Medical and Psychologic Risks of Maternal Cocaine Use

The growing use of crack-cocaine by women of child-bearing age poses significant management problems for physicians. Both animal and human studies suggest that cocaine exerts significant negative effects on maternal health, the course of pregnancy, and infant developmental outcome. Maternal pregnancy complications and increased rates of low birth weight and prematurity in infants who are fetally exposed are well documented. However, available studies of neurobehavioral outcomes for cocaine-exposed infants are still inconclusive. Physicians need to become knowledgeable about the potential effects of maternal drug addiction during pregnancy to provide appropriate medical care.

Lynn Singer, Ph.D., Professor, Departments of Pediatrics and Psychiatry, Case Western Reserve University School of Medicine; Director, Center for the Advancement of Mothers and Children at Metro Health Medical Center, Cleveland, OH

Robert E. Arendt, Ph.D., Assistant Professor, Department of Pediatrics, Case Western Reserve University School of Medicine, Cleveland, OH

Sonia Minnes, M.A., Research Coordinator, Department of Pediatrics, Case Western Reserve University, Cleveland, OH

Rachel M. Garber, M.D., Assistant Professor of Pediatrics, Case Western Reserve University School of Medicine, Cleveland, OH

Cocaine is one of the most frequently used illegal drugs among women of child-bearing age in urban America. Although there are no data regarding the exact number of infants born with in utero cocaine exposure, the maternal use of cocaine during pregnancy and its resulting high medical and social costs have become chronic problems that significantly affect current hospital-care practices.

Physiologic Effects of Cocaine

The manufacturing and marketing of inexpensive “crack”-cocaine in the 1980s appears to have precipitated the current epidemic. Cocaine is an amphetamine-like drug that stimulates dopamine neurotransmission by blocking its reuptake and increasing receptor activity. On a short-term basis, cocaine use increases alertness, clarity, and energy; however, long-term exposure to cocaine results in compulsive use because of the depletion of dopamine in nerve terminals. Withdrawal from cocaine is associated with significant behavioral and mood disturbances, including depression, fatigue, disordered sleep patterns, irritability, continued craving, and the substitution of other drugs (especially alcohol and marijuana).

Because cocaine use activates the sympathetic nervous system, it is associated with significant acute medical complications, including vasoconstriction, sharp increases in arterial blood pressure, tachycardia, predisposition to ventricular arrhythmias, hyperglycemia, and hyperthermia.

Complications During Pregnancy

The use of cocaine places pregnant women at risk for numerous perinatal sequelae (Table 1). As cocaine crosses the placenta and blood-brain barrier, immediate effects on fetal behavior have been noted on ultrasound studies. Fetal complications include hypoxia from decreased uterine blood flow and impaired oxygen transfer, as well as vasoconstriction and hyperthermia. Significant pregnancy complications include hypertension, tachycardia, abruptio placenta, and preterm or precipitous labor and delivery. Although some complications can be related directly to cocaine’s pharmacologic effects, others are associated with the severity of addiction and the impact of drug dependence on behavioral and psychologic factors that affect pregnancy outcome. These factors include the tendency for drug-addicted women to neglect their own health care and to negatively affect
### Pregnancy Complications Associated with Cocaine Use

- Poor nutrition
- Low weight gain
- Late or no prenatal care
- Preterm labor and delivery
- Increased infectious disease, especially sexually transmitted disease and HIV
- Abruptio placenta
- Hypertension and tachycardia
- Propensity for family violence and/or increased battering

**Table 1**

### Potential Developmental Sequelae of Prenatal Cocaine Exposure

- Low birth weight and later failure to thrive
- Prematurity
- Neonatal behavioral impairments
- Elevated risk for sudden infant death syndrome
- Attention deficits
- Behavioral problems

**Table 2**

A pregnancy outcome through poor nutritional habits and low weight gain, avoidance of appropriate prenatal care, and increased exposure to infectious diseases, especially those related to less discriminating sexual practices associated with sexually transmitted diseases and human immunodeficiency virus (HIV). Finally, the majority of women who use drugs during pregnancy are polydrug users. Cocaine's euphoric effects are usually prolonged (or its withdrawal effects cushioned) through the use of alcohol, marijuana, heroin, and tobacco, all of which may exert their own negative effects on pregnant women and their fetuses.

**Infant Outcomes**

Research on the effects of prenatal cocaine exposure continues to evolve. An initial burst of case studies and small, inadequately controlled clinical studies, with their generally dire findings and predictions, have been replaced by larger, more rigorous research programs.

In utero exposure to crack-cocaine is associated with several negative perinatal outcomes (Table 2). The most consistent findings involve impaired somatic growth. Decreased birth weight, length, and head circumference are consistently reported. Decreased gestational age and increased rates of preterm birth have also been reported. However, the majority of cocaine-exposed infants are not premature or have a low birth weight. The risk of sudden infant death syndrome has been found to be elevated in infants exposed to cocaine in utero, but not to the extent that routine apnea monitoring has indicated. Some studies have suggested that the vascular effects of fetal cocaine exposure, which include increased arterial blood pressure and cerebral blood flow velocity, may increase neonatal intracranial hemorrhage.

- **Neurobehavioral Effects**—Studies of neurobehavioral outcome in crack-exposed infants are still inconclusive. Contrary to reports in the popular media, infants born to women using crack are not “hooked” on cocaine. Cocaine exposure generally does not produce physiologic withdrawal symptoms, such as those seen in newborns exposed to opiates. Although mild symptoms, such as tremors or increased crying, are occasionally apparent at birth in some infants exposed to cocaine in utero, the opposite pattern (a lethargic and unresponsive newborn) has also been reported.

The most commonly used measure to assess neonatal behavior is the Brazelton Neonatal Behavioral Assessment Scale (BNBAS). A number of published studies employing the BNBAS during the first week of life have investigated the neurobehavioral sequelae of in utero cocaine exposure. Some studies found depressed interactive behavior, impaired responses to environmental stimulation, and deficits in orientation, motor, and state regulation in infants exposed to cocaine in utero. One study found that infants exposed to cocaine were less likely than infants not exposed to cocaine to demonstrate adaptive habituation to repeated stimulation. In contrast, other studies found no significant deficit on the BNBAS during the early neonatal period in infants exposed to cocaine in utero.

Motor development has been used as a sign of neurologic maturation/damage. Several studies now report that infants exposed to cocaine in utero are at significant risk for motor dysfunction. In general, because of methodologic flaws and/or a lack of standard procedures, it is difficult to draw definitive conclusions regarding the neurodevelopmental effects of cocaine on newborns and young infants.

**Follow-Up Studies**

Infants who were identified as exposed to cocaine in utero are now
Cross-Species Findings

Numerous studies have used various animal species to model prenatal cocaine exposure. Although there are certain important caveats to cross-species comparability of drug effects, the degree of control available to address critical periods and dose levels, the relatively rapid accumulation of life-span information, and the option of invasive techniques to study precise patterns of physiologic modification induced by early drug exposure make animal models an important parallel line of research in the area of in utero drug exposure.

In general, findings from animal research on the reproductive and birth outcome effects of prenatal exposure to cocaine are compatible with those reported in the clinical infant literature, with the exception that reduced gestation has not been found. In the area of behavioral consequences, animal studies support the hypothesis that rather than a general effect spread over all domains of development, certain types of behaviors may be particularly susceptible to the influence of prenatal exposure to cocaine. Findings indicate that a basic form of learning (i.e., conditioning performance) may be adversely affected, especially when the task is sufficiently challenging. Social and sex-typical behavior and susceptibility to stress are also areas in which animals exposed to drugs suffered behavioral deficits.

Risks of Postnatal Maternal Drug Use

Unfortunately, many mothers who expose their infants to cocaine and other drugs prenatally continue to use drugs during the postnatal period. A mother’s continued drug use can compromise her parenting skills and expose her infant to other risk factors that threaten cognitive and emotional development. Examples of these factors include poor mother-infant interaction, infant neglect and abuse, and behaviors associated with a drug-using lifestyle (Table 3). Because the infant’s health and development can be seriously compromised, an ongoing assessment of maternal cocaine and other drug use is an integral part of caring for infants exposed to drugs in utero.

Signs of possible substance exposure include mothers and/or family members who appear to be under the influence of drugs at the time of medical visits, late or no prenatal care, frequent change of residence, and a history of drug use or alcoholism, domestic violence, incarceration, and/or removal of other children from the home. Nonjudgmental, direct questioning of mothers regarding drug use is indicated once the index of suspicion has been raised. This approach allows patients to admit drug use and, at times, request help. A special “window of opportunity” often exists shortly after infants are born in which mothers may be more forthcoming in acknowledging their drug use to obtain information about whether their infants have been affected. Physicians must use this period to facilitate maternal assessment and entry into drug treatment.

Screening for drug use should be a routine component of prenatal and perinatal care. Maternal drug use is detectable by clinical interview and urine and/or meconium assessments. Minimally, both a clinical interview and physiologic measures should be used. Meconium screening allows a three-month window of detectable drug use, whereas urinalysis is valid for less than one week. There is the potential for postnatal cocaine exposure of infants, either through breast-feeding, accidental ingestion of small
“rocks” of cocaine, or passive exposure to crack smoke. Mothers who continue to use drugs or alcohol should not breast-feed. A urine drug screen is recommended if an infant’s vital signs or behavior seem irregular, especially when maternal drug use is suspected.

Physicians should be alert to identify maternal drug use in populations often not typically screened through public health or county welfare systems. Middle-class or privately insured patients who use illegal drugs are often not identified, and a valuable opportunity for medical education and intervention is lost.

Independent of information obtained by a thorough history, the interactional behavior between mothers and their infants can be observed easily during an office visit or in the hospital postpartum. Whereas it is natural for mothers to respond to their infants through talking, eye contact, and tactile stimulation, drug-dependent mothers may be impaired in their ability to respond to their infants’ behavioral cues. The impairment may be the result of drug intoxication and withdrawal, and/or psychologic and personality characteristics. Alternatively, because of exposure to cocaine, the interactional effects of cocaine, alcohol, and other drugs and/or possibly low birth weight or prematurity, mothers may find their drug-exposed infants particularly difficult to quiet or comfort. Nevertheless, maternal responsiveness to these behavioral cues is essential for an infant’s optimal intellectual and emotional development. Although modeling appropriate interactions may be helpful in some cases, referral to a counselor, social worker, or psychologist for assessment of parenting skills and support is recommended.

Passive, as well as overt, forms of neglect and abuse must be monitored when caring for infants exposed to drugs in utero. Often, the caregiver’s limited financial resources are used for obtaining cocaine rather than family essentials. Although crack-cocaine is relatively inexpensive, the addictive nature of the drug often compels drug-dependent mothers to use money or other resources to purchase more of the drug. Frequently, cocaine is purchased at the expense of supplies, such as diapers, formula, or medication, for infants. The increased incidence of failure to thrive in children of mothers who use cocaine can be a serious outcome caused by the redirection of time, food, and energy. Failure to thrive, which is characterized by an infant’s failure to grow along an established growth curve, can result in serious medical and psychologic consequences.

Many maternal behaviors associated with a drug-using life-style also may threaten the development of infants during the postnatal period. For example, sexual favors may have been exchanged for free drugs or needles may have been shared by pregnant women. These behaviors place infants at an increased risk of developing sexually transmitted diseases. Also, physical and/or sexual abuse of substance-dependent women may place infants in jeopardy. Children of mothers who use cocaine are at risk because of the potential for additional injury inflicted through battering prenatally, as well as witnessing ongoing violence in the home and/or being victims of abuse themselves. Children who live in violent families are prone to more behavior problems, more difficult temperaments, and to display more aggressive behavior than children from nonviolent families. Additionally, women who use illicit drugs may expose themselves and their children to the potential violence inherent in drug acquisition.

Removing children from the home frequently becomes the only solution to prevent further harm. Out-of-home placement of infants exposed to cocaine is common. A national study of 10 hospitals found

<table>
<thead>
<tr>
<th>Recommendations for Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Drug and social history</td>
</tr>
<tr>
<td>• Referral to social service agency and outreach programs</td>
</tr>
<tr>
<td>• Referral to drug treatment programs and monitoring of maternal compliance, with consideration for residential drug treatment</td>
</tr>
<tr>
<td>• Frequent infant visits to monitor growth and attainment of developmental milestones with monthly visits for at least six months</td>
</tr>
<tr>
<td>• Formal standardized developmental assessments of infants’s motor function, language development, and behavior at 9 to 12 months, 18 months, and yearly thereafter</td>
</tr>
<tr>
<td>• Ongoing infant assessment for postnatal drug exposure at each visit</td>
</tr>
</tbody>
</table>

Table 4
that approximately 30% of the 4,000 infants born in 1989 who were exposed to drugs in utero were placed in foster care. Although foster care may be a necessary alternative to protect these children, it may also pose threats to normal attachment relations and cognitive and emotional development. Therefore, careful assessment of maternal care-giving ability and referral for treatment to drug intervention programs that incorporate caring for children as an important aspect of their treatment approach are necessary.

Management

Although developmental delays or behavioral problems in children exposed to cocaine in utero cannot always be attributed to drug exposure, physicians should not dismiss this possibility.

Continued efforts at follow-up and continuity of care are essential (Table 4) to establish a rapport with substance-abusing mothers and to facilitate referral to a drug treatment program. Gynecologists and obstetricians must learn to recognize and treat substance-abusing women in relationship to their own health or long-term well-being, their pregnancy outcome, and the long-term effects of their addiction on their infants. The earlier in pregnancy that women who use drugs are identified, the more likely they are to engage in intervention, care for themselves during their pregnancy, and minimize adverse effects.

Physicians must be vigilant of environmental stressors that might compromise the health and development of infants exposed to drugs. In cases where continued drug use is known or strongly suspected, signs related to neglect, such as failure to obtain proper immunizations on schedule, nonorganic failure to thrive, or failure to achieve developmental milestones, must be sought.

Early and ongoing assessment of the child’s development is necessary. Although complete developmental assessments can best be accomplished by referral to a developmental specialist, a thorough developmental screening should be standard for periodic well-child-care visits. Children with identified delays should be enrolled in intervention programs as early as possible. Speech and motor delays, attention difficulties, and impulsive and aggressive behaviors have been identified most frequently in children exposed to cocaine in utero.11,19,21-33

Although firm conclusions about the extent of, and specific problems related to, fetal cocaine exposure on

The Authors

Lynn Singer, Ph.D.

Dr. Singer is Professor in the Departments of Pediatrics and Psychiatry at Case Western Reserve University School of Medicine, and Director of the Center for the Advancement of Mothers and Children at Metro Health Medical Center, in Cleveland, Ohio. She is principal investigator for longitudinal studies of infants with very low birth weights and bronchopulmonary dysplasia, as well as cocaine-exposed infants. After receiving her master’s and doctorate degrees in clinical psychology from Case Western Reserve University, she completed a fellowship in special education at the University of Pittsburgh, Pennsylvania.

Robert E. Arendt, Ph.D.

Dr. Arendt is Assistant Professor in the Department of Pediatrics at Case Western Reserve University School of Medicine in Cleveland, Ohio. After receiving his Ph.D. degree in mental retardation research/developmental psychology from Vanderbilt University in Nashville, he completed a pediatrics fellowship at Rainbow Babies and Childrens Hospital in Cleveland.

Rachel M. Garber, M.D.

Dr. Garber is Assistant Professor of Pediatrics at Case Western Reserve University School of Medicine in Cleveland, Ohio. After receiving her medical degree from the University of Texas Medical Branch in Galveston, she completed a residency at University Hospitals of Cleveland.

Sonia Minnes, M.A.

Ms. Minnes is Research Coordinator in the Department of Pediatrics at Case Western Reserve University in Cleveland, Ohio. She received her Master’s degree in psychology from Cleveland State University and is a doctoral candidate at the Mandel School of Applied Social Sciences in Cleveland.
child development cannot yet be drawn, it is clear that maternal drug use is most associated with significant psychologic, social, and medical problems that place mothers and their children at risk. Physicians must recognize and treat maternal cocaine use prenatally and postnatally to control this national problem.

References

This article was supported by grants from the National Institute of Health, MCH, NIDA, CSAP, The Shibley Mental Health, The George Fund, and the Cleveland Foundations. The authors would like to acknowledge Rose Marie Ashley for her assistance with manuscript preparation, the Cleveland, Shibley Mental Health Foundation, George Gund Foundation, and the Woodruff Foundation, which helped support the clinical services of the Center.