delivery by instrumentation was not more likely to result in perinatal morbidity or mortality in this study than was normal vaginal delivery. In

comparison with the results of the latest national perinatal survey in France of 2010 [22], we observed in our series a higher rate of perinatal asphyxia (3.97% versus 1.7%) and a higher perinatal mortality (7 per 1000 births versus 4.6 per 1000 births). Conversely, the rates of preterm birth (1.36% versus 6.6%) and low birth weight (2.49% versus 6.4%) were lower in our series. This could be explained in part by the lower rate of primiparous mothers in our series (35.24% versus 43.46%) which is a known risk factor for preterm birth and low birth weight.

This study had some limitations. It suffered from the fact that outside of working hours, there was just one attending pediatric resident at the labor ward to cope with a high number of deliveries. Therefore, he was not able to collect all the data on healthy newborns. Thus, data of some women were missing, especially data concerning the maternal history, maternal weight and height, smoking status, pregnancy complications and drug taking or plant use during pregnancy. As a result, we were unable to examine risk factors such as maternal chronic and comorbid conditions, obstetric complications, infections and congenital malformations. Otherwise, information on gestational age was limited to the clinicians estimate and last maternal menstrual period information often reported as weeks, thus some error in the classification of preterm births is likely. The dearth of information on the neonatal short-term outcome in case of perinatal morbidity was also a limitation in this study. To strengthen our findings, we recommend similar prospective research involving all the obstetric pediatric team over a longer period of time with a comparison of the results with some regional and developed world countries.

## 5. CONCLUSION

Perinatal morbidity and mortality remains a public health concern in Morocco. The results of the present study highlight the need to strengthen efforts at the national level to reduce perinatal morbidity and mortality. Attendance for prenatal care is still below desirable level and strategies to improve early diagnosis, adequate prenatal surveillance of pregnancy, screening and management of high-risk pregnancy and appropriate monitoring of delivery may decrease perinatal morbidity and mortality. Prematurity prevention targeting infections and widespread use of corticosteroid therapy for pulmonary maturity would lead to reductions in perinatal morbidity and mortality from low birth weight and

preterm birth. During labor, skilled care with regular fetal heart monitoring is crucial for identifying compromised fetuses. Quick intervention by assisted or emergency cesarean delivery markedly reduces perinatal morbidity and the number of fresh stillbirths. The role of the attending pediatrician is also crucial. He's the most competent member of the obstetric pediatric team to carry out proper neonatal resuscitation. And therefore, his permanent presence is required at the labor ward of Souissi maternity Hospital. An on-call pediatrician is not enough given the high number of deliveries taking place in this maternity hospital and the observed rate of perinatal morbidity and mortality.

### CONSENT

All authors declare that informed consent was obtained from all patients included in the study.

### ETHICAL APPROVAL

All authors hereby declare that this study has been approved by the ethics committee of the faculty of medicine and pharmacy of Rabat in accordance with the ethical standards.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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