Understanding Alcohol Abuse and Addiction

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Agenda

- Understanding Alcohol/Drug impact on brain
- Reward Pathway – the pleasure of alcohol
- Relapse and Craving
- Physical Effects
- Alcoholism
Why Do People Drink?

• Curiosity
• Enjoy the Beverage
• Cultural Practices – Peers
• Makes us feel better/different
• Dependency
Voluntary Use

Compulsive Use (Addiction)
Addiction is a Brain Disease

Prolonged Use Changes the brain in Fundamental and Long Lasting Ways
SPECT IMAGES

NORMAL

3-4 DRINKS/DAY
Active drug and alcohol abuse

A year drug and alcohol free
Alcoholic v. Normal Brain
Non-Alcoholic Drinker

- .05 Diminished alertness, impaired judgment
- .10 Increased reaction time, impaired motor skills
- .15 Increasingly impaired motor responses
- .20 Obvious intoxication
- .25 Staggering; grossly impaired motors skills
- .30 Stupor; inability to communicate or comprehend surroundings
- .35 Surgical anesthesia; LD 1
- .40 LD 50
- .60 LD 100
Alcoholic Drinker

- .00  Severe withdrawal—tremors, vomiting, delirium, hallucinations, possible seizure
- .05  Continued severe withdrawal
- .10  Some relief of symptoms; discomfort
- .15  Reductions in tremor and gastric distress
- .20  “Normal” range; appetite returns, tremors not evident
- .25  Comfortable
- .30  Upper limits of tolerance
- .35  Obvious signs of sedation, intoxication
- .40  “Drunk” state
- .50  Passes out from alcohol’s effect

Tolerance
The Reward Pathway and Addiction
Natural Rewards
Reward Pathways
Activation of the reward pathway by addictive drugs

- Alcohol
- Cocaine
- Heroin
- Nicotine
- Heroin
Natural Rewards Elevate Dopamine Levels

**FOOD**

Source: Di Chiara et al.

**SEX**

Source: Fiorino and Phillips
Effects of Drugs on Dopamine Levels

Source: Di Chiara and Imperato
Behavior Pathways

• Rewarding behaviors can become routine
• “Subconscious” control of the behavior
• Difficult to extinguish behaviors because people are not always aware when they are initiated.
• Resistant to change
Alcohol

- Most popular drug of abuse
- Probably the most physically toxic of drugs
- Damages almost every organ in the body
- Easy access, adults use, advertising, relatively inexpensive.
- THE DRUG for Youth
Action

• Dopamine – excitement & reward
• Serotonin – feel – “normal”
• GABA – lowers anxiety
• Endorphins – pain relief, reward, craving
Endorphins

Craving

Endorphins

Stop Drinking

Drink

Reward

Endorphins

Block Endorphins with Naltrexone—Break Reward Cycle
Naltrexone

- For people who have stopped drinking, Naltrexone reduces the craving for alcohol
- Naltrexone does not help someone stop drinking or doing drugs, it is used to help people who have already stopped maintain abstinence
- Sold as ReVia (daily) Vivitrol (monthly)
Depressant Withdrawal and Overdose

Death
Seizure
Agitation

Overdose
Passing Out
Coma
Death

Shakes
DT’s
Physical Effects

• Vasodilator in skin - ↑ blood flow – warm flush – actually indicates loss of body heat.
• Reduction in REM (dream) sleep - important for feeling well rested – without feel irritable
• Sensory changes - ↓ Acuity of hearing and sight ↓ Pain – masked fatigue
Physical effects

- Burning sensation – warm going down – esophagus and stomach irritated
- Initial stimulation of respiration – (disinhibited) – eventually depressed – overdose death due to respiratory arrest
- ↑ Urine production – blocks anti-diuretic hormone – dehydrate – dry mouth
Physical Effects

- Hangover effect – nausea, headache, thirst, anxiety, the shakes – caused by rebound/build up of acetylationdehyde, and other substances.
Long Term Effects

- Gastrointestinal – esophageal varices – dilation of vessels – can bleed – possibly fatal
- Gastritis – Inflammation of stomach lining – nausea, vomiting, pain, bleeding
- Peptic ulcers – ETOH ↑ stomach acids
Long Term Effects (2)

- Duodenal ulcers – internal bleeding
- Pancreatitis – pancreas makes insulin – inflammation – fatal
Liver Problems

- Alcoholic hepatitis – onset of fever – death
- Fatty liver – ETOH ↑ fat in blood stored in liver ↓ function -reversible (6 drinks/day for 18 days – 8X fat in liver)
- Cirrhosis – scar tissue in liver – decreased liver fcn – reverse tolerance - can be fatal. Caused by acetylaldehyde.
Physical Effects (3)

• ↑ P450 – creates toxins in blood – damage liver – also decreases testosterone and estrogen.
• Enlarged spleen
• Fluid in abdomen
• Cancer links to tongue, mouth, throat, liver (especially linked with smoking)
Cardio/Circulatory effects

• – enlarged heart – heart attack
• Arrhythmias
• ↑ Stroke risk
• Hypertension
• ↑ in fat – coronary artery disease
• loss of elasticity – hardening of arteries
• ↑ bleeding and bruising
Malnutrition

• Alcohol empty calories – decreased food intake
• Poor diet – vitamin deficiencies – B vitamins
• Thiamine deficiency – Wernicke’s – rapid onset – confusion, vision, ataxia, memory, stuporous,
• 16% die within 1 month of symptoms – brain lesions – reversible
Korsakoff’s

- Gradual - amnesia – short term
- Confabulation – make up facts, etc.
- Disoriented – brain lesions – irreversible
Neurological Effects

• Brain Atrophy – Cerebellum
• Larger Ventricles
• Cognitive impairment
  • Memory
  • Abstract thinking
  • Impulse Control
  • Etc.
Alcoholism

- Traditionally – Moral problem
- Today – Disease model
- Loss of control
- Cannot safely predict how much will drink
- Prone to relapse
Disease Model

• Primary – not caused by something else
• Progressive – It gets worse
• Chronic – lasts a long time
• Fatal – can kill you

• Other chronic diseases – Diabetes, Asthma, Heart Disease, Cancer, etc.
Alcoholism

• Prevalence – 10% of population are problem drinkers
• A portion of them are alcoholics
• Genetic Factors
  • Neurotransmitter models
  • Risk increased if parent is alcoholic
• Treatable not Curable
Neural Models

• Dopamine – excitement / reward
• Endorphins – escape, pain relief, craving
• GABA – stress / anxiety
• Serotonin – Never felt normal
Drinking patterns

- Constant intoxication
- Daily use without gross intoxication
- Binge users
All of these must be considered in developing strategies to effectively treat addiction.
Go & Stop

- Craving elicits Go!!
- Powerful
- Activity in limbic system not frontal cortex
- Feeling/reacting vs. thinking/planning
- Thinking initiates Stop!!
- Addicts have “bad brakes” – Stop!
- Hard to stop this fast moving car.
Fred Flintstone Brakes
Craving

Trigger

Memory

Stimulation of Nucleus Accumbens & Amygdala

Focus on Drug

Anxiety Increases

Relapse

Impaired Judgement
Implications of Arrested Development: Drug Abuse Vulnerability

Research question addressed by scientists:

“Are adolescents more susceptible than adults to alcohol?”

4 lines of evidence
Implications of Arrested Development: Drug Abuse Vulnerability

Research question addressed by scientists:

“Are adolescents more susceptible than adults to alcohol?”

1. Epidemiological data
Drug use starts early and peaks in the teen years

Evidence from surveys
Implications of Arrested Development: Drug Abuse Vulnerability

Research question addressed by scientists:

Are adolescents more susceptible than adults to alcohol?

1. Survey data
2. Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication.
Susceptibility to Alcohol

Direct evidence can not be obtained from human adolescents for ethical reasons.

Much of what is known about alcohol susceptibility is from adolescent rat studies.

Comparing adolescent and adult rats, both having no prior exposure to alcohol and matched on temperament....

Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication. more drinking before “signals to stop”

Source: Spear, 2002
Adolescents have low sedative response to alcohol

| Adolescent | Adult |
Implications of Arrested Development:
Drug Abuse Vulnerability

Research question addressed by scientists: “Are adolescents more susceptible than adults to alcohol?”

1. Survey data
2. Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication.
3. Adolescent rats are more sensitive to the social disinhibition effects of alcohol.
Social Disinhibition

Adolescent rats are more sensitive to the social disinhibition effects of alcohol compared to adults.

These studies suggest that adolescent rats derive greater “social comfort” from intoxication than adult rats.

Source: Spear, 2002
Lowered Social Inhibition = Party!!
Implications of Arrested Development: Drug Abuse Vulnerability

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“Are adolescents more susceptible than adults to alcohol?"

1. Survey data
2. Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication.
3. Adolescent rats are more sensitive to the social disinhibition effects of alcohol.

2 and 3 may contribute to binge drinking and increased risk to alcohol dependence.
Implications of Arrested Development: Drug Abuse Vulnerability

Research question addressed by scientists:

“Are adolescents more susceptible than adults to alcohol?”

1. Survey data
2. Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication.
3. Adolescent rats are more sensitive to the social disinhibition effects of alcohol.
4. Alcohol produces greater cognitive disruptions in adolescents.
Animal Data: Alcohol’s Effects

When exposed to alcohol, adolescent rats, compared to adult rats, reveal more…

- Disruption in memory
- Impairment of neurotransmission in hippocampus and cortex

Source: Spear, 2002
Early Recovery Issues

• Loss of lifestyle
• Loss of Coping Strategy
• Withdrawal
• Cognitive deficits related to early abstinence
Cognitive Deficits

• Memory problems - short term loss
• Difficulty with abstractions
• Difficulty with impulse control
• Similar performance to those with brain damage - improves.
• HAT
• BOAT
• CAR
• BIKE
• HORSE
• STEAK
• BUS
• HOUSE
• LAKE
• SHIRT
• DOPAMINE
• AMYGDALA
• RIVER
• LUNCH