The Infant Born With Neonatal Abstinence Syndrome
by
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Vanderbilt University School of Nursing

Faculty Disclosure
• I am the developer of the inter-observer reliability program for the Finnegan Scoring Tool.

Objectives
1) Describe the incidence of drug dependence within the neonatal population.
2) Identify screening methods used to diagnose neonatal drug exposure.
4) Describe NAS scoring tools and the importance of being reliable in using these tools.
5) Describe the item definitions for the signs of NAS using the Finnegan Scoring Tool.
6) Identify when NAS scoring should occur.
7) Describe how to determine your inter-observer reliability with the Finnegan Scoring Tool.

Case Study
• Baby boy A is a 36 week infant admitted to the NICU at 12 hours of age for tachypnea, tremors, vomiting, high pitched cry and hypertonicity. The mother had no prenatal care. What is going on with this baby?

Differential Diagnosis
• Hypoglycemia – glucose is 96
• Hypocalcemia - calcium is 9
• Hypomagnesemia – magnesium is 1.58
• Hyponatremia – Na is 140
• CNS insult – Apgars 8 & 9
• All must be considered and evaluated

Hamdan, et., al, 2012
Case Study

• Check further in the history and you find:
  – Mother’s urine toxicology is positive for opiates, marijuana and cocaine.
  – Check with the labor & delivery room nurse and find the mother was in a methadone treatment program during the latter part of her pregnancy.
  – Mother has had her three other children taken away from her due to her drug use.

Final Diagnosis

• Neonatal Abstinence Syndrome
• Generalized disorder
• Licit & illicit drugs
• Poly drug use

What is Addiction?

• A chronic, relapsing, disease involving drug-seeking and abuse by long-lasting chemical changes in the brain
• Uncontrollable craving, seeking, and use of a substance such as a drug or alcohol

What is NAS?

• Two types:
  – Maternal use during pregnancy
  – Postnatal use (fentanyl, morphine)


Hudak & Tan, 2012; Hamdan, 2010
What is NAS?

• Causes alterations in functioning:
  – CNS disturbances
  – Metabolic, vasomotor, Respiratory Disturbances
  – Gastro-Intestinal Disturbances

Finnegan, et al 1975

Epidemic of Prescription Opiate Use/Abuse

• In 2006 the estimated total cost in the United States of nonmedical use of prescription opioids was $53.4 billion
  – $42 billion was attributable to lost productivity,
  – $8.2 billion to criminal justice costs
  – $2.2 billion to drug abuse treatment
  – $944 million to medical complications

Hansen et al. 2011

Opiate Pain Relievers (OPR’s)

• Deaths from OPR’s:
  • increased 5 fold between 1999 and 2010 for women.
  • More women have died each year from drug overdoses than from motor vehicle accidents.
  • In 2010 enough OPR’s were prescribed to medicate every adult in US with a typical dose of 5 mg of hydrocodone taken every 4 hours for 1 month.

CDC MMWR, July 5, 2013

Mothers Use of Opiates per 1,000 Hospital Births

Patrick, et al, 2012

Magnitude of Problem

• Estimated that 13,500 babies are born each year with NAS from non-iatrogenic causes
• One baby born each hour in the US with signs of neonatal abstinence.

Patrick et al, 2012
Neonatal Cost of Care

- 2000 - $190 million
- 2009 - $720 million
- 5 fold ↑ # women using opioids during pregnancy
- 3 fold ↑ in babies diagnoses with NAS

Patrick et al, 2012

Drugs Associated with NAS

- Opioids:
  - Heroin
  - Methadone
  - Fentanyl
  - Morphine
  - Demerol
  - OxyCodone
  - Buprenorphine

- Nonopioid CNS Depressants
  - May present with some or mimic symptoms of NAS
  - Benzodiazepines
  - SSRI's
  - Barbiturates
  - Anticonvulsants
  - Antipsychotics
  - Alcohol

Properties

- Heroin
  - 20-25 times stronger than morphine
  - Very addictive
  - Fetal tissue within 1 hour
- Methadone
  - Substitute for heroin
  - Detected in fetal brain: 1-2 hrs
  - Metabolite present in urine up to 5 days

Buprenorphine

- Buprenorphine
  - Similar to methadone
  - Better outcomes/less relapse
  - Easily tapered for detox
  - Less withdrawal
  - Approved for use with non-pregnant women
  - Preliminary studies

Findings

- 131 babies (58 buprenorphine; 73 methadone)
- % of neonates needing treatment was not significantly different (p=0.26)
- No difference in peak NAS scores (p=0.04)

Neonatal Abstinence Syndrome after Methadone or Buprenorphine Exposure

Hannah E. Jones, Ph.D., Kendal Kellenbach, Ph.D., Sarah H. Hoel, Ph.D., Susan M. Stavr, M.D., Ph.D., Janice C. Zipple, M.D., Amanda M. Arria, Ph.D., Alice E. O'Grady, Ph.D., Peter Safy, M.S., Peter R. Martin, M.S., and Colleen Father, M.D.

New England Journal of Medicine, December 9, 2010
Funded by NIDA
**Findings**

- **Significant differences**
  - Buprenorphine vs Methadone:
    - 89% less treatment with morphine - mean total dose 1.1 mg vs 10.4 mg
      \( p=0.0091 \)
    - 43% less time in the hospital - 10 days vs 17.5 days
      \( p=0.0091 \)

**Signs of Withdrawal in Neonate**

<table>
<thead>
<tr>
<th></th>
<th>Physiologic</th>
<th>Heroin</th>
<th>Methadone</th>
<th>Buprenorphine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sneezing</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stuffy nose</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spitting/Drooling</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Diarrhea</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Poor feeding</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sweating</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Tachypnea</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tachycardia</td>
<td></td>
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</table>

**Signs of Withdrawal in Neonates**

<table>
<thead>
<tr>
<th>Neurobehavioral</th>
<th>Heroin</th>
<th>Methadone</th>
<th>Buprenorphine</th>
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</thead>
<tbody>
<tr>
<td>Peri suckling</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Irritability</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Restlessness</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Tremors</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>High‐Pitched Cry</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Seizures</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Yawning</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed sleep</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Increased crying</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Dreaminess</td>
<td>Increased sleep</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Barbiturates/Alcohol**

**Commonalities**

a) depressants  
b) cross placenta readily  
c) addictive  
d) produce withdrawal

**Alcohol Use During Pregnancy**

<table>
<thead>
<tr>
<th>Status</th>
<th>Age</th>
<th>Current</th>
<th>Binge</th>
<th>Heavy</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>Pregnant</td>
<td>15-44</td>
<td>9.4%</td>
<td>2.3%</td>
<td>0.4%</td>
<td>2012 &amp; 2013</td>
</tr>
<tr>
<td>Non-Pregnant</td>
<td>15-44</td>
<td>52.2%</td>
<td>22.9%</td>
<td>6.3%</td>
<td>2012 &amp; 2013</td>
</tr>
</tbody>
</table>

Note: These data were averaged over 2 years

**Fetal Alcohol Spectrum Disorder**

- Spectrum of deformities  
- Criteria are ranked from 1 (normal) to 4 (significant of FAS)  
- Elimination of the FAE term  
- Includes dysmorphology scoring system  
- More objective diagnosis
Marijuana

1) Cannabis plant
2) Delta 9 Tetrahydrocannabinol (THC)
3) Crosses placenta
4) Detected in infant’s urine 1st day & stool for up to 3 days

Nicotine

- Tobacco is the only source of nicotine
- Active ingredient in tobacco
- Stimulant & relaxant
- Causes relaxation, calmness, alertness, decreases appetite and increases metabolism through release of chemicals
Nicotine

- Release of:
  - Acetylcholine - ↑ concentration, memory
  - Norepinephrine - ↑ arousal
  - Acetylcholine & Beta-Endorphin - ↓ pain
  - Beta-Endorphin - ↓ anxiety
  - Dopamine - ↑ arousal and reward

http://en.wikipedia.org/wiki/Nicotine

Signs of Withdrawal in Neonates

<table>
<thead>
<tr>
<th>Neur/Behavioral</th>
<th>Alcohol</th>
<th>Marijuana</th>
<th>Barbiturates</th>
<th>Nicotine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fussing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Irritability</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Restlessness</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>Hyperactivity</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Drowsiness</td>
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<tr>
<td>Increased sleep</td>
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</tbody>
</table>

Phencyclidine (PCP)

- Psychoactive Drug
- Used as anesthetic before 1965
- Low doses: numbness in extremities & intoxication (staggering, slurred speech)
- Mod doses: analgesia & anesthesia
- High doses: convulsions

http://en.wikipedia.org/wiki/Phencyclidine

Phencyclidine (PCP)

- Psychological effects – out of body experiences, paranoia, hallucinations, euphoria, suicidal impulses
- Infant: metabolites found in urine for 1-7 days after mother stopped using 3 months before delivery

http://en.wikipedia.org/wiki/Phencyclidine

Crack/Cocaine

- Powerful CNS stimulant
- Crosses placenta
- Metabolite present in urine & stoo (urine 1-2 days; meconium > 7 days)
- t½ ~ 60 +/- 30 min in adult; 6-8 hr in infant
- Powerful vasoconstrictor

Askin & Diehl-Jones, 2001
Methamphetamine

1) Highly addictive form of amphetamine
2) Stimulant like cocaine
3) Man-made where cocaine is plant-derived
4) Damages neurons that produce serotonin & dopamine

NIDA Notes, September 2000; April 2002

Selective Serotonin Reuptake Inhibitors (SSRIs)

- Increases the availability of serotonin
- Weak affinity for acetylcholine and dopamine
- Uses:
  - Depression
  - General anxiety disorder
  - Obsessive compulsive disorder
  - Eating disorders


Signs of Withdrawal in Neonates

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<tr>
<td>Tachycardia</td>
<td>X</td>
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</table>

Frequency of NAS

- 50-80% of heroin exposed infants develop NAS
- 60-90% of methadone and buprenorphine exposed infants develop NAS
- 60-80% of infants with NAS will require pharmacologic management


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<th>SSRI</th>
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<tbody>
<tr>
<td>Flat-scaping</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Irritability</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
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<td></td>
<td></td>
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<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Increased crying</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Hyper irritability</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drowsiness</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Increased deep</td>
<td>X</td>
<td></td>
<td>X</td>
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</tr>
</tbody>
</table>
**Onset of Signs**

- Depends upon:
  - Type of drug
  - Additional Substances
  - Timing of maternal dose
  - Infant metabolism
  - Gestational age and birth weight
  - Genetics

Hudak & Tan, 2012; Ashraf et al., 2014

**Onset of Signs**

- Alcohol – 3-12 hours
- Barbiturates - 1-14 days
- Caffeine – At birth
- SSRI – Hours to days
- Heroin (opioids with short t1/2) – 12-24/peak 72 hrs
- Methadone – 48 hours to as long as 7-14 days

Hamdan et al., 2012; Sanz, et al., 2005; Pierog, et al., 1977; Tierney, 2013

**Onset of Signs**

- Cocaine/Methamphetamine
  - After the first week of life
  - First week: signs are drug effect
    - Irritability
    - Hyperactivity
    - Tremors
    - Increased crying
    - Increased sucking

Oro & Dixon, 1987

**Premature Infant**

- Lower risk of having signs of NAS
  - < 35 weeks More immature CNS
  - Less fat stores
  - Differences in total drug exposure


**Genetics**

- Genes in adults (SNPs)
  - Mu-opioid receptor (OPRM1)
  - Multidrug resistance (ABCB1)
  - Catechol-0-methyltransferase (COMT)
- Study in Infants
  - 5 hospitals in Mass & Maine
  - DNA samples were genotyped for SNPs, and then NAS outcomes were correlated with genotype.

Wachman, et al., 2013

**Genetics**

- 86 mother/infant dyads
- 36wks or greater; exposed to methadone or buprenorphine
- Collected cord blood, maternal peripheral blood, or a saliva sample
- Outcome
  - Variants in the OPRM1 and COMT genes were associated with a shorter length of hospital stay and less need for treatment.
Detection and Screening

Testing for drug exposure:

– Urine
  • Obtain as soon as possible after birth
  • High false-negative (up to 60%) rate because only reports recent drug exposure

– Meconium
  • Better than urine
  • Drug exposure from 16 weeks GA

Ostrea, 2001

Screening

• Umbilical Cord
  – 10 cm section of cord at delivery
  – Rise with sterile saline
  – Place in sterile container
  – ELISA based test
  – Information: www.usdtl.com

Montgomery et al., 2008

Compared to Meconium

<table>
<thead>
<tr>
<th>Drug</th>
<th>UC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamine</td>
<td>Agreement – 96.6%</td>
</tr>
<tr>
<td></td>
<td>Specificity – 97%</td>
</tr>
<tr>
<td></td>
<td>Sensitivity – 95%</td>
</tr>
<tr>
<td>Opiates</td>
<td>Agreement – 95%</td>
</tr>
<tr>
<td></td>
<td>Specificity – 96%</td>
</tr>
<tr>
<td></td>
<td>Sensitivity – 78%</td>
</tr>
</tbody>
</table>

Montgomery, et al, 2005

Compared to Meconium

<table>
<thead>
<tr>
<th>Drug</th>
<th>UC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocaine</td>
<td>Agreement – 99%</td>
</tr>
<tr>
<td></td>
<td>Specificity – 100%</td>
</tr>
<tr>
<td></td>
<td>Sensitivity – 75%</td>
</tr>
<tr>
<td>Cannabinoids</td>
<td>Agreement – 91%</td>
</tr>
<tr>
<td></td>
<td>Specificity – 91%</td>
</tr>
<tr>
<td></td>
<td>Sensitivity – 89%</td>
</tr>
</tbody>
</table>

Montgomery, et al, 2005

Neonatal Abstinence Scoring Tools

• Lipsit
• Neonatal Withdrawal Inventory
• Neonatal Narcotic Withdrawal Index
• Finnegan Neonatal Abstinence Scoring Tool

Lipsit, 1975; Green & Sullit, 1981; Zahorskey, 1998; Finnegan, 1975
# Lipsit Hypertonicity

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremors</td>
<td>Minimal</td>
<td>Markedly increased</td>
<td>2</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Normal</td>
<td>Traction: pull</td>
<td>3</td>
</tr>
<tr>
<td>Skin abrasion</td>
<td>No</td>
<td>Traction: pull</td>
<td>4</td>
</tr>
</tbody>
</table>

# Hypoactive Moro Reflex

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posturing</td>
<td>Normal</td>
<td>Markedly increased</td>
<td>2</td>
</tr>
<tr>
<td>Reflexes</td>
<td>Normal</td>
<td>Markedly increased</td>
<td>3</td>
</tr>
<tr>
<td>Irritability (crisis, even of limbs)</td>
<td>Normal</td>
<td>Markedly increased</td>
<td>4</td>
</tr>
</tbody>
</table>

# Neonatal Withdrawal Inventory

<table>
<thead>
<tr>
<th>Hypertonicity</th>
<th>Hypoactive Moro Reflex</th>
<th>Tremors when disturbed</th>
<th>Tremors when undisturbed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sneezing or yawning</th>
<th>Regurgitation</th>
<th>Loose, Watery Stool</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 2 per session</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Irritability (restlessness, even after intervention)</th>
<th>Crying or Fist Sucking</th>
<th>Fresh Excoriation</th>
<th>Continuous Crying</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

# Respiration Rate/Min

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspiratory delay</td>
<td>1</td>
</tr>
<tr>
<td>No crying</td>
<td>1</td>
</tr>
<tr>
<td>Dry</td>
<td>1</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>&lt;61</td>
</tr>
<tr>
<td>Crying</td>
<td>No crying</td>
</tr>
<tr>
<td>61-80</td>
<td>&gt; 5 min without handling</td>
</tr>
<tr>
<td>&gt;80</td>
<td>&gt; 5 min without handling</td>
</tr>
<tr>
<td>Tremors</td>
<td>No tremors</td>
</tr>
<tr>
<td>5 min without handling</td>
<td>Traction: pull</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Head lag</td>
</tr>
<tr>
<td>Sitting</td>
<td>Traction: pull</td>
</tr>
<tr>
<td>Muscle tone (highest in last 24 hr)</td>
<td>100</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0 or 1/24 hr</td>
</tr>
<tr>
<td>&gt; 2/24 hr</td>
<td>&gt; 2/24 hr</td>
</tr>
<tr>
<td>Other (circle)</td>
<td>Stuffy</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Hic.</td>
</tr>
<tr>
<td>Sweat</td>
<td>Wt. Loss: &gt;15%</td>
</tr>
<tr>
<td>Skin Abr.</td>
<td>Wt. Loss Pre: &gt;15%</td>
</tr>
<tr>
<td>Green &amp; Suffet, 1991</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>5 and over</td>
</tr>
</tbody>
</table>

# Multiple Drug Use

**Accurate in Assessing Infants for Signs of NAS**

**Assessment tool recommended to examine infants for signs of NAS is the Finnegan Scoring Tool**

# Finnegan Neonatal Abstinence Scoring Tool (PANST)

<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crying: Excessive High Pitched</td>
<td>1</td>
</tr>
<tr>
<td>Crying: Cont. High Pitched</td>
<td>2</td>
</tr>
<tr>
<td>Sleeps &lt; 1 hr After Feeding</td>
<td>3</td>
</tr>
<tr>
<td>Sleeps &lt; 2 hr After Feeding</td>
<td>4</td>
</tr>
<tr>
<td>Hypertonic Moro Reflex</td>
<td>5</td>
</tr>
<tr>
<td>Markedly Hypertonic Moro Reflex</td>
<td>6</td>
</tr>
<tr>
<td>Mild Tremors: Disturbed</td>
<td>7</td>
</tr>
<tr>
<td>Mod. Severe Tremors: Disturbed</td>
<td>8</td>
</tr>
<tr>
<td>Mild Tremors: Undisturbed</td>
<td>9</td>
</tr>
<tr>
<td>Increased Muscle Tone</td>
<td>10</td>
</tr>
<tr>
<td>Excitement (Specific Area)</td>
<td>11</td>
</tr>
<tr>
<td>Metabolic, Vasomotor</td>
<td>12</td>
</tr>
<tr>
<td>Respiratory Disturbance</td>
<td>13</td>
</tr>
</tbody>
</table>

**Patient ID: Name:**

**Today’s Weight:**
Important Points

- Scoring is dynamic and not static
- Signs present within the 3-4 hr scoring interval need to be scored when it is time for the scoring
- Decide whether you will score Q 3hrs or Q 4 hours and stick with it

Problems Using Scoring Tool

- Inconsistency regarding scoring intervals and feeding schedule.
  - Example: Babies awakened after a feeding to be scored.
- Inconsistency between staff with scoring.
Problems Using Scoring Tool

- Inconsistency with defining the signs & symptoms of withdrawal.
  - Example: How do you differentiate between mild, moderate and severe tremors?
  - Example: How do you differentiate between a hyperactive and a markedly hyperactive Moro reflex?

Remedy

- Developed item definitions
- Inter-Observer reliability program

Scoring Frequency

- Initially after transition (2-4 hours after birth)
- Then, Q 3-4 hours
- Treatment begins when score is 8 or greater

Scoring Frequency

- If no treatment required by 72 hrs scoring can be discontinued & discharged after 24 hrs

Important Points

- Scoring is dynamic and not static
- Signs of withdrawal present within the 3-4 hour scoring interval need to be scored

Techniques

- Check tone:
  - Pull-to-Sit method
Techniques

- Check tone:
  - Upright Suspension method

- Flexion/Extension method

Moro Reflex

Check for Clonus

Crying

- Score 2 if excessive high pitched and unable to self console in 15 sec or continuous up to 5 minutes despite intervention.
- Score 3 if unable to self console in 15 sec or continuous >5 min despite intervention.

Sleep

- Based on longest period of sleep light or deep after feeding.
- Score 3 if <1 hour
- Score 2 if <2 hours
- Score 1 if <3 hours
Moro Reflex

- **Hyperactive**: elicit from quiet infant.
- Score 2 for hyperactive-jitteriness that is rhythmic, symmetrical, and involuntary.
- Markedly Hyperactive:
  - Score 3 for jitteriness as above with clonus of hands/arms. May test at hands or feet if unclear (more than 8 to 10 beats).

Tremors Disturbed

- **Tremors are** involuntary, rhythmical muscle contraction and release involving to and from movements
  - **Disturbed**:
    - Score 1 for mild/disturbed- of hands or feet while being handled.
    - Score 2 for moderate/severe disturbed - of arms or legs while being handled.

Tremors Undisturbed

- **NOT** touching baby after the infant has been handled (wait 15-30 seconds)
- Score 3 for mild undisturbed - Tremors of hands or feet when not handled.
- Score 4 for moderate/severe undisturbed - Tremors of arms and/ or legs or both when not handled.

Increased Muscle Tone

- **To test**: perform pull to sit maneuver.
- Score 2 - no head lag with total body rigidity. Do not test while asleep or crying. Other maneuvers may be used.

Excoriation

- Score 1 if present at nose, chin, cheeks, elbows, knees, or toes.
- Do not score for diaper area. This is related to loose or watery frequent stools.

Myoclonic Jerks

- Involuntary twitching of muscle.
- Score 3 for twitching at face/ extremities or jerking at extremities (more pronounced than jitteriness of tremors).
Generalized Seizures

- Score 5 for tonic seizures with extension or flexion of limb(s). Does not stop with containment. May include few clonic beats and/or apnea.

Sweating

- Score 1 for wetness at forehead, upper lip, or back of neck
- Do not score related to the environment (be consistent with linen)

Fever/Frequent Yawning/Mottling

- Fever
- Score 1 if 37.2-38.3 C (101F or <)
- Score 2 if 38.4 C (>101F)
- Frequent Yawning
- Score 1 if >3 within interval
- Mottling (marbled appearance (pink & white)
- Score 1 if present at chest, trunk, arms, or legs.

Nasal Stuffiness/Sneezing

- Nasal Stuffiness - nares partially blocked from drainage with noisy respiration
- Score 1 if present with/without runny nose
- Sneezing - individual or serial
- Score 1 for >3 during scoring interval

Nasal Flaring

- Nasal Flaring - nostrils flared out during respirations.
- Score 2 if present

Respiratory Rate

- Respiratory Rate - tachypnea >60 with/without retractions.
- Score 1 for rate >60 without retractions
- Score 2 for rate >60 with retractions
- Count for one full minute
**Excessive Sucking**
- Rooting with attempts to suck fist, hand, or pacifier before or after feeding.
- Score 1 for >3 attempts noted.

**Poor Feeding**
- Excessive sucking - (as described previously) but infrequent or uncoordinated with feeding. Gulping with frequent rest periods to breath.
- Score 2 if present

**Regurgitation/Projectile Vomiting**
- Regurgitation - effortless (not associated with burp).
- Score 2 for 2 or more episodes
- Projectile Vomiting - forceful during or after feed.
- Score 2 for 1 or > episodes

**Loose/Watery Stools**
- Loose stool - Loose, curdy, seedy, or liquid without water ring
- Score 2 if present
- Watery stool - Soft, liquid or hard with water ring
- Score 3 if present

**Optimal Scoring**
- Important to know the item definitions
- Important to establish an inter-observer reliability strategy to assure accurate scoring
- Scoring is dynamic and not static

**Inter-observer Reliability**
- The two nurses compare their scores
- Goal: Achieve 90% agreement or greater
- Determine their percent agreement

<table>
<thead>
<tr>
<th>Total Number of Items of Agreement</th>
<th>Total Number of Items of Disagreement</th>
<th>Percentage Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>95%</td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>90%</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>85%</td>
</tr>
<tr>
<td>17</td>
<td>4</td>
<td>80%</td>
</tr>
</tbody>
</table>
Reliability Testing

- Initial
- Each new staff member caring for the baby
- Two staff score at same time
- Determine a protocol – reliability assessment every 9, 10 or 11th score

Demonstration and Training Video

References 1


References 2


References 3

- Perinatal and Neonatal Nursing 14(4), 61-82.

References 4

