

Epidemiology of Fetal Death and Analysis of Causes According to CODAC Classification at Amath Dansokho Regional Hospital of Kedougou, Senegal

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Abstract

Objectives: This paper aims to study the epidemiology and causes of fetal deaths in utero at Regional Hospital Amath Dansokho of Kedougou (RHADK). **Methodology:** This was a retrospective epidemiological study conducted at the Maternity Ward of the Regional Hospital Amath Dansokho of Kedougou from June 01, 2022 to June 30, 2023, including all patients seen for delivery care. Data were analyzed using Statistical Package for Social Science (SPSS 22, Windows version). The parameters studied were the frequency of *in-utero fetal death*, sociodemographic characteristics, pregnancy and delivery data, neonatal data and cause-of-death classification according to the Cause of Death and Associated Conditions (CODAC) classification. **Results:** We recorded 1628 deliveries, with 231 cases of *in-utero fetal death*, a frequency of 14.2%. Fetal death occurred most frequently in multiparous women (64.5%). The majority of patients (72.3%) were transferred. 51.9% of patients with fetal death had at least 3 antenatal visits. On admission, fetal heart rate was absent in 73.2% of patients. The etiology of *in-utero fetal death* was dominated by maternal factors (high blood pressure, anaemia and diabetes), which accounted for 36.9% of deaths, followed by placental pathologies (retroplacental haematoma) and intrapartum pathologies (uterine rupture, abnormal presentation). **Conclusion:** *In-utero fetal death* can be prevented, and is mainly due to direct obstetric complications. The focus should be on the prevention and management of hypertensive disorders and their complications during pregnancy, the fight against anaemia and, above all, the rapid and correct management of dystocia.

Keywords

Obstetrical Complications, Fetal Death, CODAC Classification

1. Introduction

Despite medical advances, the worldwide prevalence of *in-utero fetal death* over 28 weeks' gestation or weighing more than 1000 g is estimated at around 2%, with a prevalence of around 5/1000 in high-income countries [1]. In 2010, France had the highest *in-utero fetal death* rate in Europe, at 9.2 per 1000 births [2]. In Africa, rates vary from one country to another; in Mali, there are data on fetal death despite its acuity, its rate was 11.94‰ at the Reference Health Centre of Commune II in the district of Bamako in 2014 [3]. In Senegal, data on *in-utero fetal death* are often under-reported. Nevertheless, a study conducted in 2018 at National Health Centre of pikine found a frequency of 3.3%.

Identifying cause of intra-uterine fetal death (IUFD) and preventing recurrence must be a priority for medical teams. However, the difficulty lies in finding the cause (s). IUFD of unexplained cause remains the majority (between 30 and 50% of cases) despite all the investigations carried out [2]. Faced with a lack of studies on this psychologically burdensome subject and the extent of the situation in our daily practice, we decided to carry out this study. The main objective was to analyze the epidemiological characteristics of intra-uterine fetal death from June 01, 2022 to June 30, 2023 at Amath Dansokho Regional Hospital in Kedougou by identifying causes using the CODAC classification, and to develop strategies to reduce perinatal mortality in rural areas.

2. Methodology

2.1. Design, Population and Setting

This was a retrospective epidemiological study conducted from 06/01/2022 to 06/30/2023, including all patients admitted for delivery management at the Maternity Ward Amath Dansokho Regional Hospital of Kedougou. 700 km from Dakar, the hospital is a level II Public Health Establishment opened on May 31, 2021. It is the referral maternity unit for the Kedougou region. Emergency obstetric, neonatal and gynecological care is provided 24 hours a day by a team including a gynecologist, a senior anesthesia technician, midwives and nurses. Gynecology visits, pre- and post-natal check-ups, family planning and ultrasound scans are carried out on a daily basis. Scheduled surgery is performed using a wide range of approaches (abdominal, vaginal and endoscopic).

We adopted the World Health Organization (WHO) recommendations to define stillbirth as fetal death at 22 weeks of gestation or greater or birthweight higher than 500 g if the gestational age is unknown. If neither weight nor gestational age is available, crown-heel length ≥ 25 cm is used as a criterion for reporting fetal death and distinguishing a fetal death from a miscarriage [4].

The study population was all mothers who had delivered in the Hospital after completing 22 weeks of gestation with stillbirth as the outcome.

The dataset included information on maternal characteristics (age, parity, medical history), obstetric and perinatal outcomes.

Furthermore, causes of death were classified according to CODAC classification [5]. This is a fully computerized classification using an Excel-type spreadsheet that can be downloaded directly onto a computer and, in our case, integrated into the E-perinatal database software. This CODAC classification considers the mother and fetus globally. It contains a first part corresponding to classification of the cause of death (“Cause of Death”) and a second part corresponding to associated conditions (“Associated Conditions”).

In this study, we chose to refer to a recent consensual classification: the CODAC classification, published in 2009 [5]. Its aim is to associate a main cause of death with 2 other conditions involved in the fetal demise. Each fetal death has been recorded (cause of death, associated conditions, patient history, pregnancy and delivery history, complementary examinations leading to the diagnosis) and thus easily classified in each group. The simplified CODAC classification is summarized in **Table 1**.

2.2. Data Analysis

The data was recorded in our E-Perinatal digital database. They were then extracted and analyzed, first in Microsoft Excel 2016 and then using the Statistical Package for Social Science (SPSS 26, Mac version).

In the descriptive part, mean, median and standard deviation were considered to describe continuous variables while frequencies were reported for categorical and nominal variables.

3. Results

During the study period, we recorded 1628 deliveries, 231 of which were *in-utero fetal death*, a rate of 14.2%. The characteristics of patients with fetal death are summarized in **Table 2**. According to CODAC classification of our cases, maternal causes accounted for more than one in 3 cases (36.9%). In this group, hypertensive disorder during pregnancy dominated with 20.3%, followed by the association of anemia and pregnancy (10.7%). Intrapartum fetal deaths were associated more with uterine rupture and malpresentation, particularly breech dystocia. Placental abruption was responsible involve in one on five fetal deaths 20%. The causes of fetal demise according to the simplified CODAC classification are in **Table 3**.

4. Discussion

4.1. Frequency

Fetal death is the result of a disease (maternal and/or fetal) or a maternal functional disorder, usually progressive. The worldwide prevalence of *in-utero fetal*

Table 1. Simplified CODAC.

Groups	Level 1	Level 2		
0	INFECTION	02 MALARIA 04 SYPHILIS 05 GROUP B STREPTOCOCCUS (GBS) 06 COMMON BACTERIA OF MATERNAL FLORA (NON-GBS)		
1	NEONATAL	11 EXTREME PREMATUREITY 13 CARDIO-RESPIRATORY 19 INFECTION		
2	INTRAPARTUM	23 MALPRESENTATION 25 PROLONGED/OBSTRUCTED OR INCOMPLETE LABOR 26 EXTREME PREMATUREITY 29 UNKNOWN (FETAL RESPIRATORYFAILURE/ASPHYXIA)		
3	CONGENITAL ANOMALY	31 CENTRAL NERVOUS SYSTEM 32 CARDIOVASCULAR AND LYMPHATIC VESSELS 37 TRISOMIES		
4	FETAL	43 ALLOIMMUNIZATION 47 HYDROPS OF UNKNOWN ORIGIN		
5	CORD	51 KNOTS 52 LOOPS 53 ABNORMAL INSERTION		
6	PLACENTA	63 ABRUPTION 64 INFARCTIONS AND THROMBI		
7	MATERNAL	71 HYPERTENSIVE DISORDER 73 DIABETES 79 INFECTION		
8	UNKNOWN	81 UNKNOWN 85 UNEXPLAINED 86 UNCLASSIFIABLE	8) ASSOCIATED PERINATAL	81 SMALL FOR GESTATIONAL AGE 83 MULTIPLES 87 OVER-TERM 89 SUBOPTIMAL CARE
9	TERMINATION	91 FOR CONG. ANOMALY 94 FOR FETAL DISEASE 96 FOR MATERNAL CONDITION	9) ASSOCIATED MATERNAL	91 OBSTETRIC HISTORY 92 SMOKING 95 POVERTY

Example: A code with 3 digits 87? **Level 1:** Associated pregnancy. **Level 2:** Over-term. **Level 3: 0** Non-specific; 41 weeks remaining; 42 Weeks remaining; 43 Weeks remaining; 44 Weeks remaining. **9** Other.

death is estimated around 2%, and 5% in developed countries. low-incomes countries are the most affected [6]. This prevalence is variable and depends mainly on the socio-economic and health status of countries, on study methodology. In our study, we recorded 231 cases of fetal death out of a total of 1628 deliveries, a frequency of 14.2%. This rate is significantly higher than those

Table 2. Characteristics of patients with fetal death.

	Characteristics N	Percentage
Age		
<25 ans	129	55.8
26 - 35 ans	85	36.4
>35 ans	18	7.8
Parity		
Nulliparous	51	22.1
Primiparous	31	13.4
Multiparous	149	64.5
Admission		
Direct admission	64	27.7
Referral	167	72.3
Provenance		
District Kédougou	111	66.5
District Salémata	18	10.8
District Saraya	38	22.7
Terme of delivery		
Preterm	152	65.8
Term	64	27.7
Post-Term	15	6.5
Type of pregnancy		
Singleton	221	95.7
Twin	10	4.3
Number of antenatal visits		
[0 - 2]	120	51.9
[3 - 4]	94	40.7
>5	17	7.4
Foetal Heart rate		
Not present	169	73.2
Normal	36	11.3
Abnormal	26	15.6
Labour Induction		
Spontaneous	138	59.8
Medical induction of labour	68	29.4
Emergency C-section	25	10.8

Continued

Mode of delivery		
Vaginal delivery	161	69.7
Caesarean-section	70	30.3
Infant condition		
Fresh stillborn	115	49.8
Macerated stillbirth	116	50.2

N = number of cases.

Table 3. CODAC Classification of fetal death recording.

Groups	Level 1	Level 2	N	Percentage %	
0	Infection	01 HIV	01	1	1.2
1	Neonatal	11 extreme prematurity	02	2	2.4
2	Intrapartum	21 Uterine rupture	08	34	21.4
		23 Malpresentation	18		
		24 Disproportion	08		
3	Congenital Anomaly	30 Non specified	02	11	4.8
		31 CNS (anencephalia/hydrocephaly)	06		
		36 Upper digestive tract	03		
4	Fetal	41 Alloimmunization	01	1	1.2
5	Cord	52 Loops	03	3	2.4
6	Placenta	63 Abruption	53	53	21.4
		71 Hypertensive disorder	44		
7	Maternal	73 Diabetes	15	80	36.9
		75 Anaemia	21		
8	Unknow	80 unspecified	07	07	7.1
9	Maternal associated	94 Medications and secondary effects (Steven-Johnson syndrome)	01	1	1.2
TOTAL			231	100	

N = Number of cases.

found by Kubuya in the Democratic Republic of Congo (DRC) [7], Adriaman-dimbison in Madagascar [8] and Diallo in Guinea, who found rates of 4.9%, 5.2% and 6.9% respectively. On the other hand, it is close to the rate found by Kangulu in the Republic of Congo, 13.9% [1]. In Senegal, a study carried out in a sub-urban area found a prevalence of 3.3% out of 6273 deliveries [9]. This difference shows the disparity between developed and low-income countries, and between urban and rural areas. This high rate of fetal death during this short

study period could be explained in part by the region's demographic, economic and social particularities. Kédougou is one of the regions with a very low urbanization rate (25%) and a very high poverty rate (71%) [10]. The population is highly variable, cosmopolitan and mobile, the continuity of quality prenatal care is a real challenge, which could have consequence on the prognosis of pregnancies. Indeed, access to healthcare facilities in an area with a population density of 11 people per square kilometer is no easy task. A study on the geographical accessibility of health facilities carried out in 2016 already showed that for the Kédougou region, on average, an individual travelled 13 to 15 km in 2009 to access a health facility, and 37 to 42 km to access a health center [11].

Moreover, our study period coincided with a period of significant structural change in the regional health pyramid, emergency obstetric activities started in the hospital (opening of the operating ward), combined unfortunately with closure of the operating unit of district health center following audit of a tragical a maternal-fetal death, making the hospital the only referral structure in the region. This situation led to the transfer of all patients with *fetal death* to the regional hospital for better care.

4.2. Causes of Fetal Death

In our study, causes of fetal death were more related to hypertensive disorder, intrapartum pathologies (uterine rupture, malpresentation) and placental anomalies (abruption). Our results reflect the African context, where direct obstetric complications are responsible of high maternal and fetal mortality. Whereas in developed countries, fetal causes (malformations and genetic anomalies) dominate.

The patient profile presenting a fetal death was a young, multiparous patient, admitted following a referral with less than 3 antenatal visits. For this patient profile, 3 factors are immediately identifiable: referral, multiparity and young age. It has been shown that in Africa, fetal death is more likely to occur in referred patients [1]. Indeed, time is a vital factor in the survival of women with complications. Cultural reluctance to seek care, lack of awareness of danger signs, especially in young women, financial constraints, partner's restriction in seeking care, all these difficulties not only lead to bad outcomes due to obstetric emergencies, but above all have an impact on the quality of antenatal visits.

The benefits of antenatal care for both mother and child are well established. Antenatal consultations (ANC) screen risky pregnancy, provides appropriate treatment for intercurrent pathology or those aggravated by pregnancy, and contribute to reduce perinatal and neonatal mortality. To achieve this, they should be done as early as possible (1st trimester) and regularly repeated. The rate of pregnant women who have undergone ANC reveals a real deficit of treatment. In fact, almost two out of three patients presented a fetal death before the end of their pregnancy. This highlights the poor quality of ANC. This can be attributed to 3 factors: patients' cultural environment (refusal to be examined by a

male provider), a lack of awareness of the risks (language barrier and illiteracy) and a deficit in quality human resources. The refusal of ANC by a male provider is reinforced by religious considerations, which make it difficult to admit a man in other than a husband into a woman's private life. This is a real problem in a difficult area where, despite the fact that health facilities are double-staffed (1 midwife and 1 nurse), men nurses are at the forefront of the field, as they are designated as head of health facility and are therefore more likely to stay a long-side to population, while midwives are more likely to be constantly on the move. Integrating head nurses into recentered ANC, Emergency obstetrical and neonatal care (EmONC) and ultrasound training programs would significantly improve ANC quality. The language barrier is also an obstacle to the continuous high-quality provision of ANC. Informing pregnant women and making them aware of the progress of their pregnancy and the warning signs are an integral part of ANC. The high percentage of fetal deaths at term (38% of fetal deaths) can be explained partly by poor communication between providers and patients, and also by the language barrier. Indeed, it is easier for a woman to cooperate when she is informed not only about the importance but about the meaning of the acts she must undergo. Screening previous pregnancy histories such as previous cesarean section, application of suction cup or forceps, history of deliveries during visits is a necessity. A study on evaluation of antenatal consultations quality in a maternity of the Kati reference health center in Mali [12] showed that these histories were rarely requested by the providers with respective percentages: 1.8%, 0.5% and 0.5%; while these elements are essential tools for the prognosis of delivery during the fourth ANC in order to avoid fetal deaths linked to dystocia (uterine rupture, disproportions).

Furthermore, ANC is often performed late. A first ANC after the 4th month of pregnancy is a missed opportunity for early diagnosis of the pregnancy, screening for risk factors and preventing morbid complications linked to serious conditions such as hypertensive disorder, anemia and diabetes, which are the main causes of fetal death in our study.

4.3. Implications of Our Results

The findings suggest that the majority of stillbirths are preventable and are mainly related to direct obstetric complications in our area. The focus should be on the prevention and management of hypertensive disorders and their complications, the control of anemia during pregnancy and, above all, the rapid and correct management of dystocia. Furthermore, fetal death is a tragedy for the family, and action must be taken to prevent the negative psychosocial consequences of stillbirth.

The scale of perinatal deaths does not seem to be taken into account by the health authorities or by maternal and neonatal health programs. Following the example of maternal death surveillance system, a continuous cycle of action must be carried out by identifying and notifying perinatal deaths in real time,

assessing whether the deaths are avoidable, formulating recommendations to prevent deaths in the future and immediately implementing the relevant recommendations.

4.4. Strengths and Limitations of Our Study

The results of this study are based on a retrospective descriptive study. Retrospective studies are less expensive to carry out than prospective studies and can be carried out immediately. The use of a classification adapted to our context, fully computerized and updated daily, makes the study easily reproducible. The limitation of our study lies in the size of our sample.

5. Conclusion

In-utero fetal death can be prevented, and is mainly due to direct obstetric complications. The focus should be on the prevention and management of hypertensive disorders and their complications during pregnancy, the fight against anemia, and, above all, the prompt and correct management of dystocia.

Conflicts of Interest

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

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