Pediatrics and Neonatology (2012) 53, 105—111

Available online at www.sciencedirect.com

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ORIGINAL ARTICLE

A Nationwide Survey of Risk Factors for Stillbirth in Taiwan, 2001—2004

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Received Jun 17, 2010; received in revised form Apr 29, 2011; accepted May 11, 2011

Key Words
ethnics;
nationwide;
oligohydramnios;
polyhydramnios;
risk factors;
stillbirth

Objective: The purpose of this study was to evaluate the nationwide stillbirth rate and explore the potential risk factors associated with stillbirths.
Patients and methods: Data from vital registrations during the time period from January 1, 2001 through to December 31, 2004 in Taiwan were used. Stillbirth was defined as fetal death with more than 20 completed weeks' gestational age (GA) or with birth weight more than 500 g if the GA was not known.
Results: There were a total of 8481 stillbirths identified nationwide between January 1, 2001 and December 31, 2004. The stillbirth rate was nine per 1000 total births in the study period, and the proportionate decline was nearly 48.8% in the most recent decade. There was a significant increase in average maternal age during this period. Advanced maternal age and teenage pregnancy were independent significant risk factors for stillbirths even after accounting for the effects of medical conditions that were more likely to occur among these particular age groups. Those fetuses that had been exposed to cord prolapse, maternal cervical incompetence and oligohydramnios/polyhydramnios were especially vulnerable. By contrast, women

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doi:10.1016/j.pedneo.2012.01.007

who had foreign nationality, fetal ultrasound surveys, fetal heart beat monitoring and hastened parturition were less likely to have stillbirth.
Conclusion: The stillbirth rate in Taiwan has remained high despite advancements in medical care. Prenatal evaluation of high risk women may decrease the adverse fetal outcomes.

1. Introduction

Stillbirth, the death of a fetus late in pregnancy before the onset of labor, accounts for two thirds of perinatal deaths.[1] For international comparisons, the World Health Organization (WHO) has defined stillbirth as fetal loss beyond 20 weeks of gestation, or if gestational age (GA) is unknown with birth body weight $\geq$500 g.[1,2] It is estimated that worldwide, 3.2 million babies are stillborn annually; the true incidence is probably higher because of the limitations of available data and the fact that stillbirths are underreported. Up to 99% of these stillbirths occur in developing countries, with half (51%) occurring in India, China, Pakistan, and Bangladesh.[3] Despite higher numbers of stillbirths reported in southeast Asian countries, data on this topic from this area have been scarce. The rate of stillbirth has been thought to be declining during recent decades in Taiwan. However, the nationwide fetal death data had not been routinely recorded in Taiwan up to the present time. The estimated stillbirth rate in case control studies was reported to be 57/1000 total births during the mid 1960s to 1970s and around 17.6/1000 total births from 1991 to 1996, respectively.[4–6] Preventing stillbirths is of great importance in improving global child health, which is the fourth goal in the Millennium Development Goals proposed by the United Nations.[7] Understanding the risk factors for stillbirth will help obstetricians design effective interventions for the fetus. Early identification of those women who are at risk of stillbirth will help the provision of targeted antepartum testing regimens to improve outcomes.

The National Health Insurance that has operated since 1995 in Taiwan has greatly enhanced the accessibility of prenatal caring programs to pregnant women and comprehensive prenatal care to mother–fetus dyads. The objective of this study was to examine the nationwide stillbirth rate and explore the potential risk factors for stillbirths in Taiwan.

2. Patients and Methods

Stillbirth was defined as stated above. GA determination was mainly based on the last menstrual period or ultrasound examination. The nationwide stillbirth rate was estimated from the data of birth and stillbirth certificates obtained from vital registration in Taiwan. The vital registration statistics have been documented by the Ministry of the Interior since 1978 and have been annually reported by the Bureau of Health Promotion since 1998. We studied the populations that included all stillbirths and live births during the time period from January 1, 2001 to December 31, 2004. This study was approved by the Institutional Review Board of National Taiwan University College of Public Health.

The maternal characteristics and the obstetrical and prenatal antecedents between live births and stillbirths were compared. Student t test, Pearson's χ^2 test, and Fisher's exact test were used appropriately to distinguish the characteristic differences between study groups. Logistic regression analysis was used, and odds ratios (ORs) were calculated with 95% confidence intervals (CIs) using a low-risk reference group before and after adjustment for maternal sociodemographic characteristics to evaluate the effect of each maternal and fetal clinical characteristic on the risk of stillbirth. The population attributable risk (PAR) was calculated for each significant risk factor OR estimate and the prevalence of stillbirth cases by using the following equation:

PAR = proportion of cases exposed to the factor $\times$ 1000 $\times$ (OR$-$1)/OR.[8,9] All tests of hypothesis were two-tailed, with a type 1 error rate fixed at 5%. All calculations were performed using SPSS version 12 (SPSS Inc., Chicago, IL, USA) for Windows.

3. Results

There were a total of 8481 stillbirths and 932,497 live births between January 1, 2001 and December 31, 2004 in Taiwan. The stillbirth rate was 9.01 per 1000 births. There was a significant increase in the advanced maternal age during the study period in Taiwan (Table 1). Both mothers older than 40 years (OR = 2.98; 95% CI 2.67, 3.32) and pregnant teenagers (OR = 2.57; 95% CI 2.29, 2.89) had a significantly increased risk of stillbirth compared with mothers aged 25 years to 29 years. Maternal age was significantly associated with adverse fetal outcome even after taking into

Table 1 Changing patterns of maternal age for stillbirths in Taiwan, 2001–2004.

Maternal age (y)*	2001	2002	2003	2004	Total
<20	2.3	2.1	1.8	1.6	2.0
20–24	19.8	19.5	18.7	17.4	18.9
25–29	35.1	35.4	35.4	35.6	35.4
30–34	30.4	30.4	30.9	31.5	30.8
35–39	10.7	10.8	11.3	11.9	11.2
$\geq$40	1.7	1.8	2.0	2.1	1.9

Data are presented as percentages.
*$p < 0.0001$, Chi-square test.