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Management and outcomes of pregnant women with cardiovascular diseases in a cardio-obstetric team



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ABSTRACT

Background: Cardiovascular diseases (CVDs) are currently the leading cause of maternal death in Western countries. Although multidisciplinary cardio-obstetric teams are recommended to improve the management of pregnant women with CVD, data supporting this approach are scarce.

Aims: To describe the characteristics and outcomes of pregnant patients with CVD managed within the cardio-obstetric programme of a tertiary centre.

Methods: We included every pregnant patient with history of CVD managed by our cardio-obstetric team between June 2017 and December 2019, and collected all major cardiovascular events (death, heart failure, acute coronary syndromes, stroke, endocarditis and aortic dissection) that occurred during pregnancy, peripartum and the following year.

Results: We included 209 consecutive pregnancies in 202 patients. CVDs were predominantly valvular heart diseases (37.8%), rhythm disorders (26.8%), and adult congenital heart diseases (22.5%). Altogether, 47.4% were classified modified World Health Organization (mWHO) > II, 66.5% had CARDiac disease in PREGnancy score (CARPREG II) ≥ 2 and 80 pregnancies (38.3%) were delivered by caesarean section. Major cardiovascular events occurred in 16 pregnancies (7.7%, 95% confidence interval [CI] 4.5–12.2) during pregnancy and in three others (1.5%, 95% CI 0.3–4.1) during 1-year follow-up. Most events (63.1%) occurred in the 16.3% of patients with unknown CVD before pregnancy.

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Conclusions: The management of pregnant patients with CVD within a cardio-obstetric team seems encouraging as we found a relatively low rate of cardiovascular events compared to the high-risk profile of our population. However, most of the remaining events occurred in patients without cardiac monitoring before pregnancy.

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1. Abbreviations

CAD	coronary artery disease
CARPREG	Cardiac Disease in Pregnancy Study
CHD	congenital heart disease
CI	confidence interval
CVD	cardiovascular disease
HF	heart failure
IQR	interquartile range
mWHO	modified World Health Organization
ROPAC	Registry Of Pregnancy And Cardiac disease
VHD	valvular heart diseases

2. Background

Cardiovascular deaths related to pregnancy have increased in developed countries and are now the leading cause of maternal deaths [1–4]. They currently account for more than one third of all deaths during pregnancy and the postpartum period [5,6], surpassing both haemorrhagic and embolic events.

Cardiovascular disease (CVD) affects up to 4% of pregnancies, and is associated with maternal and foetal cardiovascular complications in 16% of such patients [7,8]. The rise in CVD in pregnant women can be explained in part by medical and surgical advances in the management of congenital heart disease (CHD), with an increasing number of patients reaching childbearing age, and also by the higher prevalence of women entering pregnancy at an older age and with preexisting cardiovascular risk factors [1,5,6,9].

Reducing cardiovascular morbidity and mortality in pregnant women with known CVD is therefore a public health issue, as approximately 50% of these events are considered preventable [10]. This has motivated the American College of Cardiology and the European Society of Cardiology to recommend a team-based approach for the specific management of these high-risk patients in specialized centres. The cardio-obstetrics model of care involves collaboration between clinicians from multiple specialties focused on pregnant patients and encompasses management of women before, during, and after pregnancy [1,11–15]. Nevertheless, it should be acknowledged that few studies have addressed the subject, and evidence is needed to report maternal outcomes associated with cardio-obstetrics programmes, and validate the usefulness of this approach.

In line with the growing recognition of a multidisciplinary, team-based approach to pregnancy, we organized a network between all the maternity hospitals in the Hauts-de-France region (France) in 2017. Our objective was to describe clinical characteristics and maternal and foetal outcomes of a cohort of pregnant patients with CVD managed within the cardio-obstetric multidisciplinary programme of our tertiary centre.

3. Methods

3.1. Study population

We included consecutive pregnant patients with CVD referred to the cardio-obstetric team network, set up at Lille University Hospital in collaboration with all maternity hospitals in the Hauts-de-France region. Data from each pregnancy were collected consecutively from June 2017 to November 2019.

3.2. Patient care by the cardio-obstetric team

All patients with previously known, newly diagnosed or at risk of CVD were systematically referred to the Lille University maternity hospital for evaluation, risk stratification and adaptation of teratogenic treatments, either before or during pregnancy. Their management was decided by a multidisciplinary team, including obstetricians, cardiologists with expertise in cardio-obstetrics, obstetric anaesthesiologists, surgeons, paediatricians, geneticists, pharmacists, neonatologists, and other care-team members, so that patients received care adapted to the severity of their underlying pathology. All patients had at least one complete evaluation by a cardiologist in the network (clinical examination, electrocardiogram, echocardiography, N-terminal pro B-type natriuretic peptide assay and search for martial deficiency) during pregnancy. They were then followed by close quarterly or monthly monitoring for intermediate- or high-risk patients, respectively, and also during the postpartum period. Obstetric and foetal surveillance were adapted to the severity of the maternal pathology, and to any foetotoxic treatment taken. Moderate- and high-risk patients were discussed during monthly multidisciplinary consultation meetings of the entire team to organize close monitoring, plan labour and delivery and anticipate any complications. Low-risk patients could give birth in their local maternity hospital, while the most at-risk patients gave birth in our centre. Contraception and long-term follow-up were addressed before discharge. Preconception counselling was widely encouraged within the network.

3.3. Data collection

We prospectively collected maternal cardiovascular risk factors, obstetrical and cardiovascular histories, and symptoms and treatment, as well as results of electrocardiograms and echocardiograms. We used the previously published Cardiac Disease in Pregnancy Study (CARPREG) II score and modified World Health Organization (mWHO) classification to stratify the maternal risk of pregnancy [8,16].

CVDs were classified as valvular heart diseases (VHD), rhythm disorders, cardiomyopathies and heart failure (HF), adult CHD, aortic diseases, coronary artery diseases, thromboembolic diseases and other. Patients could be classified into several categories.

Delivery data were collected via the operation report and the discharge letter from the maternity ward. We noted the term and type of delivery, the mode of anaesthesia and all childbirth adverse events such as postpartum haemorrhage, preeclampsia,

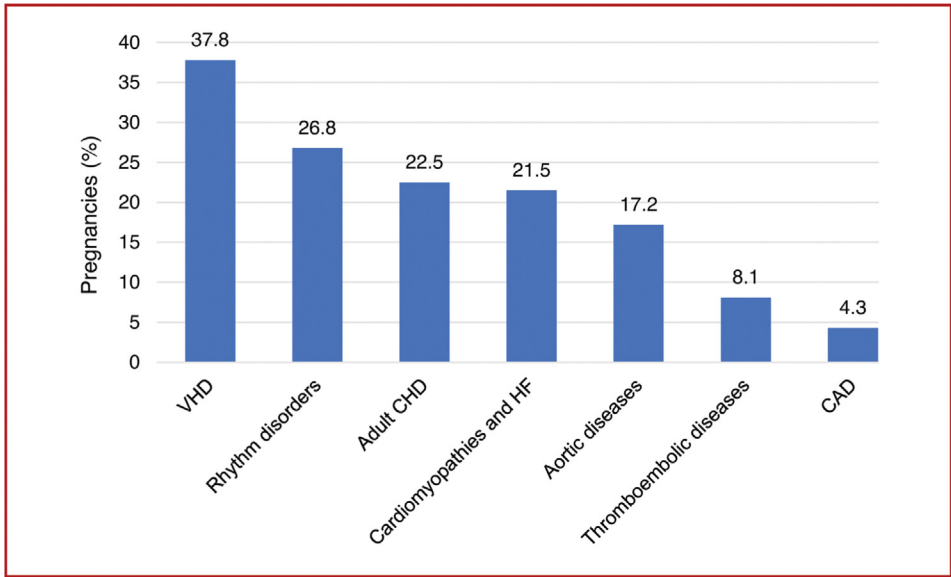


Fig. 1. Types of CVD in the study population (*n* = 209 pregnancies). CAD: coronary artery disease; CHD: congenital heart disease; CVD: cardiovascular disease; HF: heart failure; VHD: valvular heart disease.

foetal growth restriction or in utero foetal death, as well as the need for hospitalisation in an intensive care unit.

We retrospectively collected major cardiovascular events (death, HF, stroke, acute coronary syndrome, aortic dissection and infective endocarditis) during pregnancy until 1 month after child-birth, and within 1 month to 1 year after delivery.

3.4. Statistical analysis

Continuous variables were tested for normality with the Shapiro test. All continuous variables had non-Gaussian distribution and are reported as median (interquartile range [IQR]). Categorical variables are expressed as numbers and percentages. Events are reported as numbers and percentage along with 95% confidence intervals (CIs). Statistics were conducted using MedCalc v16.4 (Ostend, Belgium).

4. Results

4.1. Baseline characteristics

We analysed data from 209 consecutive pregnancies in 202 patients. The median (IQR) age was 30.9 (27.0–35.2) years (Table 1). Of note, 81 pregnancies (38.8%) were first pregnancies, seven (3.3%) were twins and 20 (9.6%) underwent medically assisted procreation.

Overall, these pregnancies were associated with few cardiovascular risk factors: 15 (7.2%) had chronic hypertension and five (2.4%) were diabetic before pregnancy. Median body mass index before pregnancy was 24.2 kg/m² and 95 (45.5%) had a body mass index > 25 kg/m², with four (1.9%) > 40 kg/m².

Regarding obstetrical history, four pregnancies were associated with a history of pregnancy-induced hypertension (1.9%), 28 (13.4%) gestational diabetes, three (1.4%) previous preeclampsia, 36 (17.2%) had a scarred uterus.

The most common CVDs were VHD (37.8%), rhythm disorders (29.7%), adult CHD (22.5%) and cardiomyopathies and HF (21.5%) (Fig. 1). Most adult CHD were ventricular septal defect (10/47; 21.3%), Fontan circulation of equivalent (14.9%) or atrioventricular septal defect (14.9%) (Table A.1). Of the 54 pregnancies (25.8%) with a history of cardiac surgery, 30 (55.6%) had been treated for adult

Table 1
Characteristics of the pregnancies.

Characteristics	All pregnancies (n = 209)
Age (years)	30.9 (27.0–35.2)
Body mass index (kg/m ²)	24.2 (21.4–27.7)
New York Heart Association ≥ II	83 (39.7)
Hypertension	15 (7.2)
Diabetes	5 (2.4)
Smoking	24 (11.5)
Dyslipidaemia	8 (3.8)
First pregnancy	81 (38.8)
Medically assisted procreation	20 (9.6)
Twin pregnancy	7 (3.3)
Obstetrical history	
Gestivity	2 (1–3)
Parity	1 (0–2)
Scarred uterus	36 (17.2)
In utero foetal death	11 (5.3)
Gestational hypertension	4 (1.9)
Gestational diabetes	28 (13.4)
Preeclampsia	3 (1.4)
Previous cardiac surgery	54 (25.8)
Medical treatment	
Beta-blocker therapy	56 (26.8)
Antiplatelet therapy	29 (13.9)
LMWH preventive dose	24 (11.5)
LMWH curative dose	19 (9.1)
Vitamin K antagonist	8 (3.8)
Diuretics	5 (2.4)
Echocardiography	
LVEF (%)	62.5 (57–66)
< 40%	12 (5.7)
LVTDD (mm)	48 (45–51)
Left atrial volume (mL/m ²)	39 (33–48)
sPAP (mmHg)	29 (25–32)

Data are expressed as median (interquartile range) or number (%). LMWH: low molecular weight heparin; LVEF: left ventricular ejection fraction; LVTDD: left ventricular telediastolic diameter; sPAP: systolic pulmonary arterial pressure.

CHD, 31 (57.4%) for underlying VHD and three (5.6%) had received a heart transplant (Table A.2).

Anticoagulation was continued in 11.5% of pregnancies at preventive doses and 9.1% at curative doses (Table 1). Antiplatelet therapy was used in 13.9%, including 5.3% in association with anticoagulation. Therefore, 29.2% of pregnancies were conducted under antithrombotic treatment.

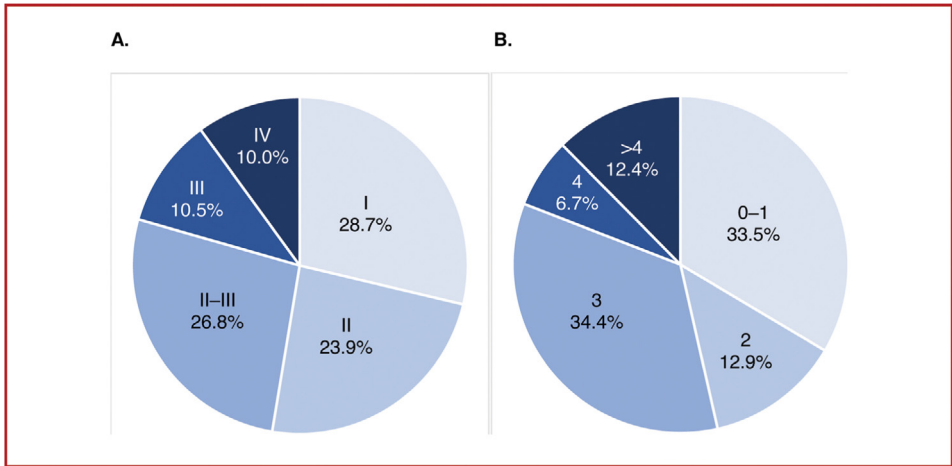


Fig. 2. Risk assessment in the study population (*n* = 209 pregnancies) according to (A) mWHO class and (B) CARPREG II score. CARPREG: Cardiac Disease in Pregnancy Study; mWHO: modified World Health Organization.

4.2. Risk assessment

Patients were at relatively high risk, with 47.4% of pregnancies being mWHO class >II, and 20.5% classified as mWHO III or IV (Fig. 2A). Most pregnancies (66.5%) had a CARPREG II score ≥ 2 (Fig. 2B). Overall, 88 pregnancies (42.1%) benefited from a preconception consultation. The underlying CVD was discovered in 16.3% during pregnancy, and in 4.3% during the third trimester or peripartum.

4.3. Pregnancy and delivery

Most pregnancies resulted in delivery at Lille University maternity hospital (80.9%). Delivery occurred at a median (IQR) term of 38.9 (36.6–39.7) weeks (Table 2). Among the 194 (92.8%) live births, six (2.9%) occurred between 28 and 32 weeks, 33 (15.8%) between 32 and 37 weeks and 155 (74.2%) after 37 weeks. There were three (1.4%) intrauterine foetal deaths and six pregnancies (2.9%) were medically terminated, five (2.4%) for maternal reasons, the other one for trisomy 21. The most common pregnancy disorders were gestational diabetes (14.8%) and foetal growth restriction (6.7%). Vaginal delivery was induced in 48 pregnancies (23.0%), for maternal cardiovascular risk indication in 18 (8.6%) (Table 2). Instrumental delivery was required in 36 (17.2%), four (1.9%) for maternal cardiovascular risk indication. There were 80 caesarean sections (38.3%), 29 (13.9%) for maternal cardiovascular risk indications (Fig A.1). The total number of pregnancies for which delivery was guided by maternal cardiovascular risk was 50 (23.9%). Sixteen pregnancies (7.7%) were associated with severe postpartum haemorrhage (> 1000 mL), including six in which the patients were on anticoagulants and/or antiplatelet agents. Epidural anaesthesia was the most common form of anaesthesia for delivery (57.4%). Only 53.6% patients were breastfeeding at the time of discharge from the maternity hospital.

4.4. Cardiovascular outcomes

During pregnancy and 1 month after childbirth, 16 patients (7.7%, 95% CI 4.5–12.2) presented with major cardiovascular events (Table 3). Two patients (1.0%, 95% CI 0.1–2.5) died, one of newly diagnosed severe pulmonary hypertension (medical termination of her pregnancy had already been decided), the second from the surgical consequences of an aortic dissection in the context of undiagnosed Marfan syndrome. A resuscitated cardiac arrest occurred in one patient (0.5%, 95% CI 0.0–2.7) in the context of long QT syn-

Table 2
Course of pregnancy and childbirth.

	All pregnancies (<i>n</i> = 209)
Birth	
Live birth	194 (92.8)
Early miscarriage (< 14 weeks)	5 (2.4)
Late miscarriage (14–22 weeks)	1 (0.5)
Intrauterine foetal demise > 22 weeks	3 (1.4)
Medical termination of pregnancy	6 (2.9)
For high-risk maternal disease	5 (2.4)
Term (weeks)	38.9 (36.6–39.7) (<i>n</i> = 194)
> 28–32 weeks	6 (2.9)
> 32–37 weeks	33 (15.8)
> 37 weeks	155 (74.2)
Other disorders of pregnancy	
Gestational diabetes	31 (14.8)
Foetal growth restriction	14 (6.7)
Gestational hypertension	8 (3.8)
Preeclampsia	7 (3.3)
HELLP syndrome	2 (1.0)
Delivery	
Vaginal	129 (61.7)
Induced	48 (23.0)
Guided by cardiovascular maternal risk	18 (8.6)
Forceps/vacuum	36 (17.2)
Guided by cardiovascular maternal risk	4 (1.9)
Caesarean section	80 (38.3)
Guided by cardiovascular maternal risk	29 (13.9)
Deliveries guided by cardiovascular maternal risk	50 (23.9)
Severe postpartum haemorrhage	16 (7.7)
Anaesthesia	
Epidural	120 (57.4)
General	25 (12.0)
Combined epi-spinal	22 (10.5)
Spinal	16 (7.7)
Breastfeeding	112 (53.6)

Data are expressed as number (%) or median (interquartile range). HELLP: haemolysis elevated liver enzymes low platelet.

drome and severe hypokalaemia. We collected 11 episodes of acute HF (5.3%, 95% CI 2.7–9.3), one stroke (0.5%, 95% CI 0.0–2.7), and one acute coronary syndrome (0.5%, 95% CI 0.0–2.7). No endocarditis occurred. One-year follow-up data were obtained for 206 pregnancies (98.6%) (Table 4). We identified five (2.4%, 95% CI 0.8–5.5) major cardiovascular events and one (0.5%, 95% CI 0.0–2.7) death following scheduled Ross surgery for symptomatic severe aortic stenosis 7 months after delivery. Four pregnancies (1.9%, 95% CI 0.5–4.8) were associated with HF: one due to acute heart transplant rejection, one with known, rapidly progressive laminopathy, and two in patients

Table 3
Major cardiovascular events during pregnancy and childbirth.

	All pregnancies (n = 209)	95% CI
Hospitalisation in ICU	27 (12.9)	8.7–18.2
Major cardiovascular event	16 (7.7)	4.5–12.2
CVD unknown before pregnancy	11 (5.3)	2.7–9.3
mWHO I	1 (0.5)	0.0–2.7
mWHO II	1 (0.5)	0.0–2.7
mWHO II–III	1 (0.5)	0.0–2.7
mWHO III	6 (2.9)	1.1–6.2
mWHO IV	7 (3.3)	1.3–6.7
Death	2 (1.0)	0.1–2.5
Resuscitated cardiac arrest	1 (0.5)	0.0–2.7
HF	11 (5.3)	2.7–9.3
Stroke	1 (0.5)	0.0–2.7
Acute coronary syndrome	1 (0.5)	0.0–2.7

Data are expressed as n (%) and 95% CI. CI: confidence interval; CVD: cardiovascular disease; HF: heart failure; ICU: intensive care unit; mWHO: modified World Health Organization.

Table 4
Major cardiovascular events during 1 year postpartum.

	Pregnancies with 1-year follow-up (n = 206)	95% CI
Emergency admission	3 (1.5)	0.3–4.1
Major cardiovascular event	5 (2.4)	0.8–5.5
CVD unknown before pregnancy	2 (1.0)	0.1–2.5
mWHO I	0 (0.0)	0.0–1.8
mWHO II	0 (0.0)	0.0–1.8
mWHO II–III	2 (1.0)	0.1–2.5
mWHO III	0 (0.0)	0.0–1.8
mWHO IV	3 (1.5)	0.3–4.1
Death	1 (0.5)	0.0–2.7
Resuscitated cardiac arrest	0 (0.0)	0.0–1.8
HF	4 (1.9)	0.5–4.8
Stroke	0 (0.0)	0.0–1.8
Acute coronary syndrome	0 (0.0)	0.0–1.8

Data are expressed as n (%) and 95% CI. CI: confidence interval; CVD: cardiovascular disease; HF: heart failure; ICU: intensive care unit; mWHO: modified World Health Organization.

who had already presented with severe HF during pregnancy (one was readmitted for heart transplantation, the other for setting up a HeartMate III because of a stroke). No endocarditis or dissection occurred.

A total of 19 pregnancies (9.1%, 95% CI 5.6–13.8) were associated with 21 major cardiovascular events during pregnancy, peripartum, and/or 1-year follow-up (Table A.3). The rate of major cardiovascular events during pregnancy and/or 1-year follow-up was thus 38.1% for mWHO IV, 27.3% for mWHO III, 5.4% for mWHO II–III, 2.0% for mWHO II, and 1.7% for mWHO I (Fig A.2). Of note, 12 patients of the 19 who presented with major cardiovascular events (63.2%) had unrecognised CVD prior to pregnancy. Thirteen patients (6.2%, 95% CI 3.3–10.4) underwent cardiac surgery peripartum and in the year following delivery, including three emergencies (acute aortic dissection, HeartMate III, and heart transplant).

We also collected nine minor cardiovascular events, namely a programmed flutter cardioversion, an electrophysiological exploration for Steinert disease, five planned automatic implantable cardioverter defibrillator implantations, and two scheduled coronary stenting procedures after positive stress echocardiography for exertional chest pain.

5. Discussion

This is the first description of clinical characteristics and outcomes of a cohort of pregnant patients with CVD managed by a structured cardio-obstetric team in Europe. The value of comprehensive multidisciplinary maternal care throughout the

preconception and peripartum periods has recently been emphasized, to improve maternal prognosis [5,6,12]. We therefore collected data from 209 consecutive pregnancies in patients with CVD referred to our network during 2017–2019, described their obstetrical and anaesthetic management during delivery, their peripartum, and their 1-year follow-up. Our population was at high theoretical risk, but only 7.7% of pregnancies were associated with major cardiovascular events during pregnancy and childbirth, and 2.4% during 1-year follow-up. Importantly, 63.1% of these events occurred in the 16.2% of patients with unknown or unmonitored CVD before their pregnancy.

5.1. Cardio-obstetric team

In a historical series on CVD and pregnancy, van Hagen et al. [16] found a 20.6% rate of cardiovascular events (during pregnancy and the week following delivery) whereas we found 7.7% during pregnancy and in the month following delivery in our population. However, these results must be viewed with caution because van Hagen et al. included data from emerging and advanced countries, and the rate of cardiac events was higher in the former [16]. In the CARPREG II study, a cohort study conducted in two Canadian centres, 1938 pregnancies of women with CVD were analysed, but there was no systematic follow-up by a specialized cardio-obstetric team [8]. Adult CHD was the most represented CVD (63.7%), 53.3% of pregnancies were classified as mWHO > II and 14.9% were classified as mWHO III or IV [8]. The rate of cardiovascular events during pregnancy and 6 months postpartum was 15.8% in that study [8], whereas we only observed 9.1% events during pregnancy and the 1-year follow-up. In 2020, Magun et al. [17] published a retrospective follow-up of a single-centre US cohort of pregnant patients with CVD managed by their cardio-obstetric team between 2010 and 2019. They described data from 306 pregnancies referred to their centre, over a longer period of 9 years [17]. In their study, the most represented CVDs were arrhythmia (28.8%), cardiomyopathy (23.5%), adult CHD (23.5%), and VHD (16.3%) [17]. In line with our results, their population had a high pregnancy risk profile and experienced a relatively low rate of cardiovascular events, where 30-day and 30–90-day readmissions were 2.0% and 4.6%, respectively [17]. We observed 2.4% of pregnancies were associated with severe cardiovascular events in the year following pregnancy. Although our population may be different from historical cohorts, we observed a lower rate of events than predicted. We also confirmed the encouraging results observed by Magun et al. in a European cohort [17]. A recent retrospective study also showed that the prognosis of patients with pulmonary hypertension secondary to CHD is better when managed by a multidisciplinary team and strict antenatal supervision [18].

5.2. Obstetrical and childbirth events

The median term at delivery of our population was 38.9 weeks, so the majority of pregnancies were carried to term, with a rate of very preterm newborns of 2.9%. We recorded 1.9% of intrauterine foetal death or late miscarriage, compared with 3.0% of the pregnancies recorded at our maternity unit for the year 2019, while the presence of maternal CVD usually increases these risks [19,20].

Vaginal delivery was the main mode of delivery, but the rate of caesarean section was high, at 38.3%, including 13.9% for maternal indications. Even so, it was lower than the 46.7% rate of caesareans performed in the Registry Of Pregnancy And Cardiac disease (ROPAC) that included pregnant women with CVD [21], or the 49.8% of caesarean in another cardio-obstetric programme [17]. In comparison, the total rate of caesareans in France and in the general population at Lille University Hospital is 20% [20]. Hayward et al. found that women with CHD were more likely to undergo caesarean

delivery (39.3%) than women without CHD (32.0%; $P < 0.001$) in a Californian Healthcare Database [22]. The higher caesarean rates among women with CVD can be explained by the high-risk profile of these patients and the high percentage of patients on antithrombotic treatment. Nevertheless, there is no evidence of a clear benefit for caesareans apart from obstetric reasons and a few specific cardiological indications (anticoagulation, aortic diseases, acute HF and severe pulmonary hypertension) [11].

Our European population developed pregnancy-induced hypertension in 3.8% of pregnancies and preeclampsia in 3.3%, while Magun et al. found 9.5% and 12.1%, respectively [17]. These differences are probably mainly explained by the higher standard cardiovascular risk profile of the US population, as the link between obesity and preeclampsia is well established [23]. Of note, preeclampsia affects 2–8% of pregnancies in the general population [23].

We also observed a high rate (7.7%) of severe postpartum haemorrhage. In the general population, its prevalence is around 2.4% in our centre and 1.8% worldwide [24]. This difference is probably due to the high rate of women taking anticoagulants (24.4%) and antiplatelet therapy (13.9%) due to their CVD.

5.3. Still room for improvement

Although our results seem to confirm the importance of the cardio-obstetric multidisciplinary team in the management of pregnant women with CVD, some problems remain to be solved. Namely, all the deceased patients were in class mWHO IV, with a theoretical contraindication to pregnancy. None of them could benefit from preconception consultation, as they had no previous knowledge of their CVD. In the same way, the majority of major cardiovascular events (63.1%) occurred among the 16.3% of patients whose CVD was discovered or revealed during their pregnancy. Pre-pregnancy counselling and close monitoring throughout gestation is needed for optimal outcomes. Given that the patients with known CVD could be advised and treated appropriately within the network, it is not surprising that the majority of the remaining events occurred in patients out of the medical loop. Moreover, the management of these unattended patients is often much more complex, as they are referred late in their pregnancy, and in a more severe state.

Indeed, it has been estimated that 49–68% of pregnancy-related deaths caused by cardiovascular and coronary conditions are preventable [10]. A lack of awareness about pregnancy-related heart

risks – among women and many physicians – likely contributes to missed opportunities to save women's lives [25]. Thus, the creation of structured cardio-obstetric teams within tertiary centres seems essential, but cannot be dissociated from the training and collaboration of all front-line practitioners and from campaigns to educate future mothers about the warning signs. In fact, obstetricians have always played a large role in screening and promoting risk identification and reduction of CVD in women [26]. The American College of Obstetrics and Gynecologists Practice Bulletin 212 recommends that all pregnant and postpartum women be screened using the California Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum toolkit algorithm [27]. Similarly, there is a real need to educate women of reproductive age about the signs and history that warrant referral to a cardio-obstetric network before pregnancy [12–14,25,28].

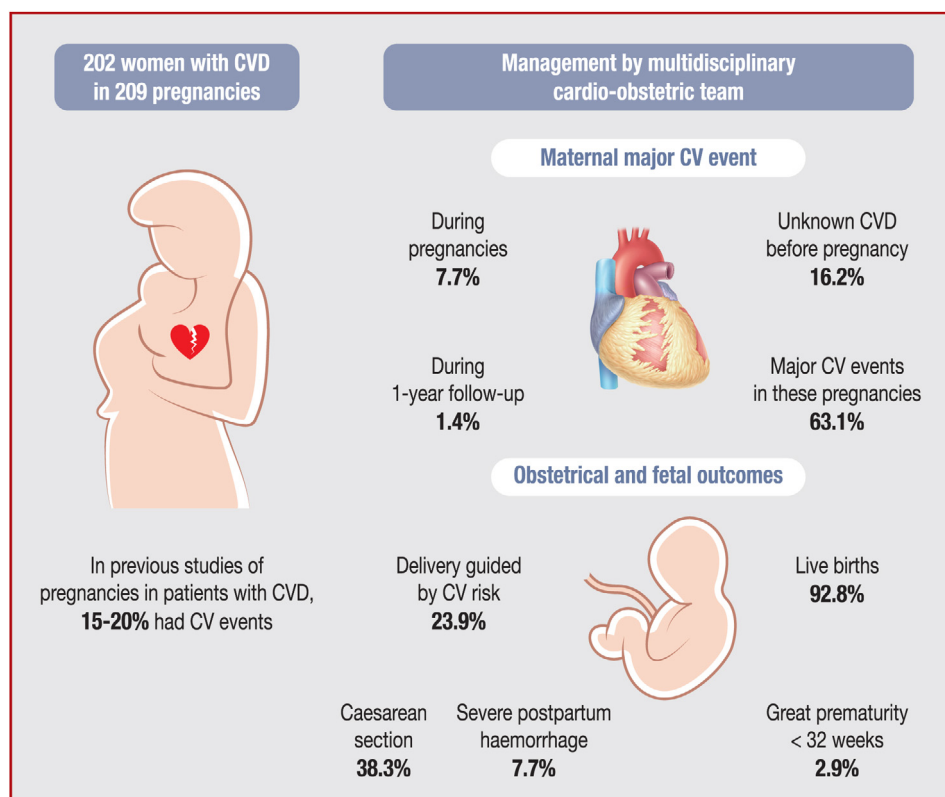
5.4. Study limitations

This work is an observational single-centre cohort study and cannot show the degree of benefit achieved by the implementation of a cardio-obstetric team as there is no comparison with a standard of care. Moreover, the low number of events does not allow us to perform subgroup analyses, but our low event rate is nevertheless encouraging. The definitions of cardiovascular and major cardiovascular events are different in the various studies, which may limit comparisons, as may the different follow-up times. Standardization of data collection to facilitate the comparison of outcomes from different programmes should be encouraged [28].

Our study was not designed to evaluate the very long-term impact of this approach on the maternal condition. Indeed, some studies suggest that pregnancy-related deterioration in functional status may be permanent [29]. Further prospective multicentre studies are therefore essential to provide solid scientific evidence of the prognostic value of cardio-obstetric networks.

6. Conclusions

Our study results show that the management of pregnant patients with CVD by a specialized multidisciplinary cardio-obstetric team may be associated with a relatively low rate of serious cardiovascular events considering the high spontaneous risk of this population. Although this finding is encouraging, most of the events occurred in patients with unknown CVD before pregnancy (Central Illustration).



Central Illustration. Management and outcomes of pregnant women with cardiovascular diseases cared for by a cardio-obstetric team. CV: cardiovascular; CVD: cardiovascular disease.

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None.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.acvd.2024.02.009>.

Disclosure of interest

The authors declare that they have no competing interest.

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