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Epidemiological, Clinical, Therapeutic, and Evolutionary Aspects of Congenital Malformations in the Pediatric Department of the Bouaké University Hospital (Côte d'Ivoire) from 2017 to 2019

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Abstract

Introduction: Congenital malformations (CM) are serious and pose a diagnostic, therapeutic and prognostic problem for the paediatrician. Despite their seriousness, data on them are rare at the University Hospital of Bouaké. The objective of the study was to assess the situation of CM in the paediatric department of the University Hospital of Bouaké. **Methods:** This was a retrospective, descriptive study conducted from January 2017 to December 2019 in the neonatology department of the University Hospital of Bouaké. It focused on malformed newborns diagnosed on the basis of clinical and/or paraclinical criteria. The variables studied were sociodemographic and diagnostic. The analysis of the data was descriptive. **Results**: A total of 5966 admissions including 100 MC (50 boys, 50 girls), *i.e.* a prevalence of 1.7%. The mothers were housewives (69%), with primary education (51%). Their median age was 29 years. Prenatal check-ups were performed in 25%. The mothers received folic acid in 25%. The main maternal pathology during pregnancy was malaria (8%). Traditional medication (23%), consanguinity (3%), previous malformations (3%) were found in the mothers. Malformation was the main reason for referral (89%). In 57% of cases, the newborn was seen on day 0 of life. Isolated CMs were found in 86.6% of cases. The main CMs were club feet

(22.0%), omphalocele (15.0%), spina bifida (10.0%) and cleft lip and palate (9.0%). Medical treatment was dominated by eye care (94%), umbilical care (93%), and vitamin K1 administration (81%). Surgical care was mainly Ponsety's method (20%), tanning (6%), and colostomy (6%). Lethality was 10%. **Conclusion**: CM is frequent in Bouake, with multifactorial causes and a high case fatality rate. For prevention, we recommend that pregnant women carry out prenatal consultations correctly and follow the advice of health professionals.

Keywords

Newborn, Congenital Malformations, Epidemiology, Etiologies, Côte d'Ivoire

1. Introduction

Congenital malformations (CM), defined as morphological and functional abnormalities present at birth [1] [2], are a major public health issue. They are the fourth leading cause of neonatal mortality worldwide, accounting for approximately 303,000 newborn deaths each year [2] [3]. In France, they affect between 3% and 4% of births, 2% of which are diagnosed during the neonatal period [4]. In sub-Saharan Africa, although the problem is real, studies remain rare and heterogeneous, with reported prevalences between 2% and 6% [5]. In Côte d'Ivoire, data is limited, often coming from hospitals and being fragmentary in nature. For example, a study conducted at the Cocody University Hospital revealed that CM accounted for 4.9% of neonatal admissions [6]. In 2018, the neonatal unit at Bouaké University Hospital recorded 2098 admissions, including several cases of newborns with malformations. What is the epidemiological and clinical profile of newborns with CM admitted to Bouaké University Hospital? What are the main types of malformations observed, how are they managed, and how do they progress? This study aims to describe the epidemiological, diagnostic, therapeutic, and evolutionary characteristics of newborns with CM at Bouaké University Hospital. It is part of an effort to better document the local situation in order to improve clinical practice, strengthen patient prognosis, and contribute to strategic planning for neonatal health in Côte d'Ivoire.

2. Methods

- Type and period of the study

This was a retrospective descriptive study conducted over a three-year period, from January 1, 2017, to December 31, 2019.

- Study location

The study was conducted in the neonatal unit of the pediatric department at Bouaké University Hospital, a leading pediatric care facility in the central region

of Côte d'Ivoire. The unit has a capacity of nine incubators, three cribs, and three radiant warmers. Newborns are cared for by a multidisciplinary team composed of pediatricians, interns, pediatric residents, midwives, nursing assistants, and students.

- Study population

The target population is represented by all newborns admitted to the neonatal unit during the study period.

Inclusion criteria:

The following were included:

- All newborns hospitalized in the neonatal unit of the Bouaké University Hospital between 2017 and 2019;
- Presenting at least one CM diagnosed on the basis of clinical and/or paraclinical evidence.

Non-inclusion criteria:

The following were not included:

- Newborns whose medical records were unusable due to missing or incomplete information. In total, 42 records were excluded on this basis. Key variables with >10% missingness included maternal serology screening (rubella, toxoplasmosis, syphilis: 74% - 93% missing) and obstetric ultrasound (86% missing), which may introduce selection bias.

- Study procedure and data collection

Data were extracted from the medical records of hospitalized newborns, using a standardized and anonymous survey form completed for each case. The variables studied were sociodemographic (gender, age, place of residence of the newborn; age, marital status, ethnicity, educational level, and occupation of the mother), diagnostic (maternal medical and obstetric history, number of prenatal consultations (CPN), prenatal assessment, prophylaxis, gestational pathologies, term of pregnancy, place and mode of delivery, amniotic fluid status, Apgar score, weight, height, head circumference, type of malformation), therapeutic (treatments administered) and evolutionary (favorable outcome or death). CM were classified by organ system according to the ICD-10 coding framework. An anomaly was considered *isolated* when only one organ system was involved, and *polymalformative* when two or more distinct systems were affected.

- Data entry and analysis

Data analysis was exclusively descriptive, using means with standard deviations for quantitative variables and proportions for qualitative variables. Although exploratory bivariate comparisons (between maternal characteristics and neonatal outcomes) were attempted, sample sizes were insufficient to yield statistically robust associations. For this reason, we restricted the analysis to descriptive statistics.

- Ethical considerations

The study was conducted in accordance with current ethical standards, in particular the authorization obtained from the Medical and Scientific Director of the

Bouaké University Hospital, as well as the confidentiality ensured by the anonymization of data via a number assigned to each survey form.

3. Results

- Prevalence

During the study period, 5,966 newborns were registered, including 100 newborns with CM, representing a hospital frequency of 1.7% (95% CI: 1.4 - 2.1).

- Sociodemographic characteristics of newborns with malformations and their mothers

Newborns with malformations were boys in 50% of cases and girls in 50% of cases. They came from the city of Bouaké in 63% of cases. The median age of the mothers was 29 years ± 6 years, with extremes of 14 and 40 years, and 63% were under 30 years of age. They were single mothers in 82% of cases, uneducated or with a primary school education in 89% of cases. They were unemployed in 69% of cases.

- Diagnostic, therapeutic, and evolutionary characteristics

Table 1. Distribution of mothers according to their gynecological and obstetric history.

Variables	Frequency	Percent
Age (years)		
<30 years	63	63
≥30 years	37	37
Gestation (pregnancy)		
Primigravida (1)	29	29
Paucigravida (2 or 3)	35	35
Multigravida (4 or 5)	16	16
High multiparity (≥6)	20	20
Parity (childbirth)		
Primiparous (1)	34	34
Paucipara (2 or 3)	35	35
Multiparous (4 or 5)	13	13
High multiparous (≥6)	18	18

The mothers of malformed newborns were primigravida and multiparous in 29% and 35% of cases, respectively. They were primiparous and multiparous in 34% and 35% of cases, respectively (Table 1). They had attended at least four prenatal consultations (CPN) in 32% of cases and had undergone prenatal screening in 21% of cases. Rubella, toxoplasmosis, and syphilis serology tests were performed in 8%, 7%, and 6% of cases, respectively. They were positive in 12.5% and 14.3% of cases, respectively. The rate of obstetric ultrasounds was 13.7%. They were performed in the second and third trimesters of pregnancy in 7 and 4 cases,

respectively. The main maternal pathologies during pregnancy were malaria (8%) and cystitis (3%). Folic acid was administered to 25% of mothers of newborns with malformations. Hypertension and consanguinity were found in 3% of mothers. Delivery took place in a hospital setting in 77% of cases and vaginally in 81% of cases. The average birth weight of newborns was 2808.5 g ± 686.3 g, with extremes of 1150 g and 5000 g. The average height was 47.1 cm ± 5.5 cm. The head circumference of malformed newborns was 33.0 cm ± 4.8 cm, with extremes of 14 cm and 70 cm. The Apgar score at 5 minutes was greater than or equal to 7 in 80.5% of cases. Malformations in newborns were discovered on day 0 of life in 57% of cases. CM were isolated in 86.6% of cases. They predominantly affected the limbs (32%) and the abdomen and digestive tract (30%). Clubfoot (22%), omphalocele (15%), and spina bifida (10%) were the most commonly observed CM (Table 2).

Table 2. Distribution of different malformations.

Type of malformation	Frequency	Percent
Clubfoot	22	22
Omphalocele	15	15
Spina bifida	10	10
Cleft lip and palate	9	9
Anorectal malformation	9	9
Hydrocephalus	7	7
Laparoschisis	6	6
Dwarfism	6	6
Prune belly	3	3
Sexual ambiguity	2	2
Syndactyly	2	2
Epispadia	2	2
Ichthyosis	2	2

The Ponsety method was the most commonly used surgical treatment in 20% of cases, with death (10%) occurring during hospitalization.

4. Discussion

This study aims to describe the epidemiological, diagnostic, therapeutic, and evolutionary characteristics of newborns with CM at Bouaké University Hospital. The results reveal a high frequency of these anomalies in the unit, associated with often delayed diagnosis, a determining factor in their high mortality rate. However, these findings should be interpreted with caution given the inherent methodological limitations. This is a retrospective study with risks of selection and information bias. In addition, the single-center approach did not allow the results to

be extrapolated to the entire Gbêkê region, and the lack of counter-references limited access to post-referral data. Despite these methodological limitations, these results raise the following points for discussion in terms of epidemiology, diagnosis, treatment, and progression.

The prevalence of CM observed is 1.7%, which is lower than the data reported elsewhere in Africa (2% - 6%) or in Western countries (3% - 4%) [7]-[9]. This disparity can be explained by heterogeneous study methodologies, differences in technical facilities and diagnostic capabilities, and sociocultural, genetic, and environmental influences.

The majority of newborns with malformations were born to mothers under the age of 30, a profile similar to that observed at the Yopougon University Hospital in 2006 [10] and at the Cocody University Hospital in 1997 [11] in Côte d'Ivoire. A study conducted at the Brazzaville University Hospital in Congo [12] reported advanced maternal age (>35 years). The literature highlights the association between advanced maternal age and chromosomal malformations [7] [13] [14], but in the local context, early marriages could explain the young age of pregnant women. The high prevalence of abnormalities in primiparous and pauciparous women (69%) and primigravid/paucigravid women (64%) corroborates the results reported at the Bouaké University Hospital [15] and in Yaoundé [16] in Cameroon. The study reveals a notable lack of prenatal care, with fewer than four prenatal visits for 68% of mothers, no prenatal check-ups for 79%, and an obstetric ultrasound rate of 13.7%. In our cohort, only 25% of mothers received periconceptional folic acid prophylaxis, a rate that falls far short of the WHO 2022 recommendation that all women take 400 µg daily from preconception through the first trimester to prevent neural tube defects [17]. This low uptake is consistent with regional findings: Moges *et al.* [18] reported that not taking folic acid was associated with a more than twofold increased risk of congenital anomalies (pooled OR = 2.67; 95% CI: 1.42 - 5.00), while Chaulo *et al.* [19] found that missed periconceptional supplementation increased the risk of hydrocephalus by 83% (aPR = 1.83; 95% CI: 1.11 - 1.96) and congenital heart disease by 78% (aPR = 1.78; 95% CI: 1.31 - 1.94). This insufficient coverage is also linked to socioeconomic vulnerability and the widespread use of traditional medicine and African pharmacopoeia, underscoring the urgent need to strengthen folate supplementation programs. Regarding the types of malformations, the detection of anomalies on day 0 of life in 57% of cases reflects a late diagnosis, likely linked to home births and the absence of obstetric monitoring. The majority of cases involved isolated malformations (86.6%) versus polymalformative syndromes (14%), which is consistent with data from the African literature [10] [12]. The most common malformations were in the lower limbs (clubfoot, 22%), the abdominal wall (omphalocele, 15%) (**Figure 1**), the nervous system (spina bifida, 10%) (**Figure 2**), the face (cleft lip and palate, 9%) and laparoschisis (6%) (**Figure 3**). This profile is similar to that reported in the university hospitals of Abidjan [11] [20], in southwestern Nigeria [21], and in Morocco, albeit in different proportions.

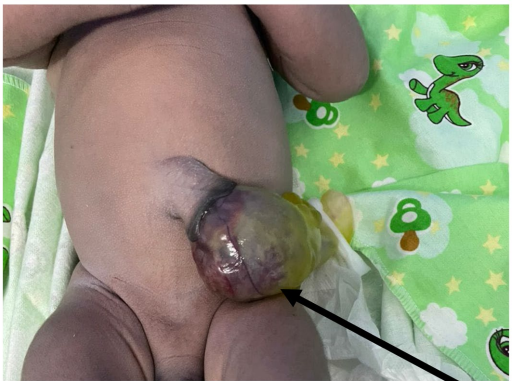

Figure 1. Omphalocele.

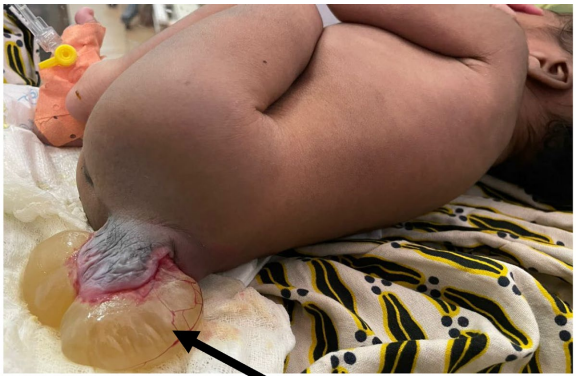

Figure 2. Spina bifida.

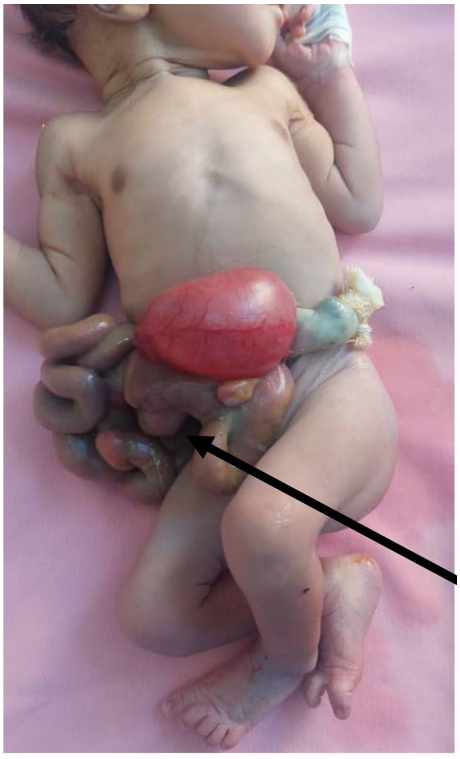

Figure 3. Laproschisis.

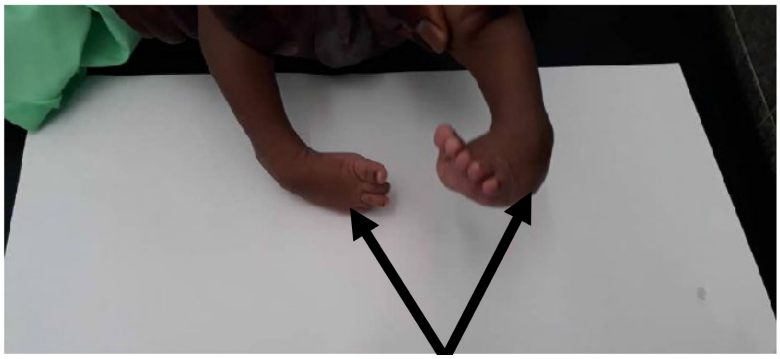

Figure 4. Clubfoot.

The study shows that treatment is mainly medical, supplemented by specific surgical procedures such as the Ponseti method for clubfoot (20%) (**Figure 4**), colostomy for anorectal malformations (6%), and tanning in cases of omphalocele (6%). The low rate of surgical intervention for conditions other than clubfoot highlights the limitations of the technical facilities, as reported in a study in Burkina Faso [22]. However, the lack of counter-referrals may explain why it was not possible to determine the outcome for the child once admitted to pediatric surgery. Regarding outcomes, the neonatal mortality rate for malformations is 10% in the study. This rate is much lower than the data reported in the literature [23] [24]. This difference could be related to the predominance of "benign" malformations in this series, particularly those of the limbs.

5. Conclusion

This retrospective study conducted in the neonatal unit of Bouaké University Hospital highlighted the high prevalence of CM, with a predominance of limb and abdominal wall abnormalities. Late diagnosis, the limitations of prenatal care, and technical and socioeconomic constraints negatively influence the neonatal prognosis. It highlights the need to strengthen prenatal diagnosis, develop protocols adapted to the local context, and structure referral systems. These recommendations aim to improve the quality of care while supporting medical training with contextualized educational tools.

Authors' Contributions

All authors participated intellectually in the preparation and revision of the manuscript prior to submission.

Conflicts of Interest

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

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