Beta Adrenergic Receptor Antagonists

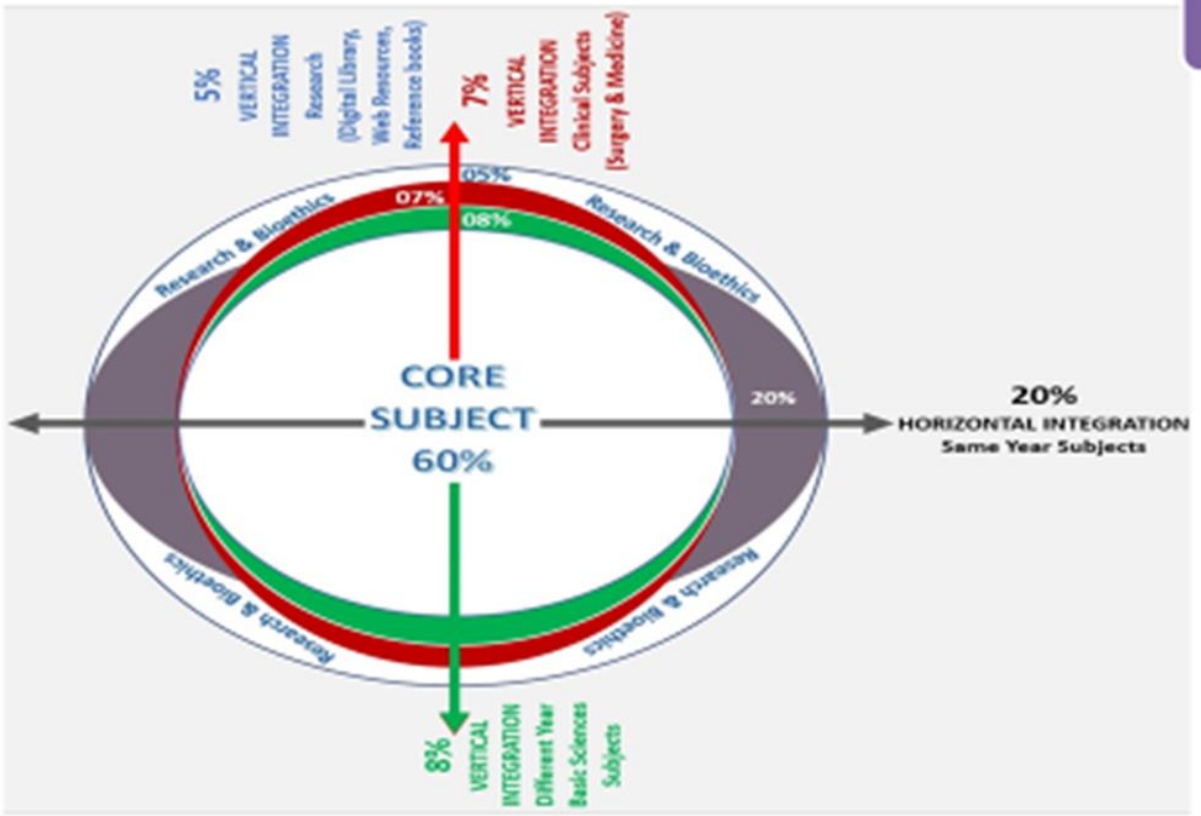
SOURCES:

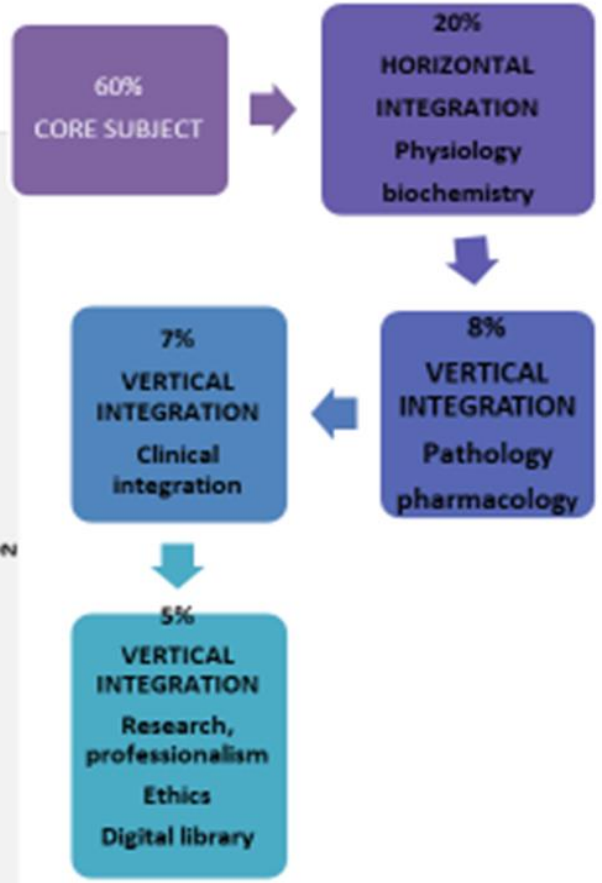
- **BERTRAM G. KATZUNG BASIC & CLINICAL PHARMACOLOGY 15TH EDITION**
- **GOODMAN AND GILMAN'S THE PHARMACOLOGICAL BASIS OF THERAPEUTICS 13TH EDITION.**

MOTTO AND VISION

- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

Professor Umar Model of Integrated Lecture





PRE- LECTURE ASSESSMENT

MCQ# 1

In the context of beta blockers, what does term "cardioselectivity" mean?

a) Beta blockers that block both beta-1 and beta-2 receptors

b) Beta blockers that primarily affect the heart

c) Beta blockers that are used for lung conditions

d) Beta blockers that block alpha receptors

e) Beta blockers that increase heart rate

MCQ# 2

Which of the following beta-blockers would be least likely to cause bronchoconstriction?

A) Propranolol

B) Nadolol

C) Metoprolol

D) Timolol

E) Labetalol

MCQ# 3

A patient on beta-blocker presents with bradycardia. Which of the following interventions would be most appropriate to address this issue?

A) Discontinue the beta-blocker immediately

B) Administer atropine to increase heart rate

C) Reduce the dosage of the beta-blocker

D) Add a calcium channel blocker

E) Prescribe a diuretic to reduce fluid retention

MCQ# 4

A 70-year-old patient with chronic heart failure is prescribed a beta-blocker. Which of the following beta-blockers has been shown to improve survival in CHF patients?

A) Atenolol

B) Bisoprolol

C) Propranolol

D) Metoprolol (succinate)

E) Carvedilol

MCQ# 5

In patients with pheochromocytoma, which of the following is the most appropriate sequence for starting beta-blocker therapy?

A) Start beta-blocker therapy before alpha-blocker therapy

B) Start alpha-blocker therapy followed by beta-blocker therapy

C) Begin with a combined alpha- and beta-blocker

D) Beta-blockers should be avoided in pheochromocytoma patients

E) Start both beta-blocker and alpha-blocker simultaneously

MCQ# 6

- **Which of the following beta blockers is considered cardioselective and predominantly acts on β1 receptors?**
- A. Propranolol
  B. Nadolol
  C. Atenolol
  D. Carvedilol
  E. Labetalol

MCQ# 7

- **Which of the following is a potential side effect of non-selective beta blockers such as propranolol?**
- A. Hypotension
  B. Bradycardia
  C. Bronchoconstriction
  D. Hyperglycemia
  E. Hypokalemia

MCQ# 8

- **Which of the following beta blockers has both beta-blocking and alpha-blocking properties, making it useful in treating conditions like hypertension and heart failure?**
- A. Esmolol
  B. Carvedilol
  C. Metoprolol
  D. Bisoprolol
  E. Sotalol

MCQ# 9

- **Which of the following beta blockers is commonly used for short-term management of supraventricular tachycardia (SVT) due to its rapid onset and short half-life?**
- A. Metoprolol
  B. Atenolol
  C. Esmolol
  D. Propranolol
  E. Carvedilol

MCQ# 10

- **Which condition should be monitored closely when prescribing beta blockers to patients with diabetes?**
- A. Hyperkalemia
  B. Hypoglycemia
  C. Hypernatremia
  D. Hypertension
  E. Hyperlipidemia

Learning Objectives

- At the end of lecture, the students should be able to:
- Classify beta blockers
- Discuss Pharmacokinetics and mechanism of action of beta blockers
- Enumerate Adverse Effects, therapeutic uses and contraindications of beta blockers

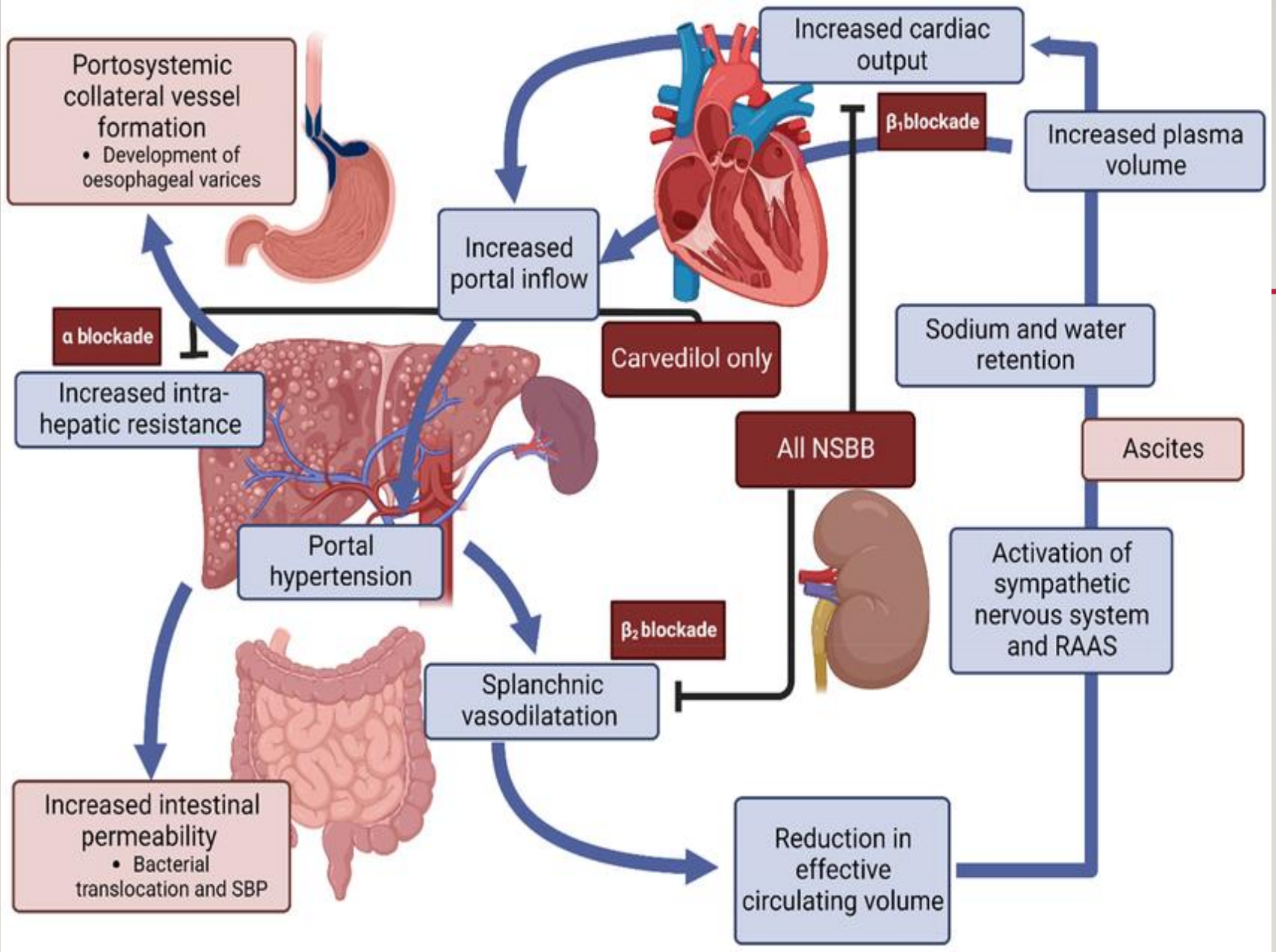
Pharmacokinetics

- ROA:
  - Oral / Parenteral
- Lipid Soluble Drugs….Propranolol
  - Rapid Absorption……Food
  - Extensive FPM……bioavailability
  - Hepatic Blood Flow & Metabolism
  - $t_{1/2}$
  - Cross BBB
- Water Soluble Drugs…Atenolol
  - Absorption……..empty stomach
  - FPM……bioavailability
  - $t_{1/2}$
  - Cannot Cross BBB
- Metabolism & Excretion

Pharmacological Actions

Cardiovascular System

- Normal / With Disease
- Heart
  - Contractility (Inotropy)
  - Heart Rate (Chronotropy)
    - Sinus rhythm / AV conduction / PR interval / Refractory Period
    - Sotalol……Antiarrhythmic…….K^+ channel blockade
  - COP
- Blood Vessels(Receptors on BV)
  - Normal BP / HTN
  - Acute / Short-term
  - Chronic / Long-term use



HORIZONTAL INTEGRATION-PATHOLOGY

Organ system	Effect
Heart	Negative inotropic and chronotropic effects
Bronchopulmonary	Increased airway resistance
Kidney	Reduced activity of the renin-angiotensin-aldosterone system
Central and peripheral nervous system	Decreased sympathetic nervous system activity
Metabolic	Inhibition of glycolysis, glucagon secretion and lipolysis
Skeletal muscle	Reduction of exercise capacity
Eye	Increased outflow and reduced secretion of aqueous humor

Pharmacological Actions

- Respiratory System
- Eye
- Kidney
- Metabolic and Endocrine Effect
- Central Nervous System
- Skeletal Muscle
- Miscellaneous Effects

Therapeutic Uses

Cardiovascular Uses

1. Hypertension
2. Ischemic Heart Disease
3. Myocardial Infarction
4. Cardiac Arrhythmias
5. Cardiac failure
6. Obstructive cardiomyopathies
7. Dissecting aortic aneurysm
8. Portal Hypertension
9. Infantile Haemangiomas

Therapeutic Uses

Non Cardiovascular Uses

1. **Conditions Associated with Sympathetic Over-activity**
   - Hyperthyroidism
   - Anxiety states
   - Acute Porphyria
   - Pheochromocytoma
2. **Miscellaneous**
   - Glaucoma
   - Migraine
   - Familial Tremors
   - Torticolis

Adverse Effects

Cardiovascular Effects

- Bradycardia / Heart Block
- Worsening of CCF
- Worsening of Peripheral Vascular Disease & Cold Extremities in Winter

- Pulmonary Effects
  - Worsening of Asthma & COPD(Switch to Selective β_1 drugs)

Adverse Effects

- Central Effects
  - Fatigue / Lethargy / Dizziness / Insomnia / Nightmares / Depression / Hallucination
- Metabolic Effects
  - Hypoglycemic Episodes
- Male Sexual Dysfunction
- Hypersensitivity

Adverse Effects

- Drug Withdrawal
  - Up-regulation of Receptors
  - Drugs with short $t_{1/2}$
- Drug Over-dosage
  - Atropine
  - Sympathomimetic agents
    - Isoprenaline / Dobutamine / Dopamine
  - Glucagon…….positive inotropic & chronotropic
- Relative Contraindications

Drug Interactions

- Calcium Channel Blocker…….Verapamil
- Enzyme Inhibitors
- Enzyme Inducers
- Anti-hypertensive drugs
- Sympathomimetic Agents……..Nasal Decongestant
- NSAIDs (Indomethacin)……PG Production

FAMILY MEDICINE

- After diagnosing a condition where beta blockers are indicated, family physicians are responsible for prescribing the appropriate beta blocker and dosing regimen based on the patient's condition and medical history. This includes choosing between different types of beta blockers (e.g., atenolol, metoprolol, propranolol) depending on the patient's specific needs.
- Family physicians monitor patient for side effects such as fatigue, dizziness, or bradycardia. Regular follow-ups are essential to evaluate whether the drug is effectively controlling blood pressure or heart rate and adjusting the dosage as necessary.
- Educating patients about the role of beta blockers regarding the benefits, potential side effects, and the importance of adherence to the prescribed regimen.

BIO-ETHICS

- **Pulliam SL, Lantz R. A Dual Beta Blocker and Calcium Channel Blocker Overdose in a Patient with Substance Abuse. Journal of BioMed Research and Reports. 2023;2(3).**
- While beta blockers are essential medications for many patients with cardiovascular conditions, their use raises a number of ethical concerns that must be carefully considered by healthcare providers. These concerns include ensuring informed consent, addressing over-prescription, considering patient quality of life, promoting equity in access to treatment, and respecting patient autonomy. Ethical prescribing of beta blockers requires balancing clinical benefits with potential harms, maintaining patient-centered care, and promoting transparency in the treatment process.

ARTIFICIAL INTELLIGENCE

- AI's role in beta blockers spans from the initial stages of drug development to personalized patient care and ongoing monitoring. By leveraging AI technologies, healthcare providers can make more informed decisions, optimize treatment plans, and improve patient outcomes in the context of beta blocker therapy.

- **Avram R, Sharma A. Tailored use of β blockers using artificial intelligence. The Lancet. 2021 Oct 16;398(10309):1385-6.**

RESEARCH

- Kjeldsen SE, Grassi G. The role of β-blockers in medical treatment. Current Medical Research and Opinion. 2024 Apr 1;40(sup1):1-2.
- L Turco, T Reiberger, G Vitale, V La Mura -Carvedilol as the new non-selective beta-blocker of choice in patients with cirrhosis and portal hypertension 2023 -https://onlinelibrary.wiley.com/doi/abs/10.1111/liv.15559


Thank
you!