

Short-Term Outcomes of Neonatal Resuscitation

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Abstract

Introduction: Neonatal resuscitation is a means to restore life to a baby from the state of asphyxia. It can end in either survival or death. Survivors may develop short-term complications in the immediate postnatal period. **Objective:** Determine the short-term outcomes following neonatal resuscitation. **Materials and Methods:** A retrospective cross-sectional study was conducted for seven months running from November 2021 to June 2022 in two hospitals in Yaounde. Admission files of newborns who benefited from neonatal resuscitation at birth from the year 2019 to 2022 were included. We recorded the clinical characteristics of newborns (gestational age, gender, and birth weight), the frequency of transfers, the duration of admission, the rate and types of complications in an operating sheet. The results were analysed using IBM SPSS 23.0 software and the data expressed as frequencies, percentages, and means. The threshold of significance was set at 5%. **Results:** A total of 245 files of newborns who benefited from neonatal resuscitation were included. The mean gestational age at delivery was 36.7 ± 3.6 weeks with a minimum and maximum of 25 weeks and 46 weeks respectively. 61.6% of newborns were born at term and were of the male sex (55.5%, sex ratio of 1.25). The average birth weight was 2748.4 ± 794.3 g (range: 800 - 5600 g) with 62.4% of newborns weighing between 2500 and 4000 g. 97.1% of the newborns were transferred to the neonatology unit with a median length of hospitalization of 5 days. The frequency of short-term complications during the study was 26.9% and hypoxic-ischemic encephalopathy was the most common (97%). Newborns resuscitated for more than 5 minutes were more likely to develop a short-term complication. **Conclusion:** Hypoxic-ischaemic encephalopathy

was the most frequent complication post-resuscitation and a prolonged duration of resuscitation favoured the development of short-term complications.

Keywords

Complications, Neonatal Resuscitation, Hypoxic Ischaemic Encephalopathy
Cameroon

1. Introduction

Birth asphyxia is one of the three main causes of early neonatal death and accounts for one fourth of neonatal mortality [1] [2]. Approximately 2.5 million newborns death occur annually globally and birth asphyxia accounts for 30% - 35% of neonatal deaths [3]. In sub-Saharan Africa, birth asphyxia brought 280,000 deaths of the newborn on the first day of life [4]. In Cameroon, 16% of neonatal mortality is due to birth asphyxia [5]. Among these newborns who had difficulties in extrauterine environment adaptation, 10% will require some assistance to begin breathing at birth and fewer than 1% will need extensive resuscitative measures [6]. The goals of neonatal resuscitation are to prevent the morbidity and mortality associated with hypoxic ischaemic tissues like brain, heart, and kidney injury and also to reestablish adequate spontaneous respiration and cardiac output. Several studies have focused on the direct impact of this intervention on neonatal morbidity [7] [8]. Other series have assessed the association between the skills of the nursing staff and the outcome of resuscitated children [9]. Our research was motivated by the ethical challenge of determining the circumstances in which neonatal resuscitation could become deleterious to the newborn. The aim of this study was then to provide an overview of short-term clinical outcomes of neonates resuscitated at birth in two hospitals in Yaounde, Cameroon.

2. Materials and Methods

A retrospective cross-sectional study was conducted for seven months running from November 2021 to June 2022 in two hospitals of Yaounde (Gynaeco-obstetrics and paediatrics hospital, Health Center Nicolas Barre). We included admission files of newborns who benefited from neonatal resuscitation at birth from the year 2019 to 2022 and excluded incomplete files or missing files and referred newborns. 245 patients were enrolled. We selected consecutively all the available files. Data were collected in patients' files recruited for the purpose of a thesis of medicine entitled: "Medico-legal aspects of neonatal resuscitation in two hospitals of Yaoundé". Information were recorded in an operating sheet which included the clinical characteristics of newborns, the frequency of transfer, the duration of admission, the rate and types of complications. All data collected were kept confidential; only investigators had access to anonymous pa-

tient data. Incomplete files were excluded. Prior to this research, we obtained the administrative authorizations of all the hospitals selected and the ethical clearance of the ethics committee of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I. Data were collected using an anonymous specific sheet and analyzed with SPSS software (Statistical package for the social Sciences) version 23.0 Statistical threshold was set at 5%.

Clinical characteristics of the newborns

The mean gestational age at delivery was 36.7 ± 3.6 weeks of amenorrhea with a minimum and maximum of 25 weeks and 46 weeks respectively. The majority of newborns (61.6%) were born at term and were of the male sex (55.5%, sex ratio of 1.25). The average birth weight was 2748.4 ± 794.3 g (range: 800 - 5600 g) with 62.4% of newborns weighing between 2500 and 4000 g (**Table 1**).

Frequency of transfers to neonatal unit and duration of admission

The median length of hospitalization was 5 days [Interquartile range (IQR): 3 - 10] with a minimum and maximum hospital stay of 1 and 40 days respectively. Most newborns (57.1%) were hospitalized for duration of 7 days (**Table 2**). In 97.1% (238 newborns) of cases, resuscitated newborns ended up being transferred to the neonatology unit for continuation of care.

Short-term complications

Table 1. Clinical characteristics of newborns at birth.

Variables	Frequency	Percentage (%)
Age at delivery (Weeks of amenorrhea)		
<28	7	2.9
[28 - 32[	18	7.3
[32 - 35[	36	14.7
[35 - 37[	33	13.5
≥ 37	151	61.6
Term at delivery		
Prematurity (<37 WA)	94	38.4
At term (≥ 37 WA)	151	61.6
Gender		
Male	136	55.5
Female	109	44.5
Birth weight (grams)		
<1000	4	1.6
[1000 - 1500[	11	4.5
[1500 - 2000[	29	11.8
[2000 - 2500[	39	15.9
[2500 - 4000[	153	62.4
≥ 4000	9	3.7

The frequency of short-term complications during our study was 26.92% (Table 3).

Types of short-term complications

The majority (97%) of resuscitated newborns who developed complications, had hypoxo-ischemic encephalopathies (Table 4).

Association between complications and duration of resuscitation

Newborns resuscitated for more than 5 minutes were 5.84 times more likely to develop complications ($p < 0.001$) (Table 5).

Association between clinical characteristics and complications

There is no significant association between gender, birth weight, term of pregnancy and occurrence of complications (Table 6).

Table 2. Duration of admission of the study population (N = 223).

Duration of admission (in days)	Frequency	Percentage (%)
<7	136	57.1
[7 - 14[	74	31.1
[14 - 28[	23	9.7
≥28	5	2.1

Table 3. Rate of complications (N = 245).

Complications	Frequency	Percentage (%)
Yes	66	26.9
No	179	73.1

Table 4. Types of short-term complications (N = 66).

Types of complications	Frequency	Percentage (%)
Hypoxic-ischemic encephalopathy	63	97.0
SARNAT I	17	25.8
SARNAT II	38	57.6
SARNAT III	9	13.6
Gastro intestinal bleeding	1	1.5
Lung disorder	1	1.5

Table 5. Association between complications and duration of resuscitation.

Complications	Duration of resuscitation		OR [CI at 95 %]	p value
	>5 min N = 81; n (%)	≤5 min N = 113; n (%)		
Yes	26 (32.1)	9 (8.0)	5.4 [2.39 - 12.47]	<0.001
No	55 (67.9)	104 (92.0)	0.18 [0.08 - 0.42]	

Table 6. Association between clinical characteristics and complications.

Variables	Complications	No complication	OR	p value
	N = 66; n (%)	N = 179; n (%)	[IC à 95%]	
Gender				
Male	39 (59.1)	97 (54.19)		0.563
Female	27 (40.9)	82 (45.41)		0.563
Birth weight				
Low birth weight	22 (33.34)	61 (34.07)		1
Normal birth weight	43 (65.16)	110 (61.45)		0.657
macrosonia	1 (1.50)	8 (4.48)		0.451
Term of pregnancy				
Prematurity	27 (40.90)	67 (37.44)		0.658
Term	39 (59.10)	112 (62.56)		0.658

3. Discussion

The mean gestational age at delivery in our study was 36.7 ± 3.6 WA and the mean birth weight was 2748.4 ± 794.3 grams. Although delivery at term gestation is considered to be of low risk, mature neonates with normal birth weight might exhibit difficulties in extra uterine adaptation that require escalation of care and admission to the NICU. In our study, term infants accounted for 61.6% of the total sample. This finding is consistent with a population-based report of infants from 38 US states which showed nearly half of all NICU admissions to be delivered at more than 37-week gestation age [10]. Half of the newborns in our study were males (55.5%). Heathcote *et al.* in study on timing and documentation of key events in neonatal resuscitation in UK in 2018 found a greater percentage of males (59%) too [11]. This could be explained by the fact that literature reports males to be more sensitive to adverse environmental factors during gestation, infancy and childhood and that this disparity is particularly evident during the newborn period. Male sex is associated with a higher risk of neurological, pulmonary, cardiovascular and infectious morbidities as well as overall mortality when compared to female infants of similar gestational age [12].

New-born's transfers rate to neonatal intensive care units (nicu) was high in our cohort compared to developed countries data. Hospital based retrospective cross sectional studies carried out among full term neonates admitted to the nicu in China and Jordan reported lower cumulative rates of admission [13] [14]. This can be explained by better antenatal care for high risk pregnancies and better preparation for resuscitation in high risk deliveries in those countries. The mean duration of admission in resuscitated neonates was low in our context in opposition to the 10 days registered in China [13]. This discrepancy could be attributed to the mild gravity of newborns clinical conditions in our sample.

Post-natal hypoxic ischaemic encephalopathy was the most common short-term outcome of neonatal resuscitation. Based on Sarnat classification, more than three quarters of babies were affected to a mild or moderate degree. These results are in line with the findings of a meta-analysis including 184 countries and more than four million births that reported that the incidence of hypoxic ischaemic encephalopathy was high following perinatal asphyxia and cardiopulmonary resuscitation [7]. Reported incidences vary markedly in high- and low-income countries with the highest range registered in developing areas [15]. These disparities could be due to early recognition of the signs of perinatal asphyxia during labour and popularisation of good neonatal resuscitation practices in the delivery room.

Newborns resuscitated for more than 5 minutes were more likely to develop short-term complications. This result could be explained by the fact that perinatal asphyxia is a condition in which insufficient oxygen supply before, during or after birth leads to cardiorespiratory depression, hypotension and reduced tissue perfusion with subsequent organ damage [7].

Our study was limited in that, its retrospective nature implied we could not exercise control over the accuracy with which information concerning the patients were collected and recorded and we analyzed data from two institutions only.

4. Conclusion

In summary, the frequency of transfers of resuscitated newborns to neonatal care units was high. The median length of stay was five days. The hypoxic-ischaemic encephalopathy was the most frequent short-term complication in resuscitated babies. A prolonged duration of resuscitation favoured the development of short-term complications.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Sintayehu, Y., Desalew, A., Geda, B., Shiferaw, K., Tiruye, G., Mulatu, T., *et al.* (2020) Knowledge of Basic Neonatal Resuscitation and Associated Factors among Midwives and Nurses in Public Health Institutions in Eastern Ethiopia. *International Journal of General Medicine*, **13**, 225-233. <https://doi.org/10.2147/IJGM.S255892>
- [2] Weldearegay, H.G., Abrha, M.W., Hilawe, E.H., Gebrekidan, B.A. and Medhanyie, A.A. (2020) Quality of Neonatal Resuscitation in Ethiopia: Implications for the Sur-

- vival of Neonates. *BMC Pediatrics*, **20**, Article No. 129.
<https://doi.org/10.1186/s12887-020-02029-5>
- [3] Moshiro, R., Mdoe, P. and Perlman, J.M. (2019) A Global View of Neonatal Asphyxia and Resuscitation. *Frontiers in Pediatrics*, **7**, Article No. 489.
<https://doi.org/10.3389/fped.2019.00489>
- [4] Workineh, Y., Semachew, A., *et al.* (2020) Prevalence of Perinatal Asphyxia in East and Central Africa: Systematic Review and Meta-Analysis. *Heliyon*, **6**, 379.
<https://doi.org/10.1016/j.heliyon.2020.e03793>
- [5] Mah Mungyeh, E., Chiabi, A., Tchokoteu Pouasse, F., Nguefack, S., Bogne, J., Siyou, H., *et al.* (2014) Neonatal Mortality in a Referral Hospital in Cameroon over a Seven-Year Period: Trends, Associated Factors and Causes. *African Health Sciences*, **14**, 517-525. <https://doi.org/10.4314/ahs.v14i3.4>
- [6] Kattwinkel, J., Bloom, R.S., American Academy of Pediatrics and American Heart Association (2011) Textbook of Neonatal Resuscitation. 6th Edition. American Academy of Pediatrics; American Heart Association, Dallas.
<https://doi.org/10.1542/9781581106299>
- [7] Anne, M., Anne, L. and Britt, N. (2018) Outcomes Following Neonatal Cardiopulmonary Resuscitation. *Tidsskrift for Den Norske Lægeforening*, **138**, 1-10.
- [8] Frazier, M.D. and Werthammer, J. (2007) Post-Resuscitation Complications in Term Neonates in USA. *Journal of Perinatology*, **27**, 82-84.
<https://doi.org/10.1038/sj.jp.7211644>
- [9] Sriparna, B., Ashok, K. and Aditya, K. (2009) Complications Associated with Neonatal Resuscitation in India. Elsevier, Amsterdam, 4-5.
- [10] Harrison, W. and Goodman, D. (2015) Epidemiologic Trends in Neonatal Intensive Care, 2007-2012. *JAMA Pediatrics*, **169**, 855-862.
<https://doi.org/10.1001/jamapediatrics.2015.1305>
- [11] Heathcote, A.C., Jones, J. and Clarke, P. (2018) Timing and Documentation of Key Events in Neonatal Resuscitation. *European Journal of Pediatrics*, **177**, 1053-1056.
<https://doi.org/10.1007/s00431-018-3160-8>
- [12] O'Driscoll, D.N., McGovern, M., Greene, C.M. and Molloy, E.J. (2018) Gender Disparities in Preterm Neonatal Outcomes. *Acta Paediatrica*, **107**, 1494-1499.
<https://doi.org/10.1111/apa.14390>
- [13] Yang, X.H. and Meng, T. (2019) Admission of Full-Term Infants to the Neonatal Intensive Care Unit: A 9.5-Year Review in a Tertiary Teaching Hospital. *The Journal of Maternal-Fetal & Neonatal Medicine*, **33**, 3003-3009.
- [14] Khasawneh, W., *et al.* (2020) Indications and Clinical Profile of Neonatal Admissions: A Cross-Sectional Descriptive Analysis from a Single Academic Center in Jordan. *Journal of Multidisciplinary Healthcare*, **13**, 997-1006.
- [15] Lee, A.C., Kozuki, N., Blencowe, H., Theo, V., Adil, B., Gary, L., *et al.* (2013) Intrapartum-Related Neonatal Encephalopathy Incidence and Impairment at Regional and Global Levels for 2010 with Trends from 1990. *Pediatric Research*, **74**, 50-72.
<https://doi.org/10.1038/pr.2013.206>