The Downside of Methamphetamine

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Amphetamines Positivity by 3-Digit Zipcode
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Chemistry

Methamphetamine

Amphetamine

3,4 MDMA

Norepinephrine

Dopamine
Pharmacology

Peripheral effects

α and β adrenergic agonist effects
  pupillary dilation
  bronchial muscle dilation
  vasoconstriction
  coronary dilatation
  bladder contraction
  increased heart rate/blood pressure
  effects on sexual function
Pharmacology - Amphetamines

CNS - Sympathomimetic promotes synthesis and release of:

- **Norepinephrine**
  - alerting, anorectic, locomotor effects

- **Dopamine**
  - locomotor stimulating effects
  - psychosis, disturbances in perception

- **5-HT**
  - delusions, psychosis
Methamphetamine

Advances in Pharmacology

Administration of methamphetamine causes long term changes in dopaminergic systems, including decreases in transporter numbers, dopamine concentrations and tyrosine hydroxylase activity.

Dopamine transporter activity is rapidly and reversibly decreased after single use.

Dopamine transporter activity recovers after 24 hours in chronic use, but declines again 8 days post use.

Woolverton et al. Brain Res. 1989;486:73-78
Fleckenstein et al. J Pharm Exp Ther 1997;282(2):834-838
Methamphetamine concentrations in the brain are eight-fold higher than in the serum during the first hour following IV administration. In tolerant subjects, serum levels are higher, while brain levels are lower.

Patterns of Use

Clinical use (Desoxyn®):
- 5 - 60mg (q.i.d.) orally – narcolepsy
- 2.5 – 40mg (Ext. Rel.) - ADHD

Abuse:
- Occasional users – ±60mg
- Heavy users 250 - >5000mg/day,
  Orally, IV, IN, IM, smoked
Methamphetamine

Crank, Crystal, Speed, Meth

Potent CNS stimulant
Euphoria
Excitation
Alertness
Agitation
Motor restlessness
Pharmacodynamics

The methamphetamine binge

- Characterized by high dose, often IV use
- Little or no sleep, no appetite
- Use is compulsive and uncontrolled
- Repeated administration at 1 - 5 hourly intervals
- Binge can persist for days or weeks
Methamphetamine Intoxication

The Rush:

- 5 minutes intense euphoria
- “Orgasmic” pleasure
- Rapid flight of ideas
- Sexual stimulation
- High energy
- Obsessive/compulsive activity
- Thought blending
- Word salad
- Dilated pupils
Methamphetamine Intoxication

The Shoulder:

- Less intense euphoria
- Hyperactivity
- Rapid flight of ideas
- Obsessive/compulsive activity
- Thought blending
- Word salad
- Dilated pupils
- Shift from seeking of High
to avoidance of Low
Methamphetamine Intoxication

“Tweaking”:

Dysphoria
Scattered, disorganized thought
Intense craving
Paranoia/Anxiety/Irritability
Hypervigilance
Auditory, tactile hallucinations
Delusions
Pupils normal
Methamphetamine Intoxication

Dealing with Tweakers

- Keep your distance
- Stay within central field of vision
- No bright lights
- Keep your hands in plain sight
- Engage them in reassuring dialogue
- Talk slowly with deep pitch
- Remind them that it’s the drug talking
- Care with restraints
Methamphetamine

Crank, Crystal, Speed, Meth

Meth withdrawal
Fatigue
Sleepiness
Irritability
Drug cravings
Anxiety
Depression
Paranoia
Delusions
Methamphetamine Intoxication

The Crash:

Intense fatigue
Uncontrollable sleepiness
Continuing stimulation
Catnapping
Craving
Methamphetamine Intoxication

Withdrawal:
- Anergia
- Anhedonia
- Waves of intense craving
  - Environmentally cued
  - Endogenous
- Stress
- Inadequately treated withdrawal
- Inadequately treated mental illness
Methamphetamine Hysteresis

Symptomatology

- Improved reaction time
- Relief from fatigue
- Euphoria
- Light sensitivity
- Nervousness
- Headache
- Motor restlessness
- Tremor
- Fatigue
- Exhaustion
- Confusion
- Extreme fatigue
- Drug craving
- Depression
- Hypersomnia
- Uncontrollable sleepiness
- Suicidal behavior
- Agitation
- Hyperactive reflexes
- Apprehensiveness
- Confusion
- Suspiciousness
- Paranoia
- Hypervigilence
- Delusions
- Hallucinations
- Irrational behavior
- Violence
- Severe hypertension/chest pains
- Seizures
- Coma
- Death

Blood methamphetamine concentration

(a) 0.1

(b) 1
Methamphetamine withdrawal

The nature, time course and severity of methamphetamine withdrawal.


- Studied 21 patients undergoing withdrawal.
- Documented peak withdrawal within 24 hours
- Withdrawal characterized by:
  - Fatigue
  - Hypersomnia
  - Drug Craving
  - Food craving
  - Poor concentration
  - Tension
  - Depression
Methamphetamine withdrawal

The nature, time course and severity of methamphetamine withdrawal.
Methamphetamine withdrawal

Methamphetamine withdrawal

The nature, time course and severity of methamphetamine withdrawal.
Methamphetamine withdrawal

Methamphetamine withdrawal

The nature, time course and severity of methamphetamine withdrawal.


- Sleep patterns were disrupted.
  - More daytime sleeping.
  - Less clearheaded on awakening.
  - Poorer quality of sleep.
  - More frequent awakenings at night.
- Acute withdrawal period lasted 9 days.
# Methamphetamine: the DRE Assessment

<table>
<thead>
<tr>
<th></th>
<th>Acute</th>
<th>Downside</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGN</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>VGN</td>
<td>No*</td>
<td>No</td>
</tr>
<tr>
<td>Lack of convergence</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pupil size</td>
<td>Dilated</td>
<td>Normal/constricted</td>
</tr>
<tr>
<td>Rxn to light</td>
<td>Slow</td>
<td>Slow</td>
</tr>
<tr>
<td>Pulse</td>
<td>Up</td>
<td>Normal to slow</td>
</tr>
<tr>
<td>BP</td>
<td>Up</td>
<td>Normal</td>
</tr>
<tr>
<td>Temp.</td>
<td>Up</td>
<td>Normal</td>
</tr>
</tbody>
</table>
# Methamphetamine: the DRE Assessment

<table>
<thead>
<tr>
<th></th>
<th>Acute</th>
<th>Downside</th>
<th>Narcotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGN</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>VGN</td>
<td>No*</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
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<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pupil size</td>
<td>Dilated</td>
<td>Normal/constricted</td>
<td>Constricted</td>
</tr>
<tr>
<td>Rxn to light</td>
<td>Slow</td>
<td>Slow</td>
<td>Little/none</td>
</tr>
<tr>
<td>Pulse</td>
<td>Up</td>
<td>Normal to slow</td>
<td>Down</td>
</tr>
<tr>
<td>BP</td>
<td>Up</td>
<td>Normal</td>
<td>Down</td>
</tr>
<tr>
<td>Temp.</td>
<td>Up</td>
<td>Normal</td>
<td>Down</td>
</tr>
</tbody>
</table>
Other Indicators:

- Speech may be slurred/slow/
- May be “on the Nod”.
- May cycle from alert/agitated to asleep.
- May be lethargic
- May be suicidal/depressed
# Methamphetamine and Driving

## Review of 101 DRE cases

101 Cases   Methamphetamine ONLY  
Alcohol <0.02g/100mL, Blood cannabinoids <10ng/mL

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Mean age (mg/L)</th>
<th>Mean (mg/L)</th>
<th>Median (mg/L)</th>
<th>Range (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>♂</td>
<td>74</td>
<td>30.6</td>
<td>0.36</td>
<td>0.27</td>
<td>&lt;0.05 – 2.34</td>
</tr>
<tr>
<td>♀</td>
<td>27</td>
<td>31.9</td>
<td>0.34</td>
<td>0.19</td>
<td>&lt;0.05 – 2.36</td>
</tr>
</tbody>
</table>

Logan, 2001
Methamphetamine and Driving

Time distribution of arrests

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Arrests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 - 0400</td>
<td>20</td>
</tr>
<tr>
<td>0400 - 0800</td>
<td>3</td>
</tr>
<tr>
<td>0800 - 1200</td>
<td>15</td>
</tr>
<tr>
<td>1200 - 1600</td>
<td>10</td>
</tr>
<tr>
<td>1600 - 2000</td>
<td>5</td>
</tr>
<tr>
<td>2000 - 0000</td>
<td>25</td>
</tr>
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</table>
# Methamphetamine and Driving

<table>
<thead>
<tr>
<th>Reason for stop</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Travel (OOL)</td>
<td>23</td>
<td>33</td>
</tr>
<tr>
<td>Erratic Driving</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Equipment</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Accident</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Speeding</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>CVE</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Hit and Run</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Lane Travel (WL)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Stolen Vehicle</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Eluding</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fail to Signal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Reckless Driving</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wrong way</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Methamphetamine and Driving
Age/Gender/Concentration Distribution

Age (yrs)
0
0.5
1
1.5
2
2.5

Male
Female

♂ = 74
♀ = 27

Age (yrs)
Methamphetamine and Driving

Methamphetamine distribution (mg/L)

Mean = 0.35mg/L, Median = 0.23mg/L
Methamphetamine Concentrations in Impaired Drivers

Logan (unpublished, 2006)

n = 1159
Mean = 0.31 mg/L
Median = 0.21 mg/L
Mode = 0.10
Lo = 0.05
Hi = 9.46
>2 mg/L = 47
Stimulants and Driving
SFST Impairment indicators:

One Leg Stand

*Sways, Uses arms, Hops, Foot touches, Inches of sway (in. bf/ss)*

Walk and Turn

*Can’t balance, Starts too soon, misses heel to toe, walks off line, stops, puts arms up, incorrect # steps*

Finger to nose

*Accuracy on 6 attempts*
Methamphetamine and Driving
Impairment vs. methamphetamine conc.

Impairment Score

Methamphetamine (mg/L)

0 0.5 1 1.5 2 2.5

0 5 10 15 20 25 30
Methamphetamine and Driving

Methamphetamine Behaviors:

Eyes:
• Tracking and pupils equal in all.
• All could follow stimulus.
• Bloodshot, watery (80%), red, glassy.
• Eyelids droopy in about half.
• HGN: Only 6 had more than 3 clues and they all had 6.
• VGN: 2 (also had 6 clues in HGN).
• 25 had lack of convergence.
Methamphetamine and Driving

Pupil diameter and methamphetamine conc.
Methamphetamine and Driving

Pulse vs. methamphetamine conc.

- 74% exceed normal range (60-90 BPM)
Methamphetamine and Driving

Blood pressure and methamphetamine conc.

Systolic – 66% exceed normal

Diasystolic – 50% exceed normal
Methamphetamine and Driving

Body temperature and methamphetamine

53% fell below normal temperature range of 97.6 – 99.6°F

3% exceeded
Methamphetamine and Driving

Methamphetamine Behaviors:

Coordination:
Poor, jerky, fast movements, jittery, fidgeting, staggering, awkward, unsteady, clumsy, deliberate, slow.

Speech:
Fast, rapid, non-stop, unintelligible, mumbling, low, raspy, hoarse, slow, thick tongued.

Injection marks
29% track marks, 26% recent injections
Same for ♂ and ♀.
## Methamphetamine and Driving

<table>
<thead>
<tr>
<th>DRE Call</th>
<th>All (n= 101)</th>
<th>Adm. (n=76)</th>
<th>No Adm.(n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulant</td>
<td>64</td>
<td>53</td>
<td>7</td>
</tr>
<tr>
<td>Stimulant &amp; Cannabis</td>
<td>11</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Stimulant &amp; Narcotic</td>
<td>7</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Stimulant &amp; Depressant</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Stimulant, Depressant &amp; Cannabis</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Stimulant, PCP, Cannabis</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Any Stimulant Call</strong></td>
<td><strong>90%</strong></td>
<td><strong>95%</strong></td>
<td><strong>79%</strong></td>
</tr>
<tr>
<td>No Drugs Present</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cannabis</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Depressant</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cannabis &amp; Narcotic</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Depressant, Narcotic &amp; Cannabis</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Depressant &amp; Narcotic</td>
<td>1</td>
<td>0</td>
<td>0</td>
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Methamphetamine and Driving

Conclusions

• Methamphetamine impairs during both the acute intoxication phase and the withdrawal or downside phase.

• The upside impairment is more agitated, euphoric, impulsive, risk taking, hypervigilant, paranoid.

• The downside impairment is more like CNS depression, with fatigue, sleepiness, motor retardation, poor concentration.

• The physiological signs may not exactly fit the matrix.