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Study of the Relationship between Pregnancy Monitoring Conditions and the Severity of Perinatal Asphyxia



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ABSTRACT

Introduction: Recognizing that perinatal asphyxia generates the main morbid risk of perinatal period, this study has traced the aim of scrutinizing the association between the conditions of monitoring of pregnancy and severity of perinatal asphyxia. **Materials and Methods:** This is a retrospective study with duration of 24 months performed, in the National Reference Center for Neonatology and Nutrition at the Children's Hospital of Rabat by recruiting all admitted asphyxial newborns regardless of their sex. **Results:** By recruiting 568 asphyxial newborns out of 7,265 hospitalized cases during the 2015-2016 period, and with a response rate of 84.51%, this study demonstrated the existence of associations between the stages of perinatal asphyxia, and the number of prenatal consultations ($P = 0.032$), the duration of appointment made for the first consultation ($P = 0.001$), conducting ultrasound examinations ($P = 0.001$) and the realization of biological examinations during pregnancy ($P = 0.001$).

INTRODUCTION

In recent decades, neonatal mortality, defined by a death occurring less than 28 days of life, has followed, at the global level, the same rate as the mortality of children under five years of age [1]. Overall, neonatal mortality has felled from 5.1 million to 2.7 million between 1990 and 2015. Nevertheless, developing countries have very high mortality rates compared to developed countries; 3 deaths per 1000 live births for developed countries compared with 21 deaths per 1000 live births for developing countries. 45% of deaths in children under 5 years are registered during the neonatal period [2], illustrating the challenge of controlling neonatal mortality. The success of this challenge requires the development of relevant and concrete actions, in order to be able to remedy the avoidable factors behind the persistence of this mortality phenomenon, despite the efforts deployed.

Morocco is omnipresent in this picture. Although since its commitment to reduce infant mortality by two-thirds by 2015, Morocco has implemented many actions to achieve this pledge. Nevertheless, neonatal mortality is still emerging with alarming figures [3].

The neonatal mortality rate in Morocco roses from 21.7 deaths per 1000 live births in 2011 to 13 deaths per 1000 live births in 2015 [4] a decrease of only 17% and it still accounts for three quarters of deaths of less than one year (77.5% in urban areas and 73.7% in rural areas) [5].

In order to reduce neonatal mortality and morbidity in Morocco and given that the action plan 2012-2016 whose purpose to accelerate the reduction of maternal and neonatal mortality, has drawn up a specific focus for research in the field of neonatal health, it is important to carry out investigations around the neonatal period. To this end, reference should be made to the key factors behind this public health problem. According to the Health in Numbers 2014 journal, the causes of neonatal mortality in Morocco are mainly prematurity, perinatal asphyxia and infection [6]. This ranking according to the degree of importance does not coincide with the situation at world level. Perinatal asphyxia is the third leading cause of neonatal mortality worldwide with the exception of Morocco, where it is the second leading cause of neonatal mortality and morbidity.

Thérèse Biselele and al, outlining the various studies conducted on infant asphyxia in low-income countries, have demonstrated that one of the ways to accelerate the reduction of perinatal mortality occurs is the concentration of investigations on perinatal asphyxia.

Illustrating, for example, the importance of carrying out studies on this pathology, in order to reduce neonatal mortality and consequently under-five years old mortality in Morocco, without forgetting the achievement of the Sustainable Development Goals. Especially since, perinatal asphyxia is responsible for Ischemic Hypoxic Encephalopathy (IHE). Among newborns that develop IHE, 15% of cases die, 10-15% develops cerebral palsy and 40% live with other disabilities such as blindness, deafness, autism overall motor retardation, cognition and memory problems, along with, behavioral problems [7].

In view of all this evidence, since perinatal asphyxia constitutes a socio-economic burden and requires an improvement in the quality of pregnancy monitoring [8]. The objective of this research was to study the existing associations between prenatal follow-up conditions of parturients with an asphyxial newborn and the severity of perinatal asphyxia.

MATERIALS AND METHODS

This retrospective study was conducted over a 24-month period, from January 2015 to December 2016. In the National Reference Center for Neonatology and Nutrition at the Children's Hospital of Rabat.

2.1 Criteria for inclusion

This study included all newborns admitted to the National Reference Center for Neonatology and Nutrition at the Children's Hospital of Rabat, diagnosed with perinatal asphyxia, regardless of their origin and sex.

2.2 Exclusion criteria

Asphyxial newborns with associated pathology and newborns whose families refuse to participate to the study were excluded from this study.

2.3 Collection of data

The study was conducted through a mixed questionnaire on medical information; such as the stage of perinatal asphyxia and data on pregnancy monitoring conditions; such as the structure of the pregnancy follow-up, the number of prenatal consultations carried out, performing ultrasound and biological examinations during pregnancy. The study was supplemented by the analysis and retrieval of additional information using the medical file.

2.4 Ethical Considerations

The Ethics Committee of the Faculty of Medicine and Pharmacy of Rabat and the administration of the National Reference Center for Neonatology and Nutrition at the Children's Hospital of Rabat have agreed to carry out this study. Informed consent was obtained from each parent at the time of study entry. Participation in the study was free, respecting confidentiality and anonymity.

2.5 Some definitions

2.5.1 Stages of perinatal asphyxia

According to the classification of SARNAT and SARNAT, perinatal asphyxia is classified in three Stages, normal state, moderate encephalopathy and severe encephalopathy.

2.5.2 Monitoring of the pregnancy

By pregnancy follow-up, this study intends to enroll any woman who has received at least one prenatal consultation regardless of the follow-up structure.

2.5.3 The structure of pregnancy monitoring

The study classified structures of pregnancy follow-up in five categories; maternity hospitals, private obstetrics practice, private practice, general practitioner's offices, public health centers.

2.5.4 Categories of women according to monitoring

Subdivided into seven groups; women who have not consulted, women who have consulted either once, twice, three times, four times, five times, or more than five times.

2.5.5 Performing ultrasound examinations

We studied likewise the performance of ultrasound examinations during pregnancy in this research, taking into consideration the number of ultrasound examinations performed and the provider of these examinations, namely; obstetrician, general practitioners, and midwives.

2.6 Statistical analysis

The data was imported into an Excel file and transferred to the SPSS V20 software. The qualitative variables were compared by the Pearson Chi2 test and the comparison of the average of the quantitative variables was carried out by the Student test. The results are reported as numbers with corresponding percentages or as standard deviation averages. Values of P-value less than 0.05 were considered statistically significant.

RESULTS

3.1 Flow Chart of the study

According to the Figure 1, the period 2015-2016 recorded 7,265 hospitalizations at the National Reference Center for Neonatology and Nutrition at the Children's Hospital of Rabat, excluding 6,547 new-born hospitalized for a disease other than perinatal asphyxia, the number of cases of perinatal asphyxia was 718 newborns. Furthermore, applying the inclusion and exclusion criteria adopted in this study, the number of newborns with perinatal asphyxia without associated pathology was 568 cases. Nevertheless, with 56 newborns lost sight and 32 families refusing to participate in this study, the number of cases studied was 480, representing a response rate of 84.51%.

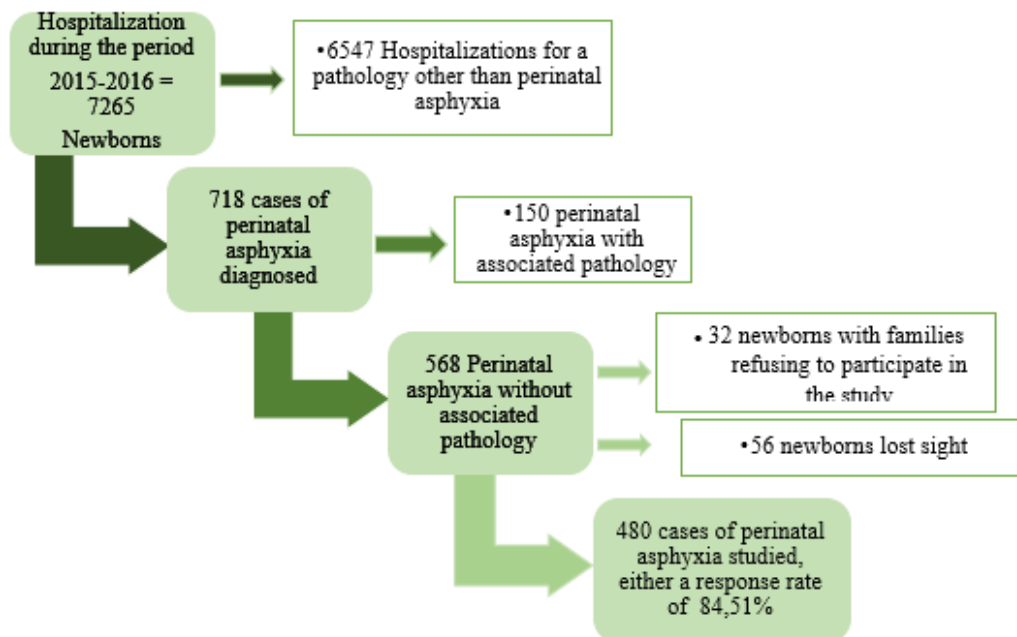


Figure No. 1: Summary of the flow of newborns participating in the study.

3.2 Socio-economic characteristics of female participants

According to the results of the survey of 480 parturients with asphyxial newborns (**Table 1**), the average age of these participants was 32.91 ± 9.22 , with predominance of the age group ranging from 30 to 40 years. 467 women in this study are married, a percentage of 97.3%. The head of household was the father in the majority of cases, with a percentage of 88.6%. Relating to the education level of participant women, 40.41% was illiterate, 21.46% have a secondary level, 14.17% have just primary level and only 11.04% of them have higher education level. Women from urban and peri-urban backgrounds accounted for 41.9% and 41.8% of the cases respectively. While women from rural backgrounds accounted for 23.3%. 83.5% of mothers did not work during pregnancy, compared to 16.4% who were active, these last, have worked in small trades in 46.84%, as employees in 39.24% and in a higher professional situation in 1.27%. The average household income of these women was $3328.31\text{DH} \pm 2449.57\text{DH}$, with 31.04% of households having an income between [2000DH, 2999DH], and 0.83% having reported an income between [10000DH, 19999DH]. 81.67% of the mothers surveyed reported that they did not incur expenses during the prenatal period. 82.29% of mothers had medical coverage. This medical coverage was RAMED in 54.68% of cases, CNSS in 36.2% and a private insurance in 2.53% of cases.

Table No. 1. Socio-economic Characteristics of parturients

Variables	Asphyxial neonates N=480	
	Effective	Percentage (%)
Parturient age (average \pm SD)	32.91 ± 9.22	
Age of the parturient		
< 20 years	73	15.21
[20, 30 years [56	11.67
[30, 40 years]	208	43.33
> 40 years	143	29.79
Marital status of the parturient		
Married	467	97.3
Single	1	0.2
Divorced	11	2.3
Widow	1	0.2
Head of the family		
Father	425	88.6
Mother	17	3.5
Mother in law	38	7.9
Level of education of the parturient		
Illiterate	193	40.21
Primary	68	14.17

Secondary	103	21.46
High school	63	13.12
Superior, 1st cycle	25	5.21
Superior, 2nd cycle	28	5.83
Provenance of the parturient (area)		
Urban	201	41.9
suburban	167	34.8
Rural	112	23.3
Professional activity of the parturient		
Yes	79	16.4
No	401	83.5
Type of professional activity		
Senior executives	1	1.27
Middle executives	10	12.66
Employees	31	39.24
Small Trades Workers	37	46.84
Household income (average ± SD)	3328.31± 2449.57	
Income of the household		
[0Dh, 499DH]	29	6.04
[500DH, 1999DH]	136	28.33
[2000DH, 2999DH]	149	31.04
[3000DH, 4999DH]	85	17.71
[5000DH, 9999DH]	77	16.04
[10000DH, 19999DH]	4	0.83
Expenditure during the perinatal period		
No	392	81.67
Yes	88	18.33
Presence of medical coverage		
Yes	395	82.29
No	85	17.71
Type of medical coverage		
CNSS	143	36.20
CNOPS	26	6.58
RAMED	216	54.68
Private insurance company	10	2.53

3.3 Pregnancy Monitoring Conditions of Women Included in this Study

According to the results in **Table 2**, the women included in this study followed their pregnancy in a public health center in 62.5% of cases, in a general practitioner office in 17.78%, and in a private clinic in 2.56% of cases. The number of their antenatal consultations was four consultations in 35.6% of cases and just one consultation in 1%. Furthermore, 26.7% of the investigated women did not proceed to prenatal consultations, essentially because of the lack of time to go to the health centers in 44.53% of cases, and do not find it useful to follow their pregnancy in 29,68%. While 70.73% of the investigated women reported that they did not know that they had to consult four times, as stipulated in the

Moroccan regulations. The average distance to reach the prenatal consultation structure was 3.25 ± 0.50 km, it was between] 2km, 5km] in 46.59% of cases and between [1km, 2km] in 40.34%. The length of time they waited in the prenatal consultation structure was more than one hour in 36.36% of cases and without waiting in 25.85%, in 64.77% of cases. The perception of the quality of the prenatal consultation, on the part of women who had followed their pregnancy, they considered it was good with a percentage of 82.39%.

Table No. 2: Pregnancy Monitoring Conditions of Women Included in this Study

Variables	Asphyxial Newborns N=480	
	Effective	Percentage (%)
Structure of pregnancy follow-up		
Hospital maternity	24	6.82
Obstetrics practice	54	15.34
Private clinic	9	2.56
General practitioner's office	45	17.78
Public Health Centre	220	62.5
Number of prenatal consultations performed		
No consultation	128	26.7
1 consultation	5	1.0
2 consultations	14	2.9
3 consultations	63	13.1
4 consultations	171	35.6
5 consultations	46	9.6
>5 consultations	53	11.0
Reasons for not following pregnancy		
I don't need it	38	29.68
I can't afford it	29	22.66
I don't have time to go to the health center to consult	57	44.53
My mother-in-law refuses	4	3.12
Reasons not to benefit from four prenatal consultations		
I did not know	58	70.73
I do not need it	1	1.22
I can't afford it	23	28.05
Distance to travel to reach the prenatal consultation structure (average \pm SD)		
		3.25 ± 0.50
Distance to travel to reach the prenatal consultation structure		
<1km	13	3.69
[1km, 2km]	142	40.34
]2km, 5km]	164	46.59
>5km	33	9.38
Wait time at delivery structure (average \pm SD)		
		40.05 ± 3.62
Wait time at prenatal consultation structure		
0min	91	25.85
10min	8	2.27

20min	38	10.80
30min	36	10.23
40min	24	7.68
1h	27	6.82
>1h	128	36.36
Perception of prenatal consultation quality		
Perfect	2	0.57
Good	290	82.39
miscommunication	21	5.97
wrong orientation	3	0.85
I do not knew	36	10.22

The parturients who consulted did not benefit from an ultrasound examination. The 35.23% who received this benefit, they received it only once in 3.52% and more than four times in 2.42%. Providers of these ultrasound examinations were obstetricians in 65.32% and general practitioners in 43.68% of cases. In addition, 72.16% of parturients reported that they did not do any biological tests during their pregnancy. The 27.84% who made these examinations, did RH groupage + VDRL-TPHA + NFS + Fasting Glucose, in 42.86% and a balance sheet consisting of RH groupage + VDRL-TPHA + NFS + Fasting Glucose + Toxoplasmosis + Rubella, in 26.53% of cases. The place where these assessments were carried out was a private laboratory in 67.35% of cases. (Table 3).

Table No. 3: Radiological and biological monitoring of parturients included in this study

Variables	Asphyxial Newborns N=480	
	Effective	Percentage (%)
Ultrasound exams Performed during pregnancy		
Yes	124	35.23
No	228	64.77
Number of ultrasound exams performed during pregnancy		
1 time	49	39.52
2 times	41	33.06
3 times	12	9.68
4 times	19	15.32
> 4 times	3	2.42
Ultrasound Exams Providers		
Gynecologist	81	65.32
general practitioner	43	34.68
Midwife	0	00
Biological examinations Performed during pregnancy		
Yes	98	27.84
No	254	72.16
Sort of assessment done during pregnancy		

Groupage RH + VDRL-TPHA + NFS + Fasting glucose	42	42.86
Groupage RH + VDRL-TPHA + NFS + Fasting blood glucose + Toxoplasmosis	30	30.61
Groupage RH + VDRL-TPHA + NFS + Fasting blood glucose + Toxoplasmosis + Rubella	26	26.53
Place of carrying out the assessment during pregnancy		
hospital laboratory	32	32.65
Private laboratory	66	67.35

3.4 Perinatal asphyxia recorded severity stages

Table 4 shows that newborns had asphyxia stage I (SNNI) in 19.8%, moderate encephalopathy (SNN II) in 38.75%, and severe encephalopathy (SNNIII) in 41.45%.

Table No. 4: Perinatal asphyxia recorded severity stages

Perinatal asphyxia levels	Asphyxial Newborns N=480	
	Effective	Percentage (%)
SNNI	95	19.8
SNNII	186	38.75
SNNIII	199	41.45

3.5 The association between the conditions of pregnancy monitoring and the severity of perinatal asphyxia

Table 5 shows that the stage of perinatal asphyxia are correlated to the number of prenatal consultations performed (P=0.032); the length of time required to go to the prenatal consultation structure (P=0.002); non-realization of ultrasound examinations during pregnancy (P=0.001); and non-realization of biological examinations during this period (P=0.002).

Table No. 5: Association between pregnancy monitoring conditions and severity of perinatal asphyxia

	SNNI	SNNII	SNNIII	P-value
Number of prenatal consultations performed during pregnancy:				
No consultation	16 (16.84%)	57 (30.65%)	55 (27.64%)	0.032
1 consultation	1 (1.05%)	4 (2.15%)	0	
2 consultations	0	9 (4.84%)	5 (2.51%)	
3 consultations	17 (17.89%)	20 (10.75%)	26 (13.07%)	
4 consultations	43 (45.26%)	59 (31.72%)	69 (34.67%)	
5 consultations	9 (9.47%)	24 (12.9%)	13 (6.53%)	
>5 consultations	9 (9.47%)	13 (9.99%)	31 (15.58%)	
Wait time at prenatal consultation structure:				
No waiting	38 (24.07%)	28 (21.70%)	25 (17.36%)	0.002
10min	0	0	8 (5.56%)	
20min	5 (9.26%)	16 (12.4%)	17 (11.81%)	
30min	8 (14.81%)	14 (10.85%)	14 (9.72%)	
40min	1 (1.85%)	11 (8.53%)	12 (8.33%)	
1h	5 (9.26%)	9 (6.98%)	13 (9.03%)	
>1h	22 (40.74%)	51 (39.53%)	55 (38.19%)	
Ultrasound exams performed during prenatal consultation:				
Yes	48 (60.76%)	40 (31 percent)	36 (25 percent)	0.001
No	31 (39.24%)	89 (69%)	108 (75%)	
Ultrasound Providers:				
Gynecologist	38 (79.17%)	14 (35 per cent)	29 (80.55%)	0.093
Generalist	10 (20.83%)	26 (65%)	7 (19.45%)	
Midwife	0	0	0	
Biological examinations Performed during pregnancy:				
Yes	37 (46.84%)	33 (25.58%)	28 (19.44%)	0.001
No	42 (53.16%)	96 (74.42%)	116 (80.56%)	

DISCUSSION

According to the results of the study, there is an association between pregnancy monitoring conditions and the quality and the severity of prenatal asphyxia.

The number of prenatal consultations performed during pregnancy is correlated with the severity of perinatal asphyxia. Indeed, the percentage of women who have not followed their

pregnancy increases with the perinatal asphyxia degree of severity, which is 16.84% of the first stage of perinatal asphyxia, 30.65% of the second, and 27.64% of the third stage of perinatal asphyxia. While the percentage of mothers who have benefited from 4 prenatal consultations declines with the evolution of the severity of perinatal asphyxia, recorded in this survey, achieving 45.26% of the first stage of perinatal asphyxia, and 34.67% of the third. These outcomes are consequently corroborating the recommendations of the World Health Organization regarding prenatal consultation. According to these recommendations, each pregnant woman must receive at least four prenatal consultations at regular intervals throughout pregnancy [9].

The wait time at the prenatal consultation structure is in association with the severity of perinatal asphyxia. This confirms the results of several studies including the work of Boulenger and al. concluding that the wait times in care structures have an impact on patients' quality of life and well-being. To explain this correlation, they argued that the main problems observed during wait times to access care are essentially worry, anxiety and stress [10]. In this same vein, Mahon et al pointed out that there is a threshold for waiting beyond which significant differences in quality of life are noted between patients [11].

This study demonstrated an association between performing ultrasound examinations during pregnancy and the severity of perinatal asphyxia. Indeed, the more the percentage of women, who have performed ultrasound examinations, decreases the more the stage of perinatal asphyxia increases. These women represent 60.76% of SNNI, 31% of SNNII, and 25% of SNNIII. Confirming the results of a multiple researches including the statements in Aïach's «social inequalities in health» [12], the work of Zeynep and Laure having stipulated that treatment according to standards is a determining element in the prevention of complications [9]; the Masseria study has suggested the need to reorganize services to enhance prevention [13].

Equally, conducting biological examinations during pregnancy is in association with the severity of perinatal asphyxia. Indeed, the percentage of newborns whose mothers did not do the biological check-up during pregnancy is 53.16% of SNN I, 74.42% of SNN II and 80.56% of SNN III. This indicator corroborates the results of Lejeune's study on precariousness and prematurity. This scientist has shown that poor follow-up of pregnancy which does not meet standards is responsible for an increase in the frequency of perinatal pathologies [14].

CONCLUSION

This study demonstrates associations between the conditions and the quality of pregnancy monitoring and the severity of perinatal asphyxia. It appears essential to reduce the rate and severity of perinatal asphyxia to review the quality of pregnancy care.

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CONFLICTS OF INTEREST

None.

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