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Original Article

The impact of prenatal group B streptococcus screening as a national health policy in Taiwan

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ABSTRACT

Objective: There was no national data on group B streptococcus (GBS) infections in Taiwan. Until 2012, when prenatal GBS screening was introduced to obstetric practices as a national health policy aimed at reducing neonatal GBS infections. The purpose of this study was to examine the impact of this national health policy on the incidence of maternal GBS colonization and neonatal GBS infection rate. Relatedly, the clinical characteristics of neonatal GBS infection were investigated to determine the correlations between the incidence of maternal GBS colonization and the neonatal GBS infection rate.

Materials and methods: This population-based nationwide study used data for 2012–2013 from the National Health Insurance Research Database of Taiwan. A total of 789 newly diagnosed pregnant women with genital GBS infection were recruited.

Results: The maternal GBS screening rate was 93.2%. The maternal colonization rate of GBS was around 8.2%, and the incidence of neonatal GBS infection was 22.6%. The data indicate that no sepsis was developed in any of the cases, while fever was found in 3 cases (3/179, 1.7%) and UTI was found in 1 case (1/179, 0.6%).

Conclusions: We conclude that a policy calling for universal maternal rectovaginal cultures for GBS with intrapartum antibiotic prophylaxis is a good national policy for reducing morbidity due to GBS infections in neonates in Taiwan.

Introduction

Group B streptococcus (GBS) is the most common cause of early neonatal infection, with 5–20% of such infections resulting in mortality or other serious complications [1,2]. An estimated of 15–28.7% of childbearing age women are colonized with GBS [3,4], and approximately 50% of infants born to these women will become infected, with 1–2% of infants with GBS colonization subsequently developing disease [5,6]. In the past, there were several reports regarding neonatal GBS infection in Taiwan [7–12], but the data used in those reports were from individual regional institutes, such that the reports could not be taken as valid representations of the incidence of neonatal GBS infections in Taiwan as a whole. Moreover, There was no national data on GBS infections in Taiwan. Until 2012, when prenatal GBS screening was introduced to obstetric practices as a national health policy aimed at reducing neonatal GBS infections. This allowed for the collection of national data on GBS infections in the National Health Insurance Research Database (NHIRD). We speculated that the maternal colonization rate and the incidence of neonatal GBS infections reported by the NHIRD, as well as the mortality rate of early-onset disease (EOD) in cases of GBS, would be consistent with those reported in previous reports.

Since the implementation of intrapartum antibiotic prophylaxis in 1996, the incidence of EOD of GBS has dropped by 50–85% in the United States [13]. Before 2012, no such intrapartum antibiotics strategy existed in Taiwan due to lack of establishing national

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policy regarding prenatal GBS screening. Researchers believed that an appropriate national health policy established as part of Taiwan's national budget system would reduce neonatal GBS infections but lacked evidence and data to confirm that supposition. The purpose of this study was to examine the impact of the national health policy established in 2012 on the incidence of maternal GBS colonization and the neonatal GBS infection rate. Relatedly, the clinical characteristics of neonatal GBS infection were investigated to determine the correlations between the incidence of maternal GBS colonization and the neonatal GBS infection rate. The data suggest that the intrapartum antibiotic prophylaxis strategy was warranted in order to reduce GBS infections in neonates.

Materials and methods

Data source and collection

We conducted a nationwide population-based study by using data from Taiwan's NHIRD. The NHIRD collects data from the National Health Insurance (NHI) program, which started in 1995 and covered 99.9% of the 23 million people in Taiwan as of Dec. 31 of 2013 [14]. The NHIRD contains all the medical records of inpatients and outpatients seen under the NHI program, including demographic data such as gender, date of birth, location, and insured amount, as well as medical records of clinical visits, admissions, and clinical procedures. Specifically, we used the Longitudinal Health Insurance Database 2000 (LHID2000), a sub-dataset of the NHIRD, for this study. The LHID2000 contains data from January 2000 to December 2013 for a randomly selected sample of one million people out of the 23 million people included in the NHIRD in 2000 [15]. The LHID2000 and NHIRD have similar demographic distributions and origin populations [16]. The clinical diagnoses were made by the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) [17].

Ethics

This retrospective study was approved by the Institutional Review Board of the Tri-Service General Hospital (no. B-104-20), and the requirement to obtain informed consent was waived. As this was a retrospective study and all data was anonymous, the Institutional Review Board agreed that it was not necessary to obtain patient consent.

Study population

The study subjects were selected from the LHID2000 covering the period from January 2012 to December 2013. The procedure for selecting the participants included in this study is shown in Fig. 1. Data for a total of 10,523 singleton pregnancies were considered. The exclusion criteria were as follows: (1) women with deliveries before Dec 31st 2011 and (2) women who were younger than 20 years of age. Of the remaining women, those who received maternal group B Streptococcus (GBS) screening were then selected (n = 9807). Those mothers who received intrapartum antibiotic prophylaxis (IAP) with intravenously administered ampicillin were defined as positive for maternal group B Streptococcus (GBS) screening. The GBS positive infants who were less than two months old newborns and defined as being GBS carriers (ICD-9-CM V02.51) or as having streptococcal meningitis (ICD-9-CM 320.2), streptococcal septicemia (ICD-9-CM 038.0), GBS pneumonia (ICD-9-CM 482.32), or GBS infection (ICD-9-CM 041.02).

Variables

The variables in this study were chosen according to related studies in the previous literature. Specifically, we selected the following variables related to GBS infection: urinary tract infection (ICD-9-CM 599.0), shock (ICD-9-CM 785.52, 785.59), fever (ICD-9-CM 780.6), persistent pulmonary hypertension in neonate (PPHN) (ICD-9-CM 747.83), continuous invasive mechanical ventilation (ICD-9-CM 96.7), endotracheal tube insertion (ICD-9-CM 96.04), acute respiratory failure (ICD-9-CM 518.81), and cardiopulmonary arrest (ICD-9-CM 799.1, 798, 427.5).

Statistical analysis

Descriptive statistical data for the study subjects and weather factors were calculated by the Microsoft® SQL Server® 2008. Further data analysis was conducted using the IBM SPSS statistics software, version 20 (IBM SPSS, 2013). A two-sided p-value <0.05 was regarded as statistically significant in all statistical tests.

Results

The study included data on 10,523 pregnant women seen under the NHI program between 2012 and 2013. A total of 9807 of these pregnant women underwent GBS screening (and thus constituted the study group). However, of these 9807 pregnant women who had undergone GBS screening, we had to exclude 127 pregnant women with incomplete medical information and 99 women who were under 20 years old or more than 50 years old. So, a total of only 9581 pregnant women were included in the final analysis. The characteristics of the study group are listed in Table 1. For these 9581 pregnant women with GBS screening, the ages were mostly in the range of 30–39 years (67%), followed by 20–29 years (29.2%). Pregnant women living in northern and southern Taiwan were more likely to undergo GBS screening than those from other regions. The income of most of the women who had undergone GBS screening was below 40,000 Taiwan Dollars (78.4%).

As shown in Table 2, 161 of the associated neonates were Group B streptococcal carriers, accounting for 20.4% of the neonates born to the women who were found to be GBS-positive when screened during their pregnancies. In addition, there were 17 babies who ultimately developed a GBS infection and 1 who had strep septicemia, accounting for 2.2% and 0.1%, respectively.

In addition, for the 17 infants infected with GBS, there were 9 kinds of potential complications. As shown in Table 3, however, only one baby had UTI symptoms, while another 3 had symptoms of fever.

Discussion

This is the first nationwide population-based study of maternal rectovaginal GBS cultures based on the utilization of data from Taiwan's NHIRD. The results revealed a high rate of GBS screening (9807/10,522, 93.2%) under Taiwan's NHI program. For the population considered in this study, the incidence of maternal GBS colonization was around 8.2% (789/9581), which is lower than the incidences reported by previous studies [3–5,12]. In the past, many pediatricians and obstetricians believed GBS infection was not prevalent in Taiwan [11]. This impression of a low incidence of GBS infection in Taiwan may have arisen from the low number of rectovaginal cultures conducted for expectant women plus the fact that antibiotics are often prescribed for high-risk pregnant mothers. That resulted in a partial or complete treatment of GBS colonization in pregnant women, masking the incidence of invasive GBS disease in infants. In this study, we consider the possibility that

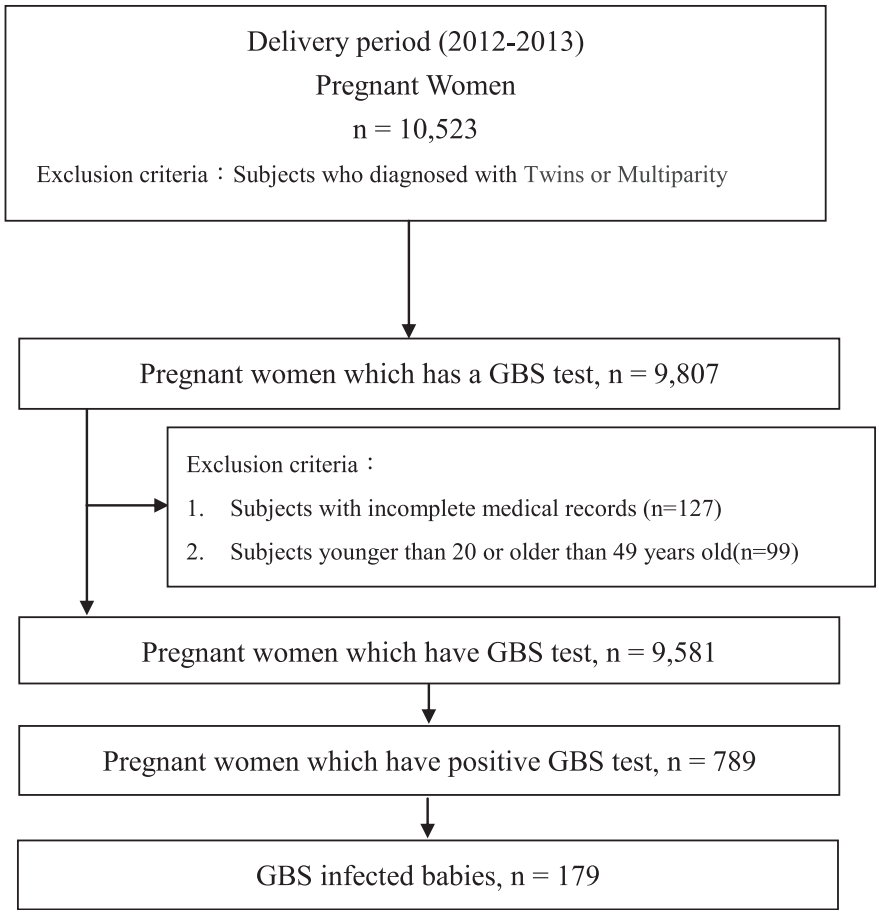

Fig. 1. Flowchart of method.

Table 1
Distribution of demographic in pregnant women which has a GBS test.

Gender	
Female	9581 (100%)
Age_Group (years old)	
20–29	2793 (29.2%)
30–39	6420 (67%)
40–49	368 (3.8%)
Income_Group (Taiwan Dollars)	
<20,000	2933 (30.6%)
20,000–39999	4578 (47.8%)
40,000–59999	1623 (16.9%)
>59,999	447 (4.7%)
Geography	
North	5285 (55.2%)
Central	1802 (18.8%)
South	2253 (23.5%)
Other	241 (2.5%)
Urbanization	
1 (highest)	4560 (47.6%)
2	2671 (27.9%)
3	1774 (18.5%)
4 (lowest)	576 (6%)

Table 2
Population of positive GBS infection baby (n = 179) in pregnant women which has a positive GBS test (n = 789).

GBS screening	No.	%
Strep meningitis	0	0.0
Strep septicemia	1	0.1
GBS pneumonia	0	0.0
GBS infection	17	2.2
Group B streptococcal carrier	161	20.4

Table 3
Population of GBS comorbidities in GBS infection baby (n = 179).

GBS comorbidity	No.	%
UTI	1	0.6
Shock	0	0
Fever	3	1.7
PPHN Persistent pulmonary hypertension in neonate	0	0
Continuous invasive mechanical ventilation	0	0
Endotracheal tube insertion	0	0
Tracheostomy	0	0
Acute respiratory failure	0	0
Csardiopulmonary arrest	0	0

Taiwan's national health policy and NHI program have led to better public health and hygiene, lowering the rate of GBS colonization in pregnant women. It is interesting that if we divide the incidence of newborn infections by the incidence of colonization in pregnant women (178/789, 22.5%), the resulting proportion is higher than those indicated in previous reports [12]. Most of the infected neonates (161/179, 89.9%) were carriers or suspected carriers of GBS. Meanwhile, the proportion of newborn GBS infections and streptococcus infections to the colonization rate of pregnant women (18/789, 2.2%) was within the range of the rates reported by previous reports [12]. The results nonetheless revealed a higher incidence of newborn infection from the colonization of pregnant women overall.

Bromberger et al. found that 95% of neonates with GBS-positive infections exhibits signs of sepsis in the first 24 h of life [18]. Sepsis was the most common clinical presentation, followed by UTI. The others were pneumonia (37%) and meningitis (20.4%) in Taiwan. 26.8% infants developed respiratory failure necessitating ventilator support (including HFOV or IMV). About 50% of GBS infections were found to result in respiratory distress in a review conducted for a period of over 11 years [9]. Chung et al. also reported respiratory distress in 50% of EOD babies in Taiwan [11]. EOD in cases of GBS infection usually occurs as a result of vertical transmission from mother to child. However, the data for this study, which were collected after Taiwan established its national health policy of prenatal GBS screening with an intrapartum antibiotic prophylactic strategy, revealed that, among the 179 babies with neonatal GBS infection, no sepsis was developed in any cases, while fever was found in only 3 cases (3/179, 1.7%) and UTI was found in only 1 case (1/179, 0.6%). These findings further demonstrate the value of the national health policy of prenatal GBS screening with an intrapartum antibiotic prophylactic strategy against vertical transmission.

Conclusions

GBS infection is the leading cause of early onset neonatal sepsis worldwide. Our study revealed that Taiwan's national policy of universal maternal rectovaginal cultures for GBS with subsequent intrapartum antibiotics prophylaxis is mandatory for reducing EOD and mortality due to neonatal GBS infections in Taiwan.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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