Neonatal Abstinence

by
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Objectives

1) Describe the incidence of drug addiction within the US and Tennessee.
2) Identify drugs associated with NAS and neonatal outcome.
3) Describe the signs of NAS.
4) Identify management strategies for treating neonates with NAS.

What is NAS?

- Also known as Neonatal Withdrawal Syndrome
- Constellation of behavioral and physiologic signs caused by cessation of exposure to licit and illicit drugs.

Hamdan, 2010
What is NAS?

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

Hamdan, 2010

What is NAS?

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

Finnegan, et al, 1975

Drugs Associated with NAS

- Opioids:
  - Heroin
  - Methadone
  - Fentanyl
  - Morphine
  - Demerol
  - OxyContin

- Nonopioid CNS Depressants
  - May present with some or mimic symptoms of NAS
  - Benzodiazepines
  - SSRI's
  - Barbiturates
  - Anticonvulsants
  - Antipsychotics
  - Alcohol
Epidemic of Prescription Opiate Use/Abuse

Prescription drug abuse is a growing national epidemic.

- Addiction, overdoses and deaths involving non-medical prescription drug use have risen significantly over the last decade.

Hansen et al. 2011

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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

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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
Illicit Drug Use In Pregnancy (2011)

- 20.9% pregnant teens
- 8.2% - pregnant women 18 to 25 years old
- 5.0% - overall (less than non-pregnant 10.8%)

http://www.samhsa.gov/data/NSDUH/2k11Results/NSDUHresults2011.pdf

Mothers Use of Opiates per 1,000 Hospital Births

Magnitude of Problem

- Estimated that 13,500 babies are born each year with NAS from non-iatrogenic causes in 2009
- One baby born each hour in the US with signs of neonatal abstinence.

Patrick et al, 2012
Cost of Care

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

Patrick et al, 2012

Reported LOS

- 8-79 days with average of 30 days
- LOS is varied because optimal treatment for NAS has not been identified
- 60-80% of these babies will require pharmacologic management


NAS in Tennessee

- 10 fold increase between 2000 – 2010
- TennCare – represents a cost of 5.6 times more than a baby without NAS in 2010
- Infants in TennCare system are 18 times more likely to enter state custody than infants without NAS

http://health.state.tn.MCN/PDFs/NAS/NAS_FAQ.pdf
**Frequency of NAS**

- 50-80% of heroin exposed infants develop NAS
- 60-90% of methadone and buprenorphine exposed infants develop NAS
- 50-75% of infants with NAS will require pharmacologic management

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**NAS in TN: 1999-2010**

[Graph showing the frequency of NAS cases in Tennessee from 1999 to 2010, with a significant increase in cases over time.]
Presentation

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

Hudak, 2012

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

Detection and Screening

- Hair Analysis:
  - Radio immunoassay
  - Grows 1 cm/month
  - Metabolite present for life of hair
  - Tells you drug use for months
  - Gets into microfibrils
  - Can use neonatal hair

Ostrea, 2001
Detection and 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

Compared to Meconium

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

Compared to Meconium

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

Montgomery et al, 2008

Montgomery, et al, 2005
Detection and Screening

- Maternal history
  - History of drug use
  - Methadone treatment (high dose does not mean infant will have NAS)
  - Family history of drug abuse
  - Prior involvement with CPS
  - Incarceration for drug abuse

Clancy et al, 2010

Detection and Screening

- Differential Diagnosis:
  - Hypoglycemia
  - Infection
  - Hypocalcemia
  - Hypomagnesemia
  - Hyperthyroidism
  - CNS injury

Hamdan et al, 2012

Detection and Screening

- Assess infant for signs of withdrawal
  - Central Nervous System Excitability
  - Gastrointestinal Dysfunction
  - Autonomic signs

Hamdan et al, 2012
Onset of NAS

Several factors
- Half-life of the drug
- Timing of maternal last dose
- Infant metabolism of the drug

Onset of NAS

Heroin or opioids with short half-life – within 12 to 24 hours with peak 72 hours (Kraft et al, 2012)
Methadone: 48 hours to as long as 7-14 days (longer half-life)

Hamdan et al, 2012

Neonatal Abstinence Scoring System (Finnegan)

Diagnostic tool
Divided into 3 systems with 21 total items
1) CNS disturbances
2) Metabolic, vasomotor and respiratory
3) Gastrointestinal

Finnegan, et al, 1975
### Finnegan Neonatal Abstinence Score

<table>
<thead>
<tr>
<th>Symptom and Synonyms</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Nervous System Disturbances</td>
<td>4</td>
</tr>
<tr>
<td>Crying, Excessive High Pitched</td>
<td>3</td>
</tr>
<tr>
<td>Crying, Cursing, High Pitched</td>
<td>3</td>
</tr>
<tr>
<td>С立面 &lt; 1 hr after feeding</td>
<td>3</td>
</tr>
<tr>
<td>Wraps &gt; 2 hr after feeding</td>
<td>3</td>
</tr>
<tr>
<td>Wraps &lt; 3 hr after feeding</td>
<td>1</td>
</tr>
<tr>
<td>Hypertonus Abdominal</td>
<td>3</td>
</tr>
<tr>
<td>Markedly Hyperactive Atonic Reflexes</td>
<td>3</td>
</tr>
<tr>
<td>Mild Tachycardia Disturbed</td>
<td>2</td>
</tr>
<tr>
<td>Mod Sev Tachycardia Disturbed</td>
<td>2</td>
</tr>
<tr>
<td>Mod Sev Tachycardia Uncontrolled</td>
<td>2</td>
</tr>
<tr>
<td>Mod Sev Tachycardia Indistinguishable</td>
<td>2</td>
</tr>
<tr>
<td>Increased Muscle Tone</td>
<td>2</td>
</tr>
<tr>
<td>Examination (Specific Area)</td>
<td>1</td>
</tr>
<tr>
<td>Myoclonic Jerk</td>
<td>2</td>
</tr>
<tr>
<td>Generalized Convulsions</td>
<td>2</td>
</tr>
</tbody>
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### Metabolic, Vasomotor and Respiratory Disturbance

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>Sweating</td>
<td>1</td>
</tr>
<tr>
<td>Fever &lt; 101 (37.2°C-38.3°C)</td>
<td>2</td>
</tr>
<tr>
<td>Fever &gt; 101 (38.4°C)</td>
<td>2</td>
</tr>
<tr>
<td>Frequent Yawning (&gt; 3)</td>
<td>1</td>
</tr>
<tr>
<td>Wetting</td>
<td>1</td>
</tr>
<tr>
<td>Nasal Stuffiness</td>
<td>1</td>
</tr>
<tr>
<td>Sneezing (&gt;2)</td>
<td>1</td>
</tr>
<tr>
<td>Nasal Flaring</td>
<td>1</td>
</tr>
<tr>
<td>Respiratory Rate (&gt; 60/min)</td>
<td>2</td>
</tr>
<tr>
<td>Respiratory Rate (&lt; 60/min with Retraction)</td>
<td>2</td>
</tr>
<tr>
<td>Pain on Feeding</td>
<td>2</td>
</tr>
<tr>
<td>Retraction</td>
<td>2</td>
</tr>
<tr>
<td>Respiratory Rate (&lt; 60/min)</td>
<td>2</td>
</tr>
<tr>
<td>Respiratory Rate (&gt; 60/min with Retraction)</td>
<td>2</td>
</tr>
</tbody>
</table>
### NAS Treatment

- “Control” withdrawal signs
- Attain a score of < 8 on Finnegan Scoring Tool
- Provide non-pharmacologic interventions
- Provide pharmacologic treatment
  - Oral morphine
  - Oral methadone

### Plan of Care: Non-pharmacological

- Swaddling, holding firmly & close to body, and slow rocking.
- Modify environmental stimulation such as light & noise.
- Soothing music
- Minimal handling
- Non-nutritive sucking

Valez & Jansson, 2008
Plan of Care:
Non-pharmacological

- Consider small frequent feedings of hypercaloric (24 cal/oz) formula and total caloric intake to provide 150-250 cal/kg/day to maintain growth
- Do not overfeed
- Gavage feeding may be necessary with disorganized suck

Velez & Jansson, 2008

Pharmacologic Management

- Withdrawal from Opiates – give oral morphine
- Withdrawal from other substances (e.g. barbiturates, ethanol, sedatives, hypnotics, give Phenobarbital

AAP, 1998
Pharmacologic Management

- Oral Morphine
  - Diluted solution: 0.4mg/ml dilution from concentrated oral morphine sulfate solution.
  - Administered Q 3 or 4 hours


Pharmacologic Management

- Methadone
  - Dose: 0.05-0.2mg/kg/dose PO Q 12-24 hrs or 0.5mg/kg/day
  - Increase by 0.05mg/kg/dose until controlled

Breastfeeding

- OK, providing mother is being monitored in a methadone treatment program
- Small amounts of the drug are transferred to the breast-milk
- Suggested that breastfeeding may decrease the severity of withdrawal signs

Abdel-Latif, et al, 2006; AAP, 2001
New Ideas

- Keep infant with his or her mother in the room (Jambert-Gray, 2009)
- Manage infant in a unit outside the NICU where monitoring can occur (Saiki, et al, 2010)
- Outpatient management (Backes et al, 2012).
  - At methadone treatment clinic
  - Mother and baby can be managed

References


References

- National Survey on Drug Use and Health, 2010. SAMSA.

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