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Original Research Article

Anaesthesiological Management of Caesarean Sections in parturient with heart disease in Low-Resource Countries

Mahamadoun Coulibaly[1,2*], Seydina A Beye[2,3], Binta Diallo[1], Aminata Dabo[1], Salia I Traore[1], Siriman A Koita[1,2], Abdoulhamidou Almeimoune[2,4], Moustapha I Mangane[2,4], Souleymane Samate[1], Brehima B Coulibaly[1], Ousmane Nientao[5], Mamadou K Toure[2,6], Sanoussy Daffé[7], Mamadou Touré[1,7], Safiatou Kallé[8], Mohamed Y Djiré[8], Youssouf Coulibaly[1,9]

[1]Department of Anaesthesia, Intensive Care, and Emergency Medicine, "LE LUXEMBOURG" Mother and Child University Hospital, Bamako
[2]Faculty of Medicine and Odontostomatology, Bamako (FMOS/USTTB)
[3]Department of Anaesthesia and Intensive Care, Mohamed VI Perinatal Clinic, Bamako
[4]Department of Anaesthesia, Intensive Care, and Emergency Medicine, Gabriel Touré University Hospital, Bamako
[5]Anaesthesia and Intensive Care Department, CNOS University Hospital, Bamako
[6]Anaesthesia and Intensive Care Department, Dermatology Hospital, Bamako
[7]Cardiology Department, "LE LUXEMBOURG" Mother and Child University Hospital, Bamako
[8]Gynecology and Obstetrics Department, Mother and Child "LE LUXEMBOURG" University Hospital, Bamako
[9]Anaesthesia, Intensive Care, and Emergency Medicine Department, Point G University Hospital, Bamako

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Abstract: ***Introduction*:** The management of caesarean sections in women with heart disease in resource-limited countries is a major challenge. Lack of infrastructure, poor access to specialized care and socio-cultural barriers worsens the maternal-foetal prognosis. ***Objective***: To describe our experience of anaesthesiologic management of caesarean sections in parturient with heart disease, identifying the difficulties encountered and prognostic factors. ***Patients and Methods***: Cross-sectional, descriptive and analytical study conducted prospectively over one year (January-December 2023). All parturient with cardiac disease referred for scheduled or emergency caesarean section were included. ***Results*:** Of 397 caesarean sections, 32 (8.06%) involved parturient with heart disease. The average age was 29 years. Cardiac diseases included rheumatic valvular disease (53.1%), congenital heart disease (21.9%), peripartum cardiomyopathy (15.6%) and coronary artery disease (9.4%). Previous cardiac surgery had been performed in 25% of patients. Of those on curative anticoagulation, only 18% had adequate compliance. Antenatal consultations were well attended by 43.8% of patients. At preoperative assessment, 68.8% were dyspneic, with a mean PAPS of 47 mmHg. Caesarean section was planned in 50% of cases. General anesthesia was preferred in 53.1% of cases. Intraoperative complications included cardiogenic shock (31.3%), cardiac arrest (9.4%, 3 cases) and neonatal resuscitation in 28.1% of cases. The maternal mortality rate was 21.9%. ***Conclusion*:** Heart disease in pregnancy remains associated with high morbidity and mortality in low-resource settings, with rheumatic valve disease being the most frequent. Delayed surgical management favors the development of severe pulmonary hypertension, complicating obstetrical management. Better therapeutic education, reinforced prenatal follow-up and wider access to cardiac surgery could improve maternal-fetal prognosis.

Keywords: Heart Disease, Caesarean Section, Anaesthesia, Maternal Mortality, Sub-Saharan Africa.

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INTRODUCTION

Pregnancy induces significant physiological changes in women, particularly in the cardiovascular system, which can decompensate pre-existing heart disease. The epidemiology and prognosis of these heart diseases vary around the world. In industrialized

***Corresponding Author:** Mahamadoun Coulibaly
Department of Anaesthesia, Intensive Care, and Emergency Medicine, "LE LUXEMBOURG" Mother and Child University Hospital, Bamako

countries, they are the leading cause of maternal death during pregnancy [1, 2].

The types of heart disease encountered during pregnancy differ depending on the geographical and socioeconomic context. In Western countries, congenital heart disease predominates, accounting for 75 to 82% of maternal heart disease [2]. In contrast, in low- and middle-income countries, particularly in sub-Saharan Africa, rheumatic valve disease linked to acute rheumatic fever remains the most common, with a prevalence ranging from 56% to 89% [2]. In addition, hypertensive heart disease, including preeclampsia and gestational hypertension, affects approximately 5 to 10% of pregnancies [2]. The maternal and fetal prognosis depends on the nature and severity of the heart disease, multidisciplinary care, and the optimal choice of delivery method. Pregnancy in women with heart disease must be carefully planned and monitored in order to limit complications.

However, in countries with limited resources, several obstacles compromise this care: lack of effective prenatal monitoring, shortage of qualified personnel, inequalities in access to specialized care, and insufficient infrastructure. Added to this is the lack of access to cardiac surgery for approximately 75% of the global population requiring intervention, due to financial and logistical constraints [3]. In this context of precarious healthcare, maternal heart disease is associated with high maternal and fetal morbidity and mortality, making an appropriate and structured approach essential.

The aim of this article is to report on our experience in the anaesthesiologic management of parturients with heart disease, highlighting the challenges and strategies for optimizing care in a context of limited resources.

PATIENTS AND METHODS

This is a cross-sectional, descriptive, and analytical study conducted over a one-year period from January 2023 to December 2023. This prospective study included all parturients with heart disease, whether or not they were being monitored, who were referred to the anesthesia team for a cesarean section, whether scheduled (elective) or performed as an emergency.

Inclusion and Exclusion Criteria:

Patients included in the study were those with heart disease diagnosed before or during pregnancy and requiring anesthesia for a cesarean section. Cases of severe heart disease requiring specialized care not available at our facility were excluded from the study.

Data Collection: Data were collected using a standardized survey form including:

- Demographic data: age, parity, medical and obstetric history.
- Clinical data: type and severity of heart disease, presence of signs of cardiac decompensation, functional status according to the NYHA (New York Heart Association) classification.
- Therapeutic data: anesthetic strategy adopted (general or regional anesthesia), intraoperative and postoperative management, and any complications.
- Cardiovascular risk stratification: Each pregnant woman was assessed according to the Modified World Health Organization (mWHO) Classification of Maternal Cardiovascular Risk [4], which allows a maternal cardiovascular risk score to be established and care to be adapted accordingly. During pregnancy, specific adjustments are made to minimize the risks of teratogenicity during the first trimester and the risk of hemorrhage during the third trimester. We prescribed substitution of vitamin K antagonists (VKAs) with low molecular weight heparin (LMWH) during the first and third trimesters of pregnancy.

Data Analysis:

The data were analyzed using SPSS 27 software. Quantitative variables were expressed as means ± standard deviation, and qualitative variables as percentages. Univariate and multivariate analyses were performed to identify factors associated with maternal-fetal complications. The threshold for statistical significance was set at $p < 0.05$.

Ethical Considerations:

Authorization from the local ethics committee was obtained to carry out this work. While respecting data confidentiality, authorization was obtained from the parturient to use their data in this manuscript.

RESULTS

During the period, 32 living parturients with heart disease underwent cesarean section. They represented 8.06% of the total number of cesarean sections. The average age of the parturients was 29 years, ranging from 19 to 42 years. The main cardiac pathologies were: rheumatic valvular heart disease: 53.1%, congenital heart disease: 21.9%, peripartum cardiomyopathy: 15.6%, and coronary artery disease: 9.4%. The various diagnoses are listed in **Figure 1**. The average number of pregnancies was 3 (range: 1-11) and 43.8% of the women had a history of cesarean section. Previous cardiac surgery had been performed in 25% of patients, including 29.4% with valvular heart disease and 42.9% with congenital heart disease. Surgical corrections performed before pregnancy are listed in **Table I**.

Cardiovascular treatments administered included: anticoagulants: 37.5%, diuretics: 81.3%, and ACE inhibitors/ARBs in 40.6%. Only 18% of parturients receiving curative anticoagulation therapy had good

compliance and regular follow-up. In addition, 43.8% of patients had received adequate prenatal care.

Preoperative Assessment:

56.3% of our parturients were classified as mWHO III and 65.6% had a mWHO class ≥ III. Before the procedure, 68.8% of parturients were dyspneic, with a NYHA score between 2 and 3. Lower limb edema was present in 50% of cases. Doppler echocardiography showed a mean left ventricular ejection fraction (LVEF) of 52% (range: 29-70%) and a mean pulmonary artery systolic pressure (PASP) of 47 mmHg (range: 12-93 mmHg). Preoperative intensive care was required in 28% of patients.

Course of the Cesarean Section:

Cesarean section was planned in 50% of cases, while the other procedures were performed on an emergency basis. General anesthesia was used in 3.1% of cases. The main intraoperative complications observed were: cardiogenic shock: 31.3%, cardiac arrest: 9.4% (3 patients) and postpartum hemorrhage: 12.5%

Neonatal resuscitation was required in 28.1% of newborns.

All women in labor were admitted to intensive care after cesarean section, with an average length of stay of 2 days (range: 1-5 days).

Maternal Mortality and Risk Factors:

The observed maternal mortality rate was 21.9%. Analysis of risk factors (**Table 2**) identified several significant elements in a logistic regression model: lack of regular prenatal consultations (p = 0.008; RR = 2.27) , the presence of preoperative dyspnea (p = 0.44; RR = 1.66), preoperative PAPS > 48 mmHg (p=0.003; RR = 3.57), urgent indication for caesarean section (p = 0.00; RR = 2.77), and the occurrence of acute intraoperative pulmonary edema**, the most predictive factor for mortality (p < 0.001; RR = 6.25).

Table 1: Types of heart disease and surgical corrections

Types of Heart Disease			
Diagnosis	**Frequency**		**Percentage**
Valvular heart disease	17		53.1
Congenital heart disease	7		21.9
Coronary artery disease	3		9.4
MEADOW cardiomyopathy	5		15.6
Total	**32**		**10**
Surgical treatment			
Surgical corrections	**Frequency**		**Percentage**
Valve replacement Mitral	2		6.3
Double Mitral + aortic valve replacement	3		9.4
Interventricular Communication Repair	1		3.1
Treatment for Tetralogy of Fallot	2		6.3
Total	**8**		**25**
Heart disease/surgical correction ratio			
Types of heart disease	**Total number**	**Total percentage**	**Percentage operated on**
Rheumatic valvular heart disease	17	53.1	15.7
Congenital heart disease	7	21.9	9.3
Total	**24**	**75**	**25**

Table II: Factors associated with death after logistic regression

Mortality factors	Chi-square	RR	p
Absence of regular prenatal checkups	6.97	2.27	0.008
Preoperative dyspnea	4.073	1.66	0.044
Preoperative PAPS >48 mmHg	8.88	3.57	0.003
Emergency cesarean section	8.96	2.77	0.003
Intraoperative OAP	17.10	6.25	<0.001

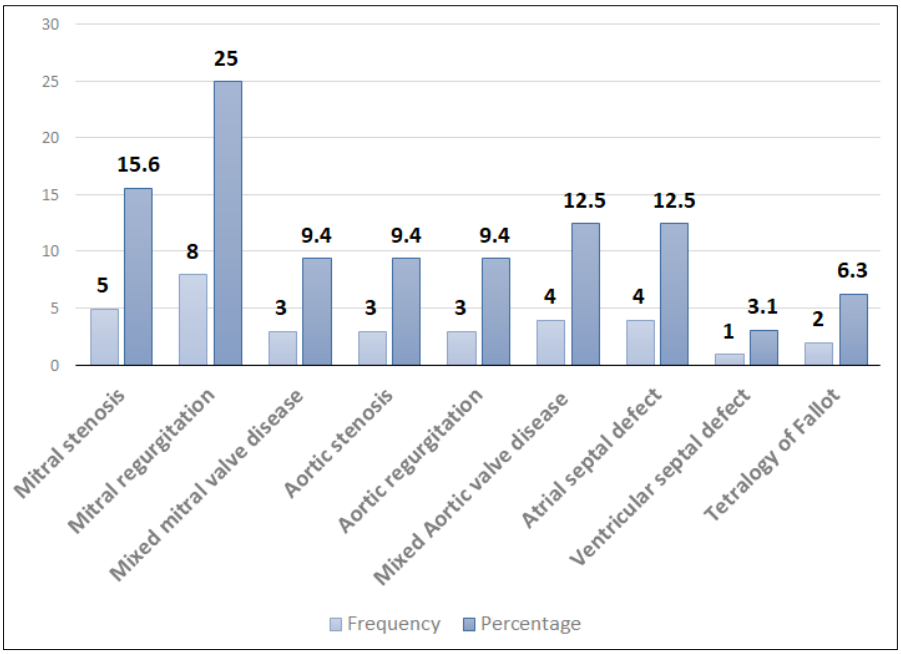

Figure 1: Valvular and congenital heart disease

DISCUSSION

Rheumatic fever (RF) remains a public health problem in developing countries, where it is a common cause of severe valvular heart disease. Management of these complications is limited by the lack of specialized facilities and qualified human resources, thus compromising the obstetric prognosis of young women affected.

In our study, rheumatic valve disease accounted for 53.1% of the heart diseases observed, followed by congenital heart disease (21.9%). Rheumatic valve disease was the most common heart disease during pregnancy in several African series [5, 6]. In our series, 53.1% of cases involved rheumatic valvular heart disease and 21.9% involved congenital heart disease.

The maternal-fetal prognosis depends on the type of valvular heart disease and whether surgical correction is performed. Heart failure occurs in 20-25% of rheumatic cases and in one-third of cases of severe mitral stenosis (area ≤1 cm²) [7].

Limited Access to Cardiac Surgery and Anticoagulation:

Only 25% of women in labor had undergone cardiac surgery, as Mali had only one surgical center open in 2018. The waiting time exceeds three years for 39.7% of patients, and the cost is a major obstacle [3]. Anticoagulation, which is essential for these patients, is poorly monitored: 37.5% of women in labor were receiving curative anticoagulation, but only 18% were following the therapeutic guidelines. The lack of therapeutic education programs increases the risk of thromboembolic and hemorrhagic complications [8]. Patient education and support programs exist in some developed countries, reducing the number and severity of accidents due to anticoagulant treatment [9]. In Africa and developing countries, these education programs are almost non-existent, and patients' levels of education, understanding, and adherence to anticoagulant treatment are insufficient and there is a high prevalence of complications and iatrogenic mortality [9–12].

Prenatal Care and Maternal Risk Assessment:

Prenatal care is inadequate: 56% of women in labor did not receive adequate care. This low rate is linked to socioeconomic, cultural, and religious factors [13]. Maternal risk assessment is a crucial step in this care. It is primarily clinical. Estimating the maximum tolerated frequency and hematosis provides information on cardiac status, and the ability to perform daily activities > 80% during pregnancy is associated with a favorable outcome for the pregnant woman [14].

The Modified World Health Organization classification of maternal cardiovascular risk allows the various maternal cardiovascular conditions to be classified and provides information for each category of condition on: the maternal risk involved, the probability of cardiac events during pregnancy, the need for preconception counseling, the care modalities during pregnancy and the mode of delivery, as well as the precautions to be taken for delivery [2].

Mode of Delivery and Anesthetic Management:

The mode of delivery depends on the type of heart disease, its stage of progression, and obstetric indications. Routine elective cesarean section does not necessarily benefit the mother.

Vaginal delivery is associated with less blood loss, a lower risk of infection, and fewer thromboembolic

events. Cesarean section is indicated for obstetric reasons, or in women undergoing anticoagulation therapy, in cases of severe aortic disease, or in cases of refractory acute heart failure [15].

Epidural analgesia reduces labor pain and attenuates adrenergic discharges due to contractions during labor. In the case of a cesarean section, it can be used to anesthetize the woman in labor; however, it can cause systemic hypotension (10%) and must be carefully titrated, particularly in patients with obstructive valvular lesions [16]. Spinal anesthesia is most often contraindicated due to the sudden hemodynamic changes it induces, while general anesthesia with appropriate hemodynamic monitoring remains the technique of choice.

We performed general anesthesia in 53.1% of cases and spinal anesthesia in 46.9%. No invasive monitoring was performed. The available monitoring parameters were: ECG with ST segment monitoring, SPO2, non-invasive blood pressure monitoring, urine output, and temperature. 31.3% of our patients experienced cardiogenic shock during the cesarean section and 9.4% suffered cardiac arrest.

Maternal Mortality and Risk Factors:

We recorded seven maternal deaths, representing 21.9% of the population. These figures are significantly higher than those reported in the literature for developed countries. Maternal deaths due to heart disease vary greatly depending on the region of the world. The causes of death also vary. Secondary maternal mortality due to mitral stenosis during pregnancy ranges from 0 to 3% in Western countries and is higher in low-income countries [17–19]. This mortality rate can reach 30 to 50% depending on the series in cases of pulmonary arterial hypertension [2].

In countries with limited resources, rheumatic valve disease, which is sometimes not treated surgically, is predominant. Only 25% of our patients had undergone surgical correction of their heart disease. This delay in treatment is responsible for impaired cardiac function and the onset and progressive worsening of pulmonary arterial hypertension [3]. Preoperative cardiac status is an independent factor for mortality in all series [2-5]. In addition to delays in treatment, sociocultural realities and the precariousness of populations play a major role in the prognosis of these young women in labor living with heart disease. In fact, less than half of our women in labor had adequate prenatal and cardiology follow-up, and only 18% of women in labor receiving curative anticoagulation therapy were properly monitored.

CONCLUSION

Heart disease during pregnancy is still associated with high morbidity and mortality in low-income countries. Rheumatic valve disease is the leading cause of heart disease. There is a delay in surgical treatment, which is responsible for the frequent occurrence of severe pulmonary hypertension. Educating the population about cardiovascular diseases, treatments during pregnancy such as anticoagulants, and adherence to monitoring and prenatal consultation programs should help minimize maternal and fetal risk.

Conflicts of Interest: The authors report no conflicts of interest in relation to this work.

Ethical Considerations:

Authorization from the local ethics committee was obtained to carry out this work. While respecting data confidentiality, authorization was obtained from the parturient to use their data in this manuscript.

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