Outcomes of Pregnancy Complicated by Heart Disease at Maharaj Nakorn Chiang Mai Hospital

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Objective: *To determine pregnancy outcomes of women complicated by heart disease.*
Material and Method: *Pregnant women complicated with heart disease between January 1993 and December 2007, at Maharaj Nakorn Chiang Mai Hospital, were recruited to a retrospective cohort study. The normal controls were identified to match the cases with a ratio of 2:1. The main outcomes for comparison included fetal mortality and morbidity focusing on preterm birth and fetal growth restriction.*
Results: *One hundred twenty five pregnant women with heart disease and 250 controls were recruited. Rheumatic heart disease was more common than congenital heart disease (48.8% and 44.8%). The baseline characteristics were similar between both groups. The prevalence of operative vaginal delivery was significantly higher in the study group (32.8% and 4.4%, $p < 0.001$) while the cesarean section rate was similar. The prevalence of fetal death, low Apgar score, preterm births, fetuses with low birth weight, and fetal growth restriction and were significantly higher in the study group with a relative risk of 6.0, 3.0, 2.2, 1.92, and 1.8, respectively.*
Conclusion: *Rheumatic heart disease is still prevalent. The fetal outcomes especially fetal death, preterm birth, intrauterine fetal growth restriction, low birth weight, and birth asphyxia were more common among pregnancies complicated by heart disease.*

Keywords: *Pregnancy, Heart disease, Fetal outcomes*

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Heart disease is one of the leading causes of maternal death during pregnancy in developed and developing countries with a wide range of incidence from 0.1 to 1.4%[1-6]. The hemodynamic changes pre-exist in women with heart disease and the physiological circulatory changes of pregnancy further add to this burden. The management in these cases may challenge the entire team providing care to mothers and fetuses. Many studies between 2000[7] and 2001[8] reported about the other pre-existing causes of maternal morbidity and mortality such as acute heart failure, arrhythmia, infective endocarditis, and respiratory tract infection. In 2003, many reports[9,10] showed that the most common heart diseases in pregnancy are rheumatic and congenital heart diseases. In developing countries, rheumatic heart disease (RHD) is the most common heart disease[11-13]. Contrary to that in developed countries, congenital heart disease is predominant. Because of improvement of cardiac surgery, women with congenital heart disease have received the effective treatment and have a longer survival with higher quality of life until pregnancy. In Thailand, at Rajavithi Hospital[14], the frequency of heart disease in pregnancy is 0.41% and congenital heart disease is the most common. Additionally, they reported 3% maternal mortality rate, 10.7% preterm labor, 10.7% fetal growth, 8.1% low Apgar score at 5 minutes after birth, 23.9% low birth weight newborn and 2.5% stillbirth. However, that report could not conclude whether the pregnant women with heart disease had an increased risk of adverse fetal outcomes or not because those were not compared with normal pregnancies.

The present retrospective cohort study was conducted to compare the maternal and neonatal outcomes in pregnancies complicated by heart disease with those of normal pregnancies at Maharaj Nakorn Chiang Mai Hospital.

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Material and Method

A retrospective cohort study was conducted at the Department of Obstetrics and Gynecology, Maharaj Nakorn Chiang Mai Hospital. The database of all pregnancies who delivered between January 1993 and December 2007 were searched to identify pregnancies complicated with heart disease and the medical records were reviewed. The inclusion criteria for the study group were as follows: (1) heart disease diagnosed during or before pregnancy by cardiologists; (2) attending prenatal care clinic and deliveries at Maharaj Nakorn Chiang Mai Hospital; (3) singleton pregnancies; (4) no other medical complications during pregnancy; and (5) available data for pregnancy outcomes. The control cases were selected from the general obstetric database by selecting the women who gave birth at the closest time to the matched study cases with the controls-to-patients ratio of 2:1. The inclusion criteria for controls included (1) normal singleton pregnancy without other medical complications, (2) attending prenatal care clinic and deliveries at Maharaj Nakorn Chiang Mai Hospital, and (3) delivery on the same day or at the closest time to the study cases. The present study was conducted with the approval of the research ethics committee of Chiang Mai University.

The heart disease was categorized to two types: congenital heart disease and acquired heart disease. The New York Heart Association (NYHA) Functional classification was used to identify heart failure. Baseline characteristics of both groups were recorded such as maternal age, the number of antenatal care (ANC), parity, functional class at first visit, and type of heart disease. Maternal outcomes were gestational age at delivery, congestive heart failure or changing of functional class, and route of delivery. Fetal outcomes were (1) perinatal death, defined by a death in utero after 20 weeks of gestation or within seven days of birth; (2) preterm birth, defined as a live birth before 37 complete weeks of gestation; (3) low birth weight, defined as a birth weight of less than 2,500 g; and (4) fetal growth restriction, defined as a birth weight of less than the 10^{th} percentile.

The data were processed with software SPSS 17.0 (SPSS Inc., Chicago, IL, USA) and analyzed using relative risk analysis, Chi-square test or Fisher exact test as appropriate for categorical data. The p-value of less than 0.05 was considered significant and was accepted at the 95% confidence level and compared between groups by relative risk. The quantitative data were reported as mean and standard deviation, and compared between groups by student t-test.

Results

Between January 1993 and December 2007, 142 pregnancies complicated by heart disease delivered at Maharaj Nakorn Chiang Mai Hospital. Seventeen of 142 were excluded because of twin pregnancy and other medical complications. The remaining 125 pregnancies with heart disease were available for analysis as the study group and 250 normal pregnancies were recruited into the control group. Demographic and clinical characteristics of the pregnant women are shown in Table 1 and 2. The mean maternal age of both groups was 27 $\pm$ 6 years old. Maternal age and parity were not significantly different between the two groups, while the number of visits in the control group was higher than the study group with statistical significance (p = 0.009). In the present study group, heart diseases in most cases were diagnosed before pregnancy but only 36% had surgical correction before pregnancy. Rheumatic heart disease (48.8%) with mitral valve stenosis (21.6%) was the most common heart disease. In congenital heart disease (44.8%), septal defects were found as a predominant form. The functional class according to the New York Heart Association (NYHA) of the study group is shown in Table 3. More than ninety percent of cases (120/125) were in NYHA class I-II at first visit and 4% (5/125) in class III-IV. During labor, 11 cases of NYHA class I-II progressively worsened to class III-IV without congestive heart failure.

Table 1. Baseline characteristic data in both groups

Characteristics	Cases (n = 125)	Control (n = 250)	p-value
Maternal age (mean $\pm$ SD)	27.28 $\pm$ 6.11	27.25 $\pm$ 5.98	0.961
Number of ANC (mean $\pm$ SD)	7.68 $\pm$ 3.93	8.84 $\pm$ 3.53	0.009*
Parity			
Primigravida	112 (89.6%)	231 (92.4%)	0.499
Multigravida	13 (10.4%)	19 (7.6%)	

Table 4 shows pregnancy outcomes, which were compared between both groups. The mean gestational age at delivery in the study and control groups were 35.27 + 5.36 weeks and, 37.7 + 2.60 weeks respectively with significant difference ($p < 0.001$). Abortion and preterm birth rates were higher in the study group. Incidence of caesarean section was similar in both groups while a rate of operative vaginal delivery in the study group was significantly higher than that in the control group ($p < 0.001$).

The fetal outcomes are summarized in Table 4. The mean birth weight was significantly different between both groups (2,395.76 + 851.28 gm and 2,833.28 + 622.55 gm, $p < 0.001$). Rates of newborns with low birth weight and neonatal death were also significantly higher in the study group. The rates of fetal growth restriction and low Apgar score (< 7) were similar. In the present study, there were two cases of fetal anomalies in the present study disease group (anencephaly and hydronephrosis).

Table 2. Type of heart disease

Type of heart disease	n = 125
Rheumatic heart disease	61 (48.8%)
Mitral stenosis	27 (21.6%)
Mitral regurgitation	23 (18.4%)
Pulmonary stenosis	5 (4.0%)
Tricuspid regurgitation	4 (3.2%)
Aortic regurgitation	2 (1.6%)
Congenital heart disease	56 (44.8%)
Atrial septal defect	18 (14.4%)
Ventricular septal defect	17 (13.6%)
Patent ductus arteriosus	9 (7.2%)
Tetralogy of Fallot	9 (7.2%)
Double outlet right ventricle	1 (0.8%)
Ebstein anomaly	1 (0.8%)
Transposition of great arteries	1 (0.8%)
Other heart disease	8 (6.6%)
Arrhythmia	7 (5.6%)
Coarctation of aorta	1 (0.8%)

Discussion

To the authors' knowledge, heart disease is one of the most common causes of maternal and neonatal morbidity and mortality. The present study was conducted to compare maternal and fetal

Table 3. Clinical characteristics of pregnant women with heart disease

	n = 125
NYHA classification at first ANC	
I	88 (70.4%)
II	32 (25.6%)
III	4 (3.2%)
IV	1 (0.8%)
NYHA classification at birth	
I	80 (64%)
II	29 (23.2%)
III	11 (8.8%)
IV	5 (4.0%)
Corrected heart disease	
No corrected	77 (61.6%)
Before pregnancy	45 (36%)
During pregnancy	3 (2.4%)

Table 4. Maternal and neonatal outcomes in both groups

	Cases (n = 125)	Control (n = 250)	p-value/RR (95% CI)
Gestational age at birth (mean ± SD)	35.27±5.36	37.7±2.60	<0.001*
Gestational at delivery			
Abortion (GA < 20wk)	4 (3.2%)	0 (0%)	No valid cases
Preterm (GA < 37wk)	42 (33.6%)	38 (15.2%)	2.21 (1.51-3.24)
Term	79 (63.2%)	212 (84.8%)	0.75 (0.65-0.86)
Mode of delivery			
Caesarean section	27 (21.6%)	54 (21.6%)	1.00 (0.66-1.50)
Spontaneous vaginal delivery	57 (45.6%)	185 (74%)	0.70 (0.62-0.80)
Vaginal operation	41 (32.8%)	11 (4.4%)	7.45 (3.97-14.00)
Birth weight (mean ± SD)	2,395.76 ± 851.28	2,833.28 ± 622.55	<0.001*
Low birth weight (< 2500 gm)	54 (43.2%)	56 (22.4%)	1.93 (1.42-2.62)
Fetal growth restriction	19 (15.2%)	21 (8.4%)	1.81 (1.01-3.24)
APGAR score at 5 min < 7	17 (13.6%)	11 (4.4%)	3.09 (1.49-6.40)
Neonatal death	15 (12%)	5 (2%)	6.00 (2.23-16.13)

outcomes between pregnant women with heart disease and normal pregnancies in a tertiary center, Maharaj Nakorn Chiang Mai Hospital, Faculty of Medicine Chiang Mai University, Thailand. Unlike in the past, congenital heart disease is currently more common than rheumatic heart disease because of the development in medical and surgical treatment as well as effective prevention of rheumatic fever. However, in the present study, which represents the population of northern Thailand, rheumatic heart disease still predominates over congenital heart disease[11-13], in contrast to the study at Rajavithi Hospital[14], which showed more prevalence of congenital heart diseases in pregnancy during 1985 to 2004. The present results imply that many of the presented patients cannot reach medical service and receive a proper treatment. Less antenatal care in the present study group reflects inadequate quality and efficacy of antenatal care unit in detecting heart disease, early detection of preterm births and early hospitalization. The present findings also support that functional class is a determining factor in predicting maternal morbidity and mortality of pregnancies with heart disease.

Similar to previous studies, the majority of women with heart disease could have vaginal delivery. The incidence of vaginal operation such as forceps and vacuum extraction in women with heart disease were as high as 7.45 times of those in normal pregnancies. On the contrary, the cesarean section rate was lower in women with heart disease. The indications for cesarean section of the present study were repeat cesarean section and fetal distress[11-13]. Adverse fetal and neonatal outcomes such as preterm birth, low birth weight, and neonatal death were increased in pregnancies with heart disease. These were likely caused by an increased risk of severe maternal diseases associated with poor perfusion to the placenta and fetuses. The adverse effects could be reflected by a high incidence of intrauterine fetal growth restriction, low birth weight, low Apgar score, and neonatal death; a relative risk of 1.8, 1.9, three, and six times respectively.

The outcomes of the present study may be flawed by several factors including the relatively small sample size of the study cases, exact information about heart disease such as definite treatment, drugs and neonatal complications. However, a nature of comparison or cohort study like this report may probably indicate the problems of this disease during pregnancy with more reliability than other descriptive one.

Conclusion

Rheumatic heart disease is still predominant in a Thai population. The functional class is a predictive factor for maternal morbidity and mortality. The fetal outcomes especially fetal death, preterm birth, intrauterine fetal growth restriction, low birth weight, and low Apgar score are more common among pregnancies complicated by heart diseases. The more effective antenatal care for pregnancies with heart diseases to prevent adverse maternal and fetal outcomes still needs more intensive audit.

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ผลลัพธ์ของการตั้งครรภ์ในสตรีที่มีภาวะโรคหัวใจที่โรงพยาบาลมหาราชนครเชียงใหม่

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วัตถุประสงค์: *เพื่อศึกษาผลลัพธ์การตั้งครรภ์ของสตรีตั้งครรภ์ที่มีภาวะโรคหัวใจร่วม*

วัสดุและวิธีการ: *การศึกษาเปรียบเทียบเชิงพรรณนาแบบย้อนหลัง โดยเก็บข้อมูลของกลุ่มตัวอย่างคือ สตรีโรคหัวใจที่คลอดที่โรงพยาบาลมหาราชนครเชียงใหม่ ตั้งแต่เดือนมกราคม พ.ศ. 2536 ถึง เดือนธันวาคม พ.ศ. 2551 โดยรวบรวมจากสมุดบันทึกการฝากครรภ์ ใบย่อครรภ์ และเวชระเบียนของผู้ป่วย เปรียบเทียบกับกลุ่มควบคุม คือ สตรีตั้งครรภ์ปกติในช่วงเวลาเดียวกันในอัตราส่วน 2:1 โดยเทียบผลของการตั้งครรภ์ด้านทารกปริกำเนิด การคลอดก่อนกำหนด และการเกิดภาวะเจริญเติบโตช้าในครรภ์เป็นหลัก*

ผลการศึกษา: *มีสตรีโรคหัวใจที่ตั้งครรภ์ทั้งหมด 125 คน และสตรีตั้งครรภ์ปกติหรือกลุ่มควบคุม 250 คน ที่เข้าร่วมการวิจัย พบโรคหัวใจชนิดรูมาติกมากกว่าโรคหัวใจพิการแต่กำเนิด(ร้อยละ 48.8 และ 44.8 ตามลำดับ) โดยทั้งสองกลุ่มมีปัจจัยพื้นฐานใกล้เคียงกัน พบว่าในกลุ่มสตรีตั้งครรภ์ที่เป็นโรคหัวใจได้รับการทำหัตถการช่วยคลอดทางช่องคลอดสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ (ร้อยละ 32.8 และ 4.4, $p < 0.001$) และไม่มีความแตกต่างกันในอัตราการผ่าคลอดทางหน้าท้องทั้งสองกลุ่ม (ร้อยละ 21.6 และ 21.6, $p = 1$) รวมถึงเพิ่มโอกาส ทารกตายปริกำเนิด APGAR < 7 คลอดก่อนกำหนด ทารกแรกคลอดน้ำหนักน้อย และทารกเจริญเติบโตช้าในครรภ์ อย่างมีนัยสำคัญโดยเมื่อเทียบกับสตรีตั้งครรภ์ปกติเป็น 6.0, 3.0, 2.2, 1.92 และ 1.8 เท่าตามลำดับ*

สรุป: *โรคหัวใจชนิดรูมาติกเป็นชนิดที่พบมากที่สุด สตรีตั้งครรภ์ที่เป็นโรคหัวใจเพิ่มความเสี่ยงในการเกิดทารกเสียชีวิตในครรภ์ การคลอดก่อนกำหนด การเจริญเติบโตช้าในครรภ์ ทารกแรกคลอดน้ำหนักน้อย และทารกขาดออกซิเจนอย่างมีนัยสำคัญทางสถิติ*