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CLINICAL RESEARCH

Pregnancy in women with heart disease in sub-Saharan Africa

La grossesse des femmes atteintes de cardiopathie en Afrique subsaharienne

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Received 27 October 2010; received in revised form 7 March 2011; accepted 7 April 2011
Available online 14 June 2011

KEYWORDS

Pregnancy;
Rheumatic heart
disease;
Africa

Summary

Background. — Although previous studies showed that pregnancy with heart disease is associated with significant complications, few focused on patients with valvular heart disease in sub-Saharan Africa.

Methods. — We report maternal and foetal outcomes in 50 pregnant women with heart disease admitted to the Department of Cardiology of the University of Dakar, during an 8-year period.

Results. — Rheumatic heart disease was observed in 46 women, seven of whom had previously been operated on. Among the remaining 39, 32 had mitral stenosis (isolated or associated with other valvular lesions). At admission, 36 women presented with pulmonary oedema, two with pulmonary embolism and 18 with arrhythmia. There were 17 maternal deaths (34%). Maternal death was associated with: mitral stenosis ($P=0.03$); severe tricuspid regurgitation ($P=0.001$); New York Heart Association functional class III or IV ($P=0.001$); symptoms of heart failure ($P<0.001$). A favourable maternal outcome was associated with: prior cardiac events ($P<0.001$); prior surgical valve replacement ($P=0.03$); cardiac prosthetic valve ($P=0.03$). There were 30 live births, six foetal deaths and five therapeutic abortions; nine women were lost to follow-up. Delivery was vaginal in 19 out of 30 cases and by caesarean section in 11 cases. Median gestational age at delivery was 28 weeks (range, 8–38 weeks). Five births occurred preterm. There were four stillbirths (neonatal mortality, 7.6%).

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MOTS CLÉS

Grossesse ;
Cardiopathie
rhumatismale ;
Afrique

Conclusions. — Heart disease severely impacts maternal and foetal outcome in our study. Pregnant women who underwent appropriate valve replacement before pregnancy had a better prognosis.

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Résumé

Contexte. — Les études antérieures ont montré que la grossesse est associée chez les femmes atteintes de cardiopathie à un risque de complications cardiaques maternelles, fœtales et néonatales. Peu d'entre elles ont cependant porté sur les complications gravidiques des cardiopathies rhumatismales en Afrique subsaharienne.

Méthodes. — Nous rapportons l'évolution maternelle et fœtale des grossesses de 50 femmes atteintes de cardiopathies (âge moyen 28,4 ans ; 18–43 ans) admises dans le service de cardiologie de l'université de Dakar, au cours d'une période de huit ans.

Résultats. — Une cardiopathie rhumatismale est observée chez 46 femmes, dont sept ont été opérées auparavant. Une sténose mitrale, isolée ou associée à une autre atteinte valvulaire, est présente chez 32 des 39 autres femmes. À l'admission, 36 femmes ont un œdème pulmonaire, deux une embolie pulmonaire, 18 une arythmie, Onze sont asymptomatiques. Un décès maternel survient dans 17 cas (34%), lié à une insuffisance cardiaque ($n=8$), à une embolie pulmonaire ($n=3$), un choc cardiogénique ($n=2$) ou septique ($n=1$), une hémorragie ($n=2$). Les facteurs associés à la mortalité maternelle sont la sténose mitrale ($p=0,03$), l'insuffisance tricuspide sévère ($p=0,001$), une classe fonctionnelle NYHA III ou IV ($p=0,001$), des symptômes d'insuffisance cardiaque ($p<0,001$). À l'inverse, les facteurs associés au pronostic maternel favorable sont les antécédents d'événements cardiaques préalables ($p<0,001$), de remplacement valvulaire ($p=0,03$) et la présence d'une prothèse valvulaire ($p=0,03$). Les 50 grossesses se terminent par la naissance de 30 nouveau-nés vivants, six morts fœtales et cinq avortements thérapeutiques. Neuf femmes sont perdues de vue. L'accouchement a lieu par voie naturelle dans 19 cas sur 30 (avec forceps dans trois cas) et par césarienne dans 11 cas. La médiane d'âge gestationnel à l'accouchement est de 28 semaines (8–38 semaines), avec cinq accouchements prématurés et quatre mort-nés. La mortalité néonatale est de 7,6%. La médiane de poids à la naissance des 26 nouveau-nés survivants est de 2366 g (1350–3100 g).

Conclusion. — La présence d'une cardiopathie impacte sévèrement le pronostic maternel et fœtal de la grossesse en Afrique subsaharienne, lorsqu'une prise en charge appropriée comprenant traitement médical et correction chirurgicale préalable, prévention, planning familial, disponibilité d'une salle de cathétérisme permettant la valvuloplastie percutanée, n'est pas accessible. À l'inverse, les femmes qui ont bénéficié d'un remplacement valvulaire dans leurs antécédents ont un meilleur pronostic gravidique.

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Abbreviations

NYHA New York Heart Association
VHD valvular heart disease

Background

Circulatory changes during pregnancy may result in adverse maternal and foetal outcomes in women with heart disease. Circulating blood volume, cardiac output and heart rate increase progressively after the first trimester, and worsen during the uterine contractions of labour and subsequent delivery [1].

Previous studies performed in Western countries have shown that pregnancy in women with heart disease is associated with significant cardiac and neonatal complications, despite state-of-the-art obstetric and cardiac care [2–6].

Risk factors associated with an unfavourable outcome have been recognized, and include older age, tobacco smoking, multiple gestations, anticoagulant therapy, poor functional class, cyanosis and left heart obstruction [2–6]. However, only a few reports have focused specifically on pregnancy outcome in women with valvular heart disease (VHD) [7–9], especially in lower-income countries [10].

Sub-Saharan Africa is characterized by a high prevalence of rheumatic fever and rheumatic VHD. Prevalence of rheumatic heart disease has been estimated at two to three cases per 1000 among school-age children in Africa who underwent clinical screening [11,12] and was recently reported to be about 10-fold higher if they also had an ultrasound examination [12,13]. The spectrum of the disease in sub-Saharan Africa also includes severe valvular disease in patients who have previously been operated on, in some of those receiving anticoagulant therapy, and in many others who have declined surgery, mainly because of financial constraints. In many instances, lack of financial

support, lack of information about the risks of pregnancy in women with heart disease, and social and cultural drawbacks preclude any appropriate prevention strategy. As a result, management of pregnancy in such patients remains a medical challenge in most low-income African countries.

In this study, we report maternal and foetal outcomes in 50 pregnant women with heart disease admitted to the Department of Cardiology of the University of Dakar, Senegal.

Methods

The study was a retrospective evaluation of pregnancy outcome in women with heart disease. All cases were followed during pregnancy, labour and delivery at the University Hospital of Dakar, Senegal, between February 1996 and February 2004. Exclusion criteria included: therapeutic abortion for non-cardiac reasons; miscarriage (foetal loss before 20 weeks' gestation); hypertensive heart disease; and peripartum cardiomyopathy.

Clinical data were recorded at the first prenatal visit, including: age; occupational, educational and marital status; gestational age; parity status; cardiac conditions, prior cardiac events and therapy; NYHA functional class; cyanosis; comorbid conditions; and anaemia.

Treatment and outcome data were obtained during hospitalization. Prepartum, peripartum and postpartum complications were grouped into cardiac, neonatal or obstetric events. The mode of delivery and obstetric complications were documented.

Data were analysed to evaluate maternal and foetal outcomes. Criteria to evaluate maternal outcome included: dyspnoea; NYHA functional class; congestive heart failure; and new onset or exacerbated arrhythmia. Neonatal complications were defined as: premature birth (< 37 weeks' gestation); small-for-gestational-age birth weight (< 10th percentile for gestational age); neonatal and respiratory distress syndrome using the Apgar score; foetal death (> 20 weeks' gestation before death); and neonatal death (occurring between birth and age 28 days).

Statistical analysis

Continuous values are presented as means (standard deviations) and were compared using a non-paired *t* test. Comparisons of baseline characteristics and maternal outcome were made using the Chi² test. Statistical significance was accepted at the 95% confidence level ($P < 0.05$).

Results

During the 8-year study (February 1996 to February 2004), 50 pregnant women with heart disease were included, accounting for 2.7% of patients hospitalized in the Department of Cardiology during the same period. The mean age of the women was 28.4 years (range: 18–43 years). Forty-five women (90%) had low educational status (no school or primary school only) and low socioeconomic status (income less than 2.5 \$ per day); only three women (6%) were engaged in any professional occupation.

Table 1 Rheumatic heart disease of native valves in 39 pregnant women.

	Valvular disease observed	<i>n</i> (%)
Single cardiac valve involvement (<i>n</i> = 12; 30.7%)	MS	7 (18)
	MR + MS	3 (7.7)
	MR	1 (2.5)
	AR	1 (2.5)
Multiple cardiac valve involvement (<i>n</i> = 27; 69.3%)	MS + TR	9 (23)
	MS + MR + TR	6 (15)
	MR + TR	3 (7.7)
	MS + MR + AR + TR	3 (7.7)
	AR + MR	2 (5)
	MS + AR	1 (2.5)
	MS + AR + TR	1 (2.5)
	MS + AS + AR	1 (2.5)
	MR + AR + TR	1 (2.5)

AR: aortic regurgitation; AS: aortic stenosis; MR: mitral regurgitation; MS: mitral stenosis; TR: tricuspid regurgitation.

Previous heart disease was known before pregnancy in 37 women (74%), with a mean follow-up of 6.5 years (range: 4 months to 30 years).

Rheumatic VHD was the predominant cardiac condition, observed in 46 women (92%), of whom seven (16%) had previously been surgically treated with prosthetic mechanical valve replacement. Among the remaining 39 women with non-surgically-corrected VHD, 32 had mitral stenosis (76%), including seven isolated forms of mitral stenosis, three associated with mitral regurgitation and 22 associated with any other valvular lesions (Table 1).

The remaining heart diseases were congenital in three patients (tetralogy of Fallot, *n* = 1; ventricular septal defect, *n* = 1; pulmonary stenosis, *n* = 1) and one patient had ischaemic heart disease. A history of congestive heart failure was documented in 14 women (28%). In addition, one woman (2%) had had a previous stroke.

Maternal outcome

At admission, 36 women (72%) presented with pulmonary oedema, two (4%) with pulmonary embolism, and only 11 (22%) were asymptomatic. Cardiac arrhythmia was observed in 18 women (36%), including nine patients with atrial fibrillation, four with atrial flutter and one with atrial tachycardia. Ventricular premature beats were observed in 11 patients (22%). No patient presented with ventricular tachycardia.

All women required cardiovascular medication, including diuretics (*n* = 23; 46%), nitrates (*n* = 22; 44%), digoxin (*n* = 8; 16%) and beta-blockers (*n* = 1; 2%). Anticoagulants were administered to 30 patients (60%). An electrical cardioversion, performed in three patients, restored sinus rhythm in all three cases. No surgical or percutaneous intervention was performed.

Seventeen maternal deaths (34%) occurred, including six during the second trimester and 11 in the postpartum period.

Table 2 Predictors of adverse outcome (maternal death) in 46 pregnant women with rheumatic valvular disease.

	Adverse outcome (<i>n</i> = 17)	Favourable outcome (<i>n</i> = 29)	<i>P</i>
Age (years) ^a	29.1 (4.7)	28.8 (4.9)	0.79
Parity, <i>n</i> (%) ^a	2.52 (2.1)	1.7 (1.8)	0.26
Prior adverse cardiac events ^b	3 (17.6)	22 (75.8)	< 0.001
Prior valvular intervention ^b	0 (0)	7 (24.1)	0.03
Prosthetic valve ^b	0 (0)	7 (24.1)	0.03
Mitral stenosis ^b	15 (88.2)	17 (58.6)	0.03
Mitral regurgitation ^b	7 (41.1)	13 (44.8)	0.9
Aortic regurgitation ^b	3 (17.6)	11 (37.9)	0.15
Severe tricuspid regurgitation ^b	14 (82.3)	10 (34.4)	0.001
NYHA functional class III or IV ^b	16 (94.1)	14 (48.2)	0.001
Atrial fibrillation ^b	8 (47.0)	8 (27.5)	0.15
Heart failure ^b	17 (100)	7 (24.1)	< 0.001
Anticoagulant therapy ^b	12 (70.5)	18 (62.0)	0.6

NYHA: New York Heart Association.

^a Data are mean (standard deviation).

^b Data are number (%).

The causes of maternal deaths were: heart failure (*n* = 8; 47%), pulmonary embolism (*n* = 3; 17%), cardiogenic shock (*n* = 2; 12%), septic shock (*n* = 2; 12%) and fatal haemorrhage (*n* = 2; 12%), including one intracranial bleed due to an arteriovenous malformation rupture and one haemothorax following pleural puncture.

Characteristics predictive of an adverse cardiac outcome during pregnancy were assessed in women with rheumatic heart disease only, to avoid heterogeneity (Table 2). Maternal death (*n* = 17) occurred in women with mitral stenosis predominantly (15/17). In univariate analysis, maternal death was associated with mitral stenosis (*P* = 0.03), severe tricuspid regurgitation (*P* = 0.001), NYHA functional class III or IV (*P* = 0.001) or symptoms of heart failure (*P* < 0.001). Conversely, a favourable maternal outcome was associated with prior cardiac events (*P* < 0.001), prior surgical valve replacement (*P* = 0.03) or a cardiac prosthetic valve (*P* = 0.03).

Obstetric and foetal outcomes

Among the 50 pregnant women included, mean parity was 2 (range: 0–8). The 50 pregnancies resulted in 30 live births (60%), six foetal deaths and five therapeutic abortions during the second trimester. Nine women were lost to follow-up after the initial visit.

The mode of delivery was vaginal in 19 of 30 cases (63%), including forceps delivery in three cases. Caesarean sections were performed in 11 cases (37%), associated with a tubal ligation for subsequent contraceptive purpose in six cases.

Among the 30 women who gave birth, the median gestational age at delivery was 28 weeks (range: 8–38 weeks). Five births occurred preterm. There were four stillbirths, accounting for a neonatal mortality of 7.6%. The median birth weight of the 26 babies born alive was 2364 g (range: 1350–3100 g); their mean Apgar score was 7/10. Neonatal hypotrophy was present in 11 newborns (42.3%), with a mean weight of 1414 g (range: 1350–2450 g).

Discussion

Previous studies in industrialized countries have identified the increased risk associated with pregnancy in women with heart disease, depending on the underlying cardiac condition and the presence of risk factors such as older age, tobacco smoking, multiple gestations, anticoagulant therapy, poor functional class, cyanosis and left heart obstruction [2–6,8]. However, even in this setting, unfavourable maternal and foetal outcomes occur only in a small proportion of cases. Maternal death was reported in three over 599 pregnancies in women with unselected heart disease [6] and one over 64 pregnant women with VHD [8]. Severe non-fatal maternal cardiovascular events occurred in 13% of pregnant women with unselected heart disease in the study by Siu et al. [6], and in 11% of women with congenital heart disease [3]. Also, foetal or neonatal death occurred in about 3% of pregnancies in women with miscellaneous unselected heart disease [5], in 4% with congenital disease [3], in 3% with dilated cardiomyopathy [4] and in 3% with VHD [8,9].

In the present retrospective descriptive study performed in a tertiary-care university hospital in Senegal, the maternal and foetal outcomes of pregnancy in women with heart disease appear substantially worse, with maternal and neonatal mortality rates reaching 34% and 7.6%, respectively. The prominent underlying cardiac disease was rheumatic valvular disease, especially mitral stenosis, observed in most instances. However, although percutaneous balloon valvuloplasty has been reported to be effective in the treatment of mitral or aortic stenosis during pregnancy [7], this approach was unfortunately not available in our institution. Also, the patients included belonged to high-risk groups, as 28% had a history of heart failure and 54% presented with worsened heart failure symptoms, including 22% with pulmonary oedema. Arrhythmia and/or left atrial enlargement were present in two thirds of women.

Consistent with previous studies on maternal outcome in pregnant women with heart disease, the factors predictive

of maternal death in our series were mitral stenosis, severe tricuspid regurgitation, NYHA functional class III or IV, and heart failure. In contrast with previous studies, women with a history of cardiac events and those with a cardiac valve prosthesis had a better outcome. Also, anticoagulant therapy was not associated with an increased risk of death. This unexpected finding may result from the knowledge that the patients and the physicians in charge of them had about the disease. Indeed, although the baseline proportion of patients who were aware of their heart disease was 74%, it is likely that patients with previous cardiac events or surgery were more inclined to seek medical assistance for pregnancy and subsequent delivery than less-informed women or those with limited access to medical care. Also, women with moderate or neglected/denied/misinterpreted symptoms of a previously unknown/untreated mitral stenosis may have worsened during the last weeks of pregnancy and presented for admission to an obstetrical facility with severe heart failure symptoms.

Faced with these shortcomings, educational and socioeconomic status considerations should be taken into account. In our study, most women had a very low educational status and were unable to recognize the risks associated with their cardiac disease and the related risk of pregnancy. Only few received appropriate prior counselling or contraception. One should also consider the potential impact of individual discrepancies between women who were previously operated on – which requires financial support and a substantial income in Africa – and women with severe untreated rheumatic heart disease without previous cardiac adverse events, to whom disease knowledge or surgery would be denied due to financial constraints.

The lower mortality rate observed among women who had undergone previous cardiac valve replacement – and also among those who received anticoagulant therapy – contrasts with the results of previous studies that reported an increased risk in this subset of patients. In fact, in our study, the prominent risk factor for maternal death was untreated rheumatic heart disease, mainly mitral stenosis, for which valvular repair, either surgical or by percutaneous balloon valvuloplasty, was the procedure of choice to prevent clinical deterioration during the third trimester of pregnancy or during labour.

Conclusion

The present study demonstrates that rheumatic heart disease severely impacts maternal and foetal-perinatal outcome in sub-Saharan Africa, when appropriate management, including percutaneous interventions, outpatient medical therapy and prevention, is not available. Increased maternal morbidity was reflected by a high incidence of symptomatic heart failure and poorly tolerated arrhythmias. Maternal and foetal-perinatal mortality rates were higher than those observed in most other studies, including African studies in which appropriate family planning, optimized cardiac state prior to conception and cardiac percutaneous interventions were performed [9]. Accordingly, this study indicates

the need for maternal cardiac evaluation and management before conception and during pregnancy in these high-risk women. Repair of VHD, mainly mitral stenosis, should be performed prior to pregnancy, if possible. Catheterization and percutaneous balloon valvuloplasty facilities should be available in cardiology departments associated with medical universities located in high rheumatic fever prevalence areas.

Disclosure of interest

The authors have not supplied their declaration of conflict of interest.

References

- [1] Bonow RO, Carabello BA, Chatterjee K, et al. 2008 focused update incorporated into the ACC/AHA 2006 guidelines for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1998 guidelines for the management of patients with valvular heart disease). Endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *J Am Coll Cardiol* 2008;52:e1–142.
- [2] Almange C. Pregnancy and congenital heart disease. *Arch Mal Coeur Vaiss* 2002;95:1040–4.
- [3] Drenthen W, Pieper PG, Roos-Hesselink JW, et al. Outcome of pregnancy in women with congenital heart disease: a literature review. *J Am Coll Cardiol* 2007;49:2303–11.
- [4] Grewal J, Siu SC, Ross HJ, et al. Pregnancy outcomes in women with dilated cardiomyopathy. *J Am Coll Cardiol* 2009;55:45–52.
- [5] Siu SC, Colman JM, Sorensen S, et al. Adverse neonatal and cardiac outcomes are more common in pregnant women with cardiac disease. *Circulation* 2002;105:2179–84.
- [6] Siu SC, Sermer M, Colman JM, et al. Prospective multicenter study of pregnancy outcomes in women with heart disease. *Circulation* 2001;104:515–21.
- [7] Ben Farhat M, Gamra H, Betbout F, et al. Percutaneous balloon mitral commissurotomy during pregnancy. *Heart* 1997;77:564–7.
- [8] Hameed A, Karaalp IS, Tummala PP, et al. The effect of valvular heart disease on maternal and fetal outcome of pregnancy. *J Am Coll Cardiol* 2001;37:893–9.
- [9] Lesniak-Sobelga A, Tracz W, Kostkiewicz M, et al. Clinical and echocardiographic assessment of pregnant women with valvular heart diseases-maternal and fetal outcome. *Int J Cardiol* 2004;94:15–23.
- [10] Soma-Pillay P, MacDonald AP, Mathivha TM, et al. Cardiac disease in pregnancy: a 4-year audit at Pretoria Academic Hospital. *S Afr Med J* 2008;98:553–6.
- [11] Kimbally-Kaky G, Gombet T, Voumbo Y, et al. Rheumatic heart disease in schoolchildren in Brazzaville. *Med Trop (Mars)* 2008;68:603–5.
- [12] Marijon E, Ou P, Celermajer DS, et al. Prevalence of rheumatic heart disease detected by echocardiographic screening. *N Engl J Med* 2007;357:470–6.
- [13] Sadiq M, Islam K, Abid R, et al. Prevalence of rheumatic heart disease in school children of urban Lahore. *Heart* 2009;95:353–7.