Rx FACTOR

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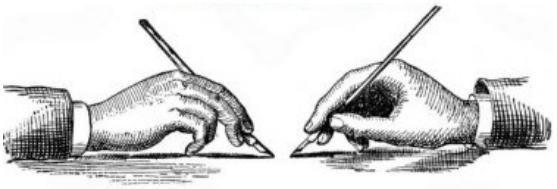

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Warm greetings to all.

Welcome to the Issue 11 of 'RxFactor', from the NATIONAL ASSOCIATION OF PHARMACOLOGY AND THERAPEUTICS (NPT). RxFactor has been designed to encompass the range and breadth of Pharmacology and therapeutics ranging from Medical Education, Pharmaco-vigilance, Research and Therapeutics. Previous editions of Rxfactor have been well received and we thank you all for the words of encouragement and appreciation.

This edition of the Rxfactor newsletter is packed with informative articles. One article highlights howTirzepatide is revolutionizing the management of Type 2 DM and obesity, offering unprecedented result in weight loss and glycaemic control. Another discusses the impact of the obesity pandemic, emphasizing the rise of undiagnosed cardiovascular illness during pregnancy and the alteration of atherogenic lipid profile in women with preeclampsia or gestational hypertension, linked to perinatal morbidity and mortality.

Engaging additions include discussions on the urgent need for new therapeutic agents to combat multidrug-resistant pathogens, with lantibiotics emerging as promising alternatives to traditional antibiotics, and the role of Artificial Intelligence in medical teaching.

We also feature articles on the first drug approved for treating liver fibrosis due to Non-Alcoholic Steatohepatitis : Resmetirom and the new FDA-approved aflibercept biosimilar, along with updates on upcoming and under-trial drugs.

Other notable inclusions are a case study on oral contraceptive pills in young women, insights into amazing drug molecules, and extracts from the NMDP WhatsApp Group. The Cool Corner offers crosswords for some brain-storming fun.

We would like to thank all the contributors of RxFactor for their efforts and support in making this issue of Rxfactor a grand success. We are especially happy to see the PG students who are the future of our speciality contributing to Rxfactor.

We look forward to a happy education and mutual learning with all our readers.

Jai Hind.

Tirzepatide: A Paradigm Shift in Addressing Obesity and Type 2 Diabetes in India

Introduction

India faces the twin epidemics of obesity and type 2 diabetes (T2D), driven by urbanization, sedentary lifestyles, and genetic predispositions. As one of the largest populations affected by T2D globally, the country also struggles with the rising prevalence of obesity. These interconnected conditions demand innovative therapies capable of addressing metabolic dysfunction holistically. Tirzepatide, a first-in-class dual agonist of glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP) receptors, emerges as a transformative solution.

This article highlights tirzepatide's mechanism of action, clinical efficacy, safety profile, and regulatory milestones, with a focus on its potential impact in India's healthcare landscape. By exploring practical considerations for its prescription and addressing challenges related to affordability and accessibility, this review offers insights tailored for pharmacologists and healthcare providers.

Mechanism of Action: Beyond GLP-1 Agonistszht loss and glycemic improvement compared to single-target therapies, positioning tirzepatide as a game-changer.

Clinical Efficacy: Results from Key Trials

Weight Management

Surmount-1 Trial:

- Population: 2539 adults with obesity/overweight.
- Results: Mean weight loss of 25.3% over 72 weeks; 87.5% achieved ⩾5% weight loss.
- Insights: Demonstrated the highest weight reduction recorded in therapeutic trials.
- Comparison with Semaglutide:
- Tirzepatide consistently outperformed semaglutide, achieving ⩾15% weight loss more frequently.

Glycemic Control

Surpass-1 Trial:

- Population: 478 treatment-naïve T2D patients.
- Results: HbA1c reduction of up to -2.07% at the highest dose (15 mg).
- Insights: Achieved euglycemia in a significant proportion of patients.

Prediabetes Study:

- Population: 1032 adults with obesity and prediabetes.
- Results: Prevented T2D progression in 88% of high-risk individuals over 176 weeks.
- Insights: Established tirzepatide's role in diabetes prevention.

Safety Profile

Tirzepatide's safety profile is favorable, with most adverse effects being mild to moderate as described in table 1.

Adverse Effect	Prevalence	Management
Nausea	~20%	Dose adjustments and dietary modifications.
Diarrhea	~15%	Symptoms typically resolve with use.
Thyroid Tumors	Potential risk	Monitoring required for high-risk patients.
Pancreatitis	Rare	Immediate cessation if symptoms develop.

Tirzepatide is contraindicated in individuals with a history of medullary thyroid carcinoma (MTC) or Multiple Endocrine Neoplasia syndrome type 2 (MEN 2).

Regulatory Approvals and India-Specific Considerations

Globally, tirzepatide has gained approval in regions such as the United States, European Union, and Middle East for managing obesity and diabetes. In India:

Approval Status:

Approved on June 19, 2024, for chronic weight management in prefilled pens and single-dose vials (2.5 mg to 15 mg).

Conditional upon Phase-IV clinical trials to ensure safety and efficacy in India's diverse population.

Challenges:

- Affordability: Global pricing may be prohibitive for many Indian patients. Local production or subsidies are essential.
- Accessibility: Rural healthcare systems need to integrate training for injectable therapies.
- Awareness: Education campaigns for physicians and patients are crucial for adoption.

Practical Prescribing Considerations for Indian Physicians

1.Patient Selection:

- Suitable for adults with T2D and obesity unresponsive to conventional therapies.
- Avoid in patients with MTC, MEN 2, or severe gastrointestinal diseases.

2. Dosing Guidelines:

- Start with 2.5 mg weekly, titrating up to a maximum of 15 mg.
- Rotate injection sites to reduce local reactions.

3.Monitoring:

- Regular assessment of HbA1c, weight, and potential adverse effects.
- Watch for signs of pancreatitis or thyroid abnormalities.

4. Lifestyle Integration:

Advocate dietary and physical activity interventions tailored to Indian habits.

Future Directions

1. Real-World Evidence: Phase-IV trials in India will provide insights into long-term safety and efficacy.
2. Policy Initiatives: Government-backed pricing models can enhance accessibility.
3. Telemedicine Role: Teleconsultations can bridge the gap in rural areas, supporting patient adherence.

Conclusion

Tirzepatide revolutionizes the management of T2D and obesity by offering unprecedented outcomes in weight loss and glycemic control. For India, where these metabolic disorders impose a significant health and economic burden, tirzepatide represents a transformative solution. Its dual GLP-1 and GIP receptor agonism not only improves therapeutic efficacy but also broadens the scope for addressing multifaceted metabolic dysfunctions.

However, achieving its full potential requires overcoming challenges related to cost, awareness, and infrastructure. Indian pharmacologists and clinicians play a pivotal role in ensuring safe and effective use through patient-centric strategies and lifestyle integration. With equitable access and policy support, tirzepatide can significantly advance India's fight against obesity and diabetes, heralding a new era in metabolic healthcare.

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Dyslipidaemia in Pregnancy

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Introduction

Normal alterations in lipid metabolism during pregnancy are linked to healthy mothers and are crucial for the growth and development of the foetus. But because of the obesity pandemic, we are now more often faced with patients who have undiagnosed cardiovascular illness during pregnancy or cardiovascular illness that develops prior to gestation. Furthermore, there is a more pronounced alteration of atherogenic lipid profiles in subgroups of gravid women who have either preeclampsia or gestational hypertension with diabetes or both. Studies in recent years have connected these changes in lipogenesis to perinatal morbidity and death, establishing the discipline of dyslipidaemia in pregnancy as an emerging field for outcomes research.

Physiology of lipids during pregnancy

Regarding magnitude, glucose is the most important nutrient that passes through the placenta. During the initial two thirds of pregnancy, the mother's fatty deposits grow because of both hyperphagia and enhanced lipid synthesis. During this period, the lipoprotein lipase (LPL) function within adipose tissue remains constant and may even rise. However, throughout the final trimester of pregnancy, there is an even greater decrease in LPL activity, which causes maternal blood triglycerides (TG) to rise and maternal fat deposits to diminish more quickly, while rises in both cholesterol and phospholipids subside. Maternal hypertriglyceridemia (HTG) and triglyceride deposition in low-density lipoproteins (LDL) and high-density lipoproteins (HDL) are caused by a rise in the synthesis of TG-enriched very low-density lipoproteins (VLDL) by the hepatic system because of a greater release of estrogens throughout pregnancy.

Normal Gestation

Increases in lipid content as gestation advances and anticipated alterations in lipid metabolism are linked to normal pregnancy. Maternal adipocytes exhibit significant deposition and hypertrophy throughout the first trimester, accompanied by a higher expression of receptors for insulin, resulting in the availability of glucose to fulfil the growing foetus's metabolic needs.3. Lipids play a crucial role in foetal growth and development, as evidenced by the increased generation of lipids and decreased lipolysis that result from a rise in maternal insulin and progesterone synthesis. These lipids are subsequently transferred across the placenta and processed.

Triglycerides (TG) and total cholesterol (TC) both increase during pregnancy, but TG increases more than total cholesterol (TC) or other lipid fractions, reaching levels that are two to four times higher than pre-pregnancy by the third trimester. These alterations, however, are thought to be largely non-atherogenic and quickly return to their pre-pregnancy levels after delivery. Changes in the makeup and dimensions of LDL particles are also linked to pregnancy. Prior research has shown that there is a drop in total LDL particle size and an increase in the fraction of more compact, dense LDL particles, which are assumed to be more atherogenic, when TG levels rise.

During a normal pregnancy, levels of apolipoprotein A-I and HDL-C also rise, reaching their highest points in the second trimester. Research has indicated that the mother may have a preventive impact to counteract increases in TG and atherogenic LDL-C levels. When comparing multiparous women to their primiparous counterparts, multiparous women typically have lower relative HDL-C levels. The correlation between

decreased HDL-C levels and elevated LDL-C fractions seems to be particularly prominent in preeclamptic and prenatal hypertensive women. Moreover, there is a correlation between elevated amounts of tiny high density LDL fractions during gestation and a larger chance of cardiovascular illness in the future.

Hypercholesterolaemia and pregnancy

Effect of hypercholesterolaemia on pregnancy: Maternal physiological hypercholesterolemia is the term used to describe the normal physiological elevation in a woman's plasma total cholesterol (TC) of 30% to 50% during pregnancy. The initial stage of arteriosclerosis and the first arteriosclerotic lesions is the kind of fatty striae that begins in intrauterine life in foetal vasculature due to elevated total cholesterol levels among women with hypercholesterolemia, endothelial dysfunction, and these conditions. Moreover, some studies have found that HTG plays a role in the progression of pre-eclampsia in pregnant women.

Use of statins in pregnancy: Most clinical recommendations and scientific consensus statements recommend against using statins during pregnancy because of the risk of teratogenesis, particularly during the first trimester. Since the United States- Food and Drug Administration (US-FDA) has categorized all statins as category X, it is recommended to avoid using them for at least a month prior to conception, as well as during pregnancy and lactation.

Other therapeutic options in pregnancy: Less is known about the teratogenic consequences of other lipid-lowering drugs. Moreover, ezetimibe, fibrates, and nicotinic acid are classified as category C drugs by the FDA. It is not advised to use them while nursing or while pregnant. Among the medications in category B are mipomersen, cholestevelam, and bile acid sequestering resins. Cholesevelam and cholestyramine are the only medications permitted for use during pregnancy, even though cholestyramine is classified as a category C drug. This is because these drugs are not released into the systemic circulation and are unlikely to increase the risk of congenital defects.

Hypertriglyceridaemia in pregnancy

Lipid metabolism throughout pregnancy and pathogenesis of hypertriglyceridaemia-induced pancreatitis: During the final trimester of pregnancy, plasma triglyceride concentrations increase two to four times, but they seldom go above 300 mg/dL. Pregnancy-related severe hypertension (HTG) is an uncommon event that typically appears in the third trimester. The mother is at risk of acute pancreatitis (AP) because of this clinical circumstance. In contrast, the incidence of AP is one in 1000–12,000 births. During pregnancy, idiopathic AP, severe HTG, and cholelithiasis are among the most frequent causes of AP. This clinical setting calls for rapid intervention, mostly in the form of dietary modifications and, if the stage of gestation allows, termination of pregnancy is done.

Diagnosis of acute pancreatitis in pregnancy: It may be challenging to differentiate the signs of acute pancreatitis during gestation from those of other causes of discomfort in the abdomen, including the onset of labor. Blood testing is recommended first. For some analytical features, both lipase and amylase are considered good markers of AP during pregnancy. While lipase levels stay constant during gestation, plasma amylase concentrations are either normal or slightly elevated. An indication of a biliary cause is an accompanying rise in alkaline aminotransferase greater than three times the upper limit of normal. The first line of action is abdominal ultrasonography to rule out biliary causes.

Prevention and management of hypertriglyceridemia and acute pancreatitis during pregnancy

Low fat diet and nutritional therapy: Regardless of whether one is pregnant or not, the cornerstone for treating severe hypertension is an incredibly reduced-fat diet (less than 20% of total calorie consumption). On the other hand, low-fat diets may result in a deficit of essential fatty acids; hence, therapy with medium-chain triglycerides (MCTS) or omega-3 fatty acids is crucial.

Lipid-lowering drugs for manging HTG in pregnancy: The mainstay of care for non-pregnant women with acute pancreatitis due to HTG is lipid-lowering drugs. Omega-3 polyunsaturated fatty acids, which include docosahexaenoic and eicosapentaenoic acid, reduce plasma total cholesterol (TG) by 25% to 30% through a variety of mechanisms. Even though they are in FDA category C, they are thought to be safe and advised for use. The utilization of fibrates in pregnancy is limited due to a lack of evidence from well-designed studies. However, in numerous cases where fibrates were given during pregnancy, no teratogenic consequences have

been documented. Pregnant women should not take statin.

Use of Insulin and heparin: Heparin and insulin both increase the production of lipoprotein lipase, which interacts with endothelial cells and reduces blood TG levels.

Plasma exchange therapy: This is advised for replenishing LPL or apolipoprotein shortage, decreasing plasma TG levels, and lowering cytokines associated with inflammation. The American Society of Apheresis recommends plasma exchange for acute pancreatitis secondary to HTG. When plasma exchange therapy was compared with conventional treatment in cases of HTG-induced AP, no statistically significant differences in mortality or morbidity was documented.

Conclusion:

Pregnancy offers a special chance to identify subclinical dyslipidaemia. A rise in lipid production during a normal gestation helps to support the normal growth and development of the foetus. Evidence, however, is mounting that atherogenic dyslipidaemia, which is defined by elevated TG, tiny dense LDL, and low HDL-C levels, increases the risk of both unfavourable pregnancy outcomes and cardiovascular disease in later life when present before pregnancy and early gestation.

Pregnant females with monogenic hypercholesterolemia, especially those with severe HTG, pose a clinical difficulty even though hyperlipidaemia is normal throughout pregnancy. Therefore, consensus standards or management algorithms are needed. Furthermore, research should be done on diet, plasma exchange, and whole parenteral nutrition as therapeutic options because lipid-lowering medications are relatively not recommended during pregnancy.

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LANTIBIOTICS VS ANTIBIOTICS

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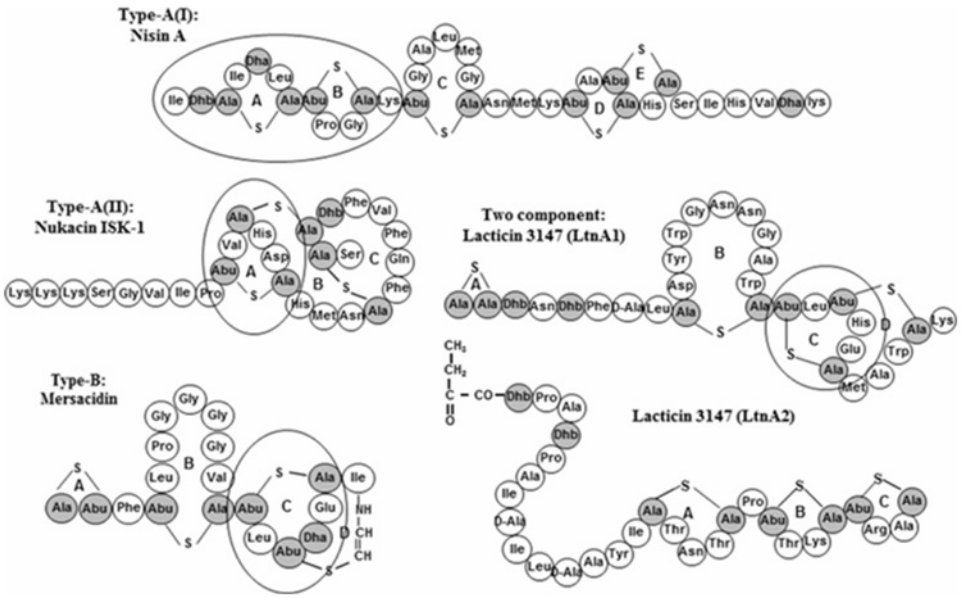
NTRODUCTION

To endure in the competitive environment, many bacteria of different taxonomic branches and residing in various habitats produce antimicrobial substances that are active against other bacteria. Ribosomally synthesized antimicrobial substances from bacteria are traditionally known as bacteriocins [1]. Bacteriocins from Gram-positive bacteria are broadly classified into two main classes: (i) post-translationally modified bacteriocins, such as lantibiotics, and (ii) non-modified bacteriocins. Lantibiotics are ribosomally synthesized antimicrobial peptides produced by Gram positive bacteria such as Streptococcus and Streptomyces to attack other Gram-positive bacteria. They undergo posttranslational alterations which result in the formation of unusual amino acids, such as dehydroalanine (Dha) and dehydrobutyrine (Dhb), as well as the eponymous lanthionine/ methyllanthionine residues. Lanthionine is composed of two alanine residues that are crosslinked on their β-carbon atoms by a thioether (monosulfide) linkage. Lantibiotics are subclassified on the basis of their biosynthetic technology and the amino acid sequence of the structural peptide[2]. The most characterized lantibiotic is nisin A (subclass 1), which has been used in the dairy and food industries for decades. It is a 3,353-Da, cationic, linear peptide of 34 amino acids, produced by *Lactococcus lactis subsp. lactis*, that contains five intramolecular ring structures. It has a dual mode of action-prevents cell wall biosynthesis and also forms pores in the cell membranes of susceptible cells[3].

HISTORY

The name lantibiotics was introduced in 1988 as an abbreviation for «lanthionine-containing peptide antibiotics».[4] The first structures of these antimicrobial agents were produced by Gross and Morell in the late 1960s and early 1970s, thus marking the formal introduction of lantibiotics.

Figure 1 | Representative examples of different types of lantibiotics
The shaded residues indicate the unusual amino acids, derived after post-translational modification. Abu-S-Ala, β-methyl-lanthionine; Ala-S-Ala, lanthionine; Dha, dehydroalanine; Dhb, dehydrobutyrine. Different rings of individual lantibiotic are indicated by capital letters. Residues within the large circles are proposed to be involved in lipid II binding.



CLASSIFICATION

Type A lantibiotics are long flexible molecules - e.g., nisin,bisin,subtilin,epidermin,gallidermin[5].Subgroup AI includes mutacin II; subgroup AII includes mutacin I and III. Type B lantibiotics are globular - e.g., mersacidin. [6][7] actagardine, duramycin, and cinnamycin.[8] Some contain 2 peptides, e.g. haloduracin[9]. [Fig 1] *(page no. 9)*

BIOSYNTHESIS

They are synthesised with a leader polypeptide sequence that is removed only during the transport of the molecule out of the synthesising cell. They are synthesized by ribosomes, which distinguishes them from most natural antibiotics.[10] There are four known enzymes (lanthipeptide synthetases) responsible for producing lanthionine rings.[11][12].

DISTINGUISHING FEATURE

Lantibiotics are intriguing because of their unique biochemistry, genetic regulation, range of biological functions and potential for engineering unique protein structures [13]. Many lantibiotics show promising activity towards a variety of pathogenic bacteria including MRSA (methicillin resistant Staphylococcus aureus) and VRE (vancomycin resistant Enterococcus) [14].

MECHANISM OF ACTION

Type-A(I) lantibiotics: nisin, subtilin and related peptides

Membrane interaction, insertion and pore formation

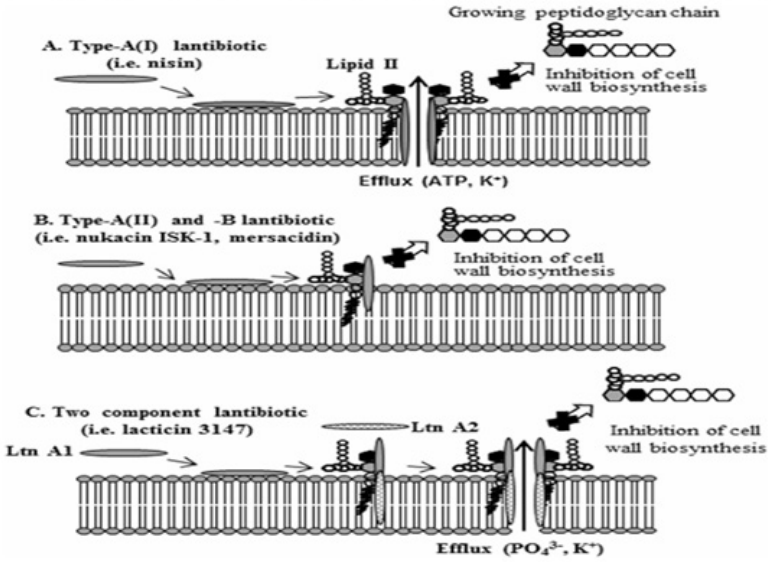
A typical type-A lantibiotic is a flexible elongated peptide with a net positive charge (Figure 1) Nisin and related lantibiotics of this group show bactericidal activity against a wide range of Gram-positive bacteria[15]. Nisin forms poration complexes in target cell membranes through a multistep process which includes binding and insertion [16–18] (Figure 2A). However, precisely how pore complexes are formed is not yet known.

The interaction between nisin and membrane components of sensitive cells is considered **important for nisin's mode of action**. Anionic lipids in the membrane may serve as functional nisin-binding sites. The cationic nature of nisin allows it to bind to lipid bilayers through electrostatic interactions with phospholipid headgroups [19]. Nisin insertion into the membrane is mediated by the hydrophobic residues in the N-terminal part [20]. Several studies have suggested that insertion is followed by aggregation of nisin monomers [21,22,23]. It is unknown how many monomers are required to form a pore, but it is probably a dynamic process in which peptides are joining and leaving the transmembrane oligomer pore complex [24].

Lipid II-mediated antimicrobial mechanism

Lipid II represents the central cell wall building block of the peptidoglycan biosynthesis that is structurally conserved among bacteria. Nisin has a unique mode of binding to lipid II, entirely different from

Figure 2 | Proposed model for the mechanism of action of different classes of lantibiotics
(**A**) Type-A(I) lantibiotics (i.e. nisin) initially interact with the membrane and then bind with lipid II, stabilizing the complex and making the poration complex in the target site. At the same time, they sequester lipid II that causes cell wall biosynthesis inhibition. (**B**) Type-A(II) (i.e. nukacin ISK-1) and -B (i.e. mersacidin) lantibiotics interact with lipid II, resulting in inhibition of cell wall biosynthesis. (**C**) Two-component lantibiotics (i.e. lacticin 3147) interact with cell membrane by A1 peptide and followed by binding with lipid II. This triggers a conformational change of A1 peptide, whereupon a high-affinity binding site is generated for the A2 peptide, which is followed by pore formation. They also inhibit cell wall biosynthesis.



glycopeptide (i.e. vancomycin). A defined network of five intermolecular hydrogen bonds between nisin's peptide backbone and the pyrophosphate moiety of lipid II are responsible for association [25]. Surprisingly, nisin variants that do not form pores, but do bind to lipid II, were found to kill bacteria efficiently.

CONCLUSION

Owing to the emergence of multidrug-resistant pathogens, development of new therapeutic agents is now indispensable to fight infectious diseases. Lantibiotics are one of the promising candidates to replace the traditional antibiotics, because of their diverse structure and unique mode of action. Most of the lantibiotics target lipid II in a variety of ways and this specific target now enables rational design strategies for clinical development of potential drugs[26].

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First Drug Approved for Treatment of Liver Fibrosis due to Non- Alcoholic Steatohepatitis

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The U.S. Food and Drug Administration approved Rezdiffra (resmetirom) on March 14, 2024 for the treatment of adults with noncirrhotic non-alcoholic steatohepatitis (NASH) with moderate to advanced liver scarring (fibrosis), to be used along with diet and exercise.(1)

Drug Information: Resmetirom is a partial agonist of the thyroid hormone receptor-beta (THR-beta), which is the main thyroid hormone receptor in the liver.(2,3) By activating this receptor, it helps reduce triglyceride levels in the liver. Lowering these lipid levels is important because elevated levels are associated with NASH and symptoms like liver inflammation, fibrosis, and cirrhosis.

Resmetirom is the first drug approved for NASH by US FDA.(1,4) The approval was granted to Madrigal Pharmaceuticals under the accelerated approval program and also included breakthrough therapy, fast track, and priority review. This means continued approval will depend on clinical benefits, which will be assessed through the outcomes of ongoing 54-month Phase 3 MAESTRO-NASH trial.(5)

The safety and efficacy of Resmetirom was evaluated on the basis of an analysis of surrogate endpoint at 12 months in a 54-month, randomized, double-blind placebo-controlled trial. The surrogate endpoint assessed the level of liver inflammation and fibrosis, and the main findings observed were as follows:

- NASH resolution without worsening fibrosis in 25.9% (80 mg) and 29.9% (100 mg) of patients, versus 9.7% for placebo.
- Fibrosis improved by at least one stage in 24.2% (80 mg) and 25.9% (100 mg) of patients.
- LDL cholesterol levels dropped by 13.6% (80 mg) and 16.3% (100 mg), compared to 0.1% with placebo.

Prescriber's Information: Resmetirom is indicated in treatment of adults who have NASH with moderate to advanced stages of liver fibrosis (consistent with stages F2 to F3 fibrosis), alongside diet and exercise.(6)

Dosage is based on actual body weight:

Less than 100 kg: 80 mg orally once a day 100 kg or greater: 100 mg orally once a day

Side Effects: The most common side effects (affecting at least 5% of patients) include diarrhoea, nausea, itching, vomiting, constipation, abdominal pain and dizziness. It may also cause serious side effects, including liver injury (hepatotoxicity), cholelithiasis, cholecystitis, or inflammation of the pancreas from gallstones.(7) Due to this, healthcare providers should monitor liver enzymes and the development of liver-related side effects. It should not be used in people with moderate-to-severe liver disease (Child-Pugh Class B or C). The safety and effectiveness of resmetirom has not been established in patients with NASH cirrhosis. No dose adjustment is required in patients with Child-Pugh Class A. Safety

of Resmeritom has not been established in children under the age of 18 years and during pregnancy and breastfeeding.

Drug Interactions:

Resmetirom has several drug interactions that may increase the risk of adverse effects:

- **CYP2C8 Inhibitors**: Resmetirom's metabolism is affected by CYP2C8. Strong inhibitors like gemfibrozil can greatly increase its levels, and their use is not recommended. With moderate inhibitors, like clopidogrel, reduce the Resmetirom dose.
- **OATP1B1 and OATP1B3 Inhibitors**: Inhibitors such as cyclosporine elevate Resmetirom levels, so concurrent use is discouraged.
- **Statins**: Resmetirom raises levels of certain statins (e.g., rosuvastatin, simvastatin), increasing the risk of muscle toxicity. Limit rosuvastatin and simvastatin to 20 mg daily, and pravastatin and atorvastatin to 40 mg.
- **CYP2C8 Substrates**: Resmetirom mildly inhibits CYP2C8, which may heighten side effects of these drugs. Monitor patients closely when used together.

References:

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8. Petta S, Targher G, Romeo S, Pajvani UB, Zheng M, Aghemo A, et al. The first
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Artificial Intelligence in Medical Teaching

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As the rate of medical knowledge grows, technologies like Artificial Intelligence (AI) are needed to enable healthcare professionals to effectively use this knowledge to practice medicine.

With medical information growing at an enormous speed, physicians are having trouble keeping up. Physicians today are working longer hours and are expected to deliver proper care in this society with complex conditions and co-morbidities where healthcare-costs are increasing, and regulations are putting an additional burden on doctors.

A large part of medical training focuses on consuming as much information as possible and learning how to apply this knowledge to patient care. This process is still largely based on memory. Little time is spent on familiarizing medical students or residents with new technologies such as AI, mobile healthcare applications and telemedicine.

To achieve a curriculum change, many political and bureaucratic hurdles must be overcome. Educational systems, program structures and objectives need to change to create new learning outcomes. A change can only be implemented when large amount of evidence is generated. Many senior physicians have little to no experience with AI. AI training could be delivered via Continuing Medical Education (CME) programs and might need to be taught also by educators from outside the medical community.

An approach to introducing AI could be to incorporate this during courses like Evidence Based Medicine (EBM). As the student is taught to appraise evidence through databases like PubMed or diagnostic tests or systematic reviews, this process could be augmented by applying concepts from data sciences, applying AI technologies like Natural Language Processing (NLP) and analysing scenarios to test them on questions of ethics and liability.

Learners in the digital age are different from past generations. They are growing in a digital world and highly value social connections. This generation of learners prefers to work in groups and share the details of their activity with their fellow learners using different software applications.

Curriculum development and analysis, learning, and assessment are the areas in which AI can be used in medical education. AI can reduce the time it takes to review various curricula, solve multidimensional problems, improve classification accuracy, and indicate a relationship between the parameters in curriculum assessment.

Virtual patient and augmented reality simulations can provide realistic clinical scenarios without endangering patients and help medical students learn and participate more effectively.

The capability of AI to modify and personalize the learning process is one of the most critical future possibilities in medical education. AI can deliver adaptive instructional content that is suitable for

each student's knowledge gaps and learning speed by analysing enormous amounts of data and utilizing machine learning algorithms.

Educational institutions and healthcare organizations must make investments in cutting-edge computing hardware, data storage, and secure networks if they want to fully benefit from AI. The establishment of uniform standards, frameworks, and guidelines requires collaboration between academics, businesses, and regulatory institutions if AI is to be used successfully in medical education.

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Pavblu (aflibercept - Ayyh) injection

FDA approved new aflibercept biosimilar.

Mechanism of action:

It is a recombinant fusion protein that works by blocking Vascular Endothelial Growth Factor (VEGF) to prevent abnormal blood vessel growth within eye and to slow down or reduce damage to retina and help reverse vision.

Indications:

It is a biosimilar to Eylea indicated for treatment of patients with

· Neovascular (wet) Age related Macular Degeneration (AMD),

· Macular Edema following Retinal Vein Occlusion (RVO),

· Diabetic Macular Edema (DME),

· Diabetic Retinopathy (DR).

It doesn't have interchangeability designation.

Contraindications:

· Ocular / periocular infections, hypersensitivity reactions, and active intraocular infections.

Precautions:

· Endophthalmitis, retinal detachment, and retinal vasculitis may occur following intravitreal injection. Proper aseptic precautions must always be taken when administering PAVBLU.

· Increase in intraocular pressure has been seen within 60 minutes of intravitreal injection. Intraocular pressure should be monitored appropriately.

· Potential risk of arterial thromboembolism events following intravitreal use of VEGF inhibitors.

Adverse reactions:

· Conjunctival hemorrhage

· Eye pain

· Cataract

· Vitreous detachment

· Vitreous floaters

· Increased intraocular pressure.

Patients are advised not to drive or use machinery until visual function has recovered sufficiently.

References:

Fifth Eylea biosimilar FDA approved: Amgen's Pavblu (alifbercept-ayyh). Venable 2024. https://www.jdsupra.com/legalnews/fifth-eylea-r-biosimilar-fda-approved-6326603/

Jeremias S. FDA approves biosimilar Enzeevu for eye conditions. The Center for Biosimilars 2024. https://www.centerforbiosimilars.com/view/fda-approves-biosimilar-enzeevu-for-eye-conditions

AI and Health care

Artificial Intelligence (AI) is defined as " a system's ability to correctly interpret external data and to use those learning to achieve specific goals & tasks through flexible adaption." AI uses complex computer algorithms to evaluate human cognition albeit with far reaching capabilities of analyzing large datasets. The incorporation of AI is increasing in health care services as it is expected to improve health care delivery by making health care accessible and affordable with improvement in the quality of care actually provided. As for example MRI scans can be read automatically by AI as well as radiology professionals. Tuberculosis which is common in India can be screened using AI and Mammography scans can be used to predict through AI, the onset of breast cancer before clinical signs and symptoms appear.

The induction of AI into healthcare has the potential to be the solution for significant challenges faced in the field of healthcare like diagnosis and screening, therapeutics, preventive treatments, clinical decision making, public health surveillance, complex data analysis and prediction of disease outcomes. This list is likely to grow continuously in future diagnostics and screening.

AI technologies provide an edge in diagnosing diseases. AI provides the hope to tackle the diagnosis. Screening button on the healthcare system. As per the National Academics of Science, Engineering and Medicine report, postmortem studies have shown that around 10% of patients deaths can be due to diagnostic errors. They also reported the rate has gone up to 17% of adverse events which is preventable. As per the review of medical records it is envisaged that AI based technologies might help reduce human error in healthcare and have the potential of enhancing various methods of screening and diagnosis of disease, ultimately improving diagnostic accuracy and getting evidence based treatment algorithms predicting outcomes. This have an overall impact on human health and wellness, as well as recently been used to predict genetic makeup based on body phenotypes.

Epidemiology is the cornerstone of public health guides, policy decisions and evidence based practice. The AI science involves scientification of the factors and determinants of the disease and the trends, patterns and predictions of disease. Conventional methods of data collection involve one or two sources, but AI methods have the potential to integrate data from separate sources, namely surveillance, administrative, hospital data, registries and General practitioner clinics to provide meaningful evidence.

AI and ML(machine learning) tools allow handling large amount of diverse database efficiently with the high accuracy of our data-driven solutions for predicting the risk and strategies to mitigate them. For example, during the initial times of the COVID-19 pandemic, many countries use AI based measures, so early detection and tracing the context to monitor the spread of the disease.AI solutions through medical image interpretation, scrutinizing societal behavior in health and medical records can provide decision and support systems both at an individual level and for large scale preventive intervention planning. It can help in reducing risk factors and hazardous explosives in places like geographic information system sources and automation services.

Behavioral and healthcare -

Medical AI models provide significant possibilities in behavioral and mental health treatment. Medical AI mproves psychology and psychiatric procedures in a variety of ways, including assistance patients in receiving a diagnosis, activity, managing their symptoms between in person consults, predicting and preventing probable flare ups, and more. Individuals with several mental behavioral conditions exhibit distinguishable symptoms that may be diagnosed by variable output.Patients tone of voice, body language and various other factors AI psychology and psychiatric models utilise patients data to keep active in their self-care to assure better treatment of their illness and optimal mental and behavioral health are one of the potential use of AI in mental health. While mental

disorders can be associated with social stigma and many people struggle to express their thoughts and feelings directly. Mental health chat boxes provide an opportunity for individuals who are innovative to seek direct professional psychology and psychiatric help to take their first step towards self-care in this approach.

AI approach on mental health can give initial assistance for people who are not ready for professional or non professional care, as well as augmented support in between interactions with psychologists, psychiatrists and peers.

Health management system using AI.

AI has a potential of improving and optimizing operational functions in a healthcare setup or healthcare organization. Healthcare management in case scheduling, admission, electronic medical records, counting, billing, claims, settling that involves repeated task and high level of scrutiny. By leveraging AI power tools and automated processes, the productivity could be enhanced, operational clinical workplace could be improved, and operating cost for healthcare practice could be reduced. Robotic process automation. Capable of advanced financial accounting, medical billing and claims, NLP can automate clinical documentation thus reducing the turn around time.

AI healthcare administration tools can help in inpatient and outpatient scheduling, interdepartmental coordination and patient alerts for optimizing the functionality. Thus, AI technology could be useful both in patient care and in back office operations, thereby boosting productivity in the health sector. Medical AI software for clinical managed system has the potential to make clinic manage.System more autonomous, efficient and functional custom.Mill is rapidly being used to accomplish task that were previously complicated.By involvement of employees, task scheduling and appointment may be automatically modified to meet the changing conditions, with assignments and timetables adjusted on the family and notifications provided to relevant physicians and other stuff to match the redirected processes.

CMS model also makes it easier for clinicians to store EMR and patients to access it, providing for quick access and preservation of health and treatment history for spiritual decision making based on a more comprehensive understanding of the patient's unique health profile.Medical health care with AI can assure the accuracy of recorded medical data by promoting follow up queries when certain symptoms are reported. These models can also assist in locating a qualified specialist in a patient's insurance network and shared partner information for future diagnosis, consolidation and treatment. CMS models may also be employed to check the medical billing and claim certification that any prescriptions given are appropriate for the insurance benefit of the patient's individual plan and pharmacy.

These AI models may also.Advanced financial accounting parameters to Content Management System allowing administrators to better balance expenses and if a new potential for efficiency improvement in their firm. Medical air software for hospital management system can enhance the hospital management system in the same manner that Content Management System could. Hospital have unique issues that may provide greater potential for the better functioning using AI technology. Medical AI may aid in the administration of inpatient and outpatient scuddling.Where decisions on patient rotation can be made based on a range of parameters such as prognosis, prior health history, treatment response, available, personal and more.

AI technology such as machine learning is being used in the field of drug discovery and epitope identification for vaccine development and has the potential to accelerate the process and make it more cost effective. Precision medicine, as the word suggests, explores the possibility of driving personalized treatments based upon individuals unique characteristics such as age, gender, race, family history, and genomic variation. Machine Learning Algorithms utilize large datasets such as genomic, sociodemographic, and electronic medical records for predicting disease outcomes. Genetic based analysis and personalized drugs to target specific health conditions using AI technology can guide treatment plans. Clinical care. Healthcare demand is ever rising and countries are facing a shortage of skilled workforce. Advances in air have been opened up new opportunities to tackle this shortage.

Telemedicine and self-care, interactive chat bots, digital monitoring devices like.Variable is one of the access which have shown significant development in the recent years. This also provides an alternative for remote monitoring and doing the early signs of disease by healthcare workers.Natural language

processing is being utilized to analyze unstructured data like position clinical notes. To facilitate clinical decision making Google Deep Mind and IBM Watson Analytics have been developed. AI part tools including mobile based medical assistant diagnostics, clinical decision tools and prognostic prediction tools for improving overall patient outcomes. AI technology can assist in self monitoring personal health related parameters like.Intake of nutrition, physical activity, blood pressure, glucose, lipids for entering high risk groups, AIB cell coaching systems and smartphone apps using new real networks and available methods could provide solutions for medications, adherence, motivation, reminders and building a care network. Chat Generative Pre- trained Transformer and robotic assistants can empower patients in self management of non chronic disease and improved decision making.

AI is growing in almost all sectors and health care professionals should be equipped to handle it in an effective manner.

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Case Study: Oral Contraceptive Pills in Young Women

Abstract:
Oral contraceptive pills (OCPs) are widely used for contraception and managing gynecological conditions in young women. This article examines a detailed case study, highlighting the pharmacological mechanisms, clinical applications, adverse effects, and psychosocial considerations of OCP use. Through a structured discussion, we explore the benefits and risks to optimize therapeutic outcomes while ensuring patient safety.

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Introduction:

Oral contraceptive pills, introduced in the 1960s, have become a cornerstone of reproductive health. They are classified into combined oral contraceptives (COCs) containing estrogen and progestin, and progestin-only pills (POPs). OCPs not only provide effective contraception but also address menstrual irregularities, acne, and hormonal imbalances. However, their use is not devoid of risks, necessitating a personalized approach to prescribing. This article provides an in-depth analysis through a case study.

Case Background:

Patient Profile: Name: xyz Age: 23 years

Chief Complaint: Persistent acne and irregular menstrual cycles.

Medical History: No history of smoking or chronic illnesses; no family history of thromboembolism.

Discussion:

OCPs work primarily by suppressing ovulation through inhibition of gonadotropins (FSH and LH). Additional mechanisms include:

1)Thickening cervical mucus, making it impermeable to sperm.

2)Modifying the endometrium to prevent implantation. COCs combine the effects of estrogen and progestin, while POPs rely solely on progestin, suitable for women contraindicated for estrogen.

Adverse Effects:

- Nausea and Vomiting
- Breakthrough Bleeding
- Breast Tenderness and Mood Changes
- Venous Thromboembolism (VTE): Increased risk in smokers or women with a predisposition.
- Hypertension: Prolonged use may raise blood pressure in some individuals.
- Liver Effects: Rare cases of hepatic adenomas with long-term use.

Clinical Presentation: : A 23 year female reported acne that had not responded to topical treatments and menstrual cycles occurring every 40–50 days with occasional heavy bleeding. Physical examination and investigations, including ultrasound, suggested polycystic ovary syndrome (PCOS) as the underlying cause.

Treatment Plan:: After counseling, patient was started on a combined oral contraceptive pill containing ethinylestradiol (30 µg) and cyproterone acetate (2 mg). This formulation was selected for its antiandrogenic effects, beneficial in acne and PCOS. She was advised to take the pill daily, starting on the first day of her menstrual cycle. Counseling covered adherence, potential adverse effects, and follow-up care

Therapeutic Applications:

Contraception: OCPs are over 99% effective with perfect use.

Menstrual Regulation: Helps in managing irregular cycles, dysmenorrhea, and menorrhagia.

Acne and PCOS: Antiandrogenic properties of certain progestins, such as cyproterone acetate and drospirenone, improve symptoms.

Other Benefits: Reduced risks of ovarian and endometrial cancers, treatment of endometriosis.

Risk Mitigation Strategies:

- Pre-prescription screening for contraindications (e.g., smoking, clotting disorders).
- Lower-dose estrogen formulations to reduce side effects.
- Regular monitoring and follow-ups.

Psychosocial Considerations: Such patients often face challenges, like

Compliance Issues: Forgetting daily doses can compromise efficacy.

Body Image Concerns: Addressing fears of weight gain or acne worsening.

Informed Decisions: Providing clear, evidence-based information fosters trust.

Case Outcome:

Patient reported significant improvement in acne and menstrual regularity within four months of therapy. Mild nausea during the first week resolved spontaneously. Regular follow-ups confirmed good adherence and no severe side effects. That patient expressed satisfaction with the treatment and its impact on her confidence and quality of life.

Conclusion:

Oral contraceptive pills offer a versatile solution for young women, addressing both contraceptive and non-contraceptive needs. While generally safe, they require careful selection based on individual health profiles to balance benefits against risks. This case emphasizes the importance of personalized care, patient education, and regular monitoring in achieving optimal outcomes.

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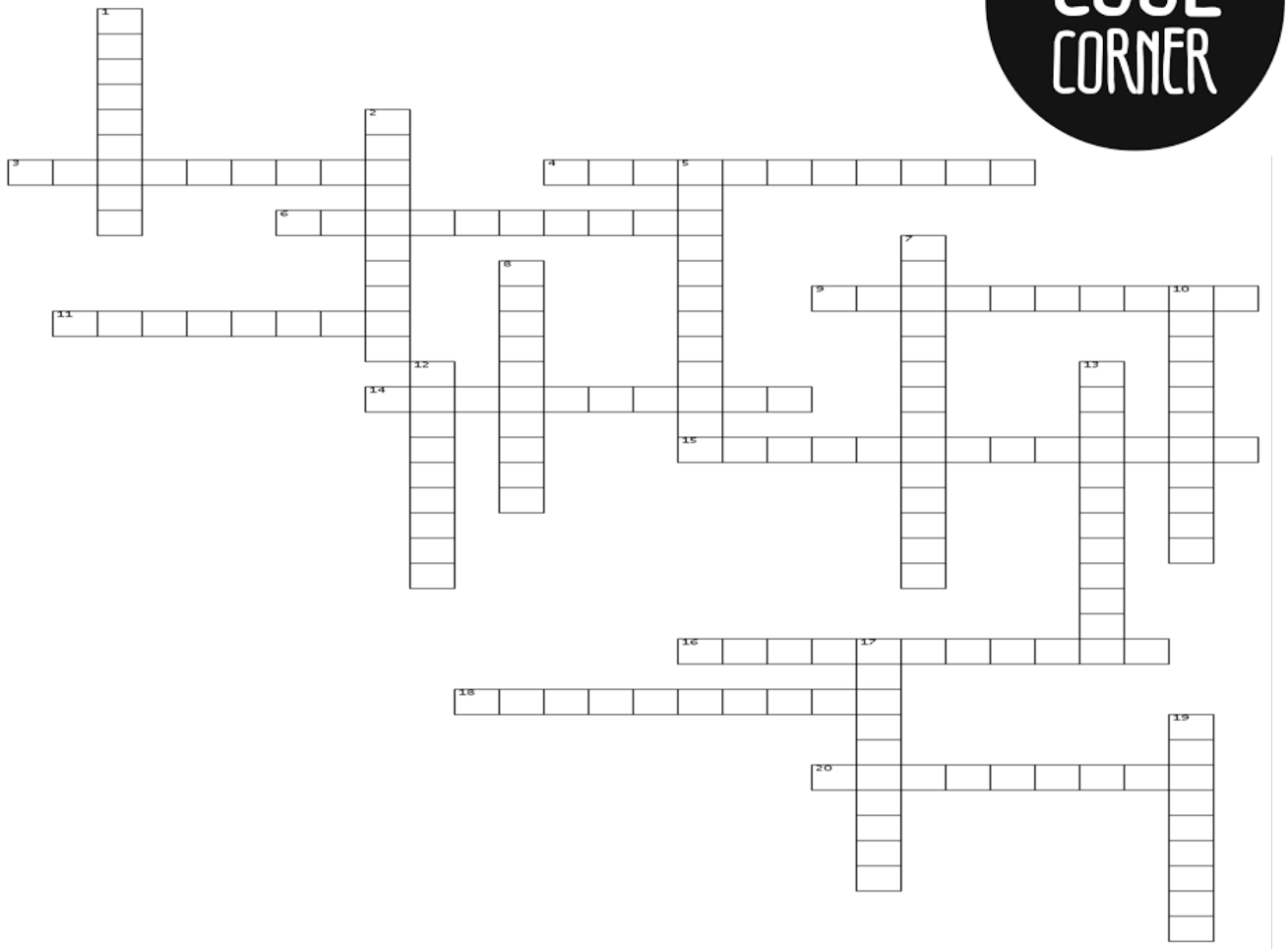
Pressure Points: The Hypertension Drug Puzzle

COOL CORNER



ACROSS

3. A unique approach, to stop renin's game, blocking the system to tame the flame.

4. It blocks them all, both beta-ways, plus stops migraines on stormy days.

6. The loop goes deep, it drains with power, in crises and fluid, it rules the hour.

9. It spares the K, keeps fluid at bay, in tough cases of high BP, it saves the day.

11. An ARB that's tough, often paired to fight, helping keep the BP light.

14. In resistant fights, this central knight, helps bring down numbers that gave us a fright.

15. A friend of hearts, helps sugar and BP align, in SGLT2's bright new design.

16. In hypertensive storms, this brings calm, a vasodilator that's true to form.

18. Alpha and beta blocker, bold and brave, for BP and heart, it's bound to save.

20. A growth-promoter, BP keeper too, with beta's help, it sees you through.

DOWN

1. Alpha-2 pro, for pressure high, it calms the numbers that reach the sky.

2. A non-steroid champ, for pressure high, it spares the kidney and keeps it dry.

5. When adrenaline flows, this blocker knows, in crises and tumors, it keeps blood lows.

7. A thiazide like no other found, keeps BP low and steady-bound.

8. ACE on high, with lasting might, it takes the pressure down just right.

10. In crisis mode, it plays the part, calcium blocked, with a steady heart.

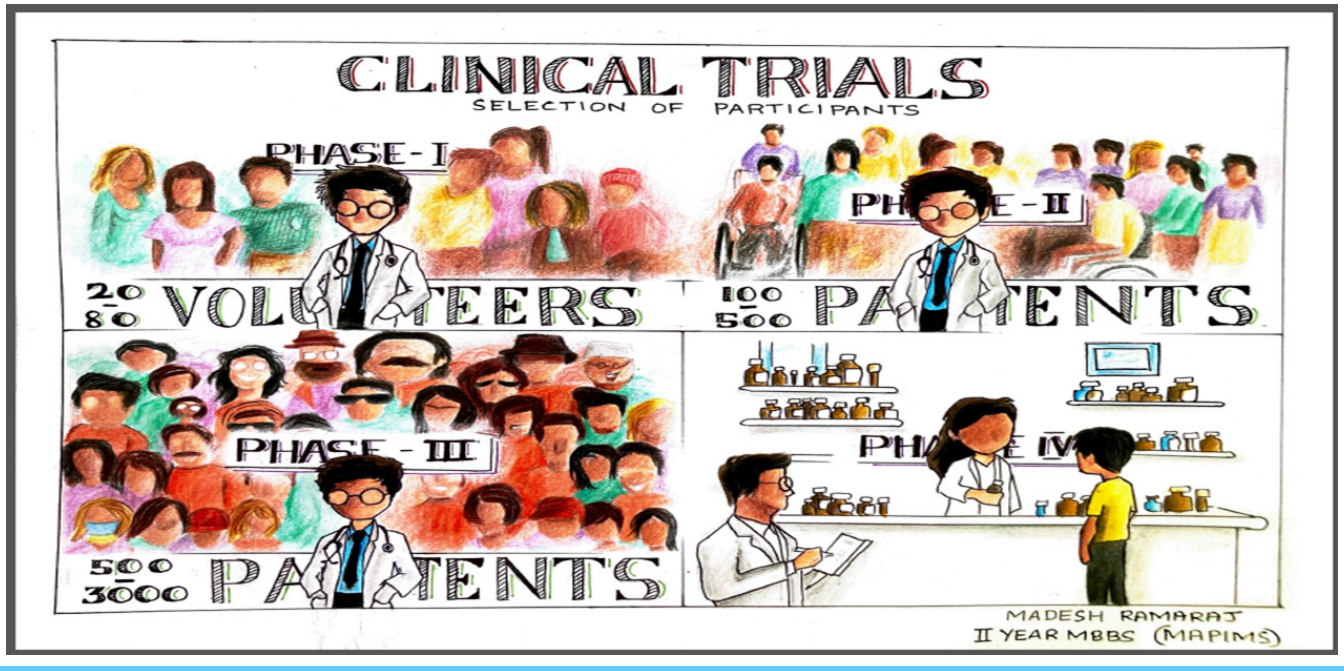
12. A loop that lasts, not fast to fade, for fluid and pressure, it's often played.

13. A new dual star, in BP fight so fierce, it reins in pressure that's hard to pierce.

17. The calcium king with steady reign, for pressure and angina pain.

19. An ARB quite the star, lowering pressure near & far


ANSWERS
CLONIDINE
ALISKIREN
FINERENONE
PROPRANOLOL
FUROSEMIDE
PHENTOLAMINE
LOSARTAN
LISINOPRIL
EPLERENONE
CHLORTHALIDONE
ICARDIPINE
MOXONIDINE
TORSEMIDE
APROCITENTAN
EMPAGLIFLOZIN
HYDRALAZINE
CARVEDILOL
AMLODIPINE
MINOXIDIL
VALSARTAN
Dr. Ayan Roy
Assistant Professor, Pharmacology
VIMSAR, Odisha


CLINICAL TRIALS
SELECTION OF PARTICIPANTS
PHASE-I
20-80 VOLUNTEERS
PHASE-II
100-500 PATIENTS
PHASE-III
500-3000 PATIENTS
PHASE IV
MADESH RAMARAJ
II YEAR MBBS (MAPIMS)

Extract

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What is EXTRACT

Extract are the collections of some important points taken from the discussion in National MD Pharmacology group. NMDP is a group of eminent pharmacologists from all over the country. The head of departments of pharmacology, deans, directors of institutions and people with significant contribution in the field of pharmacology are members of NMDP family. National association of Pharmacology and Therapeutics is promoted by NMDP group.

 # 2024 Admission Batch New NMC Guidelines: 92 competencies out of which 11 are certifiable. ENT and Ophthalmology again in Third Year, AETCOM competencies have changed to 2.2, 2.3, 2.5. AETCOM Module is updated, Now in both papers 1 question will be asked. IA marks 100 theory plus 100 practicals (except GM, GS OBG, Paedia -200 marks) SDL is added for appropriate competencies.

#About NMC Guideline: It was opined by experts that NMC will give only guidelines as per the advisory committee recommendations. Based on this at the institution level and university level, we should decide what needs to be done to achieve those competencies.

 # National Pharmacovigilance Week 17th – 25th September 2024: Drug safety and awareness activities were carried out all over the country. Amidst the celebrations concern was raised about lack of staff support to majority of AMCs from IPC and the difficulties which AMCs must face because of same.

#P.G. Thesis Evaluation: External examiner outside state will evaluate dissertation on the day of exams with value of 20 marks.

#Publishing Case reports: While publishing Case reports we should follow CARE guidelines. It will help to improve Transparency, Accuracy and Usefulness of the report.

#Public notice by AYUSH Ministry: The Union Ayush Ministry said it was illegal to advertise Ayurveda, Siddha, Unani, and Homeopathy drugs claiming miraculous or supernatural effects for the treatment of diseases stating such advertisements can mislead and endanger public health.

#World Mental Health Day 2024: Celebrated on 10th October and Theme was Mental Health at work

#World AMR Awareness Week 2024: Theme of the week was "Educate, Advocate, Act Now" and it was

Celebrated at national level from 18th – 24th November 2024. Training programmes, awareness sessions and seminars were organised on this occasion.

#Taking pharmacology to bed side: Many members opine that knowledge of pharmacology should be used directly for patient care and pharmacologist should take part in clinical rounds. Importance of prescription audit was also highlighted.

#NMC begins Registration-National Medical Register (NMR): NMC has initiated NMR registration process.

All the doctors eligible to practice in India will register and will have a unique ID.

AMAZING DRUG MOLECULES: Drugs Which Acts By Inhibiting The Enzymes [Part –2]

Drug molecules exert their pharmacodynamic therapeutic actions by inhibiting target enzymes and are useful in various pathophysiological clinical conditions.

ENZYME	DRUG
5α Reductase	Finasteride, Dutasteride
Aromatase	Anastrozole, Letrozole, Exemestane
11 β- hydroxylase	Metyrapone, Ketoconazole, Fluconazole
Cholesterol desmolase	Aminoglutethimide
Xanthine oxictase	Allopurinol
H+, K+ - ATPase	Omeprazole, Lansoprazole, Rabeprazole
3Na+, 2K+ - ATPase	Digoxin
Aldehyde dehydrogenose	Disulfiram
Alcohol dehydrogenase	Fomepizole
3 - Hydroxy - 3 - methylglutaryl - coenzyme A reductase [HMG – coA]	Atorvastatin, Fluvastatin, Lovastatin, Pravastatin, Rosuvastatin, Simvastatin
Dehydropteroate synthase	Sulfonamides
Dehydrofolate reductase [DHFR]	Trimethoprim
Topoisomerase II [DNA gyrase] Topoisomerase IV	Fluoroquinolones
Ornithine decarboxylase	Eflornithine [Difluoromethylornithine]
Topoisomerase II	Epipodophyllotoxins [Etoposide]
Tyrosine Kinase	Imatinib, Dasatinib, Nilotinib Erlotinib, Gefitinib, Sorafenib
Cholinesterase (chE)	Tacrine Physostigmine [Eserine], Neostigmine, Pyridostigmine, Edrophonium, Rivastigmine, Donepezil, Galantamine
Dipeptidyl peptidase - IV [DPP-IV]	Sitagliptin, Vildagliptin
Long chain 3 - ketoacyl - coA thiolase [LC 3 – KAT]	Trimetazidine, Ranolazine
Tyrosine hydroxylase	α - Methyl - P- Tyrosine
DOPA decarboxylase	α - Methyl Dopa
5' Deiodinase (5' DI)	Propylthiouracil, Propranolol [high dose], Amiodarone, Glucocorticoids
Dihydroorotate dehydrogenase	Leflunomide

Dr. Madhavrao
Additional Professor
Dept of Pharmacology, AIIMS, Mangalagiri, (AP)

References:

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NATIONAL ASSOCIATION OF PHARMACOLOGY AND THERAPEUTICS

Promoting Pharmacology and Therapeutics for a better tomorrow

About the organization

A national organization of medical doctors specialized in pharmacology /clinical pharmacology and therapeutics. Envisaged to provide strong leadership to promote pharmacology and therapeutics for a better tomorrow. The association is fostered by NMDP (National MD Pharmacology), a prestigious group of eminent pharmacologists.

Aims and objectives

Empowering medical doctors specialized in Pharmacology/Clinical Pharmacology and Therapeutics.

Promoting academic and clinical research in Pharmacology/Clinical Pharmacology and Therapeutics.

Enhancing the standard of teaching/training in Pharmacology/Clinical Pharmacology and Therapeutics

Promoting Pharmacology/Clinical Pharmacology and Therapeutics for the benefit of patients and society.

BENEFITS OF LIFE MEMBERS

Receive notifications on of the organization

Keep yourself updated in the world of pharmacology and therapeutics .

Get connected with fellow pharmacologists of the country.

Contest for various posts in the organization.

Receive of the permanent membership e-certificate through email, enhance your profile by writing MNPT

Participate in general body meetings (GBM) to speak and to vote.

Participate in conferences/seminars/workshops/symposiums/training sessions at subscribed charges.

Receive an e-copy of the official publications (i.e. News letter, Journal, academics, research material etc.

Glimpses of NAPTICON 2024

3rd Annual National conference of National association of Pharmacology & Therapeutics (NPT) - NAPTICON 2024, hosted by the Department of Pharmacology, AIIMS Nagpur under the visionary leadership of Dr R K Dixit (President NPT), Dr G N Dakhale (General secretary, NPT & Organizing secretary) and Dr C M Kamaal (Founder & National Coordinator, NPT). The conference, held on **22nd–23rd November 2024**, was preceded by a **pre-conference workshop on 21st November 2024**, and welcomed over **600 pharmacologists** from academia and the pharmaceutical industry across India, united to explore the frontiers of modern pharmacology for improved healthcare. NAPTICON 2024 offered an exceptional platform for scientific exchange, featuring a diverse range of engaging sessions highlighting pharmacology advancements.

Pre-Conference workshops were held on "Techniques in Scientific Writing" and "Biostatistics" with hands-on training on the use of AI in hypothesis generation, literature review, manuscript writing, and biomedical data analysis.

The conference was inaugurated by chief guest **Padmashree Dr Abhay Bang**, a distinguished public health visionary, researcher, and social reformer. Dr. Bang's keynote address was a highlight of the event, inspiring attendees with his profound insights and impactful contributions to healthcare.

The conference **was full of scientific extravaganza including 9 plenary sessions by eminent pharmacologists**, covering cutting-edge topics such as real-world evidence, vaccine clinical trials, oncology research, signal detection algorithms, CRISPR-Cas9 gene editing, and AI in drug development , etc. **Interactive sessions** provided opportunities for open discussions, including a panel on decentralized clinical trials and a deliberation on AI in medical research and drug development. **Young Pharmacologists Speaks (YPS) & Short Sessions were** focused on emerging pharmacological topics, where budding pharmacologists presented their research and innovative ideas. The conference showcased **148 oral presentations** and **102 poster presentations**, reflecting diverse research contributions from across the nation.

Pink Cap's responsibility for the next Conference NAPTICON 2025 was entrusted to Dr Bhuvaneswari K, Professor & Head, PSG IMS&R, Coimbatore.

Lifetime Achievement Award presented to **Dr. Shoibal Mukherjee** for his exceptional contributions and Recognition of notable achievements in the field of pharmacology. Felicitation of awardees for the National Award for **Research Scholar** and **Research Excellence, and outstanding research** categories, added one more feather to the cap of NAPTICON 2024.

NAPTIQUIZ 2024 was one of the most signature and most awaited events of the conference conducted by quiz masters- DR C M Kamaal, Dr Sarvesh Singh and Dr Rahul Kumar.

The Gala Event held on the evening of 22nd November 2024 was a spectacular celebration, filled with energy, entertainment, and camaraderie. It served as a perfect platform for delegates, speakers, and organizers to unwind and connect after a day of insightful sessions at NAPTICON 2024. The evening was a true fiesta, featuring Orchestra and mesmerizing Dance Performances by AIIMS Nagpur, GMC Nagpur, and IGGMC Nagpur lit up the stage with electrifying dance performances. The culinary spread offered a variety of mouthwatering dishes, ensuring a delightful experience for all attendees. The DJ took over the evening with pulsating beats, inviting everyone to the dance floor to groove to the latest tracks and celebrate the spirit of togetherness. The Gala Event was a perfect blend of fun, masti, and fellowship, leaving everyone with cherished memories and a renewed sense of community as the conference continued into the next day.

Overall, **NAPTICON 2024** was a resounding success, fostering meaningful discussions, collaborations, and innovations in pharmacology to advance healthcare for a better tomorrow in a true sense.

Glimpses of NAPTICON 2023 NAGPUR

3rd National Conference of National Association of Pharmacology & Therapeutics 22nd –23rd November 2024 organised by Department of Pharmacology & Therapeutics, AIIMS Nagpur

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