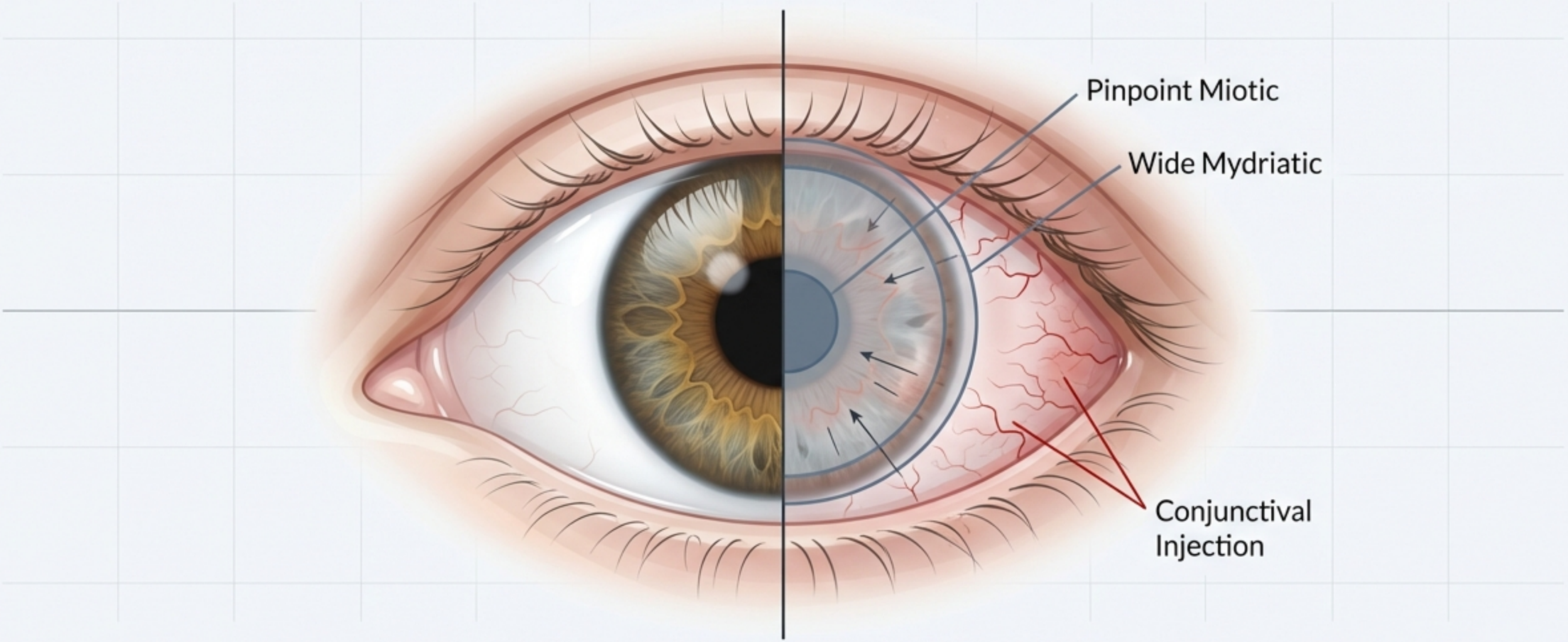
The Eyes Don’t Lie: Ocular Signs of Substance Abuse for the AMC Candidate

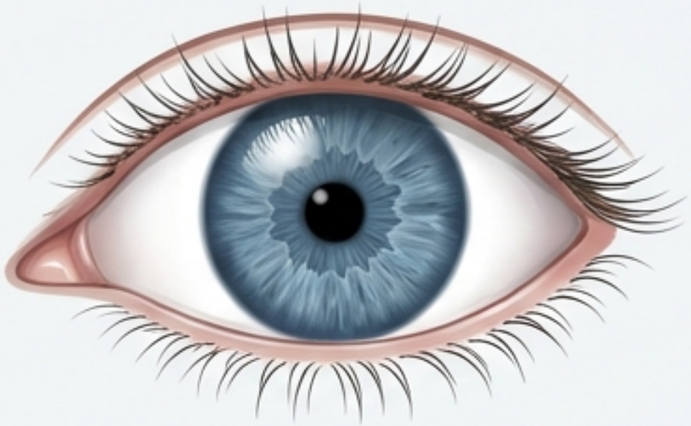
A Clinical Guide to Diagnosis from Toxin to Treatment



Pupillary size, reaction to light, ocular convergence, and nystagmus can be useful indicators of the type of drug the patient is exposed to.

The First Clue: Decoding the Pupil

MIOSIS



Miosis (Constricted)

Primary Cause: Opiates (Heroin, Morphine, Methadone)

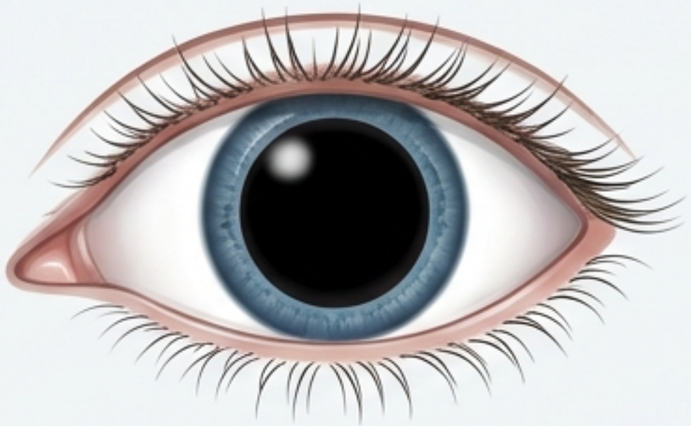
Mechanism: Excitatory action on the Edinger-Westphal nucleus of the oculomotor nuclear complex.

Opioid Poisoning Triad:

1. Coma
2. Pupillary Constriction
3. Depressed Respiration

Note: Tolerance develops in dependent users; pupillary constriction may be less persistent compared to non-dependent individuals.

MYDRIASIS



Mydriasis (Dilated)

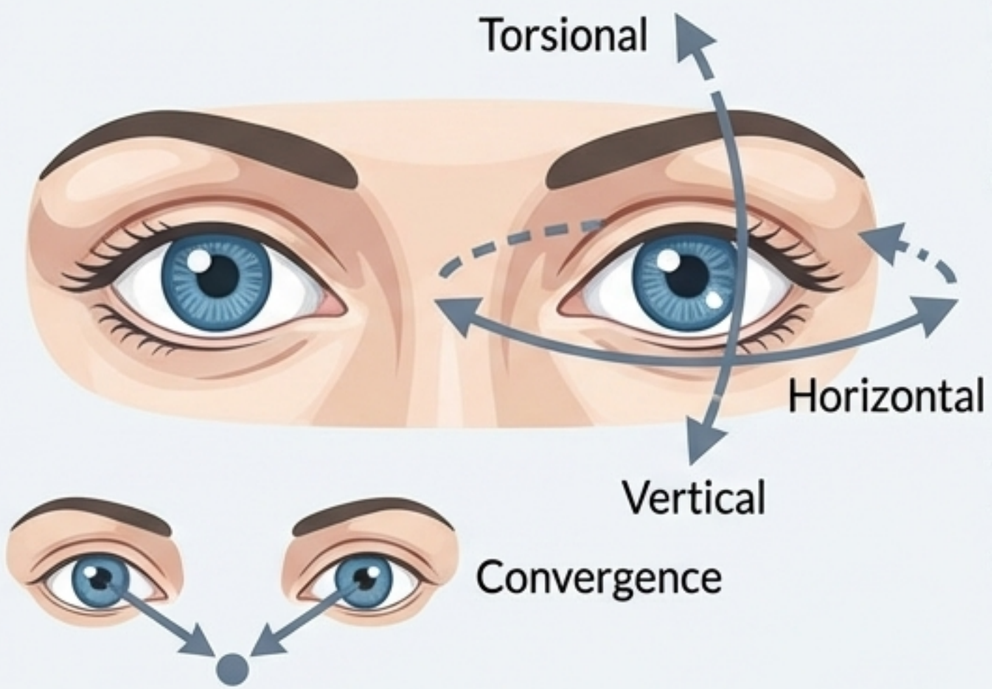
Primary Causes:

- **Stimulants:** Cocaine, Amphetamines, Methamphetamine, MDMA (Ecstasy). *Mechanism:* Inhibition of norepinephrine reuptake.
- **Hallucinogens:** LSD, Psilocybin.
- **Cannabinoids:** Cannabis (Marijuana).
- **Acute Alcohol Intoxication.**
- **Opioid Withdrawal States.**

Reading the Movements: Nystagmus and Motility Deficits

Horizontal Gaze Nystagmus (HGN)

Key Substances: CNS Depressants (Barbiturates, Benzodiazepines), Alcohol, Phencyclidine (PCP).



Vertical Gaze Nystagmus (VGN)

Key Substance: Phencyclidine (PCP) is a classic cause. May also be present in high-dose CNS depressant use.

Downbeat Nystagmus & Saccadic Intrusions

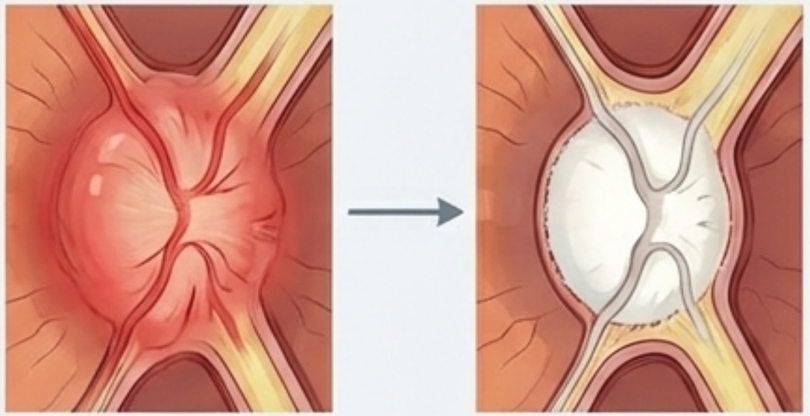
Key Substances: Intravenous Heroin and Morphine. Effects are often transient (10-15 minutes).

Impaired Convergence & Diplopia

- **Alcohol:** Acute intake leads to diplopia.
- **Barbiturates:** Cause decreased convergence.
- **Heroin Withdrawal:** Can manifest as acute-onset esotropia with binocular diplopia.

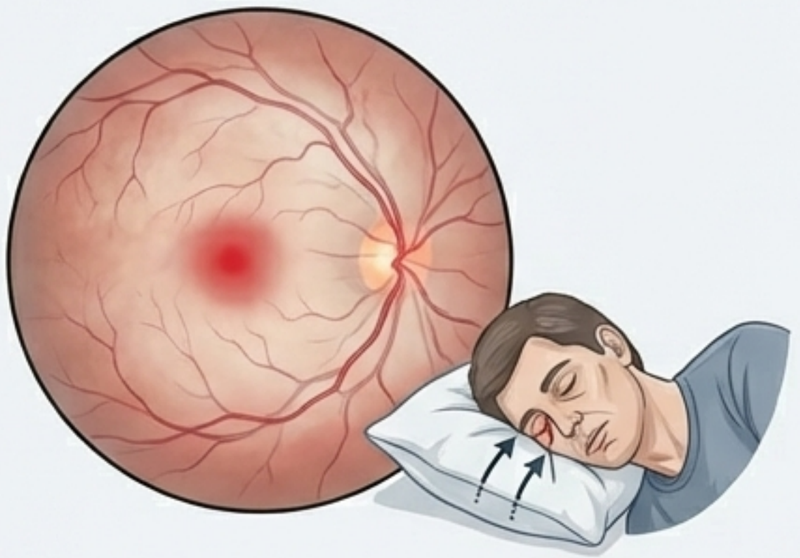
Red Flags: Recognizing Ophthalmic Emergencies

Methanol Poisoning



- **The Threat:** Blindness can occur with as little as 10 mL; a fatal dose can be 30 mL.
- **Presentation:** Delayed onset (12-24 hours). Symptoms include blurred vision, headache, abdominal pain, leading to dyspnoea, coma, and blindness.
- **Key Sign:** Optic neuropathy, presenting as **hyperemic optic disc oedema**, followed by progressive optic disc pallor and cupping.
- **Lab Finding:** Severe metabolic acidosis (due to formic acid). Acidosis at presentation is a strong predictor of poor visual acuity.
- **Management:** Gastric lavage, Ethanol/Fomepizole, Haemodialysis, Folinic acid, Sodium bicarbonate.

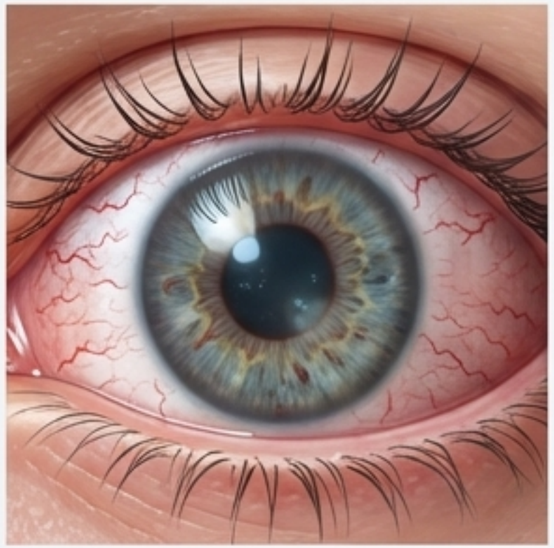
Vascular Occlusions & Ischaemia



- **'Saturday Night Retinopathy':** Unilateral vision loss, proptosis, and ophthalmoplegia after heavy IV drug abuse (alcohol, heroin) leads to patient sleeping with continuous pressure on the orbit, causing orbital congestion and **central retinal artery occlusion**. Poor visual prognosis.
- **Retinal Vascular Occlusive Disease:** Associated with Cocaine and Methamphetamine use.
- **Diffuse Retinal Ischaemia:** Reported with IV use of crushed oxymorphone.

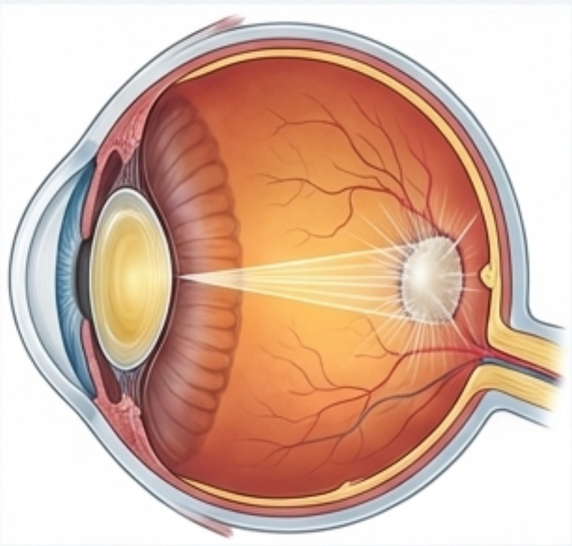
Chronic Damage: Surface Disease and Long-Term Sequelae

Ocular Surface & Conjunctiva



- **Conjunctival Injection (Red Eyes):** Classic sign of Cannabinoids and acute Alcohol use.
- **Dry Eye Syndrome:** Associated with chronic Alcohol and Nicotine use. Alcohol disturbs tear film structure and increases hyperosmolarity.
- **Corneal Damage:** Cocaine use can cause superficial punctate keratitis, epithelial defects, and ulcers due to direct toxicity and contamination from rubbing.

Lens (Chronic Use)



- **Cataracts:** Smoking (Nicotine) increases the risk of nuclear and posterior subcapsular cataracts.

Retina (Chronic Use)

- **Age-Related Macular Degeneration (ARMD):** Smoking increases the risk of late ARMD four-fold. Chronic alcohol intake is also a risk factor.
- **Tobacco-Alcohol Amblyopia:** Toxic optic neuropathy due to cyanide/formic acid levels and nutritional deficiency (B12, folate). Presents with central or centrocaecal scotoma and temporal disc pallor.

The Clinician's Quick Reference: Signs & Suspects

Ocular/Visual Manifestation	Suspected Drugs/Substances
PUPIL: MIOSIS (Constricted)	Opiates (Heroin, Morphine)
PUPIL: MYDRIASIS (Dilated)	Stimulants (Cocaine, Methamphetamine), Hallucinogens (LSD), Cannabinoids, Acute Alcohol, Opioid Withdrawal
NYSTAGMUS	Phencyclidine (PCP) (Horizontal & Vertical), CNS Depressants (Barbiturates), Alcohol
DIPLOPIA / IMPAIRED CONVERGENCE	Alcohol, Barbiturates, Heroin Withdrawal (Acute Esotropia)
TOXIC OPTIC NEUROPATHY	Methanol (Medical Emergency), Tobacco-Alcohol Amblyopia
RETINAL VASCULAR OCCLUSION	Cocaine, Methamphetamine, IV Drug Use (Emboli), Orbital Compression ("Saturday Night Retinopathy")
CONJUNCTIVAL INJECTION (Red Eye)	Cannabinoids, Alcohol
DRY EYE / KERATITIS	Alcohol, Nicotine (Dry Eye); Cocaine (Keratitis, Ulcers)
INCREASED CATARACT / ARMD RISK	Nicotine, Alcohol
INTRAOCULAR PRESSURE (IOP)	Decreased IOP: Cannabinoids; Increased IOP: Smoking (Nicotine)

Test Your Knowledge: AMC-Style Clinical Scenarios (1/2)

Question 1

A 22-year-old male is brought to the emergency department by friends after being found unresponsive at a party. On examination, his respiratory rate is 8 breaths/min, he does not respond to painful stimuli, and his pupils are 1mm bilaterally and non-reactive.

Which of the following substances is the most likely cause of his presentation?

(A) Cocaine
(B) Lysergic acid diethylamide (LSD)
(C) Heroin
(D) Cannabis
(E) Methanol

Question 2

A 45-year-old man with a history of chronic alcoholism presents with a 24-hour history of progressively worsening blurred vision, headache, and abdominal pain. He admits to drinking a 'homemade spirit' at a gathering two days ago. His arterial blood gas shows a pH of 7.15.

Which of the following findings is most expected on fundoscopic examination in the acute stage?

(A) Drusen and retinal pigmentary changes
(B) Normal fundus
(C) Temporal pallor of the optic disc
(D) Hyperemic optic disc oedema
(E) Retinal haemorrhages

Test Your Knowledge: AMC-Style Clinical Scenarios (2/2)

Question 3

A 19-year-old university student is evaluated by campus security for erratic behaviour. He is agitated, aggressive, and disoriented. Examination reveals prominent horizontal and vertical nystagmus. His pupils are 4mm and reactive to light.

Intoxication with which of the following substances best explains these findings?

(A) Phencyclidine (PCP)
(B) Barbiturates
(C) Morphine
(D) Alcohol
(E) Cocaine

Question 4

A patient with a long history of heavy smoking and alcohol consumption presents for a routine check-up. He complains of a gradual, painless decline in his central vision over several years. Visual field testing reveals bilateral centrocaecal scotomas.

Which of the following is the most likely underlying diagnosis?

(A) Saturday Night Retinopathy
(B) Age-Related Macular Degeneration
(C) Tobacco-Alcohol Amblyopia
(D) Chronic Angle-Closure Glaucoma
(E) Poppers Maculopathy

Answer Rationale & Key Learning Points

Question 1 Rationale

Answer: (C) Heroin.
Rationale: The clinical triad of coma, respiratory depression, and pinpoint pupils (miosis) is pathognomonic for opioid poisoning. Stimulants (A) and hallucinogens (B) cause mydriasis. Cannabis (D) causes red eyes and mydriasis. Methanol (E) poisoning's primary is optic neuropathy and metabolic acidosis, not miosis.

Question 2 Rationale

Answer: (D) Hyperemic optic disc oedema.
Rationale: The presentation of delayed visual loss after ingesting an unknown alcohol, combined with severe metabolic acidosis, is classic for Methanol poisoning. In the acute stage, the optic neuropathy manifests as hyperemic disc oedema. Temporal pallor (C) is a late finding.

Question 3 Rationale

Answer: (A) Phencyclidine (PCP).
Rationale: The combination of horizontal and vertical nystagmus is a hallmark sign of PCP intoxication. Barbiturates and alcohol (B, D) typically cause horizontal nystagmus only. Opioids (C) cause miosis and downbeat nystagmus. Cocaine (E) causes mydriasis.

Question 4 Rationale

Answer: (C) Tobacco-Alcohol Amblyopia.
Rationale: This condition is a toxic optic neuropathy associated with chronic smoking and alcohol use, often due to nutritional deficiencies. It classically presents with a gradual, painless decline in vision and a central or centrocaecal scotoma on visual field testing. The fundus may show temporal optic disc pallor.