DRUG ABUSE AND STROKE

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"Under disclosure rules, I'm required to tell you I own stock in the company whose drug I'm prescribing."

NO FINANCIAL DISCLOSURES
In retrospective studies of stroke patients between 15-44 years of age, drug abusers accounted for 12-31% (Sloan, et al. 1998)

Drug Abuse was the most important risk factor for stroke in those younger than 35 years of age

After controlling for other stroke risk factors, the relative risk of stroke was 6.5% higher in drug abusers

**DRUG ABUSE INCREASES RISK OF STROKE**
Intravenous drug abuse
- Endocarditis, infectious or marantic
- Embolization of foreign materials
- Right-to-left shunt in pulmonary vasculature
- Mycotic aneurysms

Direct effects of drugs
- Vascular injury: hypertensive changes, dissection
- Acute severe hypertension
- Vasoconstriction or vasospasm
- Impaired autoregulation

Indirect effects of drugs
- Vasculitis
- Pre-existing vascular malformations or aneurysms
- Cardiomyopathy and arrhythmia
- Anti-phospholipid antibodies, other hypercoagulable states
- Hypotension or hypoxia with overdose

The possible mechanisms for stroke related to drug abuse are diverse
Cocaine-derived from the coca leaf
  - Can be snorted, as a powder, freebased (smoked), injected
  - Common names: coke, crack, snow, blow, nose candy, toot

Methamphetamines-man-made
  - Usually comes in a crystalline powder, white or otherwise
  - Can be snorted, smoked or injected
  - Common names: meth, chalk, speed, getgo, tweak, glass, ice

Amphetamines, levoamphetamines and dextroamphetamines
  - Often prescribed for ADD, ADHD, narcolepsy and obesity
  - High street value, can be dangerous when misused
  - Includes Ritalin, Adderall, Vyvanse, Dexedrine, Concerta, Focalin, Strattera
Methamphetamine
C_{10}H_{15}N

Amphetamine
C_9H_{13}N

Cocaine
C_{17}H_{21}NO_4
OTHER STREET DRUGS WITH PSYCHOSTIMULANT PROPERTIES—NPS

- **MDMA—Ecstasy**, also called mollies, rolling. Taken orally or snorted. The chemical structure is similar to both methamphetamine and mescaline.
- Synthetic cathinones or beta-ketone amphetamine analogs—commonly known as bath salts—cathinones originally derived from the khat plant. Other names include jewelry cleaner, plant food, cloud nine, vanilla sky, white lightning.
- Synthetic cannabinoids—K2, Spice. Often smoked, drunk in tea.
CHEMICAL STRUCTURES OF STREET DRUGS

Mephedrone

MDMA

Methylone
Phenethylamines, including traditional amphetamines and the newer synthetic compounds, stimulate alpha and beta adrenergic receptors which result in hyper-alertness, hypertension, tachycardia, mydriasis and diaphoresis.

- Considered part of the sympathomimetic toxic syndrome.
- Cause release of neurotransmitters such as dopamine, serotonin and norepinephrine, and can also inhibit their reuptake.
- The most common causes of death related to amphetamine toxicity are arrhythmia, hyperthermia and ICH.
- Ephedrine and pseudoephedrine are structurally similar, and can be dangerous when abused.
CASE STUDY

- 24 year old male found in his car, TLKW unknown
- Many ED visits with h/o polysubstance abuse
- Ventilated at the scene, stabilized, requiring pressors
- Initially cooled, but hypothermia protocol STOPPED as not witnessed “down time”
- Initially sedated, but quickly withdrew meds to evaluate neurologic status
INITIAL CT SHOWS MASSIVE ANOXIC BRAIN INJURY

UDS positive for benzos, amphetamine, methamphetamine, cocaine and opioids
Cerebral vasoconstriction, cerebrovascular disease, and hemorrhagic and ischemic strokes are increased in cocaine users, even in patients with no other risk factors.

- Increases stroke risk 6-7xs normal
  - Etiologic mechanisms include tachycardia and increased blood pressure, artery dissection (aortic and others)
  - Vasoconstriction
  - Vasospasm, vasculitis especially with long-term use
  - Intravascular thrombosis
The major effects of cocaine seem to be caused by the inhibition of norepinephrine reuptake into the synaptic cleft by sympathetic neurons.

This inhibition results in potentiation of the response to sympathetic stimulation of innervated organs.

May also enhance the release of catecholamines from central and peripheral stores.

Cocaine also promotes thrombus formation via activation of platelets, stimulation of platelet aggregation and potentiation of thromboxane production.

Proarrhythmic, via sodium channel blockade in the heart.
48 yo male brought in by EMS
SO reported smoking “crack” and slumped to the left
Presenting BP 210/118
Patient was sleepy, but arousable and could speak
Right gaze deviated, left hemiparetic, dysarthric, left hemi-neglect
INITIAL CT HEAD

Intubated and neurosurgery consulted

Cardene drip started

Stabilized in NSICU
CT HEAD 2 HOURS AFTER ARRIVAL

Despite aggressive blood pressure management, he continued to decline.

Also found to have NSTEMI

UDS + for cocaine, opioids
IV DRUG ABUSE

Can lead to mycotic aneurysm formation
Often implicated in bacterial endocarditis
Promotes changes in the walls of the blood vessels causing increased incidence of all aneurysm formation and dissections
Ruptured mycotic aneurysm

These arise from bacterial infection in the artery wall

Often seen with IV drug abuse, bacteremia, and can be found with bacterial endocarditis
Common lesions seen with Bacterial Endocarditis
30 yo female presenting with a seizure at the Dollar Store. At OSH, she was noted to have reduced LOC and track marks on both forearms

She initially responded to sternal rub, awakened at one point, vomited and had a witnessed seizure

She received 1 mg of ativan

UDS + for THC and amphetamines, known history of illicit use/abuse

CT head revealed a large acute SAH along the left frontal, parietal and temporal lobes
INITIAL OSH CT HEAD
CT Angio head revealed a bilobed aneurysm at the left MCA bifurcation; 5 x 3 mm. The neck appeared to incorporate the inferior division of the MCA on the left, and the aneurysm projected laterally and slightly anteriorly.

She was taken emergently to neuro IR and a 6mm bilobed aneurysm was found. One lobe pointed up, with a windsock appearance. It was coiled. The other lobe had a wide neck, incorporating the inferior division of the left MCA. EVD was placed.
3D CTA
COILING
COILING NATIVE
The next day, she was taken to the OR and the coils were removed, allowing for clip to be placed across the wide neck.

A follow-up angiogram revealed no residual aneurysm with minimal narrowing of the Left M2, adjacent to the clip.

She was monitored via VEEG for seizures, keppra used.

EVD maintained with CSF of 10 mm HG.

3% sodium with Na goal 145-150.

SBP with goal of > 160.
CLIPPING NATIVE
CLIPPING AFTER COILING
FOLLOW-UP CT
She had a very prolonged, complicated hospital course, severe impulsivity, agitation

She did not qualify for rehab or SNF, despite SW trying > 20 places

She eventually went home with family

She has been back to ED twice since discharge, intoxicated, +/- seizure, consistently positive for THC and amphetamines, track marks noted on forearms

CASE STUDY, AB
COMMONLY ABUSED OPIOIDS

- Hydrocodone
- Oxycodone
- Codeine
- Morphine
- Fentanyl
- Heroin

Can lower blood pressure, respiratory rate and oxygen saturation, leading to poor cerebral perfusion and watershed strokes as well as anoxic brain injury.
19 yo male found down, minimally responsive with GCS of 8, initial BP 68/42
Intubated for airway protection, required pressors and fluid resuscitation to maintain SBP > 90
Appeared to be visually impaired, would withdraw to pain, some volitional movement
Family reported history of opioid addiction/abuse
UDS + for opioids
HALLUCINOGENS AND DISSOCIATIVE DRUGS

- LSD-acid
- PCP-angel dust
- Psilocybin-magic mushrooms
- Mescaline-peyote
- Ketamine-special “K”
HALLUCINOGENS AND DISSOCIATIVE DRUGS

No direct association, as we know of, related to strokes, but causes a multitude of other CNS problems.

People who ingest these types of drugs do have an increased incidence of trauma, which can lead to traumatic SAH, SDH, TBI and artery dissections.
CONCLUSIONS

Drug abusers are up to 7x as likely to suffer from a stroke.
Stimulants carry a direct risk, other classes more indirect.
Route of ingestion can be an important factor.
Newer synthetic or designer drugs have an unknown risk, but case reports are increasing.
Mixing multiple substances often plays a role.
All stroke subtypes are increased.
KEEP CALM AND SAY NO TO DRUGS

Thank You