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Infectious Embryofoetopathies: Situation Analysis at the Charles DE GAULLE Paediatric University Hospital in Ouagadougou (Burkina Faso)

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Abstract

Introduction: Infectious embryofetopathies are infections mainly caused by pathogens of the TORCH group, transmitted from the mother to the fetus during pregnancy and which can have an impact on the product of conception. They represent a major public health problem because of their impact on neonatal morbidity and mortality. **Objective:** To take stock of infectious embryofetopathies in children hospitalized at CHUP CDG between July 1, 2021 and June 30, 2024. **Method:** We conducted a retrospective, descriptive and analytical cross-sectional study that involved the records of children hospitalized for infectious embryofetopathies between July 1, 2021 and June 30, 2024. **Results**: We included in our study 80 children hospitalized for embryofetopathy with an IgG positivity rate of 1.5%. There were 86.25% of newborns; male sex represented 62.50%. 51.25% of mothers had performed syphilis serology during pregnancy but none of them had performed the other serologies of the TORCH group; 86.25% of children were born at term. The main signs and symptoms found on admission were respiratory distress in 36.25% of cases, fever and jaundice in 27.50% of cases each; 65% of children had a visible malformation and the main internal anomalies objectified by imaging were cardiac anomalies in 56.28% of cases. The mortality rate during our study was 31.25%. Also, our study shows an association between positivity for anti-rubella IgG and death, but it does not establish that rubella is the cause of the malformations or the adverse outcome. **Conclusion:** It is important to screen for infectious embryofetopathies during pregnancy with the aim of caring for mothers in order to limit the occurrence of these pathologies in the newborn.

Keywords

Embryofetopathy, TORCH, Toxoplasmosis, Rubella, CMV

1. Introduction

Infectious embryofetal diseases are a major public health problem due to their impact on neonatal morbidity and mortality [1].

These infections, transmitted from mother to fetus during pregnancy, are mainly caused by pathogens of the TORCH group (Toxoplasmosis, other infections including Syphilis, Rubella, Cytomegalovirus, Herpes simplex).

Among these pathologies, congenital toxoplasmosis most often results from the transplacental transmission of the parasite after a primary maternal infection [2]. In Africa, very little information is available, but a study carried out in Morocco found a prevalence of 4 - 8/10,000 live births [3].

Another pathology is congenital syphilis, which is also a major public health problem in the world [4]. It is one of the target diseases for triple elimination with HIV and hepatitis by 2030 [5].

However, the pathology that causes more mortality is congenital rubella. According to the WHO, rubella is the leading cause of vaccine-preventable birth defects. About 100,000 newborns are born with congenital rubella syndrome (CRS) [6]. Due to its scale, it is the subject of special global surveillance by the WHO. Several countries, including Burkina Faso, have been designated for this monitoring [7] [8].

The CHUP CDG is involved in this surveillance with screening serology testing and the reporting of cases, particularly the reporting of newborn cases. The aim of our work is to study the clinical aspects of children with positive serology for these infectious embryofetopathies.

2. Materials and Methods

This was a retrospective, cross-sectional, descriptive and analytical study that concerned the files of children hospitalized for infectious embryofetopathies between July 1, 2021 and June 30, 2024, *i.e.* 3 years.

Included in our study were children's records containing positive screening serology for infectious embryofetopathies. Children of all ages were screened upon admission to the pediatric emergency department. All jaundiced newborns were systematically screened in the neonatal unit. A literature review collected clinical data (anthropometric parameters at birth, neonatal history, visible malformations, jaundice), paraclinical data (results of requested serology, other orientation examinations) and the immediate evolution of hospitalized children. Some data were collected from neonatal and infant hospital registers. The positivity thresholds are those of the analysis laboratory of the Charles DE GAULLE pediatric university hospital.

This data, collected using a written form, was entered and analyzed using a computer with the Epi-info software in its version 7.2.2.6.

The chi-square test (χ^2) was used to look for a statistical relationship between the different parameters. The difference was significant when the P-value was less than 0.05.

Operational definitions: Depending on the titer of the antibodies measures (IgG and IgM) performed was considered such as:

- Low IgG if IgG ≤ 300 IU/ml;
- High IgG if IgG between 301 IU/ml and 500 IU/ml;
- Very high IgG if IgG > 500 IU/ml;
- Any positive case of IgM was considered a progressive infection;
- A suspected case of embryofetopathy is a case with a positive IgG test.

3. Results

3.1. Frequency of Testing

During our study, 5999 children were hospitalized in the 2 units; 91 children screened for infectious embryofetal disease (*i.e.* a screening frequency of 1.51%) and 80 children were included, from which 49 in the neonatology department and 31 in the infant's department. 11 files were not included due to incompleteness.

3.2. Socio-Demographic Characteristics

The mean age of the children was 53.42 days with extremes of 1 and 1080 days, the sex ratio was 1.6. Table 1 illustrates the socio-demographic characteristics of the children.

Table 1. Distribution of 80 children hospitalized for embryofetal disease by socio-demographic characteristics.

Socio-demographic profile	Frequency (n)	Percentage
Age range (in days)		
≤28	69	86.25
>28	11	13.75
Gender		
Male	50	62.50
Female	30	37.50
Residency		
Urban	34	42.50
Rural	46	57.50

More than 86% of the children screened were newborns.

3.3. Clinical Aspects

- **Medical history**
  - **Pregnancy follow-up**

In our series, there was no history of stillbirths but 14 mothers or 17.50% had miscarriages. None of the mothers had diabetes, high blood pressure or HIV/AIDS,

had reported repeated infections or fever during pregnancy. No notion of inbreeding had been found between the parents. Syphilis serology testing was performed in 41 mothers during pregnancy (51.25%) and was positive in 2 mothers (4.87%). No mother had performed the other serology testings in the TORCH group. The average number of antenatal visits performed by mothers was 3.78 ± 1.34 with extremes of 0 and 7.

➢ **Perinatal history**

The mean birth weight was 2529.50 g ± 601.21 g with extremes of 990 g and 3800 g. In our series, 21.25% of children were hypotrophic at birth. Table 2 shows a distribution of children according to perinatal history.

Table 2. Distribution of 80 children hospitalized for embryofetal disease based on perinatal history.

Perinatal history	Frequency (n)	Percentage
Gestational age		
≥37 WA	69	86.25
[32 WA - 37 WA]	10	12.50
[28 WA - 32 WA]	1	1.25
Birth Weight		
<2500 g	32	40
≥2500 g	48	60
Birth size		
<45 cm	20	25
≥45 cm	60	75
Birth PC		
<30 cm	17	18.92
≥30 cm	63	81.08

WA = weeks of amenorrhea; 86% of the children were born at term.

❖ **Main signs and symptoms on admission**

The signs and symptoms found during the admission examination are summarized in Table 3. A patient could present several signs.

Table 3. Distribution of 80 children hospitalized for embryofetal disease according to the signs at admission.

Signs and symptoms on admission	Frequency (n)	Percentage
Respiratory distress	29	36.25
Fever	22	27.50
Jaundice	22	27.50
Hypotonia	10	12.50
Heart murmur	10	12.50
Polypnea	6	7.50
Pallor	3	3.75
Hypothermia	2	2.50
Limb malformation	2	2.50

Respiratory distress was the most common sign at 36.25%.

❖ Visible deformities

The physical examination also reported birth defect in the children. A total of 89 visible birth defect were found in 52 children, *i.e.* a frequency of 65%. A child could have several visible birth defect at different locations. Table 4 shows the distribution of visible birth defect according to location.

Table 4. Visible birth defect found in 52 children.

Location	Frequency (n)	Percentage
Skull	**10**	**12.50**
Face	**25**	**41.25**
Cleft lip and palate	12	15
Microphthalmia	5	6.25
Micrognathism	3	3.75
Anophthalmia	2	2.50
Low implanted ears	2	2.50
Facial dysmorphia	1	1.25
Neck	**1**	1.25
Thorax	**3**	3.75
Spine	**6**	**7.50**
Spina bifida	5	6.25
Sacred dimple	1	1.25
Abdomen	**2**	2.50
Limbs	**35**	**45**
Clubfoot	16	20
Polydactyly	8	10
Syndactyly	3	3.75
Foot embankment	2	2.50
Shortened pelvic limbs	2	2.50
Knee recurvatum	1	1.25
Main bot	1	1.25
Typing	1	1.25
Femoral hypoplasia	1	1.25
Urogenital	**7**	**8.75**

❖ Internal Birth defect

Imaging examinations, including ultrasound and computed tomography, detected internal malformations listed in Table 5.

Table 5. Distribution of internal birth defect in children suffering from Embryofoetopathy.

Objective anomalies Imaging	Frequency (n)	Percentage
Brain abnormalities	**10**	**12.5**
Hydrocephalus	4	5

Continued

Hydranencephaly	1	1.25
Ventricular ectasia	1	1.25
Choroidal plexus cyst	1	1.25
Holoprosencephaly	1	1.25
Arachnoid cyst	1	1.25
Agenesis of the corpus callosum	1	1.25
Cardiac abnormalities	**45**	**56.25**
Patent ductus arteriosus	13	16.25
Ventricular septal defect	8	10
Permeable Foramen Ovale	8	10
Inter atrial septum aneurysm	7	8.75
Atrial septal defect	5	6.25
Ventricular atrio duct	3	3.75
Single ventricle + malposition of the large arterial trunks	1	1.25
Urogenital abnormalities	**7**	**8.75**
Sigmoid kidneys	1	1.25
Single kidney	1	1.25
Multicystic kidney	1	1.25
Ectopic kidney (pelvic position)	1	1.25
Incunosecrotal hernia	2	2.50
Bilateral renal impairment	1	1.25

Cardiac abnormalities were the most common with 56.25% of cases.

3.4. Screening for Embryofetal Diseases

In our series, 20 children had IgG positive for toxoplasmosis and rubella, seven (7) children had IgG positive for both toxoplasmosis and CMV, and 21 children had IgG positive for both rubella and CMV.

❖ **Toxoplasmosis serology**

Toxoplasmosis serology was performed in 73 children (91.25%) with IgG positive in 22 patients (30.13%). The IgM was positive in one patient, *i.e.* 1.37%. Table 6 illustrates the distribution of children according to toxoplasmosis serology.

Table 6. Distribution of 22 children with positive toxoplasmosis serology.

IgG positive levels of Toxoplasmosis	Frequency (n)	Percentage
0 - 100	8	36.36
101 - 200	5	22.72
201 - 300	3	13.63
301 - 400	1	4.54
401 - 500	4	18.18
>500	1	4.54

In our series, 6 children had a serology greater than 300.

❖ **Rubella serology**

Rubella serology was performed in 76 children (95%) with IgG positive in 67 children (88.15%). None of the children had positive IgM. Table 7 shows the distribution of 67 children hospitalized with infectious embryofetal disease by rubella-positive IgG level.

Table 7. Distribution of the 67 children hospitalized for embryofetal disease with positive rubella serology.

Positive Rubella IgG levels	Frequency (n)	Percentage
0 - 100 IU/ml	36	53.73
101 - 200 IU/ml	10	14.92
201 - 300 IU/ml	8	11.94
301 - 400 IU/ml	4	5.97
401 - 500 IU/ml	5	7.46
>500 IU/ml	4	5.97

In our series, 13 children had a serology level greater than 300.

❖ **CMV Serology**

CMV serology was performed in 33 children (41.25%) with positive IgG in all children and IgM positive in two children (6.06%). Table 8 shows the distribution of 33 children hospitalized with infectious embryofetal disease based on the level of rubella-positive IgG.

Table 8. Distribution of the 33 children hospitalized for embryofetal disease with positive CMV serology.

CMV-positive Ig G levels	Frequency (n)	Percentage
0 - 100 IU/ml	15	45.45
101 - 200 IU/ml	5	15.15
201 - 300 IU/ml	5	15.15
301 - 400 IU/ml	2	6.06
401 - 500 IU/ml	2	6.06
>500 IU/ml	4	12.12

In our series, 8 children had a serology level greater than 300.

3.5. Evolution

In our series, 55 children (68.75%) had a favorable outcome with outpatient follow-up and 25 children (30%) died during hospitalization.

For all 80 children screened, the diagnosis of discharge was probable infectious embryofetopathy. Factors associated with congenital rubella are listed in Table 9.

Table 9. Rubella-positive IgG association and signs and symptoms.

	Rubella-positive IgG n (%)	OR [95% CI]	P-value
Common Signs and Symptoms			
Respiratory distress	20 (29.85)	0.85 [0.19 - 3.74]	0.4093

Continued

Jaundice	18 (26.87)	1.28 [0.24 - 6.77]	0.4072
Fever	19 (23.36)	1.38 [0.26 - 7.27]	0.3736
Common visible Birth defect			
Clubfoot	13 (19.40)	0.84 [0.15 - 4.53]	0.4074
Cleft lip and palate	9 (13.43)	0.31 [0.06 - 1.46]	0.0881
Cardiac abnormalities			
Yes	36 (53.73)	0.58 [0.13 - 2.51]	0.2477
No	31 (46.27)		
Brain malformations			
Yes			
No	6 (8.96)	0	0.2282
Evolution	61 (91.04)		
Favourable development	46 (68.66)	0	**0.0216**
Death	21 (31.34%)		

Deaths were associated with rubella-positive serology (P = 0.0216).

4. Discussion

Our study has some limitations. These include the absence of systematic maternal TORCH serology, limited CMV screening, the lack of confirmatory tests such as PCR, and the possible persistence of maternal IgG in the infant.

4.1. Clinical and Paraclinical Aspects

❖ **Medical history**

The mean number of antenatal consultations (ANCs) performed by mothers was 3.78 ± 1.34 with extremes of 0 and 7 years. In our series, 70% of mothers had had no more than four (4) ANCs out of a number of eight (8) requested by the WHO. This inadequacy in pregnancy monitoring could be explained by the low attendance of health services by the population, despite the free care introduced in Burkina Faso.

For the assessment of infectious embryofetal diseases in the TORCH group, only syphilitic serology was performed in 51.25%. Our results are similar to those of Nacro *et al.* in 2023 in Ouagadougou, which, during a study on clinically visible congenital malformations, had found a maternal screening rate for syphilitic serology at 42.22% [9].

In our series, prematurity was present in 13.75% of cases. Indeed, in the literature, prematurity is found in cases of congenital rubella and congenital CMV infection. Our results are similar to those of Pathirana *et al.* in 2019 in South Africa who had regained prematurity in 18.88% in congenital CMV infection [10].

Motaze *et al.* [11] in 2019 in South Africa. Putri *et al.* [12] in 2019 also in Indonesia had found prematurity in 31% and 34% respectively in congenital rubella.

This difference in rates could be explained by the fact that serologies for the

detection of infectious embryofoetal diseases are not systematically carried out in cases of prematurity in our context.

❖ **Admission Signs**

The most common sign and symptom encountered on admission in our series was respiratory distress in 36.25% of cases. Our results are similar to those of Putri *et al.* in 2019 in Indonesia who had found respiratory distress in 46% of cases in congenital CMV infection [12]. This result can be explained by the fact that cardiac abnormalities, which in most cases manifest themselves as respiratory distress and are among the most common malformations in congenital CMV infection but also in congenital rubella [8] [11] [12].

Respiratory distress was followed in terms of frequency by jaundice, which was present in our series in 27.50% of cases. In literature, jaundice is a common sign in congenital rubella, congenital toxoplasmosis but especially in congenital CMV infection. Specifically in our series, jaundice was found in 26.27% of rubella-positive IgG-positive children, 27.27% of toxoplasmosis-positive IgG-positive children, and 45.45% of CMV-positive IgG-positive children. Nagalo *et al.* in 2020 in Burkina Faso, in a descriptive study about 2 cases of congenital toxoplasmosis, had found jaundice in the 2 cases described [13].

Motaze *et al.* [11] in 2019 in South Africa as well as Masresha *et al.* [8] in 2019 in the African region, had respectively found jaundice in 7% and 12% of cases of cases in their work on congenital rubella.

Concerning congenital CMV infection, the work of Putri *et al.* [12]. in 2019 in Indonesia as well as those of Pathirana *et al.* [10]. in 2019 in South Africa had found jaundice in respectively 21% and 23.9% of cases.

Concerning congenital syphilitic infection, the work of Appalsamy *et al.* [14] in 2024 in South Africa found also jaundice.

❖ **Visible deformities**

In our series, microcephaly was present in 3.75% of cases. This is a sign found in the literature in cases of congenital rubella and congenital CMV infection. Motaze *et al.* [11] in 2019 as well as Masresha *et al.* [8] in 2019 had respectively found in their work on congenital rubella a microcephaly in 24% and 32%.

Our results are much closer to those of Pathirana *et al.* [10] in 2019 in South Africa, which had found microcephaly in 2.2% of cases in a study on congenital CMV infection.

❖ **Paraclinical aspects**

In our series, 45 cardiac abnormalities, *i.e.* 72.58% of internal malformations, were objectified on cardiac Doppler ultrasound, making them the main internal malformations. These results are confirmed by the literature in which cardiac abnormalities are found in congenital rubella and in congenital CMV infection.

Our results are similar to those of Motaze *et al.* [11] in 2019 in South Africa as well as Masresha *et al.* [8] in 2019 in the African region, in their work on congenital rubella, are found in congenital rubella 71% and 22% cardiac abnormalities.

Concerning congenital CMV infection, the work of Putri *et al.* in 2019 in Indo-

nesia had found a heart anomaly in 80% of cases [12]. Davis *et al.* found also various birth defect Concerning congenital CMV infection [15].

This could be explained by the fact that embryofetal diseases occurring early in pregnancy can have an impact on organogenesis in general and more specifically on the heart.

4.2. Immediate Evolution

In our series, the evolution was favorable with outpatient follow-up in 70% of cases and death in 30% of cases. This could be explained by the high number in our series of cardiac abnormalities manifested by respiratory distress.

The only significant associated factor is the course and more specifically death in rubella-positive IgG cases. In our series, we found a rubella-related mortality rate of 31.34%. This rate differs from that found by Motaze *et al.* in 2019 in South Africa, which had found 7% [11]. An improvement in the technical platform and early management of heart disease cases in our work context could improve this situation. In addition, as they do not have a maternity ward at the CHUP CDG, children are screened late for these heart diseases, thus compromising their vital prognosis.

5. Conclusions

Our study looked at 80 cases. Half of the mothers, *i.e.* 51.25%, had performed syphilitic serology during pregnancy, but none of them had performed the other serologies of the TORCH group, which did not make it possible to establish the relationship between mother and child from a serological point of view.

Our work shows that early detection of TORCH pathologies during pregnancy, [16] [17], early care of newborns [18]-[20] and rubella vaccination in infants and girls of childbearing age, remain essential in our work context.

Author Contributions

The cited authors contributed to revising the protocol and classifying the hospitalisation records.

Conflicts of Interest

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

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