Barbiturates

Barbiturates are medications with a wide range of use and side effects. They can be remembered by having "barb" in their names, such as phenobarbital and pentobarbital. They are indicated for seizure treatment, and are effective against simple and complex partial seizures, as well as generalized tonic-clonic seizures. The barbiturate thiopental is a very fast acting medication used for anesthesia induction. These drugs work by potentiating GABA_A, leading to increased chloride channel opening duration. This increased chloride channel opening duration leads to decreased neuronal firing. It should be remembered that barbiturates increase the duration of chloride channel opening, whereas benzodiazepines increase the frequency of chloride channel opening.Side effects of this class of drug include sedation and grogginess. A severe side effect is respiratory and cardiac depression, which can progress to respiratory arrest and low blood pressure in patients who overdose or recreationally use barbiturates. CNS depression may also occur, and abuse with ethanol can cause additive adverse effects, as barbiturates and ethanol both act on GABA_A receptors. Finally, these drugs induce the cytochrome P450 enzyme complex and may affect the metabolism of other medications.



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Barb- Drug Names

Barb-wire

Barbiturates can be remembered for having "barb" in their names. Common examples are phenobarbital, pentobarbital, and secobarbital, with the anesthetic thiopental being the exception, and primidone which is used for essential tremor treatment.

Mechanism of Action

Facilitate GABA-A Action

GABA-goose with A-Apple

Barbiturates facilitate GABA-A action by increasing the duration of chloride channel opening, leading to CNS depression. Unlike benzodiazepines, which increase the frequency of chloride channel opening, barbiturates increase the duration of opening.

Increased Duration of Chloride Channel Opening

Up-arrow Open-late-clock on Chlorine-dispenser Channel

Barbiturates allosterically modulate GABA-A receptors, potentiating GABA’s action and increasing the duration of chloride channel opening. In contrast, benzodiazepines increase the frequency of chloride channel opening.

Decrease Neuron Firing

Down-arrow Nerve on Fire

Barbiturates decrease neuron firing by prolonging the duration of GABA-A receptor-mediated chloride channel opening, leading to hyperpolarization of the neuronal membrane and CNS depression.

Enhance GABA-A action ? ? Cl- influx ? Hyperpolarization ? ? Neuron firing

Indications

Anesthesia Induction

A-nest Induction-duck

Ultra-short-acting barbiturates, such as thiopental, are used for anesthesia induction due to their rapid onset and short duration of action. Thiopental is administered intravenously, with an onset of action typically occurring within 30 seconds and a duration lasting a few minutes, making it ideal for quick anesthesia induction.

Thiopental is sometimes referred to as "truth serum" due to its CNS depressant effects. These effects may cause disinhibition, leading to relaxed or impaired judgment. However, this effect is not scientifically reliable for eliciting truthful statements and is not recommended for clinical use.

Seizures and Neonatal Seizures

Caesar and Baby-Caesar

Barbiturates such as phenobarbital are used for seizure treatment, particularly in generalized tonic-clonic seizures and neonatal seizures. They are less commonly used for partial seizures.

For neonatal seizures, phenobarbital is the first-line choice.

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Essential Tremor

Espresso Trimmer

Primidone is used for essential tremors but it is not the first choice (propranolol is usually the first-line drug).

Primidone is metabolized to phenobarbital (which also helps with seizures) and PEMA (phenylethylmalonamide), both contributing to its therapeutic effects.

Side Effects

Sedation

Sedation-dart

Barbiturates, once used for treating insomnia and anxiety, are no longer commonly prescribed for these purposes due to their sedating effects and high potential for dependence. Patients often reported feeling groggy or "hungover" the next day, which led to a decline in their use for these indications. Additionally, barbiturates have a narrow therapeutic index, and their overdose potential makes them less favorable compared to other sedatives like benzodiazepines or non-benzodiazepine sleep aids.

Cardiovascular and Respiratory Depression

Deflated Heart and Lungs

Barbiturates can cause severe CNS depression, leading to respiratory depression and cardiovascular instability. This effect is especially dangerous in overdose situations, where patients may experience respiratory arrest and hypotension. While ethanol can also cause CNS depression, it is typically less potent in inducing fatal respiratory depression compared to barbiturates. Barbiturate overdose is associated with a higher risk of life-threatening effects, particularly respiratory arrest.

CNS Depression

Deflated CNS-brain

Barbiturates can cause severe CNS depression in overdose situations, and this effect is potentiated when taken concurrently with ethanol. Both substances bind to GABA-A receptors, leading to additive CNS depressant effects. Patients may exhibit symptoms such as ataxia, dizziness, impaired judgment, and, in severe cases, the condition can progress to respiratory depression and death.

Cytochrome P-450 Inducer

Pea-450 Inducer-rocket

Barbiturates are known to induce cytochrome P450 enzymes (particularly CYP3A4, among others), which increases the metabolism and clearance of many other drugs from the bloodstream. This enzyme induction can lead to reduced blood levels of concurrently administered medications, shortening their effects and potentially making them less effective.

CONSIDERATIONS

Contraindicated in Porphyria

Caution-tape Poor-fairy

Barbiturates are contraindicated in porphyria because they induce cytochrome P450 enzymes, which increase heme synthesis.

Barbiturates induce CYP450, which upregulates ALA synthase, the rate-limiting enzyme in heme synthesis. This leads to an accumulation of toxic porphyrin precursors (like ALA and PBG) in acute intermittent porphyria (AIP) and other porphyrias. The accumulation of these precursors can trigger acute attacks, leading to severe symptoms.

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