

# The Impact of the Neonatal Resuscitation Program Guidelines (NRPG) on the Neonatal Mortality in a Hospital in Zhuhai, China

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## ABSTRACT

**Aim:** The neonatal resuscitation program (NRPG) was first introduced in our hospital to replace the traditional resuscitation (TR) program in 1993. TR has been in existence in China for a long time. The implementation of NRPG was timely in reducing the number of infant mortality and also to disseminate to the many hospitals in China which are still practising TR.

**Method:** A perspective study of 4,751 newborns with 366 asphyxiated babies in a period of 2 years was carried out. A previous sample of 1,722 live births under the TR program was compared as a controlled group statistically.

**Results:** From August 1993 to August 1995, when NRPG was exclusively implemented in our hospital, only 16 newborns died within 7 days, out of 4,751 births (3.4%) with 2 deaths in the delivery room. Seventeen newborns died within 7 days out of 1,722 births (9.9%) in the TR group, with 10 deaths in the delivery room. From the data shown, it can be clearly seen that perinatal neonatal mortality rate was reduced almost 3 times after NRPG was implemented ( $\chi^2 = 10.54$ ,  $p < 0.01$ ). The follow-up results of 21 cases of severe asphyxia at 2 months - 1 year of age were normal except for one with cerebral palsy.

**Conclusions:** Our study showed that NRPG was indeed a very effective and feasible technique during the delivery process in the reduction of neonatal mortality. It is important to disseminate widely the knowledge and technique of NRPG in places where TR is still being widely practiced especially in developing countries.

**Keywords:** asphyxia, neonatal mortality, delivery room care

## INTRODUCTION

Traditional resuscitation (TR) for asphyxiated newborns has been widely used in China especially in the grass-roots (peripheral) hospitals for many years. Conventionally TR includes: 1) infusions of central stimulants (coramine or lobeline) with 50% glucose and vitamin C (the so-called triple injections); 2) wiping and stimulating the body with alcohol; 3) pressing the philtrum; 4) patting the baby's sole; 5) mouth-to-mouth breathing, and 6) manipulating the arms and legs. Sodium bicarbonate and

dexamethasone were also used empirically. Neonatal asphyxia, however, remains the leading cause of neonatal death and the second cause of infant death in our country<sup>(1)</sup>. If the situations remain unchanged and if there is no planned strategy to tackle this problem, our national goal of reducing the infant mortality by one third by the end of this century may be difficult to achieve. Actually, the majority of the asphyxia deaths could have been avoided, had the modern resuscitation method for the newborn, ie, the NRPG (Neonatal Resuscitation Program Guidelines)<sup>(2,3)</sup> method been extensively taught and implemented. These guidelines were established by a joint committee of the American Academy of Pediatrics and the American Heart Association in 1990. Zhuhai City is close to Macau and is one of the special economic zones of China. The infant mortality of Macau was 7 per 1,000 livebirths. NRPG technique was introduced in our hospital from August 1993. We note that the NRPG method is an important and effective way of reducing the neonatal and infant mortality. It is hoped that the health policy makers of the government would lend strong support to adopt the NRPG technique to ensure realisation of our national goal.

## PATIENTS AND METHOD

A 2-year prospective study was conducted from August 1993 to August 1995. All the 4,751 livebirths in our hospital during this period were studied. Only NRPG technique was applied for the newborn infants during this period, including the asphyxiated babies. Using the 1-minute Apgar score of 7 or less as the criterion, 366 cases were diagnosed to have asphyxia. Of these, 66 were considered as severe with an Apgar score of 0-3; and 300, moderate with an Apgar Score between 4-7<sup>(4,5)</sup>.

The resuscitation procedures were strictly adhered to the NRPG<sup>(6)</sup>. Airway clearing of the oro-pharyngeal or endotracheal suction was the first resuscitation step followed by bag-and-mask or endotracheal ventilation with 100% oxygen. Prompt endotracheal intubation was a very important step for those babies who were 1) severely asphyxiated, 2) not responding to bag-and-mask ventilation, or 3) found to have thick meconium in the hypopharynx and trachea. External cardiac compression would be initiated when there was no improvement in the heart rate (below 60/min).

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Unlike TR, medications in NRPG method were seldom used unless the heart rate has fallen below 80/min despite adequate ventilation. Medications would also be required when cardiac compression lasts for more than 30 seconds or when there was no heart beat. Sodium bicarbonate and adrenaline were commonly used when necessary<sup>(7)</sup>.

The control group of 1,722 babies were born in 1992 when TR was a routine method in the delivery room in our hospital.

### FINDINGS AND RESULTS

All the 366 asphyxiated babies were suctioned through oropharynx immediately after birth, 41.5% (152) needed repeat suctioning via endotracheal tube (ET) (116 had thick meconium around the hypopharynx). Bag-and-mask ventilation was done in 214 cases (58.5%); ET ventilation, in 152 (41.5%), external cardiac compression, in 30 (8.2%), and medications, in only 7 (1.9%).

Out of a total of 4,751 babies, 2 died in the delivery room (one was hydropic and the other had Potter syndrome). All other babies were resuscitated successfully by the NRPG technique. Another 14 died in the first week of life because of complex congenital heart disease, severe diaphragmatic hernia, pneumonia, and very low birth weight (below 1,500g at birth). The perinatal neonatal mortality was 3.4 per 1,000 births (16/4751). In 1992, there were 17 deaths in the control group in the delivery room giving a perinatal neonatal mortality of 9.9 per 1,000 births (17/1722). There was a significant 3-fold drop in neonatal mortality in the NRPG group ( $\chi^2=10.54$ ,  $p < 0.01$ ).

Twenty-one unselected cases of severely asphyxiated babies were followed-up at 2 months to 1 year of age after discharge with cerebral ultrasonography and DDST (Denver Development Screening Test). Twenty babies showed normal neurological development. One had cerebral palsy. The short-term neurological sequela rate in the NRPG group was 4.8%.

### DISCUSSION

For the past several years since his return from America where he acquired the skills of NRPG technique, the senior author (X Y Zhu) has been promoting strongly the practice of the NRPG in China. The author has even gone to the hospitals in the poor mountainous area<sup>(8,9)</sup> to teach the NRPG technique with some success. Although NRPG is being performed in some tertiary hospitals in China, it has not reached many grass-roots hospitals where neonatal asphyxia still occurs almost daily. It is disappointing to note that there are still published reports on TR and the use of coramine and 'triple injections.' These papers appeared in the medical journals recently<sup>(10,11)</sup> and have caused confusion to health care workers regarding the correct resuscitation procedure to adopt. This has impeded the popularisation of NRPG. The first goal of the 'National Programme of Action for Child Development in China in the 1990s' is to reduce the

infant mortality by one-third. Unfortunately, neonatal deaths account for about 60% of infant mortality, birth asphyxia being the leading cause of neonatal death in China<sup>(1)</sup>. Neonatal asphyxia and resuscitation should draw the attention of both the medical staff and the government. Deaths and sequelae from birth asphyxia can be and should be reduced or avoided. It is suggested that resolute introduction and consensus for the modern resuscitation technique (NRPG) for the newborns are essential for all the hospitals in every district. If the fatality rate of asphyxia in China remains at 10%<sup>(12)</sup> and working on the total annual deliveries of 20 million and mean asphyxia prevalence of 8%, there would be 160,000 neonatal death a year as a result of asphyxia. If NRPG replaces TR and lowers the mortality by half, 80,000 newborn babies would have been saved every year. Fortunately, an appeal by a prominent paediatrician in China to adopt the NRPG technique has been proposed recently<sup>(12)</sup>.

In the West, a neonatal paediatrician skilled in neonatal resuscitation is called by the obstetric staff to the delivery room. In China, however, paediatricians are not asked to go to the delivery room. The obstetricians will do the resuscitation themselves, usually using the TR method. In 1993, the Health Bureau and the hospital authorities strongly supported our NRPG training programme and obstetricians have requested that paediatricians be on standby in the delivery room for high risk deliveries. The co-operation between obstetricians and paediatricians is essential for the success of the NRPG programme.

In the TR technique, no one is trained to do ET intubations in the delivery room. The anaesthetist is asked to intubate when all other measures including administration of drugs have been tried, and failed. Much time has been wasted. In the NRPG method however, at least one person (usually the neonatologist) in the resuscitation team is competent in intubation. From our experience, as the baby's head appeared at the perineum and is noticed to have no facial expression, the attending staff will suspect severe asphyxia and immediate ET intubation would be done. A skillful doctor needs only 5-10 seconds to do that. Clearing of the airway and bag ventilation of the asphyxiated babies with oxygen will normally be followed by prompt improvement. Of course, problems in instituting effectively the NRPG method can still occur. These include unskilled laryngoscopic operation and intubation, incorrect assessment of asphyxia, incoordination of bag ventilation and cardiac massage, devices not available or not fitting. It is therefore necessary to compile training materials, to conduct regular NRPG training classes and to set up a national system to recognise the qualifications of the trained NRPG operators.

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