



Neuropsychiatry Block

Pharmacology Team 438

Drugs Related to Balance System

Objectives

By the end of the lecture , you should know:

- To differentiate between classes of drugs used to control or prevent vertigo
- Hint on some disorders of balance
- Details on some drugs used to control or prevent vertigo
- Identify drugs that can precipitate vertigo

Color index:

Black : Main content
Red : Important
Blue: Males' slides only

Pink : Females' slides only
Grey: Extra info or explanation
Green : Dr. notes

Editing File

Terms related to balance

Definition

Expression of impairment in stability, sensation, perception, consciousness
 =
 (Lightheadedness)¹



Definition

Type of dizziness described as the sensation that the environment is **spinning**

Symptoms :

- Nausea or vomiting
- confusion or disorientation
- feeling as if one will fall
- sweating
- nystagmus (abnormal rapid eye movement)

Balance disorders

Benign paroxysmal positional vertigo²

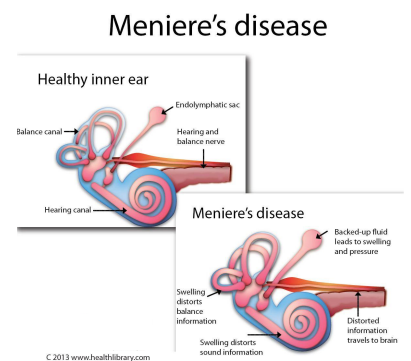
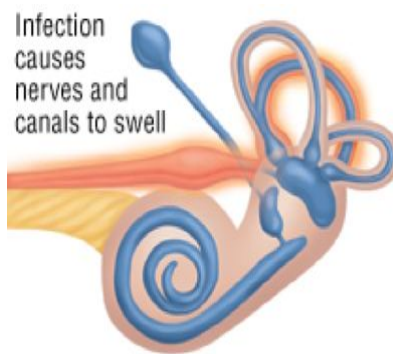
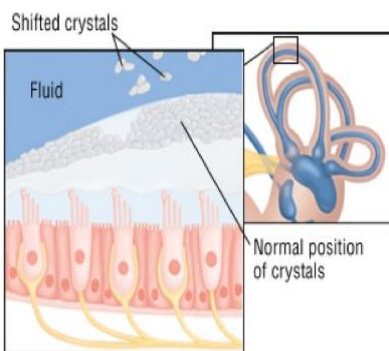
A change in head position causes a sudden sensation of spinning

Acute labyrinthitis

Inflammation of the balance apparatus of the inner ear, usually due to viral infection

Ménière's disease³

This causes **repeated** episodes of dizziness, usually with ringing in the ear and progressive low frequency hearing loss (Edema of the cochlea, the circular canal, and nerves connected to it)



1- + patient feels like he/she's about to faint
 2- Most Common
 3- Most Serious , causes edema

Drugs related to balance system

Specific treatment

Involves targeting the underlying cause of the vertigo (e.g., ear infection)

Use of:
-antibiotics
-anti inflammatory drugs
-antiviral

Symptomatic treatment

Involves controlling the acute symptoms and autonomic complaints (e.g. vertigo, vomiting and nystagmus)

Prophylactic treatment

Aims to reduce the recurrence of specific vertiginous conditions

Drugs:

- 1- diuretics²
-Not loop diuretics³
- 2- corticosteroids⁴
- 3- Ca²⁺/K⁺ channel blockers⁵
-cinnarizine
-verapamil

Vestibular suppressants

Reduce the intensity of vertigo and nystagmus evoked by vestibular imbalance

- Drugs:
- 1- anticholinergic
-hyoscine
 - 2- benzodiazepine
-lorazepam
-clonazepam
-diazepam
 - 3- betahistine¹

Antiemetic

Used to control vomiting and nausea

- Drugs:
- 1- antihistamine
-dimenhydrinate
 - 2- phenothiazine
-prochlorperazine
 - 3- dopamine antagonists
-metoclopramide
-domperidone

1- only used for balance disorder.

2- Relieve edema

3- loop diuretics are ototoxic eg. furosemide

4- decreases the inflammation & edema

5- reduce the overactivity of the hair cells

Vestibular Suppressants

Anticholinergics

Drug	Hyoscine
Action	-Inhibits firing in vestibular nucleus neurons -Reduce the velocity of vestibular nystagmus
Indications	1-motion sickness 2- sedation
Adverse Effects	-Dry mouth, blurred vision, & sedation

Benzodiazepines

Drugs	Lorazepam, Clonazepam, Diazepam
Indications	-Management of acute vertigo (in small doses) ¹ -Minimize anxiety and panic associated with vertigo
Adverse Effects	-Dependence, impaired memory, & increased risk of falling (Ataxia)

Betahistine

M.O.A	<p>It's a structural analog of histamine which works as:</p> <p>1-Weak <u>H1 receptor agonist</u>: Local vasodilation and increased permeability of blood vessels in the inner ear, which helps to reverse endolymphatic hydrops (accumulation of endolymph)</p> <p>2-More potent <u>H3 receptor antagonist</u>: Increases² the local concentration of histamine in the inner ear</p> <p>3-Increases the level of serotonin in the brainstem decreases the activity of vestibular nuclei</p>
P.K	<p>1-formulated as tablets or oral solution</p> <p>2- rapidly and completely absorbed</p> <p>3- T_{1/2} is 3-4 hours</p> <p>4-excreted in urine within 24 hours</p> <p>5- low protein binding</p>
Indications	Ménière's syndrome
Adverse Effects	-Headache (Dilatation), nausea (Stimulating CRTZ), GIT side effects (Incr. of HCL), & hypersensitivity
Contraindications	-Pheochromocytoma ³ , bronchial asthma, history of peptic ulcer ⁴ & hypersensitivity reactions

1- benzodiazepines are actually used in seizure. So large doses would treat seizure, small doses for management of acute vertigo.
 2-Blocks H3 receptors found at the presynaptic neuron, Activating H3 receptors inhibits the production of histamine, thus blocking H3 receptors increases histamine production which helps in vasodilation & increase permeability which relieves the edema.
 3- histamine is a neuromodulator, an increase in its secretion would also cause increase in catecholamines " NE & Epinephrine".
 4- histamine increases the release of HCL which worsens the peptic ulcers.

Antiemetics

Antihistamines

Drug	Dimenhydrinate
M.O.A	<ol style="list-style-type: none"> 1-Block H1 receptor in CRTZ¹ (chemoreceptors trigger zone) 2- Sedative effect 3-Weak anticholinergic effect 4- Decreases excitability in the labyrinth and blocks conduction in the vestibular-cerebellar pathways
Indications	<ul style="list-style-type: none"> -Vertigo -prevention of nausea & vomiting associated motion sickness
Adverse Effects	-Sedation, dizziness, & anticholinergic side effects (Dry mouth, blurred vision, urinary retention)
Contraindications	-Glaucoma ² , prostatic enlargement ³

Phenothiazines

Drug	Prochlorperazine
M.O.A	<ol style="list-style-type: none"> 1-Blocks Dopamine receptors at CRTZ (chemoreceptors trigger zone) 2-Antipsychotic with some sedation 3-Antiemetic 4-Some vestibular suppressant action
Indications	-One of the best antiemetic drugs used in vertigo

Dopamine Antagonists

Drug	Metoclopramide & Domperidone
M.O.A	<ol style="list-style-type: none"> 1-Block DOPAMINE D2 receptors in the CRTZ of the medulla, resulting in potent central antinausea & antiemetic action 2- has some sedation 3-Potent gastroprokinetic effect⁴
Indications	- Esophagogastric reflux
Adverse Effects	<ul style="list-style-type: none"> - Restlessness or drowsiness -extrapyramidal manifestations⁵ on prolonged use

1- CRTZ receptors are receptors responsible for vomit containing: H1, dopamine receptors, muscarinic receptor, serotonin receptor, ect..

2&3- due to its anticholinergic effects, it causes increase IOP & urinary retention. Which worsens the prostatic enlargement.

4- speed gastric emptying and this is good to decrease vomiting.

5- drug induced movement disorders + tremor (Parkinson like symptoms)

Calcium channel blockers (prophylactic treatment)

Drug	Cinnarizine
Mechanism of action	<p>1-selective K⁺ & Ca²⁺ channels blockers (vascular smooth muscle relaxation)</p> <p>2-Antihistamine, Antiserotonin, Antidopamine</p> <p>3-promotes cerebral blood flow¹</p> <p>4-inhibits K⁺ currents</p> <p>I.E. K⁺ currents are generated by increased hydrostatic pressure on hair cells, inhibition of these currents lessens vertigo and motion induced nausea by dampening the over-reactivity of the vestibular hair cells</p>
Pharmacokinetics	<p>1-taken orally in tablet form</p> <p>-low oral bioavailability due to hepatic first pass metabolism</p> <p>-better bioavailability if administered as IV lipid emulsions</p> <p>2-rapidly absorbed</p>
Adverse effects	<p>1-sweating</p> <p>2-headache</p> <p>3-drowsiness</p> <p>4-muscle rigidity and tremors</p>
Contra indications	<p>1-Parkinsonism</p> <p>2-car drivers</p>
Indications	<p>Treatment of nausea and vomiting associated with:</p> <p>1-motion sickness</p> <p>2-vertigo</p> <p>3-Ménière's disease</p>

Drugs inducing vertigo²

A- Vestibular toxins		B- Mixed ototoxins	
[Altering function]	[Altering structure]	[Altering function]	[Altering function]
<p>1- Drugs altering fluid and electrolyte balance</p> <p>-Diuretics</p> <p>2- Drugs altering vestibular firing (neural depressant)</p> <p>-anticonvulsants</p> <p>-Antidepressants</p> <p>-sedative hypnotics</p> <p>-alcohol</p> <p>-cocaine</p>	<p>Aminoglycosides antibiotics:</p> <p>-gentamycin</p> <p>-neomycin</p> <p>-kanamycin</p> <p>-streptomycin</p> <p>GentaMycin: induces apoptosis by evoking free radicals → Mitochondrial pathway</p> <p>NEomycin: induces apoptosis by activating caspases → DEath receptor pathway</p>	<p>-Quinine, chloroquine, quinidine³</p> <p>-Nitrogen mustard</p> <p>-Loop diuretics</p> <p>-NSAIDs</p> <p>-Tobacco</p> <p>They decrease local blood flow → biochemical changes → ↓electromechanical transduction → ↓firing of impulse</p>	

1- used in elderly patients to improve memory.

2- it's important to know whether the drug alters the function or structure.

3- antimalarial drugs

Quiz

MCQ

1. A 13-year-old boy complains of nausea and vomiting when he takes long road trips with his family. His family is getting ready to leave on another such trip, so he asks if there is anything he can take to lessen his nausea. The physician prescribes an anti-nausea drug with anticholinergic activity. Which of the following drugs is this?
(A) Dimenhydrinate (B) Droperidol
(C) Marijuana (D) Ondansetron
2. Which of the following drugs is the best to treat meniere disease?
(A) Hyoscine (B) Diazepam
(C) betahistine (D) Cinnarizine
3. Which of the following drugs is contraindicated in patients with vertigo?
(A) Ciprofloxacin (B) Cefuroxime
(C) Gentamicin (D) Amoxicillin
4. A car driver came to clinic complaining of spinning sensation associated with vertigo, which one is one of the following drugs can be used in his case to control the vomiting?
(A) Cinnarizine (B) Dimenhydrinate
(C) Hyoscine (D) Prochlorperazine

SAQ

A 52 year old male visited the doctor after symptoms of dizziness and sometimes he feels that everything around him around him is spinning which usually makes him end up vomiting, upon examination he turns out to be having Meniere disease.

1. Name one drugs used to treat vomiting in this disease.
2. What is the M.O.A.
3. Name 3 adverse effects .
4. Name two contraindications.

MCQ

Q1	A
Q2	C
Q3	C
Q4	D

SAQ

Q1	Cinnarizine
Q2	See page 6
Q3	Sweating, headache, drowsiness, muscle rigidity with tremors
Q4	Parkinsonism, car driving for long distances

Answers:



Good Luck , Future Doctors!

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