

Perinatal Drug Abuse in KK Women's and Children's Hospital

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Abstract

No local figures are available in Singapore on the incidence of perinatal drug abuse and its effect on the foetus and the neonate. The objectives of this study were to determine the incidence of perinatal drug abuse and neonatal abstinence syndrome; to identify a maternal profile at high risk for substance abuse and to document the presenting features and treatment of infants with neonatal abstinence syndrome. Out of 14,690 births during the period January 1994 to December 1996, 38 (0.25%) had evidence of perinatal drug abuse. The study revealed that a high-risk maternal profile for drug abuse comprised of single mothers (52%); history of smoking (52%); no antenatal care (37%) and belonging to the Malay ethnic group (82%); and younger maternal age. Self-reporting was uncommon, occurring only in 8% and in 40% of cases, there was no known history of maternal drug addiction. The drug abused in all cases was heroin. Human immunodeficiency virus (HIV) screening was done only in a minority (21%) of the mothers and it was negative in all. Eighteen (47%) infants had evidence of neonatal abstinence syndrome with neurological manifestations being the commonest. Urine toxicology screening was positive in 26% of cases and had only 70% sensitivity and 41% positive predictive value. On follow up, default rate was high with 42% babies not attending follow up at the outpatient clinic.

In conclusion, there is a need to maintain a high index of suspicion of substance abuse in those with high-risk maternal profile and their neonates should be closely watched for features of neonatal abstinence syndrome. Alternative methods of toxicology screening apart from urine need to be evaluated in order to improve the drug detection rate.

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Key words: *High-risk maternal profile, Neonatal abstinence syndrome, Substance abuse, Toxicology screening*

Introduction

In recent years, perinatal drug abuse has been emerging as an area of major concern for the perinatologists. Chasnoff^{1,2} found the prevalence of substance abuse in a pregnant population to be approximately 11% (range 0.4% to 27%) in a survey of 35 perinatal centres in the United States. Maternal drug abuse can have both short-term and long-term effects on the offspring. Perinatal complications associated with drug use include spontaneous abortions, stillbirths, abruptio, foetal distress, prematurity, intrauterine growth retardation (IUGR), congenital malformations, neonatal toxicity and withdrawal.²⁻¹¹

Follow-up studies have revealed growth deficits,¹² behavioural abnormalities and neurodevelopmental problems^{2,10,13,14} and also higher incidence of child abuse^{10,15} in these children. These infants continue to be at high risk of continuing developmental and later school problems because of compounding factors like inadequate parenting skills, poor socio-economic status and associated environmental factors.¹⁰

In Singapore, due to strict laws and regulations, the incidence of drug abuse is low compared to the Western world. However, the problem does exist and no local figures are available on the incidence of perinatal drug abuse and its effect on the foetus and the neonate.

Aim

The objectives of the study were as follows:

- 1) to determine the incidence of perinatal drug abuse and neonatal abstinence syndrome in a tertiary care perinatal centre;
- 2) to try and identify a high-risk maternal profile for substance abuse if possible; and
- 3) to document the clinical features and treatment of babies with features of neonatal abstinence syndrome (NAS).

Materials and Methods

The study was done over a period of 36 months from January 1994 to December 1996 in the Department of Neonatal Medicine II, Kandang Kerbau Hospital,

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Singapore, which is a university-affiliated public teaching hospital that currently delivers about a third of all newborn infants in Singapore.

The babies included in the study were those with a history of maternal drug abuse and/or signs of neonatal abstinence syndrome. Demographic data were collected for baby and mother. Maternal data included age, marital status, antenatal care, race, previous pregnancy outcome, smoking, alcohol use, history of drug abuse in partner, detention at drug rehabilitation centre, type and duration of drug abuse and HIV status where available. Neonatal data included gestational age, birthweight and anthropometry, gestational age status, apgar scores, congenital malformations, infections, neonatal complications, metabolic profile and Finnegan's scoring¹⁶ for diagnosis of neonatal abstinence syndrome.

All infants had Finnegan's scoring done at 4 to 6 hourly intervals and a score of 8 and above on 3 occasions or an average of ≥ 8 on 3 consecutive scores was considered as need for pharmacological intervention.

Drugs used for treatment of NAS were phenobarbitone and chlorpromazine. Other investigations included cranial ultrasound, thyroid function tests, haematological and metabolic parameters. Urine was collected from the baby for toxicological screening. Toxicological screening was done by enzyme immunoassay using an Enzyme Multiplied Immunoassay Technique or EMIT kit. EMIT kit is a popular method of routine drug screening and is based on the competitive binding to antibody of the drug by the drug in urine and an enzyme-labelled drug.¹⁷ All positive EMIT results are confirmed by gas chromatography-mass spectrometry (GC/MS) and quantified by high performance liquid chromatography (HPLC). GC/MS is an extremely sensitive and sophisticated method of drug analysis and is considered to be the definitive method of drug detection. After discharge, the babies were scheduled to be seen at the follow-up clinic.

Statistical Analysis

Statistical analysis was done by the chi-square test or Fischer's test for categorical variables. Continuous variables were assessed by the Student's t-test. A *P* value of <0.05 was considered significant.

Results

The maternal demographic data are shown in Table I. Table I shows that in the study group the mothers were younger, with a higher incidence of teenage pregnancy, single, lacking antenatal care and belonging to the Malay ethnic group. Half (52.6%) of the mothers in the study group had associated habit of smoking while a quarter (24%) gave a history of regular alcohol consumption.

Twenty-two out of 38 (58%) mothers had a previous known history of drug addiction and 16 of these were

TABLE I: DEMOGRAPHIC FEATURES

	Study population (n = 38)	KKH general obstetric population (n = 29,621)	<i>P</i> value
Mean maternal age (years) ($\pm$ SD)	26.2 (6.7)	29.2 (5.1)	<0.05
No. of teenage mothers (%)	5 (13%)	906 (3%)	<0.05
No. of single/ divorced (%)	20 (53%)	393 (1.3%)	<0.001
No. of lacking antenatal care (%)	14 (37%)	865 (3%)	<0.05
Race			
Malays (%)	31 (81.5%)	10,761 (36%)	<0.001
Other races (%)	7 (18.5%)	18,811 (63%)	

enrolled in the drug rehabilitation centre programme. Sixteen (32%) gave no history of drug abuse initially. Self-reporting was seen in only 3 (8%) cases. The drug abused in all cases was heroin. HIV status was not tested in the majority (30 or 79%) of the mothers and was negative in the remaining 8 (21%). The 38 babies in the study were born at a mean gestational age of 36.9 ± 2.3 weeks and nearly half 18 (47%), were <37 weeks. Two (5%) of the babies were <34 weeks at birth. Mean birthweight was 2454 ± 531 g, mean length at birth was 45.5 ± 3.28 cm and mean occipito frontal circumference (OFC) was 32.3 ± 1.48 cm. Sixteen (42%) of the babies were small for gestational age.

Eighteen out of 38 (47%) of the babies showed clinical evidence of neonatal abstinence syndrome. The onset of symptoms occurred at a mean age of 1.93 ± 0.94 days and peaked at 2.8 ± 1.04 days. A mean maximum Finnegan's score of 11.4 ± 7.54 (range 0 to 22) was seen in these babies and 12 out of 18 (67%) babies with NAS needed medication at 3.08 ± 1.16 days of life. The clinical features of the babies with neonatal abstinence are shown in Table II. The withdrawal symptoms were controlled with phenobarbitone in 14 infants and 4 infants needed chlorpromazine in addition. Phenobarbitone was used at a maximum dose of $10.6 \text{ mg/kg/day} \pm 3.6 \text{ mg/kg/day}$, the mean duration being 23 ± 9.7 days.

Urine toxicology screening was done in all except one case at a mean age of 2.8 ± 1.9 days and was found to be positive in 10 (26%) of the babies. The sensitivity of the test was 70% with a specificity of 63% (Table III). Comparison of babies with and without features of NAS revealed longer duration of hospitalisation in the symptomatic group compared to those without symptoms [26.2 ± 13.8 days versus 11 ± 8.6 days, respectively ($P < 0.05$)]. Fourteen out of the 38 (42%) babies defaulted follow up and 11 (29%) were given up for adoption.

Discussion

The incidence of perinatal substance abuse in our study was very low at 0.25% and this is much lower than

TABLE II: SYMPTOMATOLOGY OF NEONATAL ABSTINENCE SYNDROME

A. Neurological symptoms	No. (n = 18)	% (100%)
Tone abnormalities	14	78
Tremors/jitteriness	15	83
Hyper-reflexia	12	67
Irritability	17	94
High-pitched cry	13	72
Sleep disturbance	15	83
Seizures	1	5.5
B. Gastrointestinal abnormalities	(n = 17)	(94%)
Diarrhoea	8	44
Vomiting	9	50
Poor feeding	13	72
Frantic suck	15	83
C. Autonomic dysfunction	(n = 16)	(89%)
Neonatal pyrexia	16	89
Sweating	2	11
Skin mottling	4	22
Yawning	1	5.5
D. Miscellaneous		
Respiratory symptoms	12	66
Skin excoriation	14	78
Hiccups	1	5.5

TABLE III: URINE TOXICOLOGY SCREENING

Number of babies tested	37
Number of positive tests	10 (26%)
Age of screening (mean $\pm$ SD)	2.77 $\pm$ 1.9 days
Sensitivity	70%
Specificity	63%
Positive predictive value	41%
Negative predictive value	85%

the reported prevalence rates in the West, viz 0.4% to 44% with an average of 11% illicit drug use during pregnancy.^{1,18} This lower incidence of substance abuse locally can be explained by various factors. According to Ong,¹⁹ culturally defined characteristics of people and countries have an influence on the nature and scope of substance abuse. In Singapore, drug abuse is viewed as a social, legal and behavioural problem and the country has adopted a double-pronged strategy of supply reduction and demand reduction.¹⁹ Availability of the drug is drastically limited by strict laws and law enforcement by Central Narcotics Bureau, police and customs. Harsh penalties under the Misuse of Drug (Amendment) Act of 1993²⁰ have helped to keep the problem in check. Demand reduction has been achieved by various measures like preventive education in school and community, treatment and rehabilitation, supervision

and after care services. Finally the reported low incidence of 0.25% may be an underestimate because of lack of self-reporting and early discharge of babies and mothers within 24 hours when symptoms might not have appeared. Self-reporting is usually low and often inaccurate and unreliable because of fear of consequences which may follow. In a study by Ostrea et al,²¹ incidence of drug abuse by self reporting was as low as 11% compared to 44% by drug screening. This underestimate of the prevalence of perinatal drug abuse in our population may to some extent be overcome if we make use of the high-risk maternal profile established in our study.

In our study, we found a high-risk profile of the mothers among the study cohort and some of the characteristics of this profile included younger maternal age, lack of antenatal care, belonging to Malay ethnic group, smokers and single mothers. The higher prevalence among the Malay ethnic group is in accordance with the national ethnic distribution among drug offenders. Lack of antenatal care has also been reported by other authors^{9,22,23} as one of the common features of substances abusing women. Associated frequent use of additional licit substances like smoking and alcohol has been commonly reported by other authors^{9,19,24} and similarly in our study. Fifty-two per cent of the mothers smoked and 24% gave history of regular alcohol consumption. This incidence is higher than the national prevalence rates of smoking in our population (2% to 6%).

Unlike reports in the Western literature, we had no case of cocaine abuse. Heroin was the drug abused in all cases.

HIV screening has been recommended in pregnant addicts^{23,25} because of their possible unsafe sexual practices, HIV infection in partners and prostitution. The incidence of HIV infection in these mothers has been reported to be high from 21% to 40%.^{5,10} In our study there was a very low rate of 21% of HIV testing and in view of the high reported rates of HIV infection from 21% to 40% in this group, we need to look into instituting measures to achieve higher rates of HIV screening in the high-risk group.

The higher incidence of prematurity (47%) and growth retardation (42%) in our study is comparable to other studies^{5,23,26} and this could be attributed to opiate use, cigarette smoking and poor antenatal care. Half to two-thirds of babies born to opioid-dependent mothers, demonstrate signs of the neonatal abstinence^{5,9,16,27,28} and this was also seen in our study where 47% of the babies showed clinical evidence of NAS. As seen in other studies,^{9,16,23} the commonest manifestation was central nervous system hyper-irritability and gastrointestinal dysfunction and these appeared within 72 hours of birth.

Finnegan's score is now widely used to monitor the passively addicted neonate in a comprehensive and objective way and is essential for assessing the course of the abstinence syndrome and the need for pharmacological intervention.^{16,29} Phenobarbitone was the principal drug used in the control of neonatal abstinence syndrome in our study. Theis et al³⁰ did a Medline review of the current therapeutic drugs used and concluded that while the most commonly used drugs were phenobarbitone, paregoric or diazepam, there was very little comparative data on relative efficacy of different pharmacological treatment regimes. We found that the urine toxicological screening that was used in our study was of limited value with a sensitivity of 70% and a specificity of 63%. False negative tests from neonatal urine screening could be due to either mother abstaining from the drug for a few days prior to delivery or inability to obtain neonatal urine sample soon after birth.^{21,31} Limited usefulness of urine toxicological screening has been reported by other authors.^{21,31,32}

To overcome the limitation of urine screening, hair and meconium are also being tested to improve the diagnosis of foetal drug exposure. Meconium drug analysis is reported^{21,32} to be an easy and sensitive method to detect intrauterine exposure of neonate to drugs and is now being increasingly used in detection of perinatal drug exposure. Maintaining a high index of suspicion based on a characteristic maternal profile has been recommended by Ostrea et al²¹ and they have recommended drug screening of meconium in neonates in this high-risk group. On follow up, 29% of the babies were adopted and these had regular follow up. A high proportion (42%) defaulted follow-up in spite of repeated reminders by telephone, letter or referral to the medical social worker. Non-attendance at clinics has been found to be higher in teenage mothers and single marital status.³³

Conclusion

Single, young, unbooked smoking mothers belonging to the Malay ethnic group were identified as a high-risk maternal profile for substance abuse during pregnancy. Although the incidence of perinatal drug abuse is reportedly low, detection of newborns at risk can only be done if we maintain a high index of suspicion based on high-risk maternal profile. Early discharge of the mother and baby should be deferred in this high-risk group and the babies may need to be observed for 48 to 72 hours prior to discharge for evidence of NAS. Urine toxicology is not a very sensitive screening test and we may need to use meconium testing for better diagnosis of perinatal drug exposure. Methods to ensure comprehensive follow up of these infants including home visits need to be considered in view of the high incidence of developmental and later school problems.

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