

# Epidemiological survey on newborns born at the obstetric departments in hospitals in mid-southern region of China in 2005

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**Objective:** To investigate the situations at birth of newborns in the mid-southern region of China by performing a survey on the newborns born at urban hospitals.

**Methods:** A total of 23 hospitals in the mid-southern region of China were selected to participate in this survey. The data of 15,582 newborns who were born at the obstetric departments from January 1, 2005 to December 31, 2005 were retrospectively investigated.

**Results:** The male to female ratio among newborns was 1.16:1. The incidence of preterm birth was 8.11%, while very low birth weight (VLBW) infants accounted for 0.73%. The rates of spontaneous vaginal delivery and cesarean section were 57.52% and 40.82%, respectively, while the other delivery modes accounted for 1.66%. The incidence of neonatal asphyxia was 3.78% (0.75% for heavy asphyxia). The mortality of newborns was 0.55% (5.56% for preterm infants).

**Conclusions:** The incidences of preterm birth and neonatal asphyxia are relatively high in the mid-southern region of China. The rate of cesarean section is abnormally high, which is due mainly to social factors.

**Keywords:** Epidemiological survey; mid-southern region of China; obstetric department; newborns

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Perinatal mortality and morbidity are significant global health problems, and the major causes of perinatal deaths include preterm birth, neonatal infection and asphyxia (1). Premature infants are at high risk for morbidity and mortality because of bronchopulmonary dysplasia (BPD), necrotizing enterocolitis (NEC), intraventricular hemorrhage (IVH), and periventricular leukomalacia (PVL) (2). The morbidity and mortality of newborns are important indicators for evaluating the health care level of a certain country/area. Mid-southern region of China include six provinces in the middle and southern parts of China, whose economic development and health care services show wide disparities.

There are many factors of preterm delivery, such as medication or infection during pregnancy; threatened

abortion; PIH; preterm rupture of membranes; antepartum hemorrhage; history of abortion/induced abortion; history of preterm delivery or stillbirth; twins/multiplets; malposition; intra-uterine asphyxia; amniotic fluid contamination; placenta aging; umbilical cord abnormality; and others. However, the roles of main risk factors that may predispose neonates to these direct causes of mortality are less well understood. It is known that cesarean section is a common surgery for the management of high-risk pregnancy. As shown in many literatures, the cesarean section-related mortality and complications were 2-4 folds of those of vaginal birth, while the incidence of neonatal asphyxia showed no remarkable decrease (3,4). Furthermore, newborns are more susceptible to complications such as

wet lung, amniotic fluid aspiration, and asphyxia because they lack the process of uterine contraction and squeezing through the birth canal (5).

In this study, we investigated the conditions of newborns who born at obstetric departments in the hospitals in this region in 2005 with an attempt to provide new evidences for clinical decision-making.

## Subjects and methods

### Subjects

Totally 23 hospitals in the mid-southern region of China, including medical college-affiliated hospitals in the capital cities, province-level people's hospitals, and province-level maternal and child health care hospitals, participated in this survey. Furthermore, one comprehensive hospital and one maternal and child health care hospital from non-capital cities were also randomly selected for each province. All the subjects were newborns who were born at obstetric departments from January 1, 2005 to December 31, 2005. The survey protocol was developed based on the scheme developed by the Neonatal Subspecialty Group of Chinese Pediatric Society (6). The obstetric department and newborn department in each hospital were assigned to investigate about 1,000 newborns, respectively; if the sum was less than 1,000, all the newborns from that department were enrolled for analysis. For departments with the number of newborns more than 1,000, those who were discharged throughout the first 20, 15, 10, or 7 days of each month (i.e. 2/3, 1/2, 1/3, or 1/4 of all cases) were selected for analysis, making the surveyed newborns in both obstetric department and newborn department reach 1,000 cases each.

### Statistical analysis

Statistical analysis was performed using SPSS 11.0 software. Numeration data were compared using Chi square test.  $P < 0.05$  was considered significantly different.

## Results

### General data

Totally 15,582 newborns were born at the obstetric departments of these 23 hospitals in 2005, with a male to female ratio of 1.16:1. The incidence of preterm birth was

8.11%, and the rate of full-term delivery was 91.89%. The distribution of gestational ages at delivery was as follows: The percentages of the gestational ages at delivery that were less than 28 weeks, between 28 and 31 weeks, between 32 and 36 weeks, between 37 and 42 weeks, and more than 42 weeks were 0.29%, 0.95%, 6.87%, 91.31%, and 0.58%, respectively. More specifically, for the preterm infants, the percentages of the gestational ages at delivery that were less than 28 weeks, between 28 and 31 weeks, and between 32 and 36 weeks were 3.58%, 11.66%, and 84.76%; while for the full-term infants, the percentages of the gestational age at delivery that were between 37 and 42 weeks, and more than 42 weeks was 99.37% and 0.63%, respectively. For the birth weight, the percentages of those <1,000 g, 1,000-1,499 g, 1,500-2,499 g, 2,500-3,999 g, and >4,000 g were 0.21%, 0.52%, 5.34%, 89.83%, and 4.10%. More specifically, the distribution of the birth weight of the preterm infants was 1.57%, 6.21%, 41.98%, 49.49%, and 0.75% for body weight <1,000 g, 1,000-1,499 g, 1,500-2,499 g, 2,500-3,999 g, and >4,000 g, and that of full-term infants was 0.11%, 2.18%, 93.31%, and 4.40% for body weight 1,000-1,499 g, 1,500-2,499 g, 2,500-3,999 g, and >4,000 g. Mothers older than 35 years accounted for 6.14%; more specifically, women who were mothers of preterm infants and older than 35 years accounted for 9.26%, while women who were mothers of full-term infants and older than 35 years accounted for 5.26% ( $\chi^2=41.689$ ,  $P < 0.001$ ).

### Pregnancies of mothers

We also analyzed the data of mothers of the enrolled newborns (Tables 1,2). In their current pregnancies, the percentage of babies born to parents who had undergone in-vitro fertilization (IVF) or artificial insemination accounted for 3.43% of preterm infants, which was significantly higher than that among full-term newborns ( $\chi^2=114.903$ ,  $P < 0.001$ ). The rates of medication during pregnancy, threatened abortion, preterm rupture of membranes, and antepartum hemorrhage were higher among mothers of preterm infants than mothers of full-term newborns. Analysis also showed that the incidence of pregnancy-induced hypertension syndrome (PIH), especially severe PIH or eclampsia, was significantly higher among mothers of preterm infants than mothers of full-term newborns.

During their current pregnancies, the rate of spontaneous vaginal delivery or cesarean section was 57.52% or 40.82%,

**Table 1** Comparison of the current pregnancy between mothers of premature infants and mothers of full-term newborns (%)

Group	Mother's age (years)				Gravidity			Parity				Conception mode	
	<20	20-	30-	≥40	1	2	≥3	0	1	2	≥3	Natural	<i>In vitro</i> fertilization (IVF) or artificial insemination
Preterm labor	1.13	58.86	38.28	1.73	38.31	29.08	32.61	14.36	58.56	22.11	4.97	96.57	3.43
Full-term labor	0.85	69.04	29.21	0.90	39.91	32.08	28.01	20.33	62.27	15.36	2.04	99.31	

**Table 2** Comparison of the obstetric conditions among mothers (%)

Item	Overall incidence	Mothers of full-term newborns	Mothers of preterm newborns	$\chi^2$	P
<i>In vitro</i> fertilization (IVF) or artificial insemination	0.92 (172/18738)	0.69 (120/17267)	3.43 (52/1516)	114.903	<0.001
Gravidity ≥3 times	28.34 (5334/18819)	27.97 (4836/17292)	32.61 (498/1527)	14.914	<0.001
Parity ≥3 times	2.28 (429/18817)	2.04 (353/17292)	4.98 (76/1525)	54.453	<0.001
Medication during pregnancy	9.23 (1609/17428)	8.80 (1404/15953)	13.90 (205/1475)	41.865	<0.001
Infection during pregnancy	4.77 (894/18723)	4.74 (816/17207)	5.15 (78/1516)	0.497	0.481
Threatened abortion	3.78 (713/18871)	3.36 (583/17343)	8.51 (130/1528)	102.299	<0.001
Pregnancy-induced hypertension syndrome (PIH)	3.57 (674/18878)	2.72 (471/17350)	13.29 (203/1528)	455.780	<0.001
Severe PIH and eclampsia	57.14 (360/630)	48.51 (212/437)	76.68 (148/193)	43.348	<0.001
Premature rupture of membranes	15.69 (2956/18837)	14.30 (2476/17321)	31.66 (480/1516)	317.816	<0.001
Antepartum hemorrhage	3.04 (545/17942)	2.56 (423/16499)	8.45 (122/1448)	162.040	<0.001
History of abortion/induced abortion	46.17 (8650/18736)	46.37 (7985/17220)	43.87 (665/1516)	3.518	0.061
History of spontaneous abortion	9.62 (747/7769)	9.55 (685/7176)	10.46 (62/593)	0.521	0.470
History of preterm labor	0.96 (168/18753)	0.63 (108/17229)	3.94 (60/1524)	172.799	<0.001
History of stillbirth	0.76 (144/18815)	0.63 (108/17292)	2.36 (36/1523)	55.746	<0.001
Twins/multiplets	6.89 (1249/18120)	5.67 (944/16654)	20.81 (305/1466)	481.021	<0.001
Malposition	9.41 (1714/18223)	9.18 (1540/16774)	12.01 (174/1449)	12.513	<0.001
Intra-uterine asphyxia	10.58 (1973/18641)	10.55 (1810/17158)	10.99 (163/1483)	0.282	0.595
Amniotic fluid contamination	16.78 (3004/17906)	17.37 (2867/16506)	9.79 (137/1400)	53.161	<0.001
Umbilical cord abnormality	22.39 (4189/18713)	22.68 (3908/17228)	18.92 (281/1485)	11.133	0.001
Placenta aging	1.74 (306/17547)	1.78 (287/16124)	1.34 (19/1423)	1.509	0.219

**Table 3** Logistic regression analysis of the risk factors of premature delivery

Factors	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>P</i>	<i>Exp</i>
Threatened abortion	-0.668	0.114	34.392	<0.01	0.513
Pregnancy-induced hypertension syndrome	-1.654	0.102	265.349	<0.01	0.191
Premature rupture of membranes	-0.944	0.064	214.968	<0.01	0.389
History of stillbirth	-0.944	0.178	28.258	<0.01	0.389
Antepartum hemorrhage	-0.525	0.096	29.756	<0.01	0.592

respectively. Notably, 29.91% of cesarean sections were due to social factors. Preterm infants tended to have higher rates of twins, multiples, and malposition than full-term babies, while the latter had higher incidence of amniotic fluid contamination. The incidences of intra-uterine asphyxia and placenta aging showed no significant different between the preterm infants and full-term newborns.

Our Logistic regression analysis included the following risk factors of preterm delivery: mother >35 years; conception mode; having gravidity  $\geq 3$ ; having parity  $\geq 3$ ; medication or infection during pregnancy; threatened abortion; PIH; preterm rupture of membranes; antepartum hemorrhage; history of abortion/induced abortion; history of preterm delivery or stillbirth; twins/multiplets; malposition; intra-uterine asphyxia; amniotic fluid contamination; placenta aging; umbilical cord abnormality; and others. It was found that threatened abortion, PIH, preterm rupture of membranes, antepartum hemorrhage, and history of stillbirth were the risk factors of preterm delivery (Table 3).

### Conditions of newborns

The incidences of neonatal asphyxia were 3.78% and 1.11% one minute and five minutes after birth (0.75% and 0.48% for heavy asphyxia). Compared with full-term newborns (2.82%), preterm newborns tended to have higher rate of asphyxia one minute after birth (14.73%) ( $\chi^2=523.605$ ,  $P<0.001$ ).

The mortality of newborns born at these obstetric departments was 0.55% (5.56% for preterm infants). Among them, the mortality of preterm newborns was 5.56%, which was significantly higher than that in full-term newborns (0.11%) ( $\chi^2=673.311$ ,  $P<0.001$ ).

### Discussion

The mortality of newborns in China has shown a decreasing

trend along with the development of socio-economic conditions and medical sciences. According to the official statistics, the mortality of newborns in China was 13.2% in 2005 (7). Our current survey showed that the mortality of newborns born at obstetric departments in hospitals in mid-southern region of China was 0.55%, which was lower than the national average. Along with the continuous development of perinatal medicine, both the incidence of preterm delivery and the survival rate of preterm babies have increased. Our data have shown that the incidence of preterm delivery was 8.11% in the mid-southern region of China, which was lower than the rate in the United States in 2005 (12.7%) (8) but higher than China's nationwide data in 2002 (7.8%) (9), suggesting that the rate of preterm delivery has shown an increasing trend.

It was found in our study that threatened abortion, PIH, preterm rupture of membranes, antepartum hemorrhage, and history of stillbirth were the risk factors of preterm delivery. Therefore, routine antenatal examinations for pregnant women (especially those who are older than 35 years) and active prevention/control of pregnancy-related complications will be important to prevent preterm delivery and lower the incidence and case-fatality of preterm babies.

Cesarean section is a common surgery for the management of high-risk pregnancy. In our survey, the rate of cesarean section reached 40.82%, among which 29.91% were due to social factors. In the past decades, the misunderstanding of cesarean section (especially social factors) has made the rate of cesarean section unproportionally high (3,10). Early in 1980s, the World Health Organization proposed that the rate of cesarean section should not exceed 15%. Currently, the rates of cesarean section in the industrialized countries are maintained around 5-20% (11), but are far higher in most hospitals in China. Therefore, the indications of cesarean section should be strictly followed to decrease its rate.

Also in our survey, the incidence of neonatal asphyxias who were born at the obstetric departments in hospital in

mid-southern region of China was 3.78%, which was lower than those in some Chinese hospitals (5-11%) (10,12), but was still remarkably higher than those in developed countries. For example, it was 0.94% in Langspitali University Hospital in Iceland from 1997 to 2001 (13) and 0.09% in Edinburgh, UK, in 2005 (14). The prognosis of neonatal asphyxia is highly depended on the technique applied for resuscitation and its effectiveness. With effective and close cooperation between obstetric department and pediatric department, the application of new resuscitation method may dramatically decrease the incidence of neonatal asphyxia (15,16). Our survey demonstrated that the incidence of neonatal asphyxia was still high in the mid-southern region of China. Therefore, it is important to strengthen the cooperation between obstetric departments and pediatric departments, improve the quality of antenatal examination, and enhance perinatal monitoring for high-risk pregnancies. Once an intra-uterine asphyxia is identified, an effective new resuscitation method should be actively and strictly applied, so as to improve the quality of resuscitation.

Hospitals participated in this survey (sorted in Hanyu Pinyin order): Guangdong Guangzhou No.1 People's Hospital (Zhang Youxiang), Shenzhen Bao'an District Maternal and Child Health Care Hospital (Ye Zhenzhi), Guangdong Shenzhen People's Hospital (Wu Benqing), Guangdong Province People's Hospital (Nong Shaohan), Guangxi Beihai Maternal and Child Health Care Hospital (Wang Ruihua), Guangxi Beihai People's Hospital (Wang Ling), Guangxi Maternal and Child Health Care Hospital (Liu Xianzhi), Guangxi Mingzu Hospital, Guangxi Yulin Maternal and Child Health Care Hospital, Haikou Maternal and Child Health Hospital (Shi Lin), Hainan Sanya People's Hospital (Hu Xia), Hainan Maternal and Child Health Care Hospital (Guo Xiufeng), Hainan Wenchang Qingling Maternal and Child Health Care Hospital (Chen Xujie), The Affiliated Hospital of Hainan Medical University (Guo Shaoli), He'nan Jiaozuo Maternal and Child Health Care Hospital (Mu Xiurong), Henan Luoyang Women and Children's Health Care Center (Zhao Baili), Hubei Provincial Maternal and Child Health Care Hospital (Xia Shiwen), Hunan Provincial Maternal and Child Health Care Hospital (Cheng Linxia), Hunan People's Hospital (Li Yun), Hunan Xiangtan Maternal and Child Health Care Hospital (Zeng Jianwu), Hunan Xiangtan Central Hospital (Chen Xiaohua), Zhengzhou University Affiliated

Third Hospital (Cheng Xiuyong), Central South University Affiliated Xiangya Hospital (Wang Qinghong).

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## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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