Neonatal Abstinence Syndrome

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Indiana Society for Respiratory Care
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Disclosure

• I have no relevant financial relationships with the manufacturers of any commercial products and/or providers of services discussed in this program.

• I will discuss off label use of clonidine and buprenorphine for management of NAS.
Statistical Sources

• AAP Committee on Drugs and Committee of the Fetus and Newborn
• Substance Abuse and Mental Health Services Administration (SAMHSA)
• National Institute on Drug Abuse (NIDA)
Objectives

• Describe components of evidenced based standard of care, medication protocol and progression of withdrawal stages for NAS
• Discuss evaluation tools and demonstrate appropriate use for assessment
• Discuss comforting measures
• Identify options for fostering parental involvement during and following hospitalization
National Institute on Drug Abuse

• Component of National Institutes of Health (NIH), an agency of Department of Health and Human Services
  – Support of research on health aspects of drug abuse and addiction
  – Provision of rapid, effective dissemination of these results to improve prevention and treatment and policy development as it relates to drug abuse and addiction
Monitoring the Future (MTF) Survey

- Initiated in 1975
- Measures drug, alcohol and cigarette use and related attitudes among middle and high school students
- Initially 12th graders; 8th and 10th graders added in 1991
- Funded by NIDA; conducted at University of Michigan
- Results released each December
- More than 45,000 students participated in 2012 survey; 395 public and private schools
Trends of Drug Usage

• Significant decrease in alcohol use over past 5 yrs including underage persons (age 12-20); considered to be historically low levels

• Rates of alcohol dependence or abuse declined from 7.7% (2002) to 6.5% (2011)

• Fewer Americans are smoking and teen smoking is declining rapidly-lowest rate in survey’s history (MTF)

• Fewer teens smoke cigarettes than smoke marijuana

• After alcohol, marijuana has the highest rate of dependence or abuse; twice the number for prescription pain relievers and four times the number for cocaine
Trends of Drug Usage-con’t.

- Most individuals use drugs for the 1st time as a teenager
- Use of most illicit drugs has not changed appreciably or has declined over past decade except for marijuana however statistics for overall illicit drug use in America is increasing due to popularity of marijuana:
  - 8.7% (age 12 or older) used an illicit drug or abused a psychotherapeutic med in 2011, up from 8.3% in 2002
- More than half of new illicit drug users begin with marijuana
- Significant increases in use of marijuana over past month and increase in daily marijuana use across all 3 grades highest point since late 1990s (MTF survey)
Trends of Drug Usage-con’t.

• Nonmedical use of prescription and over the counter meds remains significant part of the teen drug problem...14.8% of seniors used a prescription drug non medically in past year

• Abuse of prescription, over-the-counter meds and prescription stimulants noted in conjunction with fewer seniors reporting occasional use as harmful

• 68% of surveyed teens report obtaining prescription drugs for free from friends and family
The National Institute on Drug Abuse is a component of the National Institutes of Health, U.S. Department of Health and Human Services. NIDA supports most of the world’s research on the health aspects of drug abuse and addiction. Fact sheets on the health effects of drugs of abuse and information on NIDA research and other activities can be found at www.drugabuse.gov.
PRESCRIPTION/OVER-THE-COUNTER VS. ILLICIT DRUGS*

*The percentage of 12th graders who have used these drugs in the past year.

- Adderall: 7.6%
- Vicodin: 7.5%
- Cold Medicines: 5.6%
- Tranquilizers: 5.3%
- OxyContin: 4.3%
- Ritalin: 2.6%
- Methaqualone/Quaaludes: 0.4%
- Marijuana: 36.4%
- Powder Cocaine: 2.7%
- Crack: 1.2%
- Methamphetamine: 1.1%
- Heroin: 0.6%

After marijuana, prescription and over-the-counter medications account for most of the top drugs abused by 12th graders in the past year.

The National Institute on Drug Abuse is a component of the National Institutes of Health, U.S. Department of Health and Human Services. NIDA supports most of the world’s research on the health aspects of drug abuse and addiction. Fact sheets on the health effects of drugs of abuse and information on NIDA research and other activities can be found at www.drugabuse.gov.
After Marijuana, Prescription and Over-the-Counter Medications\(^1\) Account for Most of the Commonly Abused Drugs Among High School Seniors\(^2\)

- Marijuana/Hashish: 36.4%
- Synthetic Marijuana: 11.4%
- Vicodin: 8.0%
- Adderall: 6.5%
- Salvia: 5.9%
- Tranquilizers: 6.6%
- Cough Medicine: 5.6%
- MDMA (Ecstasy): 5.3%
- Hallucinogens: 5.3%
- OxyContin: 4.9%
- Sedatives: 4.3%
- Inhalants: 3.2%
- Cocaine (any form): 2.9%
- Ritalin: 2.6%

\(^1\) Past Year Use
\(^2\) Monitoring the Future Survey, 2011
\(^3\) National Survey on Drug Use and Health, 2010

About 1 in 9 youth or 11.4 percent of young people aged 12 to 25 used prescription drugs nonmedically within the past year.\(^3\)
CATEGORIES OF DRUGS ABUSED
Commonly Abused Drugs/Substances

• Opioids
  – Heroin
  – Morphine
  – Methadone
  – Hydro/Oxycodone

• Hallucinogens
  – LSD
  – MDMA/MDA
  – Inhalants

• Prescription
  – CNS Stimulants
    – Amphetamines
    – Cocaine
    – Ritalin
    – Nicotine
  – CNS Depressants
    – Alcohol
    – Benzodiazepines
    – Cannabinoids
    – Methaqualone
Current Substance Use Among Pregnant Women Aged 15-44, by Age, 2008-2009 Combined

Source: SAMHSA, NSDUH, 2010
“Illicit” Drug Use* During Pregnancy

- Illicit drugs (marijuana, cocaine, hallucinogens, heroin, methamphetamines, and non medical use of prescription drugs)- 4.5%
- Binge or heavy drinking in 1st trimester- 11.9%
- Tobacco- 15.3%
- Represents rates lower during pregnancy (vs. non pregnancy) except for ages 15-17

* self reporting
Neonatal Abstinence Syndrome

- Chronic use of narcotic prescriptions (30 days or more): 5 fold increase from 1998 to 2008; NAS noted 5.6% of these infants
Intrauterine Drug Exposure (IUDE)

• Potential effects:
  – Congenital anomalies
  – Fetal growth restriction
  – Increase in risk of preterm birth
  – Signs of withdrawal or toxicity
  – Impair normal neurodevelopment
Effects of IUDE

• Mechanism of action
• Fetal effects
• Newborn effects
Effects of IUDE

• Mechanism of action:
  – Transfer from maternal to fetal circulation facilitated by:
    • Lipophilic substances
    • LMW (<1,000g/mol)
    • Rapid equilibration in fetus due to less developed glucuronidation, oxidative processes and immature renal system
    • Results in fetal and newborn effects
Effects of IUDE

• Fetal effects
  – Influenced by early vs. late, acute vs. chronic, nutrition, pharmacokinetics

• Newborn effects
  – Withdrawal (physical/neurobehavioral); toxicity
Teratogens and Their Effects

Moore, Keith, 4th ed; The Developing Human

COMMONLY ABUSED DRUGS/SUBSTANCES
Commonly Abused Drugs/Substances

• Opioids
  – Heroin
  – Morphine
  – Methadone
  – Hydro/Oxycodone

• Hallucinogens
  – LSD
  – MDMA/MDA
  – Inhalants

• Prescription

• CNS Stimulants
  – Amphetamines
  – Cocaine
  – Ritalin
  – Nicotine

• CNS Depressants
  – Alcohol
  – Benzodiazepines
  – Cannabinoids
  – Methaqualone
Alcohol

- Fetal Alcohol Spectrum Disorders (FASD): 40,000 infants/year
- Polydrug use/cigarette smoking associated with alcohol-exposed pregnancy
- 0.5-2 per 1000 live births annually
- 3 major features: facial, growth restriction, and neurodevelopmental
- FAS: leading cause of intellectual disability in western hemisphere: average IQ: 85.9
Stimulants

- Cocaine, methamphetamine
- Pregnancies at increased risk for preterm birth, placental abruption, fetal distress and IUGR
- Neurobehavioral signs may be seen dol 2 or 3 or as late as 2 wks
- Irritability, hyperactivity, tremors, high pitched cry, excessive sucking
- Seems to reflect drug effect and toxicity rather than withdrawal
- Long term adverse effects reported with methamphetamine: behavioral, cognition and physical dexterity
- No published evidence of therapeutic treatments
PRESCRIPTION DRUGS
Selective Serotonin Reuptake Inhibitors (SSRI)

- Antidepressants widely available 1988
- Prozac, Paxil*, Zoloft, Celexa
- Several signs described: irritability, tremors, restlessness, fever, hypertonia, seizures, hypoglycemia
- Onset dol 1 to 4 wks
- Support for toxicity rather than withdrawal
- Management:
  - Monitor in nursery
  - Early and frequent follow up post discharge
  - Counseling indicated (unknown potential short and long term risks) for breast feeding; appear to be minimally excreted in breast milk: paroxetine, sertraline and fluvoxamine
Opioids

• Classification
  – Natural-morphine
  – Endogenous-endorphins
  – Synthetic-heroin, fentanyl, methadone, buprenorphine

• Activate primarily opioid receptors in CNS resulting in supraspinal analgesia, sedation, euphoria, respiratory depression and decreased GI motility

• Prolonged use: physical and psychological dependence
Opioid Actions

• Acutely inhibit release of noradrenaline at synaptic terminals

• Tolerance develops with chronic exposure

• Release of increased level of noradrenaline results with **abrupt discontinuation** of exogenous opioids which leads to signs and symptoms of **withdrawal** secondary to release of noradrenaline
Opioid Maintenance

- Methadone
  - Full opioid agonist
  - Minimizes opioid craving
  - Suppresses abstinence symptoms
  - Blocks heroin induced euphoria
  - Prevents fetal stress
  - Optimizes prenatal care
  - Prolonged NAS

- Buprenorphine
  - Partial opioid agonist
  - Subutex/Suboxone
  - Results from Maternal Opioid Treatment: Human Experimental Research study (MOTHER)
  - Shorter NAS duration and lower cumulative morphine dose
Every hour, 1 BABY is born suffering from opiate withdrawal.

<table>
<thead>
<tr>
<th></th>
<th>Average length or cost of hospital stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>w/ NAS</td>
<td>16.4</td>
</tr>
<tr>
<td>w/o NAS</td>
<td>3.3</td>
</tr>
<tr>
<td>w/ NAS</td>
<td>$53,400</td>
</tr>
<tr>
<td>w/o NAS</td>
<td>$9,500</td>
</tr>
</tbody>
</table>

NAS and maternal opiate use on the rise

- Newborns in drug withdrawal
- Maternal opiate use

Source: Patrick et. al., JAMA 2012
Clinical Signs of NAS

• Involves 3 systems: CNS/autonomic, GI, and metabolic
  – Crying, difficult to console, exaggerated reflexes, tremors, vomiting, loose stools, seizures

• Scoring tools:
  – Finnegan
  – Modified Finnegan
  – Lipsitz
Neonatal Abstinence Syndrome (NAS)

IUDE

- Follows in-utero exposure and subsequent dependence upon removal following birth
- Initially used to describe withdrawal from opiates
- Onset dependent on pattern of maternal use
- May be delayed and prolonged with methadone
- “Less” typically seen with suboxone/subutex

Post Natal Exposure

- Most commonly seen following discontinuation of analgesia for management of neonatal pain
- Managements for infant’s “primary diagnoses” will impact NAS management strategies
- May result in prolongation of hospitalization
Potential Indications for Screening in Newborn (IUDE)

- Absent, late or inadequate PNC
- Admitted history of drug abuse
- Previous unexplained late fetal demise; IUGR
- Precipitous labor
- Abruptio placenta
- Hypertensive episodes
- Repeated spontaneous abortions
Drug Screens

• Urine
• Meconium
• Hair
• Amniotic fluid/gastric aspirate
• Nails
• Umbilical cord tissue
Urine Screening Detection Times

• Alcohol
  – ~6-8hrs
• Amphetamines
  – ~5 days
• Cocaine
  – ~1-2 days up to 1-3 wks (heavy use)
• Marijuana
  – ~2-4 days up to 1 month (chronic use)
• Methadone
  – ~3 days
• Opiates
  – ~2 days
SCORING TOOLS
## Lipsitz Neonatal Drug Withdrawal Scoring System

<table>
<thead>
<tr>
<th>Signs</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Tremor (limbs)</td>
<td>Normal</td>
</tr>
<tr>
<td>Irritability (excessive crying)</td>
<td>None</td>
</tr>
<tr>
<td>Reflexes</td>
<td>Normal</td>
</tr>
<tr>
<td>Stools</td>
<td>Normal</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Normal</td>
</tr>
<tr>
<td>Skin abrasions</td>
<td>No</td>
</tr>
<tr>
<td>Respiratory rate/minute</td>
<td>&lt;55</td>
</tr>
<tr>
<td>Repetitive sneezing</td>
<td>No</td>
</tr>
<tr>
<td>Repetitive yawning</td>
<td>No</td>
</tr>
<tr>
<td>Vomiting</td>
<td>No</td>
</tr>
<tr>
<td>Fever</td>
<td>No</td>
</tr>
</tbody>
</table>

# Finnegan Scoring System

## System

### Signs and Symptoms

<table>
<thead>
<tr>
<th>System</th>
<th>Score</th>
<th>AM</th>
<th>PM</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive High-pitched (OR Other) Cry</td>
<td>2</td>
<td></td>
<td></td>
<td>Daily Weight:</td>
</tr>
<tr>
<td>Continuous High-pitched (OR Other) Cry</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeps &lt; 1 Hour After Feeding</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeps &lt; 2 Hours After Feeding</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeps &lt; 3 Hours After Feeding</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperactive Moro Reflex</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Markedly Hyperactive Moro Reflex</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Tremors Disturbed</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate-Severe Tremors Disturbed</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Tremors Undisturbed</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate-Severe Tremors Undisturbed</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased Muscle Tone</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excoriation (Specify Area):</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myoclonic Jerks</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generalized Convulsions</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweating</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever &lt; 101.5°F (38.6°C)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever &gt; 101.5°F (38.6°C) and Higher</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent Yawning (&gt; 3-4 times/interval)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mottling</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal Stuffy</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sneezing (&gt; 3-4 times/interval)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal Faring</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate &gt; 60/MIN.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate &gt; 50/MIN. with Retractions</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excessive Sucking</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor Feeding</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regurgitation</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projectile Vomiting</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose Stools</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watery Stools</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Total Score

INITIALS OF SCORER
### Table 67-3. Modified Finnegan’s Scoring System for Neonatal Withdrawal

Signs and symptoms are scored between feedings.

<table>
<thead>
<tr>
<th>Cry:</th>
<th>High-pitched (2)</th>
<th>Continuous (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep hours after feed:</td>
<td>1 h (3)</td>
<td>2 h (2)</td>
</tr>
<tr>
<td></td>
<td>3 h (1)</td>
<td></td>
</tr>
<tr>
<td>Moro reflex:</td>
<td>Hyperactive (2)</td>
<td>Marked (3)</td>
</tr>
<tr>
<td>Tremors when disturbed:</td>
<td>Mild (2)</td>
<td>Marked (3)</td>
</tr>
<tr>
<td>Tremors when undisturbed:</td>
<td>Mild (3)</td>
<td>Marked (4)</td>
</tr>
<tr>
<td>Muscle tone increased:</td>
<td>Mild (3)</td>
<td>Marked (6)</td>
</tr>
<tr>
<td>Convulsions:</td>
<td>(8)</td>
<td></td>
</tr>
<tr>
<td>Feedings:</td>
<td>Frantic sucking of fists (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor feeding ability (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regurgitation (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Projectile vomiting (1)</td>
<td></td>
</tr>
<tr>
<td>Stools:</td>
<td>Loose (2)</td>
<td>Watery (3)</td>
</tr>
<tr>
<td>Fever:</td>
<td>100–101 °F (2)</td>
<td>Over 101 °F (2)</td>
</tr>
<tr>
<td>Respiratory rate:</td>
<td>&gt;60/min (1)</td>
<td>Retractions (2)</td>
</tr>
<tr>
<td>Excoriations:</td>
<td>Nose (1)</td>
<td>Knees (1)</td>
</tr>
<tr>
<td></td>
<td>Toes (1)</td>
<td></td>
</tr>
<tr>
<td>Frequent yawning:</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Sneezing:</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Nasal stuffiness:</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Sweating:</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>Total scores per day</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Once an objective score has been attained, a dose for treatment can be decided on.

Finnegan Scoring: Key Points

- “Dynamic” scoring
- Awaken then calm infant to test reflexes
- Document temp at same site
- Moro not Startle reflex to be noted
- Initial score within 2 hrs of birth or d/c analgesia
- If ≥8, score q2 hrs x24 hrs; if ≤7, score q4 hrs
- With ≥8, 3x or ≥12, 2x... consider pharmacotherapy
Timing of Presentation of Symptoms

- Narcotics: birth/pk 3-4 days, abn reflexes can last up to 8 mos
- Barbiturates: 4-7 days, can last 4 mos
- Cocaine/Methamphetamine: 1st wk due “toxicity”
- Depressants/Sedatives: ETOH 3-12 hrs / 2-3 wks
- Selective Serotonin Reuptake Inhibitors-SSRIs: 48 hrs with resolution by 4 days
Overview of NAS Protocol*

Guidelines

- Cardiopulmonary monitor at all times
- Remember to consider other potential causes of symptoms:
  - Hypoglycemia, hypocalcemia, sepsis, ICH, HIE, hyperviscosity,
- Collect first urine/meconium for tox screens (IUDE)
- Begin scoring* within 4 hrs of birth, 2 hrs after d/c of analgesia, and 2-4** hrs after feedings
- Scoring is dynamic not a single time-point
- Ensure timely physician notification of scores
- Utilize comfort measures
- Initiate pharmacotherapy if scores are **consistently** >7/8**
- Request social service consult
- Encourage participation with care by family

*Familiarization with your institution’s Protocol and Scoring Tool is crucial
** Based on Scoring Tool guidelines
COMFORT MEASURES
Environmental Stability

- Learn infant’s cues
- Remain calm
- Reduce environmental stimulation
- Offer pacifier
- Do not overdress infant
- Gradually (re)introduce stimuli
- Use soft music and relaxation baths
Therapeutic Handling

- Minimize “hands on” time
- Provide cluster care
- Hold infant firmly and closely
- Gently rock infant
- Use infant swing or vibration seat
- Swaddle infant
- Use sleep sack; monitor preferred positions
- Encourage skin-to-skin contact (Kangaroo care)
Nutrition/Feedings

• Increase calories for satiety
• Feed on early hunger cues
• Consider simethicone drops
• Burp frequently
• Monitor stooling pattern...use barrier creams for diaper rash
• Support breastfeeding, when appropriate
Family Involvement

• Assess family’s knowledge of drug withdrawal along with symptoms and comfort measures
• Maintain therapeutic non-judgemental relationship with parents
• Encourage parental involvement with care
• Utilize comfort measures and educate parents throughout hospitalization in preparation for discharge
PHARMACOTHERAPY
NAS Pharmacotherapy Guidelines

• Pharmacotherapy may be necessary if Lipsitz Scores are consistently >7 or if Finnegan Scores are >8 x3 or >12 x2
  – Medication Table, Dosing Guide (example)

• Weaning doses can be considered when scores are <8 for 1-2 days
  – Weaning Dose Chart (example)

• Continue to score infant 2-3 days off pharmacotherapy
# NAS - Medication Table

<table>
<thead>
<tr>
<th>Maternal Drug:</th>
<th>Recommended Pharmacotherapy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narcotics →</td>
<td>Morphine sulfate</td>
</tr>
<tr>
<td>Methadone →</td>
<td>Morphine sulfate</td>
</tr>
<tr>
<td>Barbiturates →</td>
<td>Phenobarbital</td>
</tr>
<tr>
<td>Benzodiazepines →</td>
<td>Lorazepam; Phenobarbital</td>
</tr>
<tr>
<td>Multiple drugs →</td>
<td>Morphine sulfate</td>
</tr>
</tbody>
</table>
Morphine: 0.04mg/kg q 4 hrs PO with increase as needed to control symptoms; (Max: 0.16-0.2mg/kg dose-consider other diagnoses if unable to control symptoms with this dose) wean gradually q 2-3 days based on acceptable scores. See “Weaning Dose Chart”

Phenobarbital (seizures): 20mg/kg loading dose; maintenance dosing: 3-5mg/kg/day; IV or PO; will lessen irritability however will not treat GI symptoms

Lorazepam: 0.05-0.1mg/kg per dose IV-slow push
Additional Pharmacologic Therapy

- Clonidine*: 1mcg/kg every 4 hrs; wean by 50% as opiate is weaned (RCT)-adjunctive: shorter tx time + lower DTO dose
- Buprenorphine** (sublingual): 13-15 mcg/kg/day divided in 3 doses; increase dose by 25% until control; wean by 10% daily (RCT): shorter LOS and tx time
- Methadone***: 0.05-0.1 mg/kg every 6 hrs; increase 0.05mg/kg per dose “to effect”

- *Agthe, AG, 2009
- **Kraft, WK 2008/2010
- ***AAP, 2012
NAS Pharmacotherapy Guidelines

• Pharmacotherapy may be necessary if Lipsitz Scores are consistently >7 or if Finnegan Scores are >8 x3 or >12 x2
  – Medication (morphine) Table, Dosing Guide and Protocols

• Weaning doses can be considered when scores are <8 for 1-2 days
  – Weaning Dose Chart (example)

• Continue to score infant 2-3 days off pharmacotherapy
Therapy Initiation

• Initiate morphine when scoring system criteria are met
• Usual starting dose: 0.04mg/kg/dose
• Increase dose in 0.04mg/kg/dose increments
• Doses greater than 0.16mg/kg/dose rarely required; consider addition of phenobarb
• Max dose of 0.2mg/kg/dose referenced in 2012 AAP Clinical Report
Morphine Sulfate Weaning Guidelines for NAS

- Calculate 10% of individual (peak) dose to determine weaning percentage
- Wean individual dose by this percentage/amount every 2-3 days
- When < 20%, consider increasing interval-follow infant’s tolerance closely and d/c after 2-3 days at this dose
- Observe 2-3 days off med before d/c home
PROTOCOL OVERVIEW EXAMPLE
**NAS TREATMENT PLAN**

<table>
<thead>
<tr>
<th>Patient:</th>
<th>Weight: kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>mg/kg/dose</th>
<th>mg Q4h</th>
<th>Total Daily Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>_______</td>
<td>_______ mg/day</td>
</tr>
<tr>
<td>_______</td>
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<td>_______</td>
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<td>_______ mg/day</td>
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<tr>
<td>_______</td>
<td>_______</td>
<td>_______ mg/day</td>
</tr>
</tbody>
</table>

**THERAPY INITIATION:**

- Initiate morphine in patients that meet any of the following criteria based on the Modified Finnegan Scoring System:
  - Three consecutive scores ≥ 8 OR average of three consecutive scores ≥ 8
  - Two consecutive scores ≥ 12 OR average of two consecutive scores ≥ 12

- Normal starting dose = 0.04 mg/kg/dose, rounded to an easily measured amount (morphine available as 2 mg/mL)
- Increase dose in 0.04 mg/kg/dose increments (i.e., 0.04 mg/kg/dose → 0.08 mg/kg/dose → 0.12 mg/kg/dose, etc.)
- Doses greater than 0.16 mg/kg/dose are rarely needed and other causes for irritability should be considered, however doses up to 0.2 mg/kg/dose are referenced in the 2012 AAP Neonatal Drug Withdrawal Clinical Report

**WEANING:**

- Once patients’ symptoms have improved (Modified Finnegan scores consistently averaging 7 or less), calculate a decrease in mg/dose that will be approximately 10% of the peak dose required
- Wean by this same ‘mg’ increment each time—a decrease is warranted: goal is to wean by ~10% every 2-3 days
- Once the dose reaches 20-30% of the peak dose required, consider increasing interval instead of decreasing the dose
- Once the patient reaches 10-15% it is reasonable to discontinue morphine—patient should be observed for 2-3 days off medication prior to discharge

**PEAK DOSE = _____ mg/day**

<table>
<thead>
<tr>
<th>Date</th>
<th>Current Dose &amp; Frequency</th>
<th>Dose (mg/day)</th>
<th>Percent of Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEAN #1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEAN #12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DOSING CHART EXAMPLE
DOSING CHART EXAMPLE

PATIENT: _______________ Infant X ___________ DOSING WT. __________ 3 __ kg

Weaning Guidelines: Once withdrawal symptoms are controlled and the infant's scores are acceptable, weaning of the morphine sulfate can be considered according to the following guidelines:

DOSE* = __________ mg/kg/dose → __________ mg PO Q4h

TOTAL DAILY DOSE: __________ mg/day (PEAK DOSE)

Using 10% weaning percentage of individual peak dose:

<table>
<thead>
<tr>
<th>WEAN #1</th>
<th>0.11 mg PO Q4h</th>
<th>~90% PEAK (Based on total daily dose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEAN #2</td>
<td>0.09 mg PO Q4h</td>
<td>~80% PEAK</td>
</tr>
<tr>
<td>WEAN #3</td>
<td>0.08 mg PO Q4h</td>
<td>~70% PEAK</td>
</tr>
<tr>
<td>WEAN #4</td>
<td>0.07 mg PO Q4h</td>
<td>~60% PEAK</td>
</tr>
<tr>
<td>WEAN #5</td>
<td>0.06 mg PO Q4h</td>
<td>~50% PEAK</td>
</tr>
<tr>
<td>WEAN #6</td>
<td>0.05 mg PO Q4h</td>
<td>~40% PEAK</td>
</tr>
<tr>
<td>WEAN #7</td>
<td>0.04 mg PO Q4h</td>
<td>~30% PEAK</td>
</tr>
<tr>
<td>WEAN #8</td>
<td>0.03 mg PO Q4h</td>
<td>~20% PEAK</td>
</tr>
<tr>
<td>WEAN #9</td>
<td>0.03 mg PO Q4h</td>
<td>~17% PEAK</td>
</tr>
<tr>
<td>WEAN #10</td>
<td>0.03 mg PO Q6h</td>
<td>~13% PEAK</td>
</tr>
<tr>
<td>WEAN #11</td>
<td>0.03 mg PO Q12h</td>
<td>~ 8% PEAK</td>
</tr>
<tr>
<td>WEAN #12</td>
<td>STOP?</td>
<td>STOP?</td>
</tr>
</tbody>
</table>

*NOTE:

- Reassess infant after 3-6 morphine doses to determine need to increase dose to control symptoms.
- May need to increase dose to capture and/or control infant’s symptoms to decrease & maintain Lipsitz scores less than 8.
- As noted in this example, once the dose is less than 20% of the total daily dose, consider increasing the interval, i.e. from every 4 to 6 hrs, etc... (Weans #9 - #11) while continuing to follow Lipsitz scores.
- Once you are down to 10-15% of peak dose and you're on a miniscule dose, you may be able to discontinue; monitor Lipsitz scores.
- Percentages of peak doses may become approximations with subsequent weans.
Summary

• Illicit drug use declining except for use of marijuana
• More than half of new illicit drug users start with marijuana
• Nonmedical use of prescription and OTC meds significant for teens and seniors
• NAS affects 3 systems
• Objective evaluations, appropriate managements and protocol utilization by medical team are crucial
• Caregiver understanding is important for successful transition towards discharge
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THANK YOU!
QUESTIONS?