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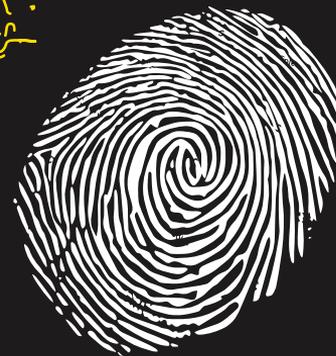
# methanol toxicity



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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ  
سَلَامٌ عَلٰی رَسُوْلِهِ وَاٰلِهِ وَسَلَّمَ  
وَعَلَيْكُمْ السَّلَامُ



# What is methanol?

Methanol is a clear, colorless liquid at room temperature, known for its burning taste.

- \* It is also referred to as "wood alcohol" or "wood spirits".
- \* Methanol has **no approved medical or therapeutic uses**.

Industrially, it is used in products such as antifreeze, fuel, paint and varnish removers, dyes, inks, and automotive cleaning agents.

Illegally, it is sometimes used to adulterate ethanol. (( like what happen in Jordan in 28-7-2025 which resulted in 9 deaths and 50 injuries according to use a methanol in the alcohol)) So Outbreaks of methanol poisoning can occur.



← هو كبر ذاته - شحادة - اسمه لكن علينا نتح لآكول الميثانول في السلامة

\* مستحضرات طبية تافهة

← مادة كحول يتم استخدامها في methanol بنظر خص وبيع في سوريا وظهرت مع سكرات

# The KINETICS of Methanol

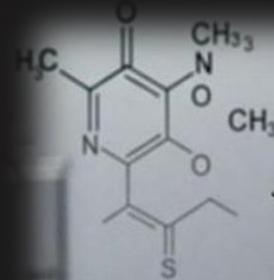
## Absorption :

Methanol can be absorbed through the skin, gastrointestinal (GI) tract, and respiratory system. This means exposure may occur through ingestion, inhalation, or skin contact.

## Excretion:

- Liver: Metabolizes approximately 80–85% of the ingested methanol.
- Kidneys: Excrete around 12–15% of the dose through urine.
- Lungs: Eliminate about 3–5% via exhalation.

↳ water + lipid  
Soluble



# Metabolism of Methanol (in liver)

## 1) Methanol → Formaldehyde

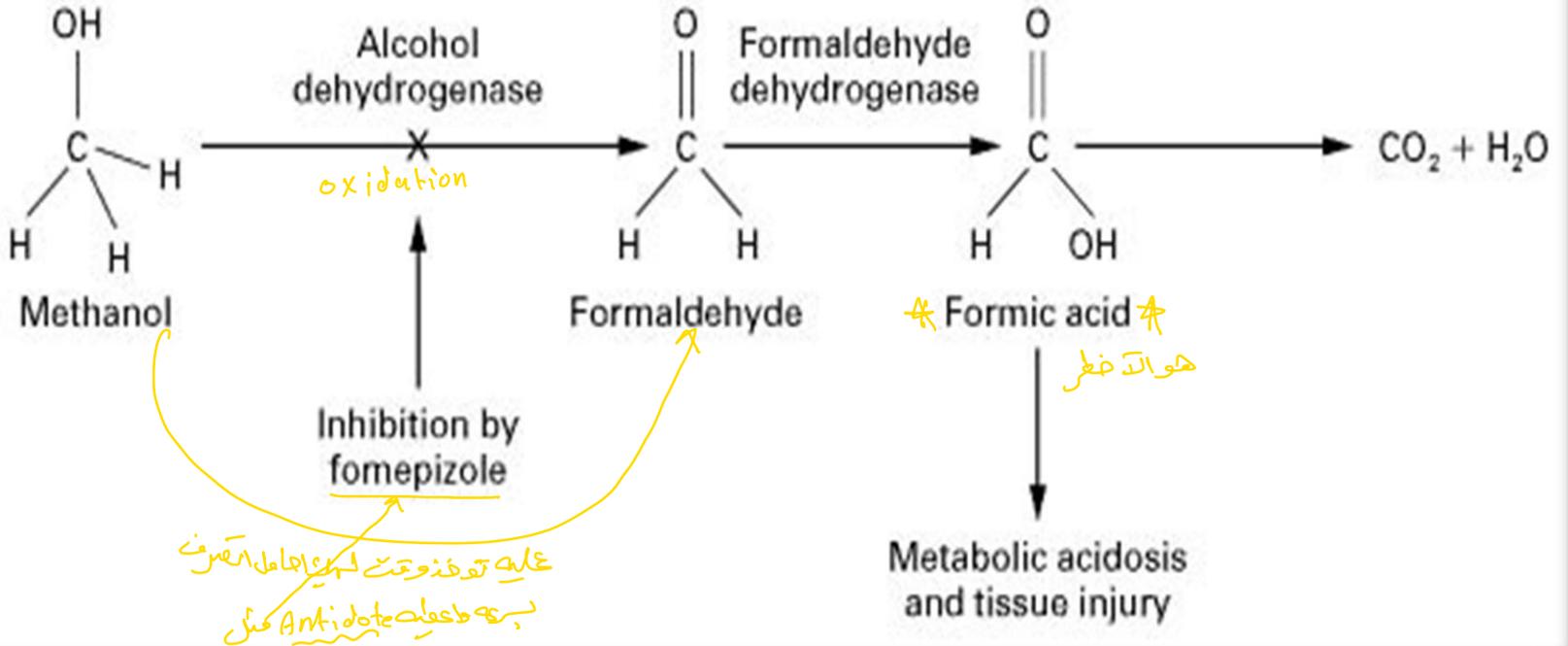
- **Enzyme:** Alcohol dehydrogenase (ADH)
- This is the initial step, where methanol is oxidized to formaldehyde.
- This step is relatively slow, which is why early intervention can prevent toxicity

## 2) Formaldehyde → Formic Acid (Formate)

- **Enzyme:** Aldehyde dehydrogenase (ALDH)
- Formaldehyde is rapidly converted to formic acid, the **main toxic** metabolite



# metabolism



# Methanol Metabolism pathway



When **methanol** enters the body, the liver changes it into more toxic substances using special enzymes:

## **Methanol**

↓ (by the enzyme *Alcohol Dehydrogenase – ADH*)

## **Formaldehyde**

A very toxic substance, but it doesn't stay long in the body.

↓ (by the enzyme *Aldehyde Dehydrogenase – ALDH*)

## **Formic Acid (or Formate)**

This is the **(main toxic substance)**



میتو کونڈریا CNS میں اکٹرا ہوتا ہے Ethanol

# Why Methanol are Toxic<sub>00</sub>

لہذا تڑپ سے اقلیہ AS

- accumulation in vital organ  
chronic &  
phlor

## Mechanism of Action (Unclear but Known Effects):

- 1. Metabolic Acidosis** – This occurs due to the accumulation of formic acid and lactic acid.
- 2. Central Nervous System (CNS) Depression** – Including suppression of the respiratory center.
- 3. Ocular Toxicity** – Formic acid inhibits cytochrome oxidase activity in the optic nerve, disrupting axoplasmic flow and leading to visual disturbances.
- 4. Direct Myocardial Depression** – A serious and late-stage effect, often considered a terminal sign.

میتو کونڈریا  
ATP  
Hypoxia  
Lactic Acid  
Meth-Acidosis



- صنوفا ستمما حصا شراب لانا ستم



## Fatal dose

- 60-100ccs (more toxic than ethanol).
- The minimal dose reported to cause blindness is 10ml of pure methanol.



## Fatal period

It is expected to be delayed 3-7 days (long half life).



## Mode of poisoning

شراب مشروب فيه عينا نولا مخرى عن  
It occurs mostly accidentally by alcoholics. It also may be used intentionally as it is cheap and easily available.

؟  
\* Epidemic شراب مماناس  
شربوا منه



# CLINICAL PRESENTATION

## History

Usually in epidemic outbreaks.

There is latent period from 2-3 days with the presence of vomiting, ***snow storm vision (blurred)***, and abdominal pain during this period.

## Examination: → Hypotension

- Metabolic acidosis: it is the first cause of death in such cases.
- CNS manifestations: initial inebriation - especially if ethanol coingested.

# The Manifestation

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## Ocular manifestations: \* Snow Storm Vision\*

- Diminished visual acuity.
- Irreversible blindness (25 % of cases).
- Nystagmus.
- Optic disc examination:
  - Early: hyperemia & peripheral edema.
  - Late: pallor.

Decreased pupillary response to light.



# Manifestation

- Miscellaneous disorders:

## Respiratory manifestations:

- Dyspnea:
- Early: due to unmetabolized methanol.
- Then: Tachypnea to compensate acidosis.
- Late: Sudden respiratory failure.



# Manifestation



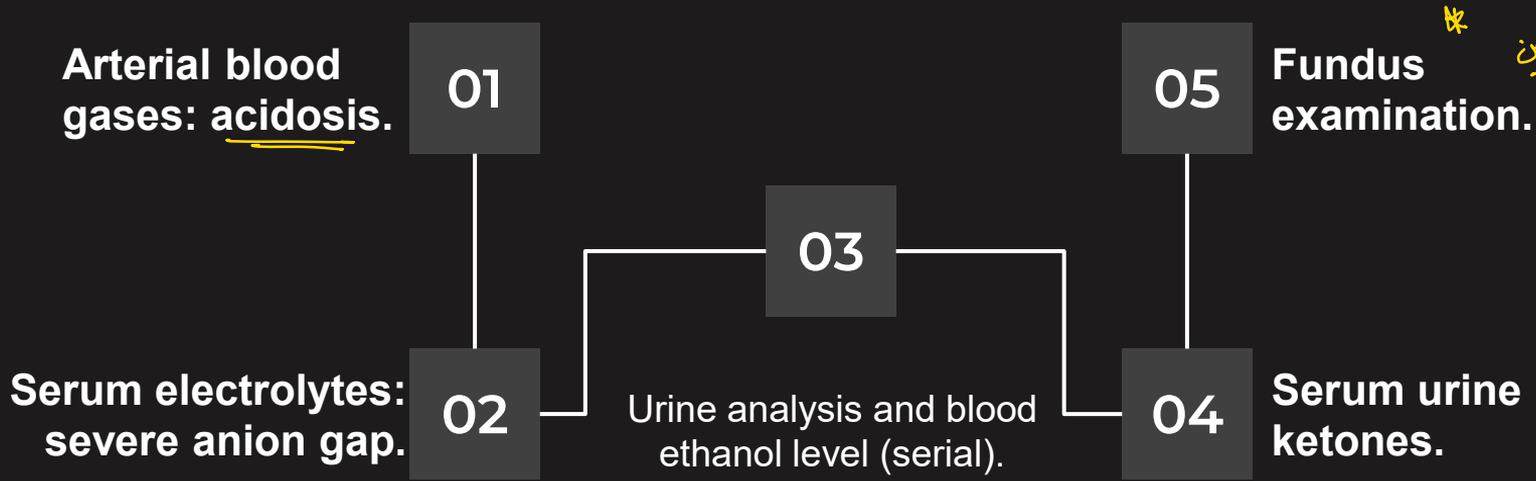
## Cardiovascular manifestations:

- Maintained normal blood pressure.
- Terminally: hypotension and bradycardia (a grave sign).

**GIT disorders:** (early manifestations): nausea, vomiting and

- severe abdominal pain.

# LABORATORY EVALUATION:



\*  
لاعين

له بعد نسبة الـ ميتانول عن طريق  
قياس الكيمياء ايمتanol بالدم بـخه او بـ urine  
لانه اخذ هو  
كلها حائت منه الـ ميتانول ↑ هنا سبباً كويس  
لاخص الـ methanol ودرتكون الـ metabolite

## ◆ علاقة الميتانول بالإيثانول

الإيثانول (كحول الشرب) والميثانول (كحول الخشب) بيتنافسوا على نفس الإنزيم Alcohol dehydrogenase. لذلك في التسمم بالميثانول:

• بنعطى Fomepizole (يمنع الإنزيم).

• وإذا مش متوفر، بنعطى Ethanol IV لأنه بيتنافس الميثانول على الإنزيم → بيوقف تكوين الـ Formic acid ويبخلي الميثانول يُطرح من الجسم.

يعني الإيثانول دواء للتسمم بالميثانول (لأنه بيوقف تحوله لمواد سامة).



# Treatment

General — Specific — supportive

## Emesis

- GL → Gastric Lavage
- AC → Activated Char...

- Acidosis ⇒ Give Bicarbonate IV
- Respiration
- Dialysis ⇒ in severe cases
- Heart
- Convulsion



# General measures:

## **Emesis: not preferred as;**

- The patient is usually comatose.
- Altered mental status.
- Rapid deterioration of consciousness is expected at any moment.

## **Gastric lavage:**

- Better as it overcomes the contraindications of emesis by ensuring airway protection prior to lavage.

## **Activated charcoal and cathartics:**

- Only indicated if co-ingestion is suspected.

## 2- SPECIFIC MEASURES (ANTIDOTES):

# Ethanol

إيثانول  
ينافس الميثانول على ADH

Competes with methanol for ADH,  
reducing formation of toxic  
metabolites.

Can be given **IV** or orally.

# Methyl pyrazole

Inhibits alcohol dehydrogenase (ADH).



	<b>ethanol</b>	<b>Methyl-Pyrazole: (4-MP= fomepizole)</b>
<b>Aim</b>	decrease the conversion of methanol into the more toxic format	decrease the conversion of methanol into the more toxic format
<b>Mechanism:</b>	strong competitive inhibitor of methanol at the dehydrogenase enzyme	alcohol dehydrogenase inhibitor
<b>Advantages</b>	Cheap, available	No CNS depressant, easier to use,
<b>disadvantages</b>	CNS depressant, difficult dose adjustment	Expensive, not available



# Cofactor therapy

هون بييجي دور Folic acid (الفوليك أسيد):

- الجسم طبيعياً يقدر يتخلص من الـ Formic acid عن طريق إنزيم بيجناج Folate.

- إذا عطينا المريض Folic acid أو Folinic acid (Leucovorin) → بتزيد سرعة تكسير الـ Formic acid → لغاز ثاني أكسيد الكربون + ميه (أمين).

- هيك متقلل شمية الميتانول خصوصاً على العين والدماغ.

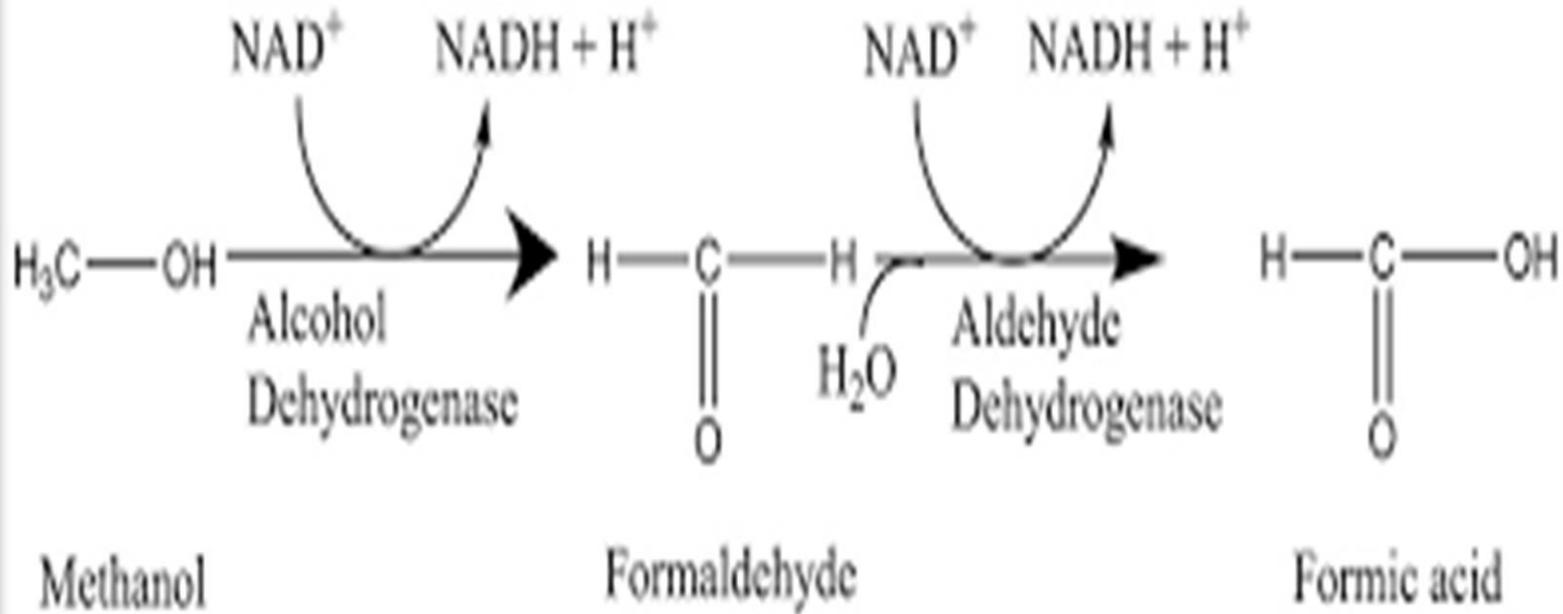
(Folic acid and folinic acid :  
( Leucovorin):

عشان

Because that the tetrahydrofolate is  
the rate limiting in conversion of  
formic acid to CO<sub>2</sub> and water, all  
patient receive ADH inhibitors  
should receive 50mg of folinic acid  
every 4 hours until  
ADH inhibitor therapy is discontinued.

عشان أكسج  
العصول للأنسجة





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*Pand Medayat*

**Thank You**

