

METHAMPHETAMINE ABUSE DURING PREGNANCY AND ITS HEALTH IMPACT ON NEONATES BORN AT SIRIRAJ HOSPITAL, BANGKOK, THAILAND

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Abstract. To ascertain the impact of intrauterine methamphetamine exposure on the overall health of newborn infants at Siriraj Hospital, Bangkok, Thailand, birth records of somatic growth parameters and neonatal withdrawal symptoms of 47 infants born to methamphetamine-abusing women during January 2001 to December 2001 were compared to 49 newborns whose mothers did not use methamphetamines during pregnancy. The data on somatic growth was analyzed using linear regression and multiple linear regression. The association between methamphetamine use and withdrawal symptoms was analyzed using the chi-square. Home visitation and maternal interview records were reviewed in order to assess for child-rearing attitude, and psychosocial parameters. Infants of methamphetamine-abusing mothers were found to have a significantly smaller gestational age-adjusted head circumference (regression coefficient = -1.458, $p < 0.001$) and birth weight (regression coefficient = -217.9, $p \leq 0.001$) measurements. Methamphetamine exposure was also associated with symptoms of agitation (5/47), vomiting (11/47) and tachypnea (12/47) when compared to the non-exposed group ($p \leq 0.001$). Maternal interviews were conducted in 23 cases and showed that: 96% of the cases had inadequate prenatal care (< 5 visits), 48% had at least one parent involved in prostitution, 39% of the mothers were unwilling to take their children home, and government or non-government support were provided in only 30% of the cases. *In-utero* methamphetamine exposure has been shown to adversely effect somatic growth of newborns and cause a variety of withdrawal-like symptoms. These infants are also psychosocially disadvantaged and are at greater risk for abuse and neglect.

INTRODUCTION

During the past decade, methamphetamine abuse among the Thais has reached epidemic proportions. It is estimated that over 1 million people in Thailand regularly abuse methamphetamine or 'Ya Ba', as it is nick named in the Thai language. Originally popular among the working class for its stimulant effects, the use of methamphetamine has spread into schools and universities at an alarming rate. A survey done by Thailand's leading information service provider reports that, among the over forty-five thousand youths ranging from 6th grade

to university level being surveyed, one in four (25.5%) admit to having used methamphetamine at some time in their lives.

Besides the obvious loss of productivity and deterrent from meaningful professionals or vocational education, methamphetamine use among young men and women leads to other risk-taking behaviors such as unprotected sexual intercourse and unplanned pregnancy. At Siriraj Hospital, one of the major metropolitan hospitals in the Bangkok area, there has been a substantial increase in the numbers of infants born to women who continue to abuse methamphetamine during pregnancy. A rising concern regarding the short term and long term impacts that maternal addiction may have on the lives of these infants prompted a study to determine the effects of methamphetamine exposure during fetal and neonatal life, and the psychosocial

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ramifications of maternal drug addiction.

MATERIALS AND METHOD

During the period of January to December 2001, all infants born to mothers who admitted to using methamphetamine during pregnancy had their urine screened via Fluorescent Enzyme Immunoassay (FEIA) method for the presence of methamphetamine postnatally. Those infants whose samples were positive for methamphetamine were included in the study. Data was collected on APGAR scores at one and five minutes respectively, estimated gestational age based on ultrasound or Dubowitz scoring, birth weight, head circumference and length. The infants were all admitted to the Neonatology service and possible intoxication and withdrawal symptoms, as derived from the pharmacologic actions of the drug, and from modification of the guideline proposed by the American Academy of Pediatrics, were also recorded. The control group consisted of infants whose mothers did not report methamphetamine use during pregnancy and who were born during the same time period. Occurrence of possible withdrawal symptoms during the initial observation period of 48 hours were recorded for both the exposed and unexposed infants and included agitation, sleep disturbances, vomiting, tremor, excoriation, tachypnea, and temperature instability.

The data on somatic growth was analyzed using linear regression. Multiple regression analysis was employed to adjust for the effect that gestational age might have on somatic growth. The association between withdrawal symptoms and methamphetamine status was analyzed using the chi-square test.

Whenever possible, the pediatric social worker conducted thorough maternal interviews and home assessment visits prior to the infant's discharge. Descriptive data regarding marital status, living conditions, and child-rearing attitudes were collected.

RESULTS

We recorded 49 cases of infants born to methamphetamine-abusing mothers during the period between January to December 2001. The average birth weight, length, and head circumference measurements of this group were $2,682 \pm 445$ g, 47.6 ± 2.48 cm, and 31.7 ± 1.7 cm respectively. The con-

trol group, consisting of 49 infants born during the same time period, showed the following average measurements, $2,872 \pm 521$ g for birth weight, 47.6 ± 2.48 cm for length, and 31.7 ± 1.7 cm for head circumference. The methamphetamine-exposed group had average APGAR scores at one and five minutes of 8.6 ± 1.1 and 9.9 ± 0.5 , while the non-exposed group had average APGAR scores of 8.8 ± 1.5 at one minute and 9.8 ± 0.5 at five minutes. Mothers in the methamphetamine-exposed group were also found to be significantly younger in age (23.2 ± 5.2 years) than the non-exposed control group (26.5 ± 6.7 years). A summary of linear regression results is found in Table 1.

When using multiple regression analysis, controlling for the differences in gestational age between the exposed and non-exposed groups, the exposed group was found to have a significantly smaller average head circumference measurement [regression coefficient -1.46 , CI $(-2.10, -0.82)$, $p < 0.001$] and birth weight [regression coefficient -217.90 , CI $(-415.11, -20.69)$, $p < 0.05$]. The results are summarized in Table 2.

Of the 47 cases in the methamphetamine-exposed group, there was a statistically significant association ($p \leq 0.05$) between the symptoms of withdrawal, such as agitation (5), vomiting (11), and tachycardia (12) and methamphetamine exposure. A summary of withdrawal symptoms is found in Table 3.

There were 23 women who received home visitation during the study period. Of these, 65% admitted to having been an addict for greater than 5 years. Virtually all of the cases (96%), the mother received little (< 5 visits) or no prenatal care. In 57% of the cases, the father was also an addict and in 48% of the families being assessed, one or both parents were sex workers. Moreover, 39% of parents admitted that they were unwilling to take the child home. Government or non-government assistance was provided in only 30% of the cases. A summary of this and other psychosocial characteristics of the mothers is found in Table 4.

DISCUSSION

Methamphetamine abusers in Thailand represent a somewhat unique population. The drug is used via snorting or inhaling, making the onset of action on the central nervous system rapid, and the undesirable cardiovascular side effects less. Its

Table 1
Methamphetamine status and neonatal parameters.

	Methamphetamine-exposed group N=47	Non-exposed group N=49	p-value
Male (%)	24 (51.1)	34 (69.4)	
Female (%)	23 (48.9)	15 (30.6)	
Maternal age (years)	23.2 ± 5.2	26.5 ± 6.7	0.009 ^a
Birth weight (grams)	2,682 ± 445	2,872 ± 521	0.058
Length (centimeters)	47.6 ± 2.48	48.5 ± 2.53	0.098
Head circumference (centimeters)	31.7 ± 1.7	33.0 ± 1.4	0.001 ^a
Average APGAR score at 1 minute	8.6 ± 1.1	8.8 ± 1.5	0.545
Average APGAR score at 5 minutes	9.9 ± 0.5	9.8 ± 0.5	0.881
Gestational age (weeks)	38.5 ± 2.5	37.9 ± 1.8	0.161 ^a

^astatistical significance; $p \leq 0.05$

Table 2
Association of methamphetamine status and neonatal somatic growth, adjusting for the differences in gestation age.

	Regression coefficient	95% confidence interval	p-value
Birth weight (g)	-217.902	-415.112, -20.692	<0.05
Length (cm)	-0.945	-1.999, +0.109	0.069
Head circumference (cm)	-1.458	-2.101, -0.815	<0.001

Table 3
Selected post-natal abstinence characteristics associated with methamphetamine exposure.

Symptoms	Number of cases with symptom (N=47)	p-value (chi square)
Agitation	5	≤ 0.05
Sleep disturbances	3	$= 0.113^{\text{NS}}$
Vomiting	11	≤ 0.001
Tremor	5	≤ 0.001
Excoriation	6	≤ 0.001
Tachypnea	12	≤ 0.001
Temperature instability	7	≤ 0.001

Table 4
Maternal and life style characteristics in a piloted home visitation program (N = 23).

Mother is an addict for > 5 years	65%
Father is also an addict	57%
Mother or father is involved in prostitution	48%
Parents unwilling to take the child home	39%
Had no antenatal care	72%
Had inadequate antenatal care (< 5 visits)	96%
Family members assume responsibility for the child	57%
Government or non-government organizations provided assistance	30%

affordability of a little more than one dollar per pill easily rank methamphetamine as the most popular drug of abuse in Thailand today (Inthawiwat *et al*, 2002).

Up until now, the impact of amphetamine use during pregnancy has been reported mainly in women who ingested the drug for weight control purposes or in sporadic case reports of recreational and intravenous use (Blinick *et al*, 1976; Eriksson

et al, 1981; Oro and Dixon 1987; Dearlove *et al*, 1992; Catanzarite and Stein 1995; Eriksson *et al*, 2000a; Ho *et al*, 2001). In these circumstances, the exposed neonates were shown to also have a reduced birth weight, length, and head circumference. One study demonstrated a persistently smaller head circumference measurement at one year of age and aberrant neurodevelopmental progression up to 14 years of age (Eriksson *et al*, 2000b). In our study,

we demonstrated a significant relationship between maternal methamphetamine abuse and decreased head circumference and birth weight measurements. In addition, there is a trend toward a significant relationship between maternal amphetamine abuse and decreased fetal length. We believe that, if the number of subjects were greater than the present study (power = 0.74), the relationship might be statistically significant.

Other effects of methamphetamine exposure in-utero include increased incidence of intracranial hemorrhage, prematurity, intrauterine growth retardation, and perinatal complications (Behnke *et al*, 1999). Neonatal abstinence syndrome, that is typical of opiod withdrawal, has not been reported for methamphetamines (Neuberg, 1970; Oro and Dixon, 1987; Wagner *et al*, 1998).

Unfortunately, methamphetamine exposure during fetal life has an impact far beyond the neonatal period. The insults sustained in-utero, ranging from increased incidence of intracranial hemorrhages, smaller overall growth, and utero-placental insufficiency, all contribute to problems with behavior, learning, and cognition reported throughout the literature (Billing *et al*, 1988; 1994; Wagner *et al*, 1998; Eriksson *et al*, 2000a,b). Unfavorable family circumstances and psychosocial situations found in our study, such as co-existing drug addiction of the father, prostitution by one or both parents, and the existence of little to no family support, have been reported extensively in the literature. These factors contributed greatly to the increased risk of child abuse and neglect in these types of families (Lejeune *et al*, 1997; Parkinson *et al*, 2001).

Further study is needed to better quantify the depth of impact that intrauterine methamphetamine exposure has on the developing child. From what we know about methamphetamine today, issues such as the implications of methamphetamine addiction on breast feeding recommendations and the effectiveness of medical and social interventions on reducing neurodevelopmental sequelae are still being debated.

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