Marijuana and the Brain
Harder than Thought
Nursing Section
Monday, June 20, 2011
3:30 – 4:30 p.m.

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Marijuana – cannabis sativa
Most widely abused and readily available illicit drug in the U.S.
Over 90 million lifetime users in the U.S.
16.7 million current users in the U.S.

“War Over Weed”
Highly charged emotional and political issues:
The “Legalization” Issue
The Medical Marijuana Debate
The “Soft” vs. “Hard” Drug Issue

Legalization Issues
Proactive group lobbies
Hemp issue, buyers clubs, vending machines
Mandatory minimum sentencing, decriminalize possession, drug courts
Marijuana Possession Penalties: <1 ounce to 4 ounces - 1 year max. - $2000 fine max.
15 states have medical marijuana laws
Many local governments have banned or restricted sale/growing
Pro-legalization Groups using medical debate as tactical maneuver to legalize marijuana
and other drugs
Others attempt to transform the medical debate into one of compassion and care for
people with serious diseases

Medical Marijuana Debate
Proponents say marijuana can:
Help control glaucoma
Ease the nausea brought on by cancer chemotherapy
Foretall the AIDS-related wasting syndrome
Relieves some of the pain and muscle spasms associated with movement disorders
(multiple sclerosis, ...)

Institute of Medicine Report
Marijuana and Medicine: Assessing the Science Base
National Academy Press; www.nap.edu

American College of Physicians
Position Paper: Supporting Research into the Therapeutic Role of Marijuana
2008; www.acponline.org

Medical Value of Marijuana – IOM Science Based Study
Glaucoma
Cancer chemotherapy
AIDS wasting syndrome
Pain and Neurological Disorders
Milestones in Cannabinoid Research
Cannabinoid receptor sites found: CB1 and CB2
Identified endogenous cannabinoids, *endocannabinoids*
Brain receptors located in the reward pathway, hippocampus, amygdala, cerebellum, basal ganglia, and neocortex
The *Endocannabinoid System* was discovered:
- Involved in memory and learning, motor coordination, eating behavior, immune and inflammatory responses, pain sensations, reproduction, …
- This system is thought to plays a role in: relaxation, eating, sleeping, forgetting, and protecting from stress and more…

**Abusing marijuana overstimulates the cannabinoid receptors and disrupts this system**

The **“High!!!” is a big reason kids take drugs but other things also happen…**

*Marijuana affects the mood, emotions, senses, thought processes, decision making, and more*

![Many Brain Areas Affected](image)

The Marijuana **“High” – dose dependent**
Initial sense of euphoria in some individuals
Enhanced physical and emotional sensitivity

*Users claim:*
- Auditory and visual enhancement
- Time seems to passes very slowly
- Feelings of interpersonal closeness
  - "relaxed dreamlike state"
Followed by drowsiness, lethargy and sedation

**Early onset of marijuana use is a huge risk factor for problems**
Nucleus Accumbens (NAc) is the "Pleasure Center" and is activated by pleasurable behavior
Frontal Cortex is involved in inhibitory control and assigns value to stimuli

**Brain Maturation in Adolescents and Young Adults**
Recent brain imaging studies show that areas controlling sensory and physical development mature first, the last to mature are regions in the frontal lobes; areas controlling judgment and involved in inhibitory control of behavior

![Brain Maturation Diagram](image)
**Research Conclusions:**
1. Young brains are more susceptible to drug use than adults
2. Drug use may impact normal brain development and maturation:
   - Learning ability and emotional development
3. Implications of these studies are *enormous* for parents

**Mind-alterations effects in:**
- Sensory functions
- Motor control and coordination
- Cognitive (decision-making) processes

**Disinhibitory effect**

**Psychomotor tasks and cognitive functions are all impaired:**
- Poor coordination
- Harder to sustain attention
- Errors in judgment, time and space coordination
- Distorted perception (sights, sounds, time, touch)
  - *Delayed reaction times*
  - *Increased risk for accidents*

**Impaired Driving Performance**
- Decreased tracking ability
- Divided attention problems
- Decreased alertness

**Summary of IOM Report:**

“There is little future in the use of smoked marijuana as a medication”

“The future lies in cannabinoid-type drugs with more certain composition, characterization and delivery systems”

**American College of Physicians**

Recommends continued research into the medical use of marijuana for:
- For AIDS patients as an appetite stimulant and pain reliever
- For chemotherapy patients who suffer nausea and appetite loss
- For patients with muscle spasticity and movement disorders

**Drug Control Schedule Change**

Reclassification of THC/analogues into a Schedule II or III would permit use for medical purposes: *Public must be educated about this change!*

*Marijuana should be in the health care system not the political system!*

*Our Goal must be to education everyone about the science and to prevent the misuse and abuse of marijuana, especially by our youth*

**Current drugs on the market:**

The pharmaceutical industry is showing increased interest in synthetic modulators of the endogenous cannabinoid system and is funding clinical studies with cannabis whole plant extracts

**Dronabinol/Marinol** - Treatment of nausea and vomiting for patients in cancer treatment; Appetite stimulant for AIDS patients; Analgesic to ease neuropathic pain in multiple sclerosis patients

**Nabilone/Cesamet** - Treatment of nausea and vomiting in patients undergoing cancer treatment

**Sativex** - Treatment of neuropathic pain and spasticity in patients with Multiple Sclerosis (MS); Analgesic treatment in adult patients with advanced cancer who experience moderate to severe pain. Not approved in the U.S.
Health and Impairment Risks of Marijuana Use
Cannabis sativa - ground up hemp plant material
There are 66 cannabinoids in the plant
\(\Delta^9\)-THC (tetrahydrocannabinol) – primary psychoactive ingredient
Lipophilic - fat soluble

Marijuana - high-potency forms
Commercial grade – over 9% \(\Delta^9\)-THC
Sensimilla - buds and flower of female; as high as 15-20%

Higher potency means stronger effects

Heart and Circulatory System
Increased heart rate and blood pressure and reduces oxygen-carrying capacity of blood
Risk for middle age and older individuals with coronary artery and vascular disease
Dizziness may occur on standing
Red and blood shot eyes due to dilation of the blood vessels – watch for eye drops

Designer Cannabinoids- incense and herbal smoking blends
New products, incense and herbal smoking blends, popped up on the internet and in head shops in 2002 under a variety of trade names: Spice Silver®, K2®, Buddha Melt, Yucatan Fire®, Genie®, and Skunk® …
Smokers claimed they produced strong marijuana-like effects but analysis could not detect any chemical responsible for alleged effects; attributed it to a “placebo effect”
By 2008 the synthetic cannabinoid JWH-018 was discovered in the herbal smoking blend Spice®
Other synthetic cannabinoids: HU-210, HU-211, and JWH-073 were also discovered in these products
Poison Control Centers reporting problems with patients smoking these substances:
- Increased heart rate, elevated blood pressure, agitation, anxiety, hallucinations
DEA recently used emergency scheduling authority to temporarily control several of these products

Respiratory System
All the effects of smoking and more …
High concentrations of tar and carcinogens
Increases inflammation, cellular changes and secretions in the airways
Chronic cough and bronchitis, …
Decreased pulmonary function and exercise tolerance

Immune System
Marijuana has immunosuppressant activity:
- Decreases some antibody production
- Decreases resistance to infection (fungal and bacterial)
- May interfere with inflammatory reactions
- May increase the risk for cancer

Reproductive system – heavy use
In males: decreased testosterone levels, sperm count and motility
In females: disruption of normal menstrual cycle and suppression of ovulation
Risky sex practices
Babies born to users have lower birth weight and abnormal responses indicating problems with neurological development

Marijuana and Memory
Marijuana interferes with the formation of “new memory” in the hippocampus
Impairment of learning ability – chronic exposure may hasten nerve cell loss
Cellular Mechanism of Action

**Impairment of Learning Ability**
Marijuana compromises the ability to learn and remember information
Students who smoke marijuana get lower grades and are less likely to graduate from High School
Loss of interest and desire to study, work…
Decreased energy, productivity
Generalized apathy
Sullenness, moodiness and inability to concentrate
Slovenly habits and appearance
Life-style revolving around procurement and use of marijuana
Long term cognitive impairment is one of the most important consequences associated with cannabis use:
This may be a serious drawback for therapeutic use of marijuana

**Cannabinoids block hippocampal long term memory mediation**
"Cognitive impairment is one of the most important negative consequences associated with cannabis use"
Marijuana triggers cellular signaling pathways which lead to memory loss, "amnesic effect"
"This is a serious drawback for therapeutic use of marijuana"

**Marijuana Affects Daily Living and Social Life:**
Depression, anxiety, and personality disturbances
Makes a person's existing problems worse
Continued use causes intellectual, job, or social skills to diminish

**Several studies have shown workers who smoke marijuana have:**
Increased absences, more tardiness, higher accident rates and injuries, more workers' compensation claims, higher job turnover

**Cognitive Functioning and Marijuana Use in Adults**
Long-term heavy users performed significantly less well than short-term users on standardized learning testing:
- Impaired learning
- Retention
- Retrieval
Impairments in memory and attention worsened with increasing years of use

**Cognitive Effects of Heavy Marijuana Use by College Students**
Heavy smokers performed poorly on standardized learning tests:
- Abstract ability
- Sustained attention
- Verbal fluency
- Ability to learn and recall

"Someone who smokes once daily may be functioning at a reduced intellectual level all of the time"

**The “Soft” vs “Hard” Drug Issue:**
Marijuana is Addictive
*Popular view* – hardest part of kicking an addiction is beating the physical withdrawal
*People look at drugs as being dangerous if they cause severe withdrawal*
Marijuana withdrawal: anxiety and insomnia, loss of appetite, decreased pulse rate, excessive salivation, irritability, mood swings, even tremor.

Δ⁹-THC acts on the brain’s Reward System a common pathway associated with reinforcement and addiction.

Long term use can lead to addiction
- Continued use of the drug in spite adverse consequences
- Loss of control over use
- Compulsive drug seeking behavior

References and Additional Reading


American College of Physicians, Position Paper: Supporting Research into the Therapeutic Role of Marijuana, 2008; www.acponline.org


