Management of the newborn infant affected by maternal opiates and other drugs of dependency

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Abstract: Illicit drug use during pregnancy is common and probably underestimated in the majority of published studies. The infant exposed to opiates or other drugs of dependency during intrauterine development is at risk for post-natal withdrawal as well as to long-term problems that are associated with drug-effects and often, adverse social circumstances. This article examines the early management of the infant and mother for detection and monitoring of drug-exposure, pharmacological intervention for withdrawal and the management of associated, particularly infective and psychosocial, problems. Practical concerns surrounding these issues are discussed and further research on psychosocial intervention to improve long-term outcome are much needed.

Key words: illicit drug; neonatal abstinence syndrome; opiate; pregnancy.

Incidence of Drug Abuse during Pregnancy

Illicit drug use during pregnancy is not an uncommon problem and indeed, the majority of women in drug-treatment centres are of child-bearing age. It was estimated in a national government survey that 25.6% of women aged 20–29 years (and thus of typical child-bearing age), had consumed some form of illicit drugs in the 12 months previous to the survey. However, the exact number of drug-dependent pregnant women is unknown because this statistic relies heavily on voluntary patient disclosure. To give an idea of the scope of this problem, recent statewide surveys of maternity hospitals (involving New South Wales and the Australian Capital Territory) in 2000 and 2004 (with an over 92% response rate) consistently estimated that 1.3% of all women who presented for delivery reported some form of dependency or substantial exposure to illicit drugs during their pregnancy. In another study, we found that up to 5% of high-risk newborn infants admitted to intensive care units in New South Wales and the Australian Capital Territory had mothers who had used some form of illicit drugs during their pregnancy. So far, the only domestic database review is that by Kennare, who found that substance use was reported by 0.8% of confinements in South Australia, with 12.5% of these involving heroin. As the estimates of perinatal drug use rely so heavily on individual disclosure, international rates vary widely depending on local practices, with rates of reporting ranging from 10% to 50% of the pregnant population and generally being more prevalent in urban areas and Western societies.

We are even less certain of the number of live drug-affected births or the number or children with neonatal abstinence syndrome (NAS) who are born each year. Many drug-exposed pregnancies may be terminated prematurely, either intentionally or non-intentionally, if the infants are born alive, maternal drug use may not be disclosed at all. The USA has estimated that about 7000 babies are born each year to heroin and methadone users and Arlettaz reported that 7.5/1000 live births were the result of methadone-affected pregnancies in Switzerland, but these figures are likely gross underestimations and there are no comparable published figures for Australia.

The Effect of Illicit Drugs on the Newborn Infant

The majority of illicit drugs cause an addiction in both the mother and the infant. Addiction or tolerance in the latter is due to passage of the drugs across the placental barrier and this occurs in varying degrees depending on the pharmacokinetic properties of the individual drugs. Disruption of this transplacental passage of drugs at birth therefore results in the development of a withdrawal syndrome. This withdrawal syndrome, generically termed the neonatal abstinence syndrome, is a constellation of behavioural and physiological signs and symptoms.
symptoms that are remarkably similar despite marked differences in the properties of the causative agent. NAS is often predominated by autonomic over-reactivity, typified by yawning, sneezing, mottling and fever. Paramount, however, is cerebral irritation, resulting in an irritable and hypertonic infant. More than 30% of opiate-exposed infants studied during the 1980s had abnormalities on electroencephalogram and 2–11% of infants in the 1970s developed overt seizures when not adequately treated for New South Wales. Seizures are also common in non-opiate drug withdrawal including those due to barbiturates, alcohol and sedatives.

Gastrointestinal dysfunction (e.g. diarrhoea, vomiting and poor feeding) is common in untreated NAS. These infants do not suck or feed as well as unexposed infants and infants with untreated NAS often fail to thrive. By the second week of life, however, some infants develop hyperphagia, often drinking more than 250 mL/kg/day of milk. Hyperphagia seems to be particularly associated with difficult-to-control NAS.

### Tools to Assess the Presence and Severity of NAS

The majority of tools used to assess NAS have been developed in reference to opiate withdrawal and are used to assess non-opiate infants simply because there are no other validated measures. These tools are mainly used to (i) Distinguish between drug-exposed and non-drug exposed infants and (ii) to monitor the severity of NAS and the need for, or response to, pharmacological treatment, in infants with established drug-exposure. Commonly used tools include the Finnegan Neonatal Abstinence Severity score, the Lipsitz tool, the Neonatal Narcotic Withdrawal index and the Neonatal Withdrawal inventory. These tools or scores are usually used to assess an infant during a wakeful period before a feed and such infants, especially one that is breastfeeding frequently, may have as many as 12 scores per day.

It must also be noted that some drugs (such as selective noradrenergic reuptake inhibitors or SNRIs) may cause adverse effects due to intoxication rather than withdrawal. Intoxication, generally presents with pronounced symptoms that gradually abate over the first subsequent days of life. Withdrawal, on the other hand, develops over the subsequent days to weeks after birth in an infant who was otherwise born quite normally. Again, no assessment tool has been validated to assess intoxication and this is an area much deserving of further research.

In addition, these scoring systems or measures rely heavily on multiple observational items and may be subject to bias depending on the experience of the assessor. To limit this bias, some studies have investigated the benefits of evaluating standard elements of newborn physiological behaviour or responses to assess withdrawal. For example, Chasnoff devised a scale based on the quality of the infant’s primitive Moro reflex to assess drug-related CNS irritability, and O’Brien used a motion sensor to monitor muscle activity to quantify withdrawal severity. Nevertheless, regardless of the type of tool chosen to monitor NAS, it is important to ensure that the health-care workers administering these assessments are adequately trained and familiar with performing these evaluations in infants at risk of NAS.

### Influences on the Severity and Frequency of NAS

#### Types of drugs

The severity, frequency and duration of NAS vary considerably with the types and amounts of drugs to which the infant has been exposed. Stimulant (e.g. amphetamines, cocaine) withdrawal generally appears to be less severe than narcotic withdrawal. Symptoms caused by cocaine and other stimulants may be due to intoxication rather than withdrawal and the short duration of symptoms are a result of the short half-life of these drugs. Bartu found that only 46% of amphetamine-exposed infants developed significant NAS compared to 80% methadone-exposed infants and when clinicians were blinded to the types of drugs to which the infants had been exposed, only 6% of cocaine-exposed infants withdrew enough to need treatment compared to 14% of heroin-exposed and 35% of heroin and cocaine-exposed infants.

Buprenorphine, a potent long acting (72 h) synthetic opioid with partial μ-receptor agonist and κ-receptor antagonist properties, has been introduced in many countries as an alternative to methadone for the treatment of opiate-dependency. The frequency of severe (i.e. requiring pharmacological treatment) NAS secondary to buprenorphine exposure appears to be variable and ranges from nil to slightly more than 50% of cases. The peak age at which symptoms of buprenorphine withdrawal occurs appears to be about the same time as withdrawal from methadone (about 40 h) but peak NAS scores (in this case, Lipsitz scores), occurred considerably later, at about 70 h of age. Further information is required to delineate the efficacy and safety of buprenorphine in pregnancy as well as the character of buprenorphine-associated NAS. At present, methadone remains the only recommended mainline treatment for opiate-dependence during pregnancy in Australia.

Many drug-dependent women, however, take multiple drugs in a practice known as polydrug abuse. A review from Switzerland found that 62% of drug-using women from a single institution took a combination of heroin, methadone, cocaine, benzodiazepines, alcohol and marijuana during pregnancy. The effect of polydrug use on NAS is uncertain and most likely depends on the particular combination and quantities of drugs used by the mother. Benzodiazepines, for example, may distort the presentation of opiate-induced NAS because benzodiazepine withdrawal may only start after the first week of life and continue in a subtle fashion for up to several months. Benzodiazepines in combination with methadone also appear to worsen the severity of NAS. In a cohort of infants assessed and treated in a standardised fashion, we found that formula-fed full-term polydrug-exposed infants, the majority of whom had been exposed to combinations of benzodiazepines and opiates (cocaine was uncommon), had the most rapid onset of withdrawal and the highest withdrawal scores during the first week of life compared to infants from single drug-using mothers. The effect of cocaine on NAS appears to be variable. While cocaine does not appear to worsen methadone withdrawal, the combination of heroin and cocaine together exacerbates the severity of NAS, but the effects of different drug mixtures (e.g. contamination by other agents such as benzodiazepines) cannot be excluded.
A high proportion of drug-addicted mothers also smoke tobacco and nicotine withdrawal has been associated with a withdrawal syndrome in both adults and infants. Heavy cigarette smoking has been shown to worsen and modulate the presentation of narcotic withdrawal. Choo showed that babies of methadone-exposed mothers who smoked heavily (>20 cigarettes/day, \( n = 13 \)) had higher withdrawal scores (9.8 vs. 4.8) that also took longer to peak (113 h vs. 37.8 h) than infants of light smokers (>10 cigarettes per day, \( n = 16 \)). The study recommended that methadone-affected women reduced their intake of cigarettes prior to delivery.

### Amount of maternal drugs

Whether or not the amount of drugs taken by a pregnant woman affects NAS severity is difficult to ascertain because quantitative drug history is usually dependent on personal recall or willingness of disclosure. The most easily quantified drug is methadone, which is usually dispensed from drug-treatment centres or pharmacies. Studies assessing the effects of methadone dose on NAS severity are unfortunately, also often confounded by polydrug abuse. Some studies have found a positive correlation between maternal methadone dose and NAS severity while others have found little relation.

Berghella examined 100 mother/infant pairs and found that women on less than 80 mg of methadone had a higher incidence of illicit drug use but there was no difference between their infants' need for treatment, the duration of treatment or the maximum NAS score when compared with the infants of women on higher doses of methadone. The need for NAS treatment in methadone-exposed infants may be related to the types of other drugs to which the infant has been exposed in utero and this is often unquantifiable or undeterminable.

Until the late 1990s, there was widespread recommendation to reduce a pregnant woman's daily methadone intake to ≤20 mg/day in order to prevent NAS. It has since been acknowledged that a woman's volume of distribution is increased during pregnancy and that the majority of pregnant women need more methadone to prevent withdrawal and relapse into illicit drug use than non-pregnant women. For example, Drozdiek found that daily methadone doses of at least 50–150 mg were needed to maintain sufficient serum trough levels (above 0.24 mg/L) to prevent illicit drug cravings. In a recent study, Jackson found that the duration of NAS treatment, the need for 2nd line treatment and a requirement for nursery admission (as a surrogate marker for the severity of NAS) was independently associated with a low (30–35 mg) daily maternal methadone dose. Conversely, although Arlettaz also found that infants of mothers taking <30 mg methadone a day had a 43% chance of requiring medication for NAS compared with 65% of infants of mothers on more than 30 mg of daily methadone, this population was strongly contaminated by polydrug abuse.

### Incidence of NAS

The incidence of clinically important NAS affecting an infant born to a known drug-exposed mother, is highest in methadone and opiate pregnancies (see previous). In comparison, clinically important NAS is less frequent in stimulant-exposed infants. Fulroth found that only about 1/3 of cocaine-exposed infants, as determined by maternal history and toxicology screen, demonstrated signs of withdrawal. Furthermore, only 6% of these infants required treatment. Smith found that of 134 infants exposed to metamphetamines, 49% exhibited withdrawal symptoms but only 4% required pharmacological treatment. The overall proportion of infants with NAS severe enough to require pharmacological treatment may be heavily dependent on individual clinician or institutional policies. Some hospitals or care givers may attempt to avoid medication by using supportive therapies such as swaddling because medicated infants have been shown in some reports to have undesirably prolonged periods of hospitalisation.

### Timing of Withdrawal

The timing of withdrawal is largely dependent on the half-life of elimination, that is, the longer the half-life, the later the onset of withdrawal. For example, heroin withdrawal may start from about 48–72 h after birth while withdrawal from methadone, a drug with a significantly longer half-life, usually peaks at about 80 mg of methadone a day had a 43% chance of requiring medication for NAS compared with 65% of infants of mothers on more than 30 mg of daily methadone, this population was strongly contaminated by polydrug abuse.

### The Utility of Serum Methadone Levels

Studies have shown that a rapid decline in neonatal methadone concentrations results in more severe infant withdrawal. Infants with the lowest serum levels of methadone are most likely to need treatment. For example, Kuschel found that infants who required pharmacological NAS had undetectable serum methadone levels at 48 h of age compared with the majority of untreated infants who had moderate amounts of detectable methadone (median 23 mg/mL). Serum levels of other drugs have not been widely explored because of their short half-lives.

### The Value of Drug Screening during the Neonatal Period

Newborn toxicological tests continue to be domains of large tertiary hospitals and are often not widely available. The value of drug screening a newborn infant depends on the confidence the care providers have on the history obtained from the mother. A detailed drug and alcohol history, conducted in a...
non-punitive fashion, may often be more revealing than an extensive panel of toxicology tests. Drugs and their metabolites can be detected in amniotic fluid, infant nails, gastric fluid, hair, meconium and urine, but only urine toxicology is available in most centres.

Hair is the most sensitive product for drug testing (100% for cocaine, 80% for opiate detection) but is subject to high false positive rates because of passive exposure. A considerable amount of hair is also required for this test (about a pencil shaft in diameter), including the roots, and it is unlikely that parental consent will be easily obtainable for such a potentially disfiguring test. Urine testing has a high false negative rate. Drug tests on newborn urine will be negative if the mother abstains a few days prior to delivery because of continual excretion of the drug by the fetal kidneys. Likewise, tests may also be negative if specimens are not collected within the first days after birth as the drugs will be continually excreted by the infant’s urinary system. Toxicology tests on meconium have the lowest rate of false negatives, with a sensitivity of 87% for cocaine and 77% for opiates. Drugs are stored in a temporal fashion in an infant’s meconium from about 12 weeks gestation after formation of the fetal gut. However, only a few centres have the ability to perform meconium toxicology and the chances of drug detection decrease rapidly after the formation of transitional (or fed stools) after the 3rd or 4th day of life.

Treatment of the NAS Infant

Adjunctive therapies

Drug-exposed infants exhibiting signs of withdrawal should be supported with adjunctive therapies before pharmacotherapy is instituted. These infants benefit from nursing in a quiet, darkened environment with minimal environmental disturbance. Swaddling may help, as may a prone sleeping position, shown to lower peak NAS scores more than supine sleep. Prose sleeping, however, should not be practised in an unmonitored environment because of the increased risk of sudden infant death syndrome. Waterbeds have an inconsistent effect on the severity of NAS. Oro found that methadone-exposed infants nursed on oscillating waterbeds had lower total withdrawal scores than infants nursed on conventional beds, but polydrug infants were more agitated and had worse withdrawal from rocking bed care.

Pharmacological treatment

Medications should be considered for NAS when supportive measures fail to ameliorate the infant’s withdrawal. This may be manifested early on as difficulty feeding, extreme irritability and poor sleeping. If a scoring system is used, pharmacological treatment is commonly started when the average of three scores is 8 or more on the Finnegan scale or 4 or more on the Lipsitz scale.

What drug to use?

The drugs available to treat NAS are divided into two main categories – non-opiate and opiate-related. Tincture of opium or laudanum is an alcoholic extract of more than 10 opioid alkaloids and is not widely used in Australia. Paregoric, a mixture of opium, camphor, alcohol and anise oil is not widely used anywhere because of the potential hazards of the added preservatives. Morphone mixtures in varying strengths are the most frequently used drugs to treat opiate-related NAS because of its short half-life (T1/2 – 4 h).

Receptor-appropriate drugs are superior to unrelated drugs withdrawal treatment. In adults, for example, sedatives are ineffective in treating opiate withdrawal. Anaesthetic doses are often needed where as only small amounts of narcotics can relieve the signs and symptoms of opiate withdrawal without obting the patient. Seizures associated with opio withdrawals respond better to an opioid-derived agent rather than to traditional sedatives/antiepileptics like phenobarbitone. Kandall et al. randomly treated 153 NAS infants with paregoric and phenobarbital. Seven of the 62 phenobarbita-treated infants developed seizures but none of the 49 paregoric-treated infants fitted. Furthermore, when compared with opiates, phenobarbitone impairs sucking in opiate-withdrawing infants and is associated with a more protracted duration of treatment than morphine (8 vs. 12 days). Morphine as a single agent ameliorates opioid-derived NAS symptoms with greater efficacy than a combination of phenobarbitone, diazepam or even a combination of morphine, phenobarbitone and diazepam.

Methadone has been used in some centres as a treatment for opiate-related NAS. Methadone has a long half-life and is not recommended for this purpose in Australia because of the possibility of prolonged and pronounced side effects after inadvertent overdosing when compared with a shorter-acting drug like morphine. Furthermore, there is a possibility that the infant’s methadone may be confused with the parent’s methadone, especially if withdrawal treatment is conducted from home. Treating opiate-related NAS with methadone does not seem to decrease length of infant hospitalisation, but in a small series of inpatients, Guo found that methadone, in a dose of 0.1 mg/kg three times a day, reduced peak Finnegan scores more rapidly than tincture of opium given at 0.1 mg/kg every 3 hours.

Is one type of opiate better than another?

There is only one randomised trial comparing different types of opioid-based medications for NAS treatment. Langenfeld randomised 33 infants to either tincture of opium or morphine. The infants treated with morphine needed more opioid to suppress symptoms and required a longer duration of treatment (37.5 vs. 35.2 days). They, however, had better weight gain (although both groups gained weight poorly compared with normal infants). Also, as mentioned above, Guo found that methadone was superior to tincture of opium and reducing numerical scores of withdrawal but neither drug is used commonly for NAS treatment in Australia.

Other agents

Phenobarbitone is another commonly used drug for NAS treatment. It is uncertain if a loading dose is necessary for
phenobarbitone is administered for NAS. Kaltenbach found that a loading dose of phenobarbitone reduced the duration of treatment if phenobarbitone was used as a single agent.89 Combinations of non-opioid and opioid agents may offer an advantage if the mother uses multiple drugs. Coyle compared diluted tincture of opium with a combination of tincture of opium and phenobarbitone in 20 methadone and/or heroin-exposed term infants and found that the addition of phenobarbitone reduced the length of hospital stay, symptom severity and amount of opium needed but phenobarbitone was required for an average of 3.5 months.91 This may be of concern because prolonged exposure to phenobarbitone may adversely affect the developing brain. Recent animal work demonstrated alterations of GABA receptor subunits in the hippocampus even after cessation of phenobarbitone therapy.92

Clonidine has been explored as a possible therapeutic option in NAS because noradrenergic hyperactivity, resolved with the 0.2 mg/kg clonidine, was increased in 10-day-old neonatal opiate dependent rat pups.93 Paediatric use has been generally limited to post-operative withdrawal from long-term opiates.94–97 There has only been one small case series where seven methadone-exposed infants were treated with 3–4 µg/kg/day of oral clonidine. In six of these infants, the major symptoms of narcotic withdrawal were ameliorated but one infant failed to respond.98 Clonidine may cause undesirable side effects such as profound hypotension and its utility as a treatment for NAS requires considerably further research.

The utility of diazepam and other sedatives (e.g. chlorpromazine) as a single agent to treat NAS has only been explored in a small case series from France.99 In this study, 23 infants of opioid-dependent mothers were treated for an average of 7 days with diazepam for symptoms of NAS. The infants recovered their birth weight by 10 days of age, with a mean percentage of weight loss of 6.5%. The population of mothers in this study; however, had a high (19/23 or 91.3%) incidence of polydrug use (including alcohol, cocaine and benzodiazepines) and the success of diazepam in this group may have been due to its effects on the non-opioid drugs. However, Kron found that diazepam significantly depressed sucking rate, nutrition consumption and percentage of sucking time even when compared to phenobarbitone99 and to date, there is insufficient evidence to recommend diazepam for routine treatment of either opioid or non-opioid NAS.

**Dose of medications used to treat NAS**

There have been no randomised trials evaluating the efficacy of different doses of medications for NAS treatment. Most centres and studies start morphine or its equivalent at doses ranging from between 0.2 and 0.5 mg/kg/day with increases between 10% and 20% of the dose every 2–3 days depending on clinical progress.85,100,101 There is no report of any ceiling dose of morphine used for NAS treatment although there are recommendations from some centres that infants be monitored for adverse cardiorespiratory incidents if morphine requirements exceed 0.8 mg/kg/day.101

The dose of phenobarbitone in most studies is 5 mg/kg/day, again with increases or decreases of between 10% and 20% of the dose every 2 or 3 days according to response. Serum levels have been used to titrate dosing, for example, Coyle titrated phenobarbitone doses to maintain a mean serum level of 20–30 mg/dL.102 but whether or not this exercise is useful in reducing the severity of NAS remains to be seen.

**Duration of pharmacological NAS treatment**

We acknowledge that the duration of pharmacological treatment is highly variable and published reports quotes lengths of treatment that vary from as little as 4 days100 to more than 120 days.101 Outpatient weaning may take longer but the case series by Oei et al. is the only one to so far report any length of treatment for outpatients.101 In this series, infants were weaned from medications at a weekly rate according to weight gain and parental report of sleeping and feeding behaviour with no reported adverse consequences.

**Weaning NAS medications**

There are no studies evaluating the speed at which NAS medication should be weaned. Often, medications are weaned (in addition to the clinical condition of the child) according to the facilities available at individual institutions and to other unquantifiable and non-pharmacological factors. For example, medications may be weaned faster if there is no available outpatient facility and there is pressure to release the baby’s bed. In contrast, the rate of weaning might be slower if the infant was not feeding or gaining weight well. Medications should be weaned according to the clinical symptoms of the infant and in hospital, may be decreased at a rate of 10–20% of the total dose every 2–3 days if withdrawal scores are consistently less than 8 on the Finnegan scale or less than 4 on the Lipsitz scale. In our experience, weaning medications in an outpatient setting was best achieved by decreasing the volume of the medication at a set rate each week in order to prevent parental/care-giver confusion. Morphine (strength 0.5 mg/mL) and phenobarbitone (strength 10 mg/mL) are both weaned at a rate of 0.1 mL per week regardless of patient weight if the infant is clinically asymptomatic.101

**Duration of Hospitalisation**

The NAS infants traditionally have protracted periods of hospitalisation for a number of reasons. The withdrawal might be difficult to control, there may be social issues or there may be reluctance for the hospital authorities to continue withdrawal treatment on an outpatient basis. In our historical comparison, the establishment of a co-ordinated multidisciplinary outpatient clinic halved the length of hospitalisation for drug-exposed infants from 14 to 7 days.101 The duration of hospitalisation is variable and some infants may stay in hospital for up to 380 days.11 Many NAS infants, however, stay in hospital at least a month.110 As some cases of withdrawal (most noticeably benzodiazepine or methadone) may not be noticed until late in the first week or early in the second week of life, it is recommended that infants exposed to long-acting drugs of addiction be allowed to stay in hospital for at least 5 days after birth.103
The Role of Breastfeeding in NAS

Apart from a small case series, there is little evidence to suggest that breastfeeding can prevent NAS. Such studies are often difficult to conduct because feeds are often mixed (i.e. between formula and breast milks). Methadone and other drugs are certainly excreted in minute amounts into breast milk, and there are case reports where NAS developed after abrupt cessation of breastfeeding. The rates of breastfeeding among the drug-dependent population is uncertain but most likely lower than the general population due to certain lifestyle constraints. In addition, some drug-dependent mothers may be reluctant to breastfeed for fear of intoxicating their infant or because of an increased risk of transmissible diseases such as HIV via breast milk. Jansson, in a 2004 review concluded that the amount of drugs present in breast milk was most likely to be so minimal that in general, the benefits of breastfeeding considerably outweighed the risks associated for most cases of drug-exposed infants. She also emphasised that many of these women were prone to lactation difficulties including maternal drug use relapse and needed intense support from lactation consultants. She cautioned that women who had inadequate prenatal care and/or no substance abuse treatment should be dissuaded from breastfeeding even if they should choose to breastfeed.

Arlettaz compared breastfed with formula-fed methadone-exposed infants and found that 7/27 (26%) breastfed infants developed NAS while 78% (42/54) formula-fed infants developed NAS. We compared the Finnegan scores in a larger sample of 85 breastfed infants to 105 formula-fed infants over the first 9 days of life and found that infants who were fed breast milk, regardless of drug exposure or maturity, had significantly and consistently lower withdrawal scores than formula-fed infants.

Other Problems Associated with in utero Drug Exposure

Infants exposed to illicit drugs often have non-withdrawal related problems. For example, cocaine, because of its vasoconstrictive properties, causes an increased rate of intrauterine growth retardation, premature birth, placental accidents and stillbirths. Infants exposed to opiates just prior to birth may have profound respiratory depression and need ventilatory support for a short time. Olsen showed that ventilatory insensitivity to carbon dioxide persists for up to 15 days in some of these infants. In the long term, we noticed that methadone infants had an almost 10 times risk of developing NAS while 78% (42/54) formula-fed infants developed NAS. We compared the Finnegan scores in a larger sample of 85 breastfed infants to 105 formula-fed infants over the first 9 days of life and found that infants who were fed breast milk, regardless of drug exposure or maturity, had significantly and consistently lower withdrawal scores than formula-fed infants.

Psychosocial Problems Associated with NAS

Many pregnant women who abuse drugs remain unidentified and it is possible that the ones who are identified to health authorities represent those who are the most impaired and dysfunctional. There is a high incidence of domestic violence, child abuse, poverty, single parenthood and paucity of community support among families affected by drug-dependent mothers. The mothers themselves have a high incidence of psychiatric disorders such as depression, stress and even overt psychosis that will considerably impair adequate parenting ability. Drug-using pregnant women should be thoroughly assessed by specialist teams to see whether there are any coexisting mental health issues and the ability of the mother or father to parent effectively should be thoroughly assessed prior to discharge from hospital. If necessary, additional support from child welfare authorities should be sought.

Whether or not exposure to common drugs of dependency during intrauterine development affects ultimate childhood neurodevelopment is uncertain. Unless a drug specifically affects fetal neurodevelopment, for example, cocaine or alcohol, the influence of illicit drugs on long-term cognition and development is most likely due to social and environmental factors such as parenting skill and peer influence. Genetic factors have been recently implicated in the expression of addictive behaviours, for example, polymorphisms of dopamine receptor genes have been associated with poor adult retention in detoxification programmes and the contribution of heredity towards the development and severity of NAS is a field deserving of more research.

Pregnancy may offer a unique window of opportunity for the woman to stabilise her drug use because this has been shown to be the period when women are most amenable to such positive changes. It is thus of great importance that any plans for management of the drug-dependent pregnant woman and her family encompass non-medical issues, including housing, parenting support and long-term assessment of the well-being of both the woman and her children. The principles of early engagement, continuum of care, child-at-risk assessments and hospital discharge planning are vital in providing optimal care for the drug-exposed newborn infant.

Conclusion

Most literature investigating the management of NAS is based on cohort and case series and there is very little evidence arising from randomised controlled trials. In conclusion, we can reasonably recommend the following for management of the infant and mother exposed to illicit drugs during pregnancy:
Obtain as detailed a drug and alcohol history from mother as possible.

Toxicology from either mother or infant may not provide additional information except if in cases where maternal history is inadequate.

Use receptor-appropriate agents to treat NAS, that is, Opiates for opiate withdrawal and currently phenobarbitone for sedative and stimulant withdrawal/intoxication.

Treatment duration of NAS is dependent on the infant’s clinical progress.

A hospital stay of at least 5 days for the infant to adequately evaluate progress of withdrawal and psychosocial circumstances of the family.

Discharge home only after medical and social conditions have been satisfied.

Breastfeeding should not be discouraged if there are no contra-indications. Relative contra-indication may include the unstable or excessive maternal drug intake that may have safety implications during breastfeeding.

Follow-up of other problems vital (eye checks, developmental assessments, infectious disease follow-up), an opportunity for psychosocial assessment at the time of a paediatric visit may be the only practical solution in some highly mobile population.

Further Research Needed in This Field

Much of the available research and knowledge has so far focused on the medical or drug aspects of dependency in pregnancy as well as on the pharmacological intervention in the newborn. There is still paucity of knowledge we can do to improve the long-term outcome of these children.

1. The prevalence and health-care utilisation of illicit drug dependent pregnant women and NAS in our community.

2. Validation of assessment tools for non-opiate (e.g. benzodiazepines, cannabinoids) withdrawal.

3. Utility of different medication doses for NAS.

4. Long-term outcome of the infants born to illicit drug using mothers regardless of NAS.

5. Most importantly, the development of a social intervention programme that would improve the long-term outcome of these children.

References


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