



*Neonatal Abstinence Syndrome  
Clinical Management Document*

***AUGUST 2010***



# Consensus Panel

*This protocol for the management of Neonatal Abstinence Syndrome was developed in 2006 by a consensus panel made up of experts in the related fields of healthcare. It is recommended for use as a treatment guideline and as a teaching tool.*

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## NEONATAL ABSTINENCE SYNDROME

- **Definition**  
Neonatal Abstinence Syndrome (NAS) refers to a constellation of typical signs and symptoms of withdrawal that occurs in infants that have been exposed to and have developed dependence to certain illicit drugs or prescription medications during fetal life. These symptoms are characterized by CNS irritability, gastrointestinal dysfunction and autonomic abnormalities.
  
- **Special Considerations**  
Mothers should be educated about the neonatal effects of the specific drugs of use, informed about the potential adverse neonatal outcomes and receive accurate information regarding their infant's treatment of NAS.
  
- **Purpose**
  - To assist in the proper management of NAS
  - To assist in the evaluation of signs and symptoms of withdrawal and ruling out other potential diagnosis, including hypoglycemia, hypocalcemia, sepsis, meningitis, hyperthyroidism, perinatal asphyxia, CNS hemorrhage and polycythemia.
  - To assist in determining the need for pharmacologic intervention in infants with significant symptoms of withdrawal.
  
- **Indications/Patient Population**
  - Suspected or known infants of substance using mothers
  - Infants with typical signs and symptoms of withdrawal
  - All mothers should be screened for substance use during pregnancy and at presentation for delivery.
  - Further assessment for substance use is indicated for infants born to mothers with high risk factors:
    - a. No prenatal care**
    - b. Preterm Labor
    - c. Previous unexplained fetal demise
    - d. Cerebrovascular accidents
    - e. Severe mood swings or bizarre behavior**
    - f. Placental abruption or repeated spontaneous abortions
    - g. History of STD's
    - h. History of physical and/or sexual abuse
    - i. History of substance abuse**
    - j. Incarceration
    - k. Clinical evidence of substance abuse in family member.
  
  - Neonates with high risk factors
    - a. Unexplained IUGR or prematurity
    - b. Unexplained microcephaly
    - c. Abnormal CNS exam (jitteriness, hypertonicity, irritability, poor state control)
    - d. Unexplained cerebral infarct
    - e. Vomiting and diarrhea associated with typical symptoms of withdrawal

- **Drugs of abuse**

- A - Substances of abuse that may cause abstinence in the newborn include:

- Opiates/Opioids -- (Heroin, Morphine, Codeine, Opium, methadone, Fentanyl, Demerol, Percodan, Darvon, Oxycodone, buprenorphine, and others)
    - Alcohol
    - Benzodiazepine -- (Valium & other derivatives and related drugs including Librium, Placidyl, Xanax, Ativan)
    - Barbiturates

- B – Drugs not associated with NAS

- Infants exposed to cocaine, antidepressants, and/or amphetamines may experience symptoms that may resemble those of NAS, however these symptoms appear to be the result of the toxic effects of these drugs on the CNS rather than symptoms of withdrawal.
    - Abnormal neurobehavioral findings have also been reported in infants born to mothers abusing caffeine, marijuana, tobacco, and volatile substances.
    - Management should be symptomatic and individualized.
    - Supportive, non-pharmacologic treatment is the rule as symptoms usually subside within a few days.

**Treatment with opiates is contraindicated in infants who have not developed dependence or tolerance to opiates.**

- **Initial Screening**

The Committee on Substance Abuse of the American Academy of Pediatrics recommends a comprehensive medical and psychological history that includes specific information about maternal drug use as part of every newborn evaluation. Most states do not require written consent from parents to obtain a urine toxicology screen in infants. Each hospital, however, may have specific guidelines, and parents should always be informed of any tests being performed on their infants. Regardless of socioeconomic status, it is important to screen all pregnant women for substance use with a validated questionnaire to elicit further information about the substance use pattern of the mother and its associated consequences for the outcome of the pregnancy, guiding further interventions. Testing for substance use in the mother includes urine toxicology screening while in the babies, meconium or urine is used.

- Maternal Medical History
    - Detailed Maternal Interview
    - Prenatal records from the narcotic treatment program
    - Maternal urine toxicology screen (when available)
    - Testing of newborn (urine and/or meconium screen)
  - A detailed maternal drug history should be obtained including prescription and non-prescription drugs, quantity, frequency and pattern of drug use.

- Self-reporting will identify only 40-60% of pregnant women using substances of abuse; therefore, screening is an important tool to verifying substance use and in identifying infants at risk.
- The social habits of the parents, previous referral to Children, Youth and Family Division of the Department of Public Welfare (CYF), and history of abuse or domestic violence should be tactfully obtained.
- Detailed knowledge of the drug history helps the healthcare team select specific pharmacotherapy, avoid unnecessary drugs, rapidly and effectively get symptoms under control, and decrease hospital days.
- Parental discussion of the care of the infant at risk of developing signs and symptoms of withdrawal should start before delivery, when possible.
- The first urine and/or meconium specimen should be collected to screen for exposure to drugs that may cause withdrawal in infants with high risk factors, infants with signs and symptoms of withdrawal, and infants of mothers with positive drug toxicology screens.
- Meconium toxicology-screen has the potential to detect substances the fetus was exposed to after 20 weeks gestation. Stool may test positive for up to three days postnatally.
- Urine toxicology assays are useful in detecting recent exposure only, are less sensitive and therefore have a lower rate of detection.
- Mothers enrolled in a methadone or buprenorphine treatment program should be requested to sign a release form in order to obtain her records from the provider.

- **Onset of symptoms of withdrawal:**

The clinical presentation of drug withdrawal is variable and depends on the drug(s), timing and amount of last maternal use, as well as the maternal and infant metabolism, and rate of excretion.

<b><u>DRUG</u></b>	<b><u>ONSET OF SYMPTOMS</u></b>
Opiates	48 – 72 hours (90% by five days)
Alcohol	3 – 12 hours (as long as 1-2 days)
Barbiturates	4 – 7 days
Benzodiazepine	1 – 2 weeks

- Sixty to 90% of term infants prenatally exposed to “narcotics” develop NAS.
- Infants less than 34 weeks gestation rarely develop the typical symptoms of withdrawal seen in term and close to term infants.
- The early symptoms are mostly autonomic and central nervous system irritability, followed by gastrointestinal dysfunction.
- Seizures can but rarely occur in 2-10% of infants withdrawing from opioids but may more frequently occur with other drugs.
- Over 30% of infants will have abnormal EEG’s without overt seizure activity.
- Multi-drug exposure may manifest clinically with a biphasic pattern of withdrawal characterized by an exacerbation of symptoms occurring 1-2 weeks after successful treatment of the initial symptoms.
- Infants should remain inpatient 5-7 days to assess for neonatal abstinence syndrome.

- **Initial Neonatal work-up**
  - Collect the first urine and/or meconium for toxicology screen. Urine collected after 24-36 hours is likely to be negative. Meconium toxicology screen in a term infant has the potential to detect substances the fetus was exposed to after 20 weeks gestation.
  - Observe for symptoms of opioid withdrawal shortly after birth and begin Neonatal Abstinence Scoring starting at 2-4 hrs after birth if indicated.
  - When suspected or clinically indicated: sepsis work-up, metabolic screen, CBC and Diff, and neurological evaluation may be helpful
  - Hepatitis B Vaccine to be given as per AAP guidelines
  - Screening for HIV and others STD's will be performed according to the mother's history.
  - No clinical signs or symptoms should be attributed solely to drug withdrawal without appropriate clinical assessment and/or diagnostic test to rule out other causes.
  - Infants with persistent loose stools should be evaluated further for other etiologies of diarrhea, i.e., lactose intolerance.
  
- **Neonatal Abstinence Score (Finnegan Scores)**
  - A tool that gives us a quantitative measure of the severity of symptoms of withdrawal (see page 7).
  - It allows us to evaluate the onset and progression of these symptoms, and assess the response to detoxification management strategies.
  - Permits standardization and consistency of management.
  - The accuracy of the scoring is essential since the Finnegan scores will dictate clinical management.
  - All personnel involved in the infant's care must be proficient in the use and application of this tool.

## Neonatal Abstinence Scoring System

Date: \_\_\_\_\_ Weight: \_\_\_\_\_

Score	Signs and Symptoms	Score	Time												Comments					
			A	M									P	M						
<b>Central Nervous System Disturbances</b>	Excessive high-pitched or other cry	2																		
	Continuous high-pitched or other cry	3																		
	Sleeps < 1 hour after feeding	3																		
	Sleeps < 2 hours after feeding	2																		
	Sleeps < 3 hours after feeding	1																		
	Hyperactive Moro reflex	2																		
	Markedly Hyperactive Moro reflex	3																		
	Mild tremors disturbed	1																		
	Moderate/severe tremors disturbed	2																		
	Mild tremors undisturbed	3																		
	Moderate/severe tremors undisturbed	4																		
	Increased muscle tone	2																		
Excoriation	1																			
Myoclonic jerk	3																			
Generalized convulsions	5																			
<b>Metabolic/Vasomotor Respiratory Disturbances</b>	Sweating	1																		
	Fever < 38.4° (37.2° to 38.2° C)	1																		
	Fever > 38.4° C	2																		
	Frequent yawning (> 3 in ½ hour)	1																		
	Mottling	1																		
	Nasal stuffiness	1																		
	Sneezing (> 3 in ½ hour)	1																		
	Nasal Flaring	2																		
	Respiratory rate > 60/minute	1																		
Respiratory rate > 60/min & retractions	2																			
<b>Gastro-intestinal Disturbances</b>	Excessive sucking	1																		
	Poor feeding	2																		
	Regurgitation	2																		
	Projectile vomiting	3																		
	Loose stools	2																		
Watery stools	3																			
<b>TOTAL SCORE</b>																				
<b>INITIALS OF SCORER</b>																				
<b>Neonatal Abstinence Syndrome Score used for the assessment of infants undergoing neonatal abstinence. Evaluator should check signs or symptoms observed at various time intervals. Add scores for total at each evaluation.</b>																				
Adapted from Finnegan, L.P., Kaltenbach, K., "The Assessment and Management of Neonatal Abstinence Syndrome: Primary Pediatric Care", 3 <sup>rd</sup> edition, Hoekelman & Nelson (eds.), C.V. Mosby Company, St. Louis, MO, pp. 1367-1378, 1992.																				

PHARMACOLOGY	R	S	D	T	S	D	T	S	D	T	S	D	T	S	D	T	S	D	T
S-Status; D-Dose; T-Time																			
<b>Coding:</b>																			
(+) Initiation																			
(=) Maintenance																			
(↑) Increase																			
(↓) Decrease																			
(—) Discontinuation																			

- **Instructions for Scoring**

- Begin scores within 2-4 hours of birth in known methadone or buprenorphine exposure or for infants whose mothers have been identified as having used substances during pregnancy.
- Scoring should be done every two hours until stable.
- Scores must include all signs and symptoms exhibited during the entire scoring period, not just at a single time.
- Scores may be done every 4 hours once the baby is stable on weaning doses of medication (scores >9, or increasing scores, mandates more frequent scoring).
- Choose the most appropriate time intervals for scoring depending on nursing care.
- You may score zero where applicable or when symptoms are not present.
- **Do not wake up infants for scoring.**
- When asleep, it is reasonable to score for those symptoms that have been persistent such as increased muscle tone, hyperactive Moro reflex, and excoriated areas if applicable.
- Symptoms such as nasal stuffiness, sneezing, nasal flaring, and respiratory rate can be assessed while infant is asleep and should be scored **only** if unrelated to other lung or airway disease.
- A crying infant must be quieted before assessing muscle tone, respiratory rate, and Moro reflex.
- **Baseline:** Normal expected behavior for the age of the infant .
- **Cry:** Prolonged crying or excessive crying must be scored even if it is not high pitch.
- **Sleeping:** Allowances should be made for infants who are **beyond** the newborn period. Baseline should always be the normal infant of comparable age. **Do not wake up infants for scoring.**
- **Tremors:** This is one item in the scoring system with four levels of severity. It should be scored only **once per scoring period**. If a variety of tremors are present, score the most significant type for the period.
- **Sweating:** When due to environmental reasons or supportive nursing measures (swaddling) it should not be scored.
- **Excoriation:** Excoriation (actual break in the skin surface) of prominent areas (chin, elbows, knees, occipital area, heels) should be scored when they **first** appear and when they are **extending**. Do not score during the healing process (unless new areas appear). Diaper rash should not be scored as excoriation.
- **Poor Feeding:** Score if slow to eat or if not taking adequate amounts.
- **Regurgitation:** Score only if this occurs more frequently than usual in a newborn. This does not include “wet burps.”
- **Yawning/Sneezing:** Score if >3 times in 30 minutes.
- The scores for the period are added. The total score and the initials of the scorer are placed at the bottom of each column.
- Under “Pharmacology,” the Status (S), Dose (D), and Time (T) are to be completed if indicated.
  - i. Status (S)
    - (+) Initiation of therapy
    - (=) Maintenance - no change in dose given
    - (↑) Increase in dose
  
    - (↓) Decrease in dose
    - (-) Discontinuation of medication/dose

- ii. Dose (D) - Write the dose that is being given at that time
- iii. Time (T) - Write the time the dose was given.

- Initials, full name and status are to be completed at the bottom of the Neonatal Abstinence Scoring Assessment and Treatment Record.
  - Scores should be discussed with parents (mother and/or father).
  - Parents should be informed on the estimated length of stay and weaning process.
  - Meeting(s) to discuss the infant's progress, nursing, social and other medical issues should be scheduled with parents during the infant's hospitalization. The parents should be engaged in the infant's care as much as possible.

- **Supportive Non-Pharmacological Interventions:**

- This is the cornerstone in the management of NAS.
- Supportive care should be started at birth and continued throughout the infant's hospitalization. This is best done in a unit that can provide a quiet, private environment and the option for nesting with close supervision by experienced personnel who can perform constant evaluations of mother and infant, recognize problems, and institute the necessary interventions.
- Up to 30% of infants may be managed without medication.
- Supportive care includes:
  1. Dimly lit, quiet environment to decrease sensory stimulation
  2. Frequent feedings of regular or hypercaloric formula
  3. Swaddling, rocking, swinging
  4. Soft music
  5. Pacifier for excessive sucking
  6. Early introduction to cereal (for extra calories and to firm-up stools)
  7. Positioning to reduce spitting or vomiting
  8. Soft sheets or sheepskin to prevent or minimize excoriation
  9. Frequent diaper changes for loose and frequent stools
- It is important to teach the parents the comfort measures for the infant.

- **Pharmacologic Therapy:**

- Drug therapy should be individualized based on the severity of the withdrawal and most importantly, on the infant's specific drug exposure.
- An abstinence scoring method should be initiated within 2-4 hours of birth in all infants exposed to methadone or other known substances of abuse and in any infant suspected of having significant exposure to drugs of abuse.
- Infants without significant sign/symptoms of withdrawal (Finnegan scores less than or equal to 7) do not require therapy, despite the mother's history.
- Pharmacologic treatment of withdrawal is indicated when, despite maximal supportive care, the average of three consecutive scores is 8 or greater.
- ***Treatment of non-opiate withdrawal with opiates is contraindicated.***
- ***Medications should be started within 2-4 hours after infant has met criteria for pharmacologic intervention. The more severe the abstinence, the greater the need to start medications as soon as possible. Delay in treatment is associated with increased infant morbidity.***
- ***Vomiting and diarrhea associated with dehydration due to narcotic withdrawal are indications for treatment even in the absence of high abstinence scores.***

- **Drugs available for the treatment of withdrawal:**

(\* = Preferred agents based on current available literature.)

- 1. Morphine oral solution \***

- a. Must be diluted to 0.4mg/ml (available as 4mg/ml or 2mg/ml)
- b. Equivalent to tincture of opium and paregoric
- c. No additives or high alcohol content
- d. Dilution errors less significant
- e. May be used and titrated as tincture of opium
- f. Contraindicated in non-opiate withdrawal
- g. Has a short half life; ideal for treatment of NAS
- h. Least effect on sucking

- 2. Morphine (IV)**

- a. Helpful when infant is NPO and IV treatment is indicated
- b. May have marked respiratory depressive affect
- c. Equivalent to tincture of opium
- d. Initial Dose: 0.05mg – 0.2mg/dose every 4 hours

- 3. Methadone \***

- a. IV and PO preparations available
- b. Very little experience in newborns
- c. No long term studies
- d. Has a prolonged half-life making it less ideal for treatment of NAS
- e. Longer duration of therapy
- f. Difficult to wean despite good early response
- g. More significant and prolonged sub-clinical symptoms

- 4. Phenobarbital \***

- a. Drug of choice for non-opiate withdrawal
- b. Suppresses agitation well
- c. Can be added for combination regimen in cases where single drug therapy is not effective.
- d. Phenobarbital level should be followed as clinically indicated
- e. Has no effect on diarrhea or other GI symptoms
- f. High doses may cause significant sedation and interfere with bonding and sucking
- g. Has a long half life
- h. Has not prevented seizures due to opiate withdrawal

- 5. Tincture of Opium \***

- a. Has no additives or high alcohol content
- b. Must be diluted by pharmacy to 0.4mg/ml (available as 10mg/ml)
- c. Has a short half life making it ideal for the treatment of NAS
- d. Improves sucking quickly
- e. Superior treatment for diarrhea and GI symptoms
- f. Associated with a lower incidence of seizures than with any other drugs

- g. Contraindicated in non-opiate withdrawal

## 6. Clonidine

- a. Non-narcotic that effectively reduces withdrawal signs
- b. Should be used in conjunction with a short acting opiate
- c. Initial dose of 0.5mg-1.0mg/kg followed by maintenance dose of 3mg-5mg/kg/day divided every 4-6 hours
- d. Limited studies in newborn infants

- *Drug of choice for alcohol withdrawal is Phenobarbital*
- *Drug of choice for non-opiate withdrawal is Phenobarbital*
- *The use of Valium and Chlorpromazine is strongly discouraged because of the significant side effects including lower seizure threshold.*
- *Buprenorphine has had some clinical trial but has not been approved for use in treating neonatal abstinence syndrome.*

- **Initial Dose and Administration:**

- Infants meet criteria for pharmacologic intervention when, despite maximal supportive care, the average of three consecutive score is 8 or greater or three consecutive scores are greater than 8.
- It is recommended that infants withdrawing from “narcotics” be started on one of the opiates listed above.
- The starting dose will depend on the severity of symptoms (see titration chart below).
- Finnegan scoring should be done every two hours until infant is stable.

- ***Tincture of Opium/Oral Morphine***

<u>Score</u>	<u>Dose: q4 hours</u>
8-10	0.8ml (0.32mg)/kg/day
11-13	1.2ml (0.48mg)/kg/day
14-16	1.6ml (0.64mg)/kg/day
>16	2.0ml (0.80mg)/kg/day

- If scores continue to increase, or an adequate response is not achieved within 12 hours, Morphine or Opium may be increased by 0.4 ml/Kg/day (0.16 mg/Kg/day) increments.
  - Consider adding Phenobarbital if CNS symptoms cannot be controlled with opiates alone.
- ***Phenobarbital***
    - Loading dose – 10-15 mg/kg, as a single loading dose, followed by:
    - Maintenance dose – 3-5 mg/kg/day, given 1x/day or divided into two daily doses
    - Follow levels as clinically indicated.
  - ***Methadone***
    - Start at 0.1 mg/kg/dose every 6-8 hours
    - Increase dose by 0.05 mg/kg/dose or consider decreasing the interval, until Finnegan scores are between 8-10

- After stabilization, continue dose for 2-3 days
- Goal is scores < 8

- **Detoxification**

- Finnegan scoring and clinical evaluation should always be the basis of weaning a child from pharmacologic therapy.
- Use **birth weight** for all calculations.
- Maintain control dose for 24-48 hours before beginning to wean.
- Scores should be averaged over a 12 to 24 hour period.
- Wean medications at the **same time** every day.
- Other factors must be considered in dose adjustments such as feeding quality and weight gain.
  
- ***Morphine/Opium***
  - For Daily Average Scores 6 – 8 ► wean by 10% once daily.
  - For Daily Average Scores 3 – 5 ► wean 15% once daily.
  - If scores acutely fall to <2 within 12-24 hours, suspect the possibility of a medication error.
    - Monitor closely, and if infant is lethargic or obtunded, withhold dose.
    - Score every 2 hours until symptoms resolve.
    - Asymptomatic infants may be weaned by 20% daily or 10% every 12 hours
  - When the infant has received 24 hours of 0.1ml (0.04mg) q 4 hours of opium/morphine, and his clinical condition is stable, the medication can be discontinued.
  - It is not necessary to increase the spread of dose interval due to the short half-life of morphine and opium.
  - Infant can be observed for at least 24 hours after the medications have been discontinued.
  
- ***Phenobarbital***
  - May be weaned by 10%-20% following the same scoring principles.
  - Phenobarbital and opiates, when used together, may be weaned simultaneously or on alternate days depending on the infant's clinical response and Finnegan scores.
  - Another acceptable approach, when 2 medications are being used, is to completely wean the child off one medication before weaning the second.
  - Phenobarbital may be discontinued when the dose has been decreased to 0.5-1.0 mg/kg/day.
  
- ***Methadone***
  - Wean by 10% every other day until the dose is 0.1 mg/kg.
  - Then change interval to Q8 hours for 3-4 days.
  - Q12 hours for 3-4 days.
  - Q24 hours for 3-4 days.

- **Breastfeeding**

- Should be encouraged in compliant women on methadone.

- Breastfeeding mothers on high doses of methadone (>150mg) should be informed of the infant's potential adverse effects, including sedation, poor feeding, and apnea.
- Breastfeeding is contraindicated in cocaine, heroin and heavy alcohol use.
- Is contraindicated in HIV positive mothers.
- Mothers should be educated about the risks of breastfeeding their infants if they continue to use illicit drugs.
- Mothers with hepatitis should be informed that viral transmission and infection via breast milk is theoretically possible, but it has never been reported. Maternal hepatitis is not a contraindication for breastfeeding.
- There is no information related to buprenorphine at this time.

- **Treatment withdrawal from multiple drugs**

- Exacerbation of symptoms may occur in a biphasic pattern at 1-2 weeks of age after the initial symptoms were under control
- Consider adding a second drug to the regimen
- After control is achieved, both drugs may be weaned simultaneously or on alternative days as clinically indicated

- **Discharge Planning**

- The length of hospitalization varies, depending on the drug, severity of withdrawal symptoms and social factors.
- All other criteria for discharge of the newborn infant must be met.
- Close follow-up with the primary care physician.
- Parental Education to be done throughout the infant's hospitalization:
  - Team Meetings should be held at least once or as frequently as needed.
  - Educational information on NAS should be reviewed with the parents and management goals explained.
  - Address feeding problems and gastrointestinal symptoms.
  - The importance of the mother's own treatment and well-being.
  - Infant's sleeping problems and how to manage them.
  - Proper method of swaddling.
- Parents should understand that sub-clinical symptoms of withdrawal might persist for 4-6 months after discharge.
- Early Intervention or Developmental follow up should be arranged before discharge.
- Hearing screen and immunizations as per AAP recommendations.
- Social Service and/or CYF referral when indicated.
- Nursing Home Health Visits.
- Notify mother's treatment program of infant's discharge.
- It is important to assure the coordination of care to community resources, drug treatment providers, and support services during the inpatient stay, as well as at discharge, for continuity.

- **Monitoring**

No data exists to support or refute the use of cardio-respiratory monitoring during hospitalization for detoxification. The use of a monitor should be based on physician discretion and hospital policy.

## **BIBLIOGRAPHY:**

1. **American Academy of Pediatrics Committee on Drugs.** Neonatal drug withdrawal. *Pediatrics* 1998; **101**:1079–88.
2. **American Academy of Pediatrics Committee on Drugs.** The transfer of Drugs and Other Chemicals into Human Milk. *Pediatrics* 2001; **108**:776-789.
3. **American Academy of Pediatrics, Committee on Fetus and Newborn and Committee on Drugs** Benzyl alcohol: toxic agent in neonatal units. *Pediatrics.* 1983; **72**:356-358
4. **Bloom RS, Cropley C.** *Textbook of Neonatal Resuscitation.* Elk Grove Village, IL: American Heart Association/American Academy of Pediatrics; 1990:6-28-6-29
5. **Davis D, Templer D.** Neurobehavioral Functioning in Children Exposed to Narcotics in Utero. *Addictive Behaviors* 1988; **13**:275-283.
6. **Ornoy A, Michailovskaya V, Lukashov I, et al.** The developmental outcome of children born to heroin-dependent mothers, raised at home or adopted. *Child Abuse Negl* 1996; **20**:385–96.
7. **Ornoy A, Segal J, Bar-Hamburger R, et al.** Developmental outcome of school-age children born to mothers with heroin dependency: importance of environmental factors. *Dev Med Child Neurol* 2001; **43**:668–75.
8. **Shaw NJ, McIvor L.** Neonatal abstinence syndrome after maternal methadone treatment. *Arch Dis Child Fetal Neonatal Ed* 1994; **71**:F203–5.
9. **Hoder EL, Leckman JF, Poulsen J, et al.** Clonidine treatment of neonatal narcotic abstinence syndrome. *Psychiatry Res* 1984; **13**:243–51.
10. **Theis JG, Selby P, Ikizler Y, et al.** Current management of the neonatal abstinence syndrome: a critical analysis of the evidence. *Biol Neonate* 1997; **71**:345–56.
11. **Osborn DA, Cole MJ, Jeffery HE.** Opiate treatment for opiate withdrawal in newborn infants. *Cochrane Database Syst Rev* 2002:CD002059.
12. **Osborn DA, Jeffery HE, Cole MJ.** Sedatives for opiate withdrawal in newborn infants. *Cochrane Database Syst Rev* 2002:CD002053.
13. **Lipsitz PJ.** A proposed narcotic withdrawal score for use with newborn infants. A pragmatic evaluation of its efficacy. *Clin Pediatr (Phila)* 1975; **14**:592–4.
14. **Finnegan LP, Connaughton JF Jr, Kron RE, et al.** Neonatal abstinence syndrome: assessment and management. *Addict Dis* 1975; **2**:141–58.
15. **Finnegan LP, Mitros TF, Hopkins LE.** Management of neonatal narcotic abstinence utilizing a phenobarbital loading dose method. *NIDA Res Monogr* 1979; **27**:247–53.
16. **Sutton LR, Hinderliter SA** Diazepam abuse in pregnant women on methadone maintenance: implications for the neonate. *Clin Pediatr (Phila).* 1990; **29**:108-111
17. **Finnegan LP, Kron RE, Connaughton JF, Emich JP** Assessment and treatment of abstinence in the infant of the drug-dependent mother. *Int J Clin Pharmacol Biopharm.* 1975; **12**:19-32
18. **Kaltenbach K, Finnegan LP** Neonatal abstinence syndrome, pharmacotherapy and developmental outcome. *Neurobehav Toxicol Teratol.* 1986; **8**:353-355
19. **Zahorodny W, Rom C, Whitney W, et al.** The neonatal withdrawal inventory: a simplified score of newborn withdrawal. *J Dev Behav Pediatr* 1998; **19**:89–93.
20. **Green M, Suffet F.** The Neonatal Narcotic Withdrawal Index: a device for the improvement of care in the abstinence syndrome. *Am J Drug Alcohol Abuse* 1981; **8**:203–13.

21. **Kaltenbach K**, Finnegan LP. Neonatal abstinence syndrome, pharmacotherapy and developmental outcome. *Neurobehav Toxicol Teratol* 1986; **8**:353–5.
22. **Adams SF**, Mahowald MB, Gallaher J. Refusal of treatment during pregnancy. *Clin Perinatol* 2003; **30**:127-140
23. **Kandall SR**. Treatment strategies for drug-exposed neonates. *Clin Perinatol* 1999; **26**:231–43.
24. **Doberczak TM**, Kandall SR, Friedmann P. Relationship between maternal methadone dosage, maternal-neonatal methadone levels, and neonatal withdrawal. *Obstet Gynecol* 1993; **81**:936–40.
25. **Ostrea EM**, Knapp DK, Knapp DK, *et al.* Estimates of illicit drug use during pregnancy by maternal interview, hair analysis, and meconium analysis. *J Pediatr* 2001; **138**:344–8.
26. **Ostrea EM**, Brady M, Cause S, *et al.* Drug screening of newborns by meconium analysis: a large-scale, prospective, epidemiologic study. *Pediatrics* 1992; **89**:107–13.
27. **Harper RG**, Solish GI, Purow HM, Sang E, Panepinto WC The effect of a methadone treatment program upon pregnant heroin addicts and their newborn infants. *Pediatrics*. 1974; **54**:300-305
28. **Fricker HS**, Segal S Narcotic addiction, pregnancy, and the newborn. *Am J Dis Child*. 1978; **132**:360-366
29. **Herzlinger RA**, Kandall SR, Vaughan HG Neonatal seizures associated with narcotic withdrawal. *J Pediatr*. 1971; **91**:638-641
30. **Zelson C**, Rubio E, Wasserman E Neonatal narcotic addiction: a 10 year observation. *Pediatrics*. 1971; **48**:178-189
31. **Pinto F**, Torrioli MG, Casella G, Tempesta E, Fundaro C Sleep in babies born to chronically heroin addicted mothers: a follow up study. *Drug Alcohol Depend*. 1988; **21**:43-47
32. **van Baar AL**, Fleury P, Soepatmi S, Ultee CA, Wesselman PJ Neonatal behavior after drug dependent pregnancy. *Arch Dis Child*. 1989; **64**:235-240
33. **Smeriglio VL**, Wilcox HC Prenatal drug exposure and child outcome: Past, Present, Future. *Clin Perinatol* 1999; **26**: 17-38
34. **Nichols MM** Acute alcohol withdrawal syndrome in a newborn. *Am J Dis Child*. 1967; **113**:714-715
35. **Desmond MM**, Schwanecke RP, Wilson GS, Yasunaga S, Burgdorff I Maternal barbiturate utilization and neonatal withdrawal symptomatology. *J Pediatr*. 1972; **80**:190-197
36. **Rementeria JL**, Bhatt K Withdrawal symptoms in neonates from intrauterine exposure to diazepam. *J Pediatr*. 1977; **90**:123-126
37. **Doberczak TM**, Kandall SR, Wilets I Neonatal opiate abstinence syndrome in term and preterm infants. *J Pediatr*. 1991; **118**:933-937
38. **Strauss ME**, Andresko M, Stryker JC, Wardell JN Relationship of neonatal withdrawal to maternal methadone dose. *Am J Drug Alcohol Abuse*. 1976; **3**:339-345
39. **Ostrea EM**, Brady MJ, Parks PM, Asenio DC, Naluz A Drug screening of meconium in infants of drug-dependent mothers: an alternative to urine testing. *J Pediatr*. 1989; **115**:474-477
40. **Horowitz RM** Drug use in pregnancy: to test, to tell: legal implications for the physician. *Semin Perinatol*. 1991; **15**:324-330
41. **Bays J.**, The care of alcohol- and drug-affected infants. *Pediatr Ann*. 1992; **21**:485-495
42. **Ostrea EM**. Infants of drug-dependent mothers. In: Burg FD, Ingelfinger JR, Wald ER, eds. *Current Pediatric Therapy*. Vol 14. Philadelphia, PA: WB Saunders; 1993:800-801
43. **Kahn EJ**, Neumann LL, Polk GA The course of the heroin withdrawal syndrome in newborn infants treated with phenobarbital or chlorpromazine. *J Pediatr*. 1969; **75**:495-500

44. **Green M**, Suffet F The neonatal narcotic withdrawal index: a device for the improvement of care in the abstinence syndrome. *Am J Drug Alcohol Abuse*. 1981; **8**:203-213
45. **Carin I**, Glass L, Parekh A, Solomon N, Steigman J, Wong S Neonatal methadone withdrawal: effect of two treatment regimens. *Am J Dis Child*. 1983; **137**:1166-1169
46. **Kandall SR**, Doberczak TM, Mauer KR, Strashum RH, Korts DC Opiate vs. CNS depressant therapy in neonatal drug abstinence syndrome. *Am J Dis Child*. 1983; **137**:378-382
47. **Chasnoff IJ**, Burns WJ, Hatcher RP, Burns KA Phencyclidine: effects on the fetus and neonate. *Dev Pharmacol Ther*. 1983; **6**:404-408
48. **Eyler FD**, Behnke M Early development of infants exposed to drugs prenatally. *Clin Perinatol* 1999; **26**:107-150
49. **Gibbs J**, Newson T, Williams J, Davidson DC Naloxone hazard in infant of opioid abuser. *Lancet*. 1989; **2**:159-160
50. **Maas U**, Kattner E, Weingart-Jesse B, Schafer A, Obladen M Infrequent neonatal opiate withdrawal following maternal methadone detoxification during pregnancy. *J Perinat Med*. 1990; **18**:111-118
51. **Doberczak TM**, Shanzer S, Cutler R, Senie RT, Loucopoulos JA, Kandall SR One-year follow-up of infants with abstinence-associated seizures. *Arch Neurol*. 1988; **45**:649-653
52. **Rumack BH**, Walravens PA Neonatal withdrawal following maternal ingestion of ethchlorvynol (Placidyl). *Pediatrics*. 1973; **52**:714-716
53. **Jevtovic-Todorovic V**, Hartman R, Izumi Y, Benshoff, N, Dikranian K, Zorumski C, Olney J, Wozniak, D Early exposure to common anesthetic agents causes widespread neurodegeneration in the developing rat brain and persistent learning deficits. *Journal of Neuroscience*. 2003; **23**:876-882.
54. **Durrmeyer X**, Vutskits L, Anand K, Rimensberger P Use of analgesic and sedative drugs in the NICU: integrating clinical trials and laboratory data. *Pediatric Research*. 2010; **67**:117-127.
55. **NG E**, Taddio A, Ohlsson A Intravenous midazolam infusion for sedation of infants in the NICU. *The Cochrane Collaboration*. 2010; **1**:1-23.
56. **Kraft W**, Gibson E, Dysart K, Damle V, LaRusso J, Greenspan J, Moody D, Kaltenbach K, Ehrlich M Sublingual buprenorphine for treatment of neonatal abstinence syndrome: a randomized trial. *Pediatrics*. 2010; **122**:601-607.



