

ECHO IDAHO

Opioids, Pain and
Substance Use Disorders

Neurobiology and Diagnosis of Substance Use Disorders

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Disclosures

- No financial disclosures

Learning Objectives

- Discuss terminology used in Addiction, including Substance Use Disorder, misuse, dependence, and ~~abuse~~.
- Review the ASAM definition of Addiction and the DSM 5 criteria for Substance Use Disorders.
- Review the neurobiology of addiction and how to use this knowledge in clinical care.

Definitions

Misuse: Any use of an illegal drug, or any improper use of a prescribed or over-the-counter drug

At-risk, Risky, or High Risk Use: A pattern of substance use that is likely to lead to addiction, dependence, and/or misuse.

Dependence: When the body and brain have adapted to continued use of a substance

Substance Use Disorder: Term used to describe a problematic pattern of use of a substance that leads to distress and/or impairment in multiple areas of one's life

~~Abuse~~: This term is no longer used. It implies judgment and contributes to stigma. Use misuse, SUD, at-risk/risky use, addiction, or dependence instead, all of which are more precise terms.

What is Addiction? ASAM 2019 Definition

- “Addiction is a **treatable, chronic medical disease** involving **complex interactions among brain circuits, genetics, the environment**, and an individual’s **life experiences**. People with addiction use substances or **engage in behaviors that become compulsive** and often continue despite harmful consequences. Prevention efforts and treatment approaches for addiction are generally **as successful as those for other chronic diseases.**”

DSM 5: Substance Use Disorders

- **Problematic** pattern of use
- **Clinically significant** impairment or distress

- Also, remember: The DSM is not meant to be used as a checklist. Patients might over-report or under-report for a variety of reasons. History, collateral, physical exam, labs, etc can be key to diagnosis.

DSM 5: Substance Use Disorders

1. Taking in larger amounts or for longer than intended
2. Persistent desire or unsuccessful efforts to cut down
3. Great deal of time is spent
4. Craving, or a strong desire to use
5. Failure to fulfill major role obligations at work, school or home
6. Persistent or recurrent social or interpersonal problems
7. Important social, occupational or recreational activities are given up or reduced
8. Recurrent use in situations in which it is physically hazardous
9. Continued use despite knowledge of having a persistent or recurrent physical or psychological problem
10. Tolerance
11. Withdrawal

DSM 5: Substance Use Disorders

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3. Great deal of time is spent
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5. Failure to fulfill major role obligations at work, school or home
6. Persistent or recurrent social or interpersonal problems
7. **Impaired Control** Important social, occupational or recreational activities are given up or reduced
8. Recurrent use in situations in which it is physically hazardous
9. Continued use despite knowledge of having a persistent or recurrent physical or psychological problem
10. Tolerance
11. Withdrawal

DSM 5: Substance Use Disorders

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Social Impairment

DSM 5: Substance Use Disorders

1. Taking in larger amounts or for longer than intended
2. Persistent desire or unsuccessful efforts to cut down
3. Great deal of time is spent
4. Craving, or a strong desire to use
5. Failure to fulfill major role obligations at work, school or home
6. Persistent use despite knowledge of persistent or recurrent interpersonal problems
7. Important social, occupational or recreational activities are given up or reduced
8. Recurrent use in situations in which it is physically hazardous
9. Continued use despite knowledge of having a persistent or recurrent physical or psychological problem
10. Tolerance
11. Withdrawal

Risky Use

DSM 5: Substance Use Disorders

1. Taking in larger amounts or for longer than intended
2. Persistent desire or unsuccessful efforts to cut down
3. Great deal of time is spent
4. Craving, or a strong desire to use
5. Failure to fulfill major role obligations at work, school or home
6. Persistent or recurrent social or interpersonal problems
7. **Physiological Dependence**
8. Recurrent use in situations in which it is physically hazardous
9. Continued use despite knowledge of having a persistent or recurrent physical or psychological problem
10. Tolerance
11. Withdrawal

DSM 5: Substance Use Disorders

- Problematic Pattern of Use
- Impairment or Dysfunction in 4 Categories:
 - Impaired Control
 - Social Impairment
 - Risky Use
 - Physiological Dependence

What is Addiction? Neurobiology Definition

Dramatic dysregulation of motivational circuits caused by continued use of a substance:

- Exaggerated Incentive Saliency
- Habit Formation
- Reward Deficits
- Increased Stress Response
- Compromised Executive Functioning

Neurobiology of Addiction: Development and Genetics

- Genetic predisposition (family studies, personality traits thought to be heritable)
- Early development of brain and exposure to drugs
- Life events, particularly in childhood and adolescence
- Comorbid psychiatric disorders

Neurobiology of Addiction

Why Is It Important?

- Knowledge about disease does not cure disease.
- Addiction is primarily a limbic disorder, not a cognitive disorder.
- How can we use knowledge about the neurobiology of addiction to take better care of our patients?
- We'll answer this question later.

Neurobiology of Addiction

Overview of Complex Neural Processes

- Brain Regions:
 - Ventral Tegmental Area (VTA)
 - Nucleus Accumbens
 - Pre-frontal Cortex
 - Limbic System
 - Amygdala
 - Hippocampus
 - Anterior cingulate gyrus

Neurobiology of Addiction Dopamine Reward Pathway

Reward Pathway in the Brain

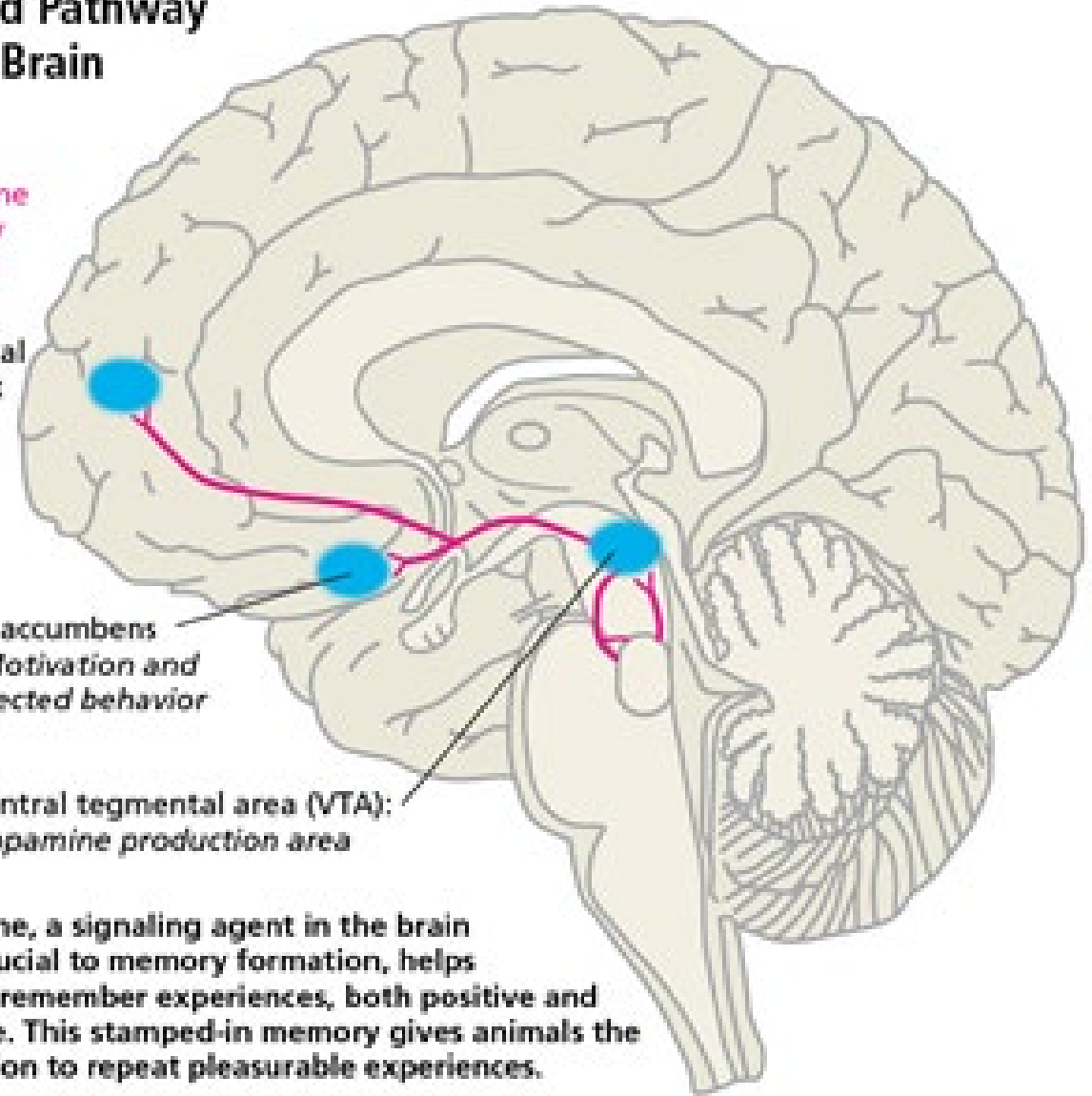
Dopamine
pathway

Prefrontal
cortex

Nucleus accumbens
(NAc): *Motivation and
goal-directed behavior*

Ventral tegmental area (VTA):
Dopamine production area

Dopamine, a signaling agent in the brain that's crucial to memory formation, helps animals remember experiences, both positive and negative. This stamped-in memory gives animals the motivation to repeat pleasurable experiences.



Neurobiology of Addiction

Three Stage Recurring Cycle

- Binge/Intoxication
- Withdrawal/Negative Affect
- Preoccupation/Anticipation (Craving)

- Over time, this recurring cycle leads to changes in brain organization and neurotransmitter systems (neuroplasticity)
- Driver of drug use shifts from impulsive (reward or pleasure seeking) to compulsive (avoidance of negative effects)

Incentive Salience

- The importance attributed to internal or external feelings, events, objects, locations, drugs, etc based on motivation for reward derived from previously learned associations.
- Drug use can cause incentive salience to anything that reminds the user of the feeling of reward experienced with prior use.
- Previously neutral stimuli (commercials for alcohol, smell of cigarettes, fishing(!)) can activate the reward system and lead to use.

Neurobiology of Addiction Binge/Intoxication

- Why do people start using drugs?
- Because it feels good!
- Activation of the Reward System: Increased dopamine release in the Nucleus Accumbens
- Why do we even have an emotion-based (limbic) reward system?

Neurobiology of Addiction

Reward System Function

- When the reward system is balanced and functioning properly, natural rewards lead to survival and propagation of the species.
- Neurocircuits involved result in inhibitory control and decision making with normal functioning of reward, motivation, stress, and memory.
- External sources of reward hijack this system, caused by abnormal and extreme increases in dopamine in the Nucleus Accumbens

Neurobiology of Addiction Withdrawal/Negative Affect

- Neuroadaptation occurs quickly in response to persistent presence of drug.
- Removal of the drug does not immediately reverse the changes to receptors caused by the drug.
- Persistence of these opposing effects produces the withdrawal response.

Neurobiology of Addiction Withdrawal/Negative Affect

- Not only does neuroadaptation result in withdrawal when the drug is removed but also results in decrease response to the taking the drug (Tolerance).
- Anti-reward adaptations via the amygdala and hypothalamic-pituitary-adrenal axis develop leading to exaggerated stress response and increased avoidance of negative emotional states.
- These “anti-reward” adaptations contribute to transition of *impulsive* drug use (reward seeking) to *compulsive* drug use (avoidance of negative affect).
- This process continues well beyond acute withdrawal phase and contributes to protracted or subacute withdrawal.

Neurobiology of Addiction Preoccupation/Anticipation

- What is a craving?
- Craving can occur as part of withdrawal process but can also occur days, months, or even years after abstinence from drug.
- Prefrontal cortex (think executive functioning) “notifies” the limbic system of incentive salience inducing the cascade of emotional and motivational desire to use again.
- Executive dysfunction occurs quickly as the limbic system takes over control and reduces ability for self-regulation and inhibitory control.

Neurobiology of Addiction

How to Use It in Patient Care

Although knowledge of the brain processes will not change brain processes alone, it can help patients to recognize the **balance of self-control and self-actualization** against the **neurobiological drives** that take control of one's behaviors and emotions.

With realistic expectations and an ***appropriate*** sense of control, patients can take charge of their own recovery and be well prepared for relapse prevention.

Neurobiology of Addiction: How to Use It in Patient Care

- Where Does an 800 Pound Gorilla Sit?



Neurobiology of Addiction:

Patient Care: Self-Efficacy

- Addiction (or the limbic system in general) can be compared to the 800 lb gorilla. The prefrontal cortex is like the trainer at the circus.
- The trainer still has control over the gorilla in many ways. But in many ways it has no control! You can't put a bunch of bananas in the gorilla cage when he's hungry and expect him to not eat.

Neurobiology of Addiction: Patient Care: Empathy and Understanding

Knowing that a patient's ability to make sound decisions and act rationally is severely compromised and often uncontrollable can allow providers to empathize more with patient, prevent burnout, and build a better therapeutic relationship that leads to better patient care.

Neurobiology of Addiction:

Patient Care: Medications

Depending on where patient is at in recovery process, knowing the neurobiology of addiction can help with choosing medications to target cue-based cravings (gabapentin, acamprosate, naltrexone in AUD), stabilize negative affect and prolonged withdrawal (buprenorphine in OUD), or assist the prefrontal cortex in inhibiting incentive salience (disulfiram in AUD). MAT is evidence based and needs to be a part of addiction treatment.

Neurobiology of Addiction:

Patient Care: Therapy

- Therapy can shift focus based on where patient is at in recovery process.
- Helping patients understand their emotions and check in with their bodies and minds (interoception) can reduce negative affect and decrease cravings.
Conscious awareness leads to better prefrontal control.
- Helping patients avoid situations or places where they will undoubtedly use (giving the hungry gorilla bananas and expecting him not to eat)
- Improving executive functioning and reinforcing inhibitory control as patient spends more time in recovery

Neurobiology of Addiction: Summary

- Addiction is a chronic biological process that causes multiple brain changes and leads to compulsive use and impairment of executive functioning.
- Addiction is treatable!
- Knowing the neurobiology of addiction can help health care providers empathize with patients and help patients develop a realistic and appropriate sense of control over the addiction.

Neurobiology of Addiction: Summary

Questions?

References

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