

The epidemiological characteristics of maternal syphilis and neonatal outcomes with intervention in Jiangyin from 2014 to 2015

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Summary

Background: To discuss the epidemic characteristics of syphilis during pregnancy and pregnancy outcomes with perinatal intervention in Jiangyin. **Materials and Methods:** A retrospective analysis of maternal syphilis cases in Jiangyin from January 2014 to December 2015. **Results:** Serological screening for syphilis was performed for 25,360 pregnant women cases from 2014 to 2015, and 83 cases with syphilis were identified. The positive rate was 3.27% (83/25,360), the detection rate of syphilis during pregnancy was 78.86% (20,000/25,360), and the standard treatment rate of maternal syphilis was 72.29% (60/83). The epidemiological survey results were as follows: Single-factor analysis showed that age, household registry, occupation, educational level, economic income, number of sexual partners, marital status, and if a sex partner had syphilis influenced whether a pregnant women would be infected with syphilis ($p < 0.05$). Logistic regression analysis showed that household registry, occupation, educational level, economic income, number of sexual partners, marital status, and whether a sex partner had a syphilis were independent factors for infection ($p < 0.05$). In 79 newborns whose mothers had syphilis while pregnant, six had congenital syphilis (7.59%), ten had positive titers (12.66%), and 63 (79.75%) were negative for syphilis. With treatment and follow-up, six neonates' clinical symptoms of congenital syphilis disappeared in one month. With preventive treatment, the RPR titers of all the positive newborns became negative in nine months. **Conclusions:** Pregnancy syphilis remained common among itinerant, low income populations with low education, and infected sexual partners in Jiangyin from 2014 to 2015. In the past two years, the city has paid attention to prevention, screening and treatment, and preliminary results show that the maternal syphilis treatment rate is high and neonatal outcomes have significantly improved. It is necessary to improve screening efforts, strengthen awareness and education, standardize treatment, and improve maternal and neonatal outcomes.

Key words: Maternal syphilis; Epidemiological characteristics; Neonatal syphilis.

Introduction

Maternal syphilis refers to the presence of syphilis infection during pregnancy. The infection may occur during pregnancy or pre-pregnancy. *Treponema pallidum* can be transmitted vertically through the placenta and severely affect the pregnancy, causing abortion, fetal death, premature delivery, fetal hydrops, and intrauterine growth restriction or congenital syphilis [1-3]. In recent years, the rates of maternal syphilis and congenital syphilis have been increasing [4-6]. Jiangyin is located on the relatively developed coastal areas in China, which have a large itinerant population, a high proportion of women of childbearing age, and a high prevalence of syphilis during pregnancy [7]. Therefore, it is crucial to analyze the factors that influence the risk of having syphilis during pregnancy and the outcomes of neonates born to mothers with syphilis to determine effective interventions and improve pregnancy outcomes. Since the introduction of the work implementation plan to prevent AIDS, syphilis, and mother-infant transmission of hepatitis B in China in 2010, the city of Jiangyin introduced a similar plan that achieved some positive results. In 2010, the city of Jiangyin introduced a work implementation plan

to prevent AIDS, syphilis, and mother-infant transmission of hepatitis B with some positive results. This study retrospectively analyzed the characteristics of Jiangyin's maternal syphilis epidemic and the pregnancy outcomes of perinatal interventions to prevent mother-infant transmission of syphilis and to improve maternal and neonatal outcomes.

Materials and Methods

A total of 25,360 pregnant women who underwent prenatal testing and delivery at medical institutions, MCH hospitals, and community service centers in Jiangyin from January 1, 2014, to December 31, 2015, were selected as the research subjects. This study, which adopted a random sampling method and included a total of 25 medical health organizations and community service centers, was approved by the present hospital's ethics committee, and every research object voluntarily participated and signed informed consent forms. The diagnosed patients were uniformly transferred to the present hospital to start standard treatment with benzathine benzylpenicillin and neonatal follow-up.

The study adopted an epidemiological survey for maternal syphilis in Jiangyin that was created by the author, a well-known obstetrics and gynecology and STD expert in Jiangsu. The contents included the patient's general condition, social demographic

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information, and behavioral data. The investigators underwent training to ensure that they administered the survey to all patients in a standardized manner. All surveys were administered in a one-to-one manner. The present authors conducted the survey in a separate room and made efforts to protect each patient's privacy.

A non-specific primary screening test and a specific final diagnostic experiment were adopted. All the pregnant women first underwent the nonspecific screening test known as the rapid plasmin roagin test (RPR). If the primary screening test was positive, a treponema pallidum passive particle agglutinating assay (TPPA) was performed. If both the screening and the TPPA yielded positive results, the patient was diagnosed with syphilis infection.

(1) Diagnostic standards for syphilis during pregnancy: a) the pregnant woman or her spouse had a high-risk sexual life or a history of syphilis and/or the pregnant woman had a history of abortion, premature birth, fetal death, and/or congenital syphilis; b) the pregnant woman presented clinical symptoms and signs at each stage; c) the RPR and TPPA were both positive [8].

(2) Diagnostic standards for congenital syphilis: a) the infant's mother was a syphilis patient; b) the infant presented clinical symptoms and signs of syphilis; c) the serological screening results were positive, the antibody titer was at least four-fold higher than the mother's, and the treponema pallidum hemagglutination assay (TPHA) test was positive [9].

Pregnant women who were diagnosed with syphilis during the first trimester of pregnancy received a course of bilateral intragluteal injections of benzathine penicillin at a dose of 240 IU once a week for three weeks, and another course during the third trimester of pregnancy. When syphilis was diagnosed later in pregnancy, one course was administered beginning on the date of diagnosis and another was administered during the third trimester, with at least two weeks' interval between courses. When syphilis was diagnosed during labor, bilateral intragluteal injections of benzathine penicillin at a dose of 240 IU were administered once, and the patient was transferred to dermatology for treatment after delivery. For patients with a penicillin allergy, erythromycin 500 mg was administered orally four times a day for 15 days. Neonates with indications of a need of preventative or treatment measures were transferred to the neonatal department for the appropriate treatment.

As required by the work implement plan for preventing AIDS, syphilis, and mother-infant transmission of hepatitis B, the present authors sent designated nurses to follow up with the syphilis-positive women's babies at three, six, nine, 12, 15, and 18 months and detected signs of syphilis. Eight cases were lost to follow-up, resulting in a loss rate of 10.13%.

After the quality inspection of the investigated information was performed, the data were input into the SPSS 19.0 statistical software package, and baseline descriptive, single-factor, trend test, and logistic regression analyses of the specific quantitative and frequency data from the questionnaire were performed (measurement data were analyzed using the *t*-test, and count data were analyzed using the χ^2 test analysis or Fisher's exact test). The statistical significance level stipulated a *p* value less than 0.05.

Results

A total of 25,360 pregnant women underwent serological screening for syphilis from 2014 to 2015; 83 cases of syphilis were identified with a positive rate of 3.27% (83/25,360), and the detection rate of syphilis during pregnancy was 78.86% (20,000/25,360). Of the 83 pregnant women with syphilis, 60 received standard anti-syphilitic

treatment; the standard treatment rate for maternal syphilis was 72.29% (60/83). Two cases of abortion and fetal death occurred among the patients did not receive standard anti-syphilitic treatment. Of 79 neonates born to women with syphilis, there were six cases of congenital syphilis (7.59%), positive reactions were observed in ten infants (12.66%), and 63 infants (79.75%) were negative for syphilis. With treatment and follow-up, the clinical symptoms of the six infants with congenital syphilis disappeared in one month. With preventative treatment, the RPR titers of all positive newborns were negative at nine months.

The epidemiological survey results were as follows: single-factor analysis showed that age, household registry, occupation, education level, income, number of sexual partners, marital status, and whether a sex partner was a syphilis patient influenced the likelihood that a pregnant woman would be infected with syphilis ($p < 0.05$). Logistic regression analysis showed that household registry, occupation, education level, income, number of sexual partners, marital status, and whether a sex partner had syphilis were independent factors related to infection ($p < 0.05$) (Tables 1 and 2).

Discussion

In recent years, many studies have shown that the incidences of maternal and congenital syphilis have increased constantly [4-6]. Syphilis spirochaeta can infect the fetus through the placenta, causing abortion, fetal death or congenital syphilis that can seriously impair the health of both mother and child. Syphilis during pregnancy has become an important public health problem. When the previous ministry of health determined that mother-infant transmission of syphilis, AIDS, and hepatitis B virus was a major national public health program and formulated a prevention implementation plan in 2010, Jiangsu province also implemented the project in 2010 and required medical institutions at various levels to adopt and implement it under the guidance of MCH organizations at different levels. Since the city began the project in 2010, medical institutions at various levels have strengthened the prevention, screening, and treatment of syphilis during pregnancy and have achieved remarkable results. In a previous study, the present authors reported that the morbidity of maternal syphilis in Jiangyin from 2010 to 2013 was 6.66% [7]; in contrast, the current research shows that of the 25,360 pregnant women who were screened for syphilis in Jiangyin from 2014 to 2015, 83 cases were identified at a positive rate of 3.27%, which was obviously lower than before. This finding indicates that this city's MCH organizations and medical institutions made enormous strides in the prevention and control of syphilis during pregnancy, resulting in a decline in the positive rate in recent years.

Studies show that the incidence of neonatal congenital syphilis is related to access to anti-syphilis treatment and

Table 1. — Single-factor analysis of syphilis infection in pregnant women [n (%)].

Projects	Positive syphilis (n=83)	Negative syphilis (n=25,277)	χ^2 value	p value
<i>Age (years)</i>			12.170	0.007
18~<25	8 (9.64%)	2396 (9.48%)		
25~<30	45 (54.22%)	9599 (37.98%)		
30~<39	23 (27.71%)	11617 (45.96%)		
≥39	7 (8.43%)	1665 (6.59%)		
<i>Household registry</i>			21.306	0.000
Local	31 (37.34%)	15670 (61.99%)		
Nonlocal	52 (62.65%)	9607 (38.01%)		
<i>Occupation</i>			50.936	0.000
Worker/staff	5 (6.02%)	3286 (13.00%)		
Peasantry/peasant worker	13 (15.66%)	11357 (44.93%)		
Jobless/seeking work	12 (14.46%)	2896 (11.46%)		
Service industry	33 (39.76%)	4350 (17.21%)		
Other	20 (24.10%)	3388 (13.40%)		
<i>Education level</i>			26.217	0.000
Middle school and below	34 (40.96%)	7756 (30.68%)		
Senior high school	43 (51.80%)	8996 (35.59%)		
College or higher	6 (7.23%)	8525 (33.73%)		
<i>Economic income (Rmb)</i>			50.114	0.000
<1000	21 (25.30%)	3989 (15.78%)		
1000~<2000	41 (46.99%)	5645 (22.33%)		
2000~<3000	13 (15.66%)	11233 (44.44%)		
≥3000	8 (9.64%)	4410 (17.45%)		
<i>Marital status</i>			417.172	0.000
Married	67 (80.72%)	25136 (99.44%)		
Unmarried	16 (19.28%)	141 (0.56%)		
<i>Number of sexual partners</i>			309.839	0.000
One	31 (37.35%)	23150 (91.56%)		
Two or more	52 (62.65%)	2127 (8.41%)		
<i>Spouse is a syphilis patient</i>				
Yes	63 (75.90%)	0 (0.00%)		0.000*
No	20 (24.10%)	25277 (100.00%)		

*p value was calculated using Fisher's exact test

Table 2. — Multi-factor logistic regression analysis of syphilis infection in pregnant women.

Projects	β	SE	Wald χ^2	p value	OR value	95%CI
Age	0.466	0.313	1.659	0.250	1.581	0.854~3.125
Household registry	1.135	0.258	12.478	0.003	3.149	1.675~5.816
Occupation	1.426	0.523	7.724	0.000	4.123	1.532~10.546
Education level	1.320	0.267	15.586	0.000	3.103	1.801~5.326
Personal income	0.651	0.178	10.325	0.000	1.873	1.325~2.675
Marital status	-0.815	-0.235	13.562	0.000	0.421	0.235~0.656
Number of sexual partners	-0.534	-0.136	10.625	0.003	0.359	0.246~0.732
Spouse is a syphilis patient	-0.617	-0.213	7.896	0.004	0.542	0.356~0.897

whether that treatment is standardized. The early standardized anti-syphilis treatment is the key to improving pregnancy outcomes and reducing the rate of congenital syphilis[10-12]. This study also showed that of the 83 pregnant women with syphilis identified during screening in Jiangyin from 2014 to 2015, 60 received normative treatment, the standard treatment rate was 72.29%, and no abortion, fetal death, premature delivery, and congenital syphilis

occurred. In contrast, the remaining 23 pregnant women who screened positive for syphilis and did not receive normative treatment, did not receive timely antenatal examinations, and were not identified at an early stage. These cases were usually identified when they came to the hospital because of an abortion, fetal death, a third-trimester check-up or during labor. For infants diagnosed with congenital syphilis and newborns with positive titer, the pres-

ent authors followed them closely and transferred them to the neonatal department for normative treatment. With treatment and follow-up, the clinical symptoms of six of the infants with congenital syphilis disappeared in one month, and all positive newborns had negative RPR titers at nine months with preventive treatment.

Previous studies in China have shown that the incidence of syphilis during pregnancy was related to the pregnant woman's age, education level and occupation, and that syphilis was more common in pregnant women who had low education levels, were underemployed, were sexually active, and were aged 20~39 years [13]. Foreign research has shown that according to the work report of WHO and the US Preventive Services Task Force in 2013, pregnant women have a higher risk of syphilis if they are poor, have no medical insurance, are drug users, are sex workers, live in an area with a high infection rate, begin their sexual life prematurely (<16 years), are married to a syphilis patient, or have a history of abortion or multiple pregnancies [14-17]. The present study's single-factor analysis found that age, household registry, occupation, education level, income, number of sexual partners, marital status, and having a sex partner who is a syphilis patient were eight factors that influenced whether a pregnant women was likely to be infected with syphilis ($p < 0.05$). Logistic regression analysis showed that household registry, occupation, education level, income, number of sexual partners, marital status, and having a sex partner with syphilis were seven independent factors for infection ($p < 0.05$). The present results also showed that syphilis infection during pregnancy mainly affects women who are members of a itinerant population, work in the service industry, have low education levels, have a personal income between 1,000~2,000, are married, have a large number of sexual partners, and have a spouse who is a syphilis patient, consistent with the findings of domestic and foreign studies. Jiangyin is located in the relatively developed area in the south of Jiangsu, which has a large itinerant population. The education and income levels of this group of itinerant people are relatively low, so an increasing number of them are forced to work in an adverse service industry, and these people lack awareness and have limited access to sexual health knowledge. The authors' previous study showed that sexual active pregnant women aged 20~39 years had an increased risk of syphilis infection and belonged to the high-risk age group for infection with sexually transmitted diseases [18]. Though the present study showed that age was not an independent factor for syphilis infection in pregnant women, to further control syphilis, we should improve sexual education for at-risk groups and help them develop appropriate sex concepts and take protective measures. In summary, to reduce the risk of syphilis among pregnant women, we should strengthen services to the itinerant population and consider those with low education, low income, and employment in the service industry as key targets for sex education and ad-

equate publicity to further reduce the occurrence of syphilis during pregnancy.

Conclusions

Syphilis during pregnancy remained common in itinerant, low income populations, and among those with low education levels and infected sexual partners in Jiangyin from 2014 to 2015. In the past two years, the city has strengthened its prevention, screening, and treatment efforts for syphilis during pregnancy, and preliminary results indicate high levels of treatment for maternal syphilis and significant improvements in neonatal outcomes. However, according to the WHO's proposal that the screening and treatment rates in every country should be above 90% by 2015 [19], there still is a clear disparity. It is necessary to strengthen the focus group, increase awareness and education, improve screening methods, and standardize treatment to further improve maternal and neonatal outcomes.

References

- [1] Braccio S., Sharland M., Ladhani S.N.: "Prevention and treatment of mother-to-child transmission of syphilis". *Curr Opin Infect Dis.*, 2016, 29, 268.
- [2] Rong Fanshang: "Specialists' consensus of the diagnosis and treatment of pregnancy merge syphilis". *Chinese J. Obstet. Gynecol.*, 2012, 47, 158.
- [3] Blencowe H., Cousens S., Kamb M., Berman S., Lawn J.E.: "Lives saved Tool supplement detection and treatment of syphilis in pregnancy to reduce syphilis related stillbirths and neonatal mortality". *BMC Public Health*, 2011, 11, S9.
- [4] Hubing Xue, Qu Bo, Liu Jie, Wu YuXin, Wang DongBo.: "Syphilis' epidemiological characteristics analysis and trend prediction in China from 1990 to 2010". *Modern Preventive Medicine*, 2014, 41, 961.
- [5] ZhouLei ming, ZhuangMing hua, NingZhen, Fu Jie, Shen XiaoPei, Gao XiaoNin, et al.: "Epidemiological analysis of syphilis in Shanghai, during 2005-2013". *Chinese J. AIDS STD*, 2015, 21, 311.
- [6] Lai Yu li, Huang Li lin: "Epidemiological investigation of maternal and neonatal syphilis and risk factors of neonatal syphilis analysis during 2011~2014". *Int. J. Lab. Medicine*, 2016, 37, 538.
- [7] Sun Yang yan, Su Hui, Ling Jing, Zhu YuLian, Tan Jie: "Epidemiological characteristic and pregnancy outcomes of 105 cases of pregnancy Complicated with syphilis". *Chinese J. Woman Child Health Res.*, 2014, 25, 758.
- [8] Zammarchi L., Borchi B., Chiappini E., Galli L., Brogi M., Sterrantino G., Trotta M.: "Syphilis in pregnancy in Tuscany,description of a case series from a global health perspective". *J. Matern. Fetal Neonatal Med.*, 2012, 25, 2601.
- [9] The Chinese Medical Association Branch of Obstetrics and Gynaecology Infectious Diseases Group: "Specialists' consensus of the diagnosis and treatment of maternal syphilis". *Chinese J. Obstet. Gynecol.*, 2012, 47, 158.
- [10] Li Xing-sheng, Liu He-ping, Huang Yin, Lin Yin, Xu WenQun: "Survey and analysis of blocking effectors between maternal and infant in pregnant women with syphilis". *Exp. Lab. Med.*, 2011, 29, 345.
- [11] Moline H.R., Smith J.F. Jr.: "The continuing threat of syphilis in pregnancy". *Curr. Opin. Obstet. Gynecol.*, 2016, 28, 101.
- [12] Charlier C., Benhaddou N., Dupin N.: "Syphilis and pregnancy". *Presse Med.*, 2015, 44, 631.
- [13] Xiao Xue, Zhou Yan Mei, Sun Wen, Chen DunJin: "Prevalence of syphilis during pregnancy and risk factors for maternal and perina-

- tal infections: a 2009-2013 survey". *J. Southern Medical University*, 2014, 34, 144.
- [14] Pan X., Zhu Y., Wang Q., Zheng H., Chen X., Su J., *et al.*: "Prevalence of HIV, syphilis, HCV and their high risk behaviors among migrant workers in eastern China". *PLoS One*, 2013, 8, e57258.
- [15] Jindal N., Arora U., Singh S., Devi B.: "Prevalence of sexually transmitted infections (HIV, hepatitis B, herpes simplex type 2 and syphilis) among asymptomatic pregnant women". *J. Obstet. Gynaecol. India*, 2012, 62, 158.
- [16] Casal C., Araújo Eda C., Corvelo T.C.: "Risk factors and pregnancy outcomes in women with syphilis diagnosed using a molecular approach". *Sex. Transm. Infect.*, 2013, 89, 257.
- [17] Araújo M.A., de Freitas S.C., de Moura H.J., Gondim A.P., da Silva R.M.: "Prevalence and factors associated with syphilis in parturient women in Northeast, Brazil". *BMC Public Health*, 2013, 13,206.
- [18] World Health Organization: The global elimination of congenital syphilis: rationale and strategy for action". Geneva: World Health Organization, 20007. Available at: <http://www.who.int/reproductivehealth/publications/rits/9789241595858/en/index.html>

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