

Mortality at the Pediatric Emergency Unit of the Mohammed VI Teaching Hospital of Marrakech

Widad Lahmini

cadi Ayyad University

mounir bourrous (✉ mounirbourrous@yahoo.fr)

CADI AYYAD UNIVERSITY <https://orcid.org/0000-0003-2044-3514>

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Abstract

Background : The death of a child at the emergency ward is a real challenge. In our country the published data concerning the causes and the factors related to pediatric mortality especially in the pediatric emergency wards is very rare. This study aimed to determine the global rate of the pediatric mortality in the pediatric emergency departement (PED), to study its epidemiology and to identify its most frequent causes.

Methods : It is a retrospective and descriptive study, over five years (1st january 2012 and 31st december 2016) including all children aged from 0 to 15 years old who died at the PED in the Mohamed VI Hospital in Marrakech.

Results : During the period of the study a total of 172.691 patients were admitted, among which 628 died in the PED (global pediatric mortality rate : 3,63%). The masculine gender was predominant with a gender ratio of 1.59. Two-thirds of the patients died in the first 24 hours. The median of time from admission to death was around 12 hours. Majority of the deceased children (75%) were from a low socioeconomic status. The most frequent cause of admissions for deceased patients in the PED was respiratory distress (47%) followed by neurological disorders (11%). Neonatal mortality was predominant (75,1%), followed by postnatal mortality (11,6%). The most frequent causes of pediatric mortality, whatever the age range, were dominated by neonatal pathologies (62,3%), followed by infecious causes bronchopulmonary infections included (7,7%), birth deformities (7,3%) while traumas were merely (0,9%). The most frequent causes of neonatal mortality were prematurity (24,4%), neonatal infections (32,2%), perinatal asphyxia (15%) and neonatal respiratory distress (12,1%).

Conclusion : Our data once again underline the crucial importance of prevention. This requires correct follow-up of the pregnancies, an adequate assistance of births, and perfecting healthcare provision to newborns in order to attain proper assistance.

Background

The death of a child at the emergency ward is a real challenge and one of the most difficult problems that the clinicians of these wards have to deal with [1]. At the international level, important progress has been made in reducing infantile mortality over the last decades. The mortality rate of children under five years old has seen a global decline between 2000 and 2016 going from 69,4 to 38,4 for 1000 live births. In morocco, despite its decrease from 80 to 27 from 1990 to 2016, the under five years old mortality is still a public health priority [2]. Pediatric emergency department only exist in University Hospital Centers (tertiary level). In the majority of provinces of our country, children are managed by general practitioners overwhelmed by adult emergencies and not trained in the management of pediatric emergencies. In addition, these emergency structures are not adapted to receive and to treat children in vital distress. This imbalance leads to a massive orientation and influx at the pediatric emergency departments of the

tertiary level, resulting in serious overcrowding that could influence the quality of emergency care for critically ill children.

On the other hand, in our country the published data concerning the causes and the factors related to pediatric mortality especially in the pediatric emergency wards is very rare. Therefore, we aim through this study, to determine the global rate of the pediatric mortality in the pediatric emergency department (PED), to study its epidemiology and to identify its most frequent causes.

Methods

It is a retrospective and descriptive study, over five years, of files that belonged to the deceased children of the PED in the Mohamed VI Hospital in Marrakech, exploited with a pre established document. The study's population consisted of children aged from 0 to 15 years old who died at the PED between 1st january 2012 and 31st december 2016. We divided the deaths into 4 groups on the basis of age at death :

- Neonatal mortality: death between birth and the 28th day after birth.
- Postnatal mortality: death between the 29th day and the 1st year of life.
- Toddlers and preschoolers mortality: death between the 1st and the 5th year of life.
- The mortality of children aged between 5 and 15 years old.

Only children aged between 0 and 15 years old and who died in the PED were included in this study. Children that were dead on arrival at the emergency unit were excluded from this study. We mainly exploited the socio-demographic and clinical characteristics of the deceased patients ; the causes of deaths, the date and the time of death. The statistical data were analyzed by the SPSS software. Conditions of confidentiality and anonymous status were thoroughly respected.

Results

During the period of the study (2011-2016) a total of 172.691 patients were admitted, among which 628 died in the PED, leading to a global pediatric mortality rate estimated at 3,63% over 5 years. The masculine gender at any age was predominant with a rate of 61% (gender ratio: 1.59). Neonatal mortality was predominant with a global rate of 75,1% followed by postnatal mortality with 11,6%. Toddlers and preschoolers mortality was at 7,3 % and the one for children aged between 5 and 15 years old was at 5,8 %. The most frequent cause of admissions for deceased patients was respiratory distress (47%) followed by neurological disorders (11%), prematurity (7%) and lastly fever (4%).

The most frequent causes of pediatric mortality, whatever the age range, were dominated by neonatal pathologies (62,3%), followed by infectious causes bronchopulmonary infections included (7,7%), and last but not least birth deformities (7,3%) while traumas were merely at 0,9% (Table I). Majority of the deceased children (75%) were from a low socioeconomic status. Their geographic origin was mostly rural

(51%). More than two thirds (67%) consulted directly in the PED, while 30% were referred from an external health institution. Most of the deaths (40%) occurred in the winter season. Majority of the deaths (68%) were recorded between the time range of 4pm to 8pm. The deceased children at the PED spent a median of time around 12 hours. Two-thirds of the patients died in the first 24 hours, among which 20% died in the first hour after their admission (Table II). The most frequent causes of neonatal mortality were : prematurity (24,4%), neonatal infections (32,2%) and perinatal asphyxia (15%) (Table III). The causes of the post natal mortality were dominated by pneumonia (27,1%) followed by birth defects (18,5%). The causes of the Toddlers and preschoolers mortality were dominated equally by pneumonia, meningitis, birth defects and neoplasia with a rate of 11,1% each. The mortality causes of children aged between 5 and 15 years old were mainly neoplastic pathologies (23,6%) (Table IV). No autopsy was performed during the study period.

Discussion

The national data on pediatric mortality is rarely available. Our study is the first to lead an audit on pediatric mortality in a third level ward of the south region. Our ward was open in July 2008 and serves not only the entire region of Marrakech but also the south of Morocco especially when it comes to third level pathologies. It includes a reception and triage unit, with a care space for patients with trauma, a resuscitation unit (2 beds), and 12 beds for short-term hospital for patients monitoring. This precision has been added in the discussion. Its activity didn't stop to increase going from 21.289 in 2008 to 70.176 admissions in 2018. During our study period, the global mortality rate was at 3,63‰. While comparing our results to similar available series from countries outside of Morocco, we found that our global rate was way underneath that of the Bassey et al [3] study with 27‰, the Robinson et al [4] study (37,9‰), the Ndu et al [5] study (58‰), the Joffiro et al [6] study 41‰ and the Santhanam study 122‰ [7]. These disparities can be explained by the socio-economic level of each country. Note that Despite of rapid economy development, Morocco is still considered as developing country. Moreover, our global rate is higher that of the Zhu et al [8] study with 0.5‰. All these studies were conducted in developing countries. In developed countries, the death of children in pediatric emergency is rare and even has a tendency of dropping [9,10]. Therefore our global rate is largely superior to the 1.7 per 10000 admissions recorded in the Maniktala et al study in the USA [11], and to the rate of 1.5 deaths per 10000 admissions recorded in the lopez et al study in Spain [12].

Parents earning low income and residing in rural areas were the main risk factors of pediatric mortality around the world [13]. In our study, we had a high rate of children coming from disadvantaged areas. In fact, the mortality level was higher in low income households and within those living in rural areas. Financial and geographic inaccessibility on top of a parent's low level of education may explain the high rate of child mortality in this group. Some studies found links between the mother's social and economical factors and the mortality, morbidity and even the children's congenital abnormalities. Understanding these associations may contribute to interventions that aim at better equity in the healthcare system [14,15]. More than one third of the deaths in our ward occurred in the winter season coinciding with the peak of bronchopulmonary infections. This observation is reported in other studies

especially from Africa [3,5]. Two-thirds of our patients died in the first 24 hours compared to 32% for Jofiro et al [6]. Our median of the period of stay in the PED was 12 hours largely exceeding that of Zhu which was around 1,5 hours [8]. Ideally, the period of stay of patients shouldn't exceed 48 hours. On the other hand, it was noted that the delay in the patients' transfer to emergency units was associated to a higher mortality level. Therefore shortening the period of stay of patients in emergency units and avoiding any delay in their transfers to the intensive care unit may reduce the mortality rate [8,16,17]. Most of the deaths were recorded between 4 p.m. and 8 p.m. This could be explained by this period coincides with the departure of the medical team including the pediatric seniors and its reduction to the only pediatric resident on call in our ED.

In our study, neonatal mortality was dominant with a rate of 75.1 %. The causes of this neonatal mortality were dominated by neonatal infections, prematurity and perinatal asphyxia. Although, this rate is high, it joins the data of other studies [7,8,18-20]. Neonatal mortality is a real tragedy of the public health especially in developing countries, even with its drop in all of the regions of the world. Between 1990 and 2017, the global rate of neonatal mortality dropped by 51% going from 36,6 deaths in 1990 to 18 per 1000 deaths in 2017 [20]. Although, a lot of substantial progress has been made to reduce the neonatal mortality in 1990, more efforts should be made to achieve the sustainable development goal by 2030 [20]. A global approach containing all of the mothers' and the newborns' aspects of health, with an improvement of the environmental and socioeconomic conditions of the mom, follow-ups of the pregnancy, medicalisation of the births and an improvement of the care given to the newborn seem necessary knowing that prematurity and perinatal asphyxia are still the main causes of mortality. On the other hand, increasing the number of adapted units and neonatology wards for a better approach of the healthcare provision seems to be a priority [18,21].

Our study noted a high level of mortality (93,3%) in children under 5 years old in our hospital, which rhymes with other studies in developing countries [5,6,8]. The main causes of this mortality were dominated by pneumonia and meningitis there by correlating with results from other countries [6,8,18]. With regards to children between 5 and 15 years old, we found that neoplasms were the main causes, similar to other studies made in China and Ethiopia [6,8]. In our context, even though we have a pediatric oncology hospital, the lack of places for hospitalization and oncology-specific care explains this high mortality rate.

The infant sudden death syndrome was also reported as a cause of death in the Lopez et al and Maniktala et al studies with the following rates: 20,7% and 31% respectively [11,12].

We couldn't explore more about this cause due to the criteria of our study that excluded children that were dead on arrival. In our context, the parents' hesitation towards the practice of the autopsy make it hard to determine the causes of the infant's sudden death syndrome. The same report was given by the Ntuli et al study [18]. Zhu et al reported a rate of 45,2% of children that were dead on arrival for whom no autopsy was done too [8]. On the other hand, other studies showed that more than the half of the deaths had one or multiple problems at the same time implying mainly severe asphyxia at birth, congenital defects, little weight at birth and prematurity [8,11]. Bad nutrition and diarrhea were also comorbidities in Africa [6,22].

This wasn't found in our study. One of the limits of our study, seeing its retrospective nature, was the intrication of multiple factors in certain patients making the search for the main cause of death complicated. On another note, the indetermined mortality rate in our work (15,2%) was lower than the Zhu et al study (20%) [8] and higher than the Ntuli et al study (6%) [18].

Conclusion

The analysis of the causes of death in the pediatric emergency units may help in the development of practical care and prevention. Our study keeps all its interest in being the first epidemiologic study of its type made in the biggest Pediatric Emergency Unit in the south of Morocco. It showed a relatively high mortality rate in children under 5 years old dominated by the neonatal mortality. Our data once again underline the crucial importance of prevention. This emphasizes the importance to increase the number of the neonatal intensive care units (NICU) and its impact to reduce neonatal mortality [18,20].

Abbreviations

PED: pediatric emergency departement.

Declarations

Ethics approval and consent to participate: This project was approved by the ethics committee of the Faculty of Medicine of the University of Cadi Ayyad in Marrakech. Given the retrospective nature of this study, the project was deemed to be of very low risk for the patients and the anonymity and confidentiality of the patients was respected throughout the study.

Consent for publication: Not applicable.

Availability of data and material: The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Authors' contributions:

- **MB** and **WL** analyzed and corrected all the details of the article.
- **WL** contributed to study conception and design; data collection, analysis, and interpretation; and manuscript preparation. She approved the final manuscript.
- **MB** conceived the study, reviewed the article, analysis and approved the submission of the manuscript.
- All authors have read and approved the manuscript.

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Authors' details :

Paediatric Emergency Department, UHC Mohamed VI, Marrakech. Department of Paediatric, Cadi Ayyad University, Faculty of medicine and pharmacy; PO Box: 7010; Sidi Abbad Street; 40000; Marrakech; Morocco.

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Tables

Table I : Main causes of pediatric mortality for all ages

Causes of death	Number of deaths	Rate
Neonatal infections	152	24,2%
Prematurity	115	18,3%
Perinatal asphyxia	71	11,3%
Neonatal respiratory distress	57	9%
Infectious causes	24	3,8%
Pulmonary infections	25	3,9%
Malformations	46	7,3%
Heart Diseases	13	2%
Neoplasia	16	2,5%
Uncertain	96	15,2%
Poisoning	9	1,4%
Traumatic causes	6	0,9%
Various	18	0,4%

Table II : Demographic characteristics and chronological distribution of deaths

VARIABLES	NUMBER	PERCENTAGE
Gender (ratio : 1,59)		
Girl	245	61 %
Boy	383	39 %

Age (0 days to 15 years)

≤ 1 month	472	75,1%
1 month-1 year	73	11,6%
1-5 years	46	7,3%
5-15 years	37	5,8 %

Socio-economic level

Low	471	75%
Average	138	22%
High	19	03%

Geographic origin

Rural	320	51%
Suburban	94	15%
Urban	214	34%

Time of death after admission (median : 12 hours)

≤ 01 hours	63	10%
01-12 hours	138	22 %
12-24 hours	220	35%
24-48 hours	138	22%
≥ 48 hours	69	11%

Reference mode

Self-reference	433	69%
Referral from another health center	195	31%

Table III : Etiologies of neonatal mortality

Causes of death	Number of deaths	Percentage
Neonatal infection	152	32,2%
Prematurity	115	24,4%
Perinatal asphyxia	71	15%
Neonatal respiratory distress	57	12,1%

Malformations	28	5,9%
Others	48	10,1%
TOTAL	471	100%

Table IV : Causes of mortality in children over 1 month

years	1 month to 1 year	1 to 5 years	5 to 15
Pneumonia	19 (27,1%)	5 (11,1%)	-
Meningitis	7 (10%)	5 (11,1%)	-
Diarrheal disease	7 (10%)	-	-
Sepsis (13,1%)	-	-	5
Malformations	13 (18,5%)	5 (11,1%)	-
Heart diseases	7 (10%)	3 (6,6%)	3 (7,8%)
Neoplasia (23,6%)	2 (2,8%)	5 (11,1%)	9
Poisoning	3 (4,2%)	-	-
Traumatic causes	-	3 (6,6%)	3 (7,8%)
Scorpions stings	-	2 (4,4%)	-
Burns	-	3 (6,6%)	-
Unclear (47,3%)	12 (17,1%)	14 (31,1%)	18
Total (100%)	70 (100%)	45 (100%)	38