following discharge,¹⁶ it has become our practice to nurse all infants <32 weeks' gestation initially in the prone position, but to turn them over to the supine position approximately one week prior to discharge. At the same time, we explain to the parents that their baby has now largely outgrown the problems initially associated with their premature birth, and that we are now preparing everything for going home, where supine is the recommended sleeping position for their baby. This approach is similar to that adopted by many British NICUs according to a recent survey,¹⁷ and includes infants still receiving additional inspired oxygen at the time of hospital discharge.

Although admittedly unproved, we feel that this approach offers a solution to the cognitive dissonance otherwise resulting from parents seeing their baby being nursed in the prone position for several weeks while still in the hospital, but then being told that they must place their baby supine once at home. At the same time it allows us to take advantage of the physiological benefits of the prone sleeping position during the first weeks of life—which is now confirmed by Kassim *et al.*¹⁵

Arch Dis Child Fetal Neonatal Ed 2007;**92**:331–332.

doi: 10.1136/adc.2006.113720

Drug misuse during pregnancy

Drug misuse during pregnancy and fetal toxicity

Mark Anderson, Imti Choonara

Perspective on the paper by Garcia-Bournissen *et al* (see page 351)

The typical age at which women in North America and Europe misuse drugs encompasses their childbearing years. In the USA, according to the 2005 National Survey on Drug Use and Health, 3.9% of pregnant women admitted using illicit drugs in the previous month.¹ However, maternal self-report probably underestimates the problem to a marked extent. In a sample of over 3000 babies born to an obstetric population considered high risk for drug misuse, 44% tested positive for morphine, cocaine or cannabinoid by meconium immunoassay. In contrast, only 11% of the mothers admitted illicit drug use.² Methamphetamine is the most widely misused amphetamine with a rapid global increase in use throughout the 1990s.

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Competing interests: None.

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mothers across the USA, 5.2% were found to have used methamphetamine at some point during their pregnancy.⁴

The potential for adverse fetal effects as a result of maternal exposure to drugs and toxins is well recognised. The earliest systematic studies investigated the effects of excess maternal alcohol consumption, with its wide spectrum of sequelae including dysmorphic features, developmental delay, learning difficulties and behavioural problems. The consequent effects of maternal smoking on growth, cognitive development and behaviour have also been well documented since the early 1980s. Withdrawal symptoms in babies born to opiate-using mothers have been recognised since the 1970s, and

Table 1 Drugs detectable by hair analysis

Drugs of misuse	Therapeutic drugs	Tobacco ingredients	Alcohol metabolites
Amphetamine/ methamphetamine	Amitriptyline	Nicotine	Fatty acid ethyl esters
Cannabinoids	Benzodiazepines	Cotinine	Ethyl glucuronide
Cocaine	Carbamazepine		
Fentanyl	Ephedrine		
Ketamine	Haloperidol		
LSD	Quinolone antibiotics		
MDMA ('ecstasy')	Thiopental		
Opiates			
Phencyclidine (PCP)			

heroin and methadone when used in pregnancy have been associated with an increased risk of perinatal mortality, preterm delivery and low birth weight. Illicit drugs are not the only ones capable of causing adverse effects to the fetus. Anticonvulsants are among the most studied medications in this regard, and the fetal valproate syndrome,⁵ with its spectrum of effects including facial dysmorphism, neural tube defects and developmental delay, is a clear example of their effects. Maternal exposure to environmental toxins has also been associated with fetal effects. For example, pesticide and herbicide use has been associated with elevated perinatal mortality and intrauterine growth retardation, respectively, and in-utero exposure to environmental polychlorinated biphenyls may affect cognition.⁶

Methamphetamine is a central nervous system stimulant and has been shown to cross the placenta in animals. Much of what is known about the effects of in-utero exposure has been extrapolated from studies of the children of women using intravenous amphetamine. In these children, the reported consequences of this are wide-ranging: an increased rate of preterm delivery and placental abruption; growth retardation, cleft palate and cardiac anomalies; and aggressive behaviour and learning problems. Gestational methamphetamine exposure has also been associated with fetal growth restriction⁷; infants reportedly exhibit lethargy, poor feeding, poor alertness, and severe lassitude in the first year of life.⁸

Garcia-Bournissen *et al*⁹ report the use of neonatal hair analysis to detect in-utero methamphetamine exposure. A variety of drugs and other substances are known to be deposited in hair (table 1). Immunoassays have been used for the detection of drugs in hair since the 1970s, with the development of gas chromatography/mass spectrometry in the 1980s offering greater sensitivity. One major advantage of hair over other biological samples is the wide time window of detection that is possible. As fetal hair grows during the last three to four months of pregnancy, it provides a biological marker for the temporal and cumulative exposure of the fetus to drugs and other substances during this period. This has many applications, including the confirmation of gestational exposure to opiates, allowing confident diagnosis of narcotic withdrawal symptoms and the verification of in-utero exposure to other drugs of misuse, including tobacco.

Recent developments in the field include a tool to detect and measure gestational exposure to alcohol, allowing correct attribution of effects to fetal alcohol syndrome.¹⁰

By showing transplacental transfer of methamphetamine with accumulation in fetal hair, Garcia-Bournissen *et al*⁹ have provided a tool for screening for gestational exposure to the drug. This allows identification of a cohort of neonates for study to further delineate the effects of in-utero exposure. It is unfortunate, therefore, that no details were given about any adverse effects in the infants identified as exposed by in this study, a limitation acknowledged by the authors. Such a follow-up study will need to control for the fact that methamphetamine users often use other drugs of misuse, as the authors also acknowledge. Other confounding variables might include the possibility that women using drugs attend prenatal care later, and may be in poor health themselves.

One major drawback of the use of neonatal hair analysis to identify a cohort for study of gestational exposure of any drug is that this test can only detect exposure during the second half of the pregnancy. This approach might fail to identify many infants whose mothers used drugs in the second and third months of their pregnancy, a developmental time window representing the critical period of most congenital anomalies.

Despite these obstacles, Garcia-Bournissen *et al* show that hair analysis has considerable promise in identifying infants and children who have been exposed to drugs, both in utero and ex utero, an important step when trying to identify the results of such exposure. This will also be important to avoid stigmatising labels, similar to those experienced by children of cocaine-misusing mothers, the so-called "crack babies". Despite many concerns regarding these children following the appearance of crack cocaine in the mid-1980s, there is limited convincing evidence that prenatal cocaine exposure in isolation is associated with long-term adverse developmental effects.¹¹ There is little doubt that, like cocaine, methamphetamine can be an extremely harmful drug, but it is essential not to make potentially detrimental conclusions about its long-term effects on the fetus before these are proved.

It is unfortunate, therefore, that we are focusing on research on the effects of drug action rather than how to prevent it.

To tackle the problems associated with methamphetamine use, we must also focus on prevention and treatment for mothers, children, and families. The question that remains unanswered is why considerable numbers of women are willing to put both their own health and that of their children at risk by misusing drugs. Until a solution is found, this problem will persist.

Arch Dis Child Fetal Neonatal Ed 2007;**92**:332-333.

doi: 10.1136/adc.2006.115303

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Competing interests: None declared.

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