Volume 10

August 2024

Rx FACTOR

Newsletter by

National Association of Pharmacology & Therapeutics

www.nationalpharmacology.org

National Association of Pharmacology & Therapeutics

Promoting Pharmacology & Therapeutics for a better tomorrow

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EDITORIAL

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Warm greetings to all.

Welcome to the Issue 10 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 Rxfactor newsletter includes many informative articles. We have an article highlighting Inclusion of special population in clinical research. The article summarized the key points / approaches that would enhance the recruitment and retention of special population in clinical research within the regulatory framework. Then we have an article discussing integration of clinical pharmacologists into direct patient care, thereby maximizing their potential to improve healthcare delivery in India.

Engaging additions are articles about correlation of gut dysbiosis with dysmenorrhoea and the clinical significance of the concept of "Ceiling' of drugs. We have included few articles on new, upcoming and under trial drugs like Vonoprazan, an innovative, oral Potassium-Competitive Acid Blocker (P-CAB) that is indicated for the treatment of reflux esophagitis and Helicobacter pylori gastritis, Bexagliflozin (Brenzavvy) for Type 2 Diabetes Management, a potent antidiabetic agent– aryl Imeglimin derivatives and Lecanemab approved for treatment of early alzheimer's disease.

A case report on DRESS associated with Amoxicillin use is another notable inclusion along with Amazing Drug Molecules and Extract from NMDP WhatsApp Group and 'Cool corner'.

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.

Special population in Clinical Trials: One size does not fit all

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Special Population includes minor (age <18 years), elderly (>65 years), pregnant women, underprivileged ethnic or racial groups. Often these critically important population are left out of pre-marketing Clinical trials. The typical inclusion/exclusion criteria for phase 1 or 2 clinical trials primarily limit participation of adults of 18-65 years age group. As this progresses to phase III, criteria are somewhat broadened. However, yet until the recent times children, pregnant women and elderly are rarely incorporated in late-stage trials.

Inclusion of special population in clinical research has been recognized as priority by health care providers, to promote fair participation and representation and ensure wholesome evidence-based practices. There are specific regulations which protect these special populations that need to be understood and adhered to in order to perform clinical research in this population. However, inclusion of these populations presents with significant challenges. In this article, I have summarized the key points / approaches that would enhance the recruitment and retention of special population in clinical research within the regulatory framework.

- Broadening eligibility criteria: especially later stages of trials- increase diversity in enrolment, avoid unnecessary exclusions, include females in adequate numbers, inclusion of children/adolescents in confirmatory trials when appropriate.
- Design and execute adaptive trial designs, enrichment strategies, broaden pediatric drug development plan early on, pharmacokinetic sampling in females who get pregnant during trials. Whenever feasible, population modeling and simulation techniques can be utilized for Pharmacokinetic analysis.
- Inclusive trial practices: include racial and ethnic minorities.
- Adopt effective recruitment and retention practices: community engagements, networking, local group activities group activities, provide trial resources and documents in multiple languages.
- Role of Institutional review Board (IRBs): IRBs should assess the proposed inclusion/exclusion criteria. Default exclusion criteria must be reviewed, if the final inclusion/ exclusion criteria provide scope for the participation of special population group, the approval should be considered based on safety of the special group in terms of scientific and ethical grounds within the local regulatory framework.
- Make trial participation accessible, feasible and affordable for the participants: financial reimbursements, logistics, use online recruitment strategies to identify potential participants. Remote monitoring and telephonic follow-up as and when feasible. Consider providing additional support system for disabled.

Apart from the above-mentioned, several other innovative approaches can be planned and executed. As mentioned in the title, one size never fits all. To make progress in research and maintain an ethical balance, special populations should be included in clinical research as and when feasible, adhering to the regulations and safeguarding their ethical rights. These patients in whom the drugs will be used, deserve dosing recommendations that are based on adequate and accurate information derived from controlled trials to increase understanding of the benefit and risks of a medication.

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Boosting Patient Safety: Unleashing Clinical Pharmacologists in India

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Introduction

Clinical pharmacologists in India are medically qualified professionals trained in clinical pharmacology. Their education equips them with critical knowledge and expertise in the clinical use of medicines. Traditionally, clinical pharmacologists are engaged in drug development, medicine access and usage research, policy development for safe medicine use, and education on the rational use of medicines. Recently, there is a growing recognition of their potential to optimize patient care directly, particularly through outpatient departments (OPDs) in hospitals.

The discussion on patient safety gained significant attention when the Institute of Medicine published its report "To Err is Human: Building a Safer Health System" in 1999. This report revealed that at least 44,000 people, and perhaps as many as 98,000 people, die in hospitals each year in the United States due to preventable medical errors. The World Health Organization (WHO) has highlighted that while there is a one in 1,000,000 chance of a traveler being harmed in an aircraft, there is a one in 300 chance of a patient being harmed while receiving healthcare. This stark comparison underscores the urgent need for improvements in healthcare safety, a sector lagging behind other high-risk industries such as aviation, automobile, and nuclear industries.

The Current Role of Clinical Pharmacologists: Traditionally, clinical pharmacologists in India have been involved in several key areas:

Drug Development Research: Conducting clinical trials and studies to evaluate new drugs.

Medicine Access and Usage Research: Studying how medicines are accessed and used, and how to improve these processes.

Policy Development: Formulating policies and procedures to ensure the safe and appropriate use of medicines.

Education: Providing professional and patient education on the rational use of medicines.

However, their role in direct patient care is underutilized. There is a need to expand their involvement to optimize patient outcomes, particularly in medication safety and prescription reconciliation.

The CPRRF Framework: The CPRRF (Clinical Pharmacological Reconciliation, Review, and Feedback) framework consists of several key strategies to ensure patient safety and optimize therapeutic effects:

Evaluating Prescriptions: Ensuring that prescribed medicines are necessary and appropriate for the given indication.

Deprescribing: Removing unnecessary, redundant, contraindicated, or poorly tolerated medicines.

Managing Transitions of Care: Identifying and correcting omissions and commissions during transitions between different care settings.

Tailoring Doses: Adjusting doses to meet individual patient needs and perspectives.

Preventing and Managing Adverse Drug Reactions: Identifying potential adverse reactions and implementing strategies to prevent or manage them.

Improving Adherence: Enhancing patient adherence to prescribed therapies.

Considering Affordability and Availability: Ensuring that medicines are affordable and available to promote adherence.

Individualizing Treatment: Customizing treatment plans to accommodate individual patient factors.

Rationalizing Polypharmacy: Reducing unnecessary polypharmacy, particularly in elderly patients.

Enhancing Quality of Life: Improving overall patient quality of life through optimized medication management. Implementation in OPD and In-Hospital Rounds.

Clinical pharmacologists can play a crucial role in outpatient departments (OPDs) and during in-hospital rounds by focusing on prescription reconciliation and addressing medication-related problems. In OPDs, they can monitor and supervise patients at higher risk of drug-related issues, applying CPRRF principles to deliver optimal care. During in-hospital rounds, they can work with other healthcare providers to ensure safe and effective medication use.

Maximizing the Potential of Clinical Pharmacologists

To fully utilize the potential of clinical pharmacologists, it is essential to involve both DM Clinical Pharmacology super-specialist and, due to the shortage of DM Clinical Pharmacologists in the country, MD Pharmacology or MD Internal Medicine postgraduates who have received specialized training in clinical pharmacology. Their integration into government and private hospitals can significantly improve therapeutic outcomes. Unfortunately, India is currently underutilizing these professionals in therapeutic specialties, despite their extensive training in clinical pharmacology.

Errors are costly in terms of human lives and economic burden. In the United States, medical errors result in annual costs ranging from $17 billion to $29 billion . Additionally, these errors erode trust in the healthcare system and diminish satisfaction among both patients and healthcare professionals. According to Allen Frances, Professor Emeritus at Duke University, “It is better to know the patient who has the disease than the disease the patient has” . This underscores the importance of a patient-centered approach to healthcare, which clinical pharmacologists are well-positioned to support.

Recommendations for Increased Utilization

Involvement in Direct Patient Care: Clinical pharmacologists should be actively involved in direct patient care, focusing on medication safety and therapeutic optimization.

Government and NMC Initiatives: The Indian Government and National Medical Commission (NMC) should develop initiatives to increase the utilization of clinical pharmacologists in healthcare settings.

Successful Integration Examples: Sharing examples of successful integration and positive outcomes can encourage broader acceptance and implementation of this model. In West Bengal, under the leadership of Prof. Santanu K. Tripathi, a Clinical Pharmacology OPD was initiated in 2017 at School of Tropical Medicine, Kolkata; followed by the successful launch of a Therapeutics Reconciliation Clinic at R.G. Kar Medical College under the Clinical Pharmacology unit.

Conclusion:

Clinical pharmacologists have the potential to play a significant role in improving patient care in India. By focusing on medication safety, prescription reconciliation, and optimizing therapeutic effects, they can enhance patient outcomes and ensure the rational use of medicines. Increased involvement and utilization of clinical pharmacologists in healthcare settings is essential for realizing these benefits. The Indian Government and NMC must take proactive steps to integrate clinical pharmacologists into direct patient care, thereby maximizing their potential to improve healthcare delivery in India.

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Probiotics and Dysmenorrhea

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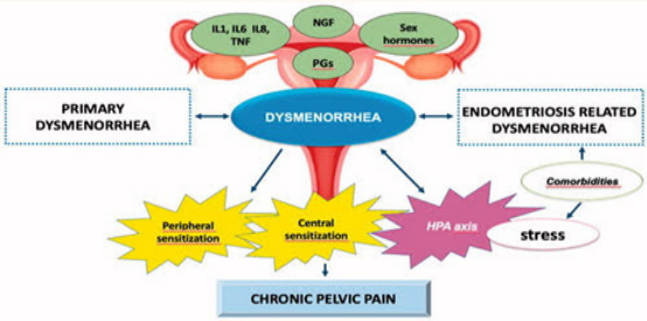
Dysmenorrhea or painful menstruation affect upto 91% of menstruating females making it one of the common gynaecological concerns.

Symptoms: lower abdominal pain and cramping which may be associated with nausea/vomiting, headache, diarrhea, fatigue, sleep disturbances, dizziness and a little bit of depression.

Etiopathogenesis: Many studies attribute to the role of prostaglandin in governing pain, uterine contraction and inflammation including other mediators like leukotriene and interleukins.

- Women suffering from primary dysmenorrhea are facing difficulties in daily life and work life balance including schooling etc.



- It seems to be major cause of absteinance from school and social gatherings including family functions.
- Probiotic supplement is very useful in balancing microbes of gut, vagina etc which helps women to tackle pain/contraction and other prodromal symptoms.
- Conventional treatment have been found to have adverse effects on health and cancer risk particularly with long-term use.
- **To diagnose primary dysmenorrhea some important test can be done like**
- Comprehensive hormonal assessment
- Micronutrient assessment
- Comprehensive stool test to check gut health
- Blood test to check haemoglobin and other counts and inflammatory markers.

Conventional management: Relies on the use of Non-steroidal anti-inflamatory drugs (NSAIDS) and oral contraceptive pills to reduce inflammation and suppress ovulation.

Risk factors:

- High stress,smoking,heavy menstrual bleeding(HMB) and premenstrual syndrome (PMS).
- Dietary patterns that include skipping breakfast and

high consumption of salt snakes, packed fruit juice, refined sugars, unhealthy fats and ultra processed foods are also associated with an increased risk of moderate to severe dysmenorrhea.

- Estrogen dominance, a hormonal state in which estrogen levels are elevated in relation to progesterone can underline both types primary and secondary dysmenorrhea.

New approach: It is important to look at the relationship between gut dysbiosis (imbalance in the different types of microscopic organisms living in human body along with increased estrogen reabsorption with symptoms of primary dysmenorrhea.

PROBIOTICS word generally reflect towards the gut health and possibly now also known that there is a link between the microbiome and the immune system.

People are less familiar with the link between the gut microbiome, the vaginal microbiome and genital, urinary and hormonal health.

Impact of Probiotics on dysmenorrhea: It is found that oral supplementation of probiotics sachet or capsule containing 5 billion colony-forming units (each of Lactobacillus acidophilus, Lactobacillus casei subsp, Lactobacillus lactis, Bifidobacterium bifidum, Bifidobacterium longum and Bifidobacterium infantis) twice daily for 1 to 3 months shows significant improvement in pain during menses and females with probiotic supplement are reported to take less non-steroidal anti-inflammatory medicines as compared to females who are not taking lactobacillus.

Conclusion: On analysing the effect of Probiotics supplementation, it is found that probiotics did not significantly improve quality of life score but did reduce the use of painkillers and improve mental health scores.

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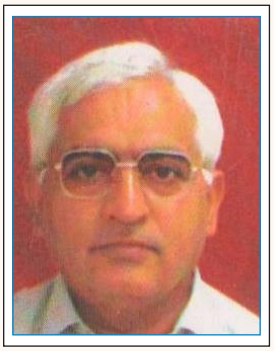
Clinical significance of the Ceiling Effect of Drugs



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Clinical significance of the Ceiling Effect of Drugs

The log dose response curve of a drug shows slop, position of curve on horizontal axis (Potency or relative potency) and maximal response (Efficacy). The dose at which maximum response is achieved is "ceiling dose". A potent drug may be more efficacious in one condition but not in other. Clinical efficacy may or not be related to observed efficacy alone. A low efficacy drug may be more effective (efficacious) clinically or therapeutically e.g., chlorthalidone in hypertension.

Efficacy (ceiling effect) of a drug is determined by characteristics of drug receptor interaction, for example, partial agonism (Buprenorphine), allosteric modulation (Benzodiazepines) or tissue specific transporter inhibition (Furosemide selectively inhibits absorptive Na+K+2Cl- symporter in ascending terminal portion of loop of Henle). A full agonist has a higher maximal response (morphine) and a partial agonist has submaximal response. In general, ceiling effect is observed for a particular action of drug (BP reduction, analgesia).

Drugs exhibiting clinical ceiling effects:

1: Some antibiotics exhibiting *'time dependent'* killing (Beta lactams, vancomycin) reach a "ceiling effect" thus increasing doses do not achieve greater antibacterial effects and the bactericidal action of these drugs is relatively slow. The time-dependent antibiotics exert optimal bactericidal effect when drug concentrations are maintained above the minimum inhibitory concentration (x 2-4 MIC) throughout the dosing interval. For such antibiotics, higher concentrations do not result in greater kill of organisms.1 This phenomena is not observed with antibiotics which exhibit 'concentration dependent killing (Amionoglycosides, fluoroquinolnes)

2: Partial mu agonists, buprenorphine, nalbuphine and pentazocine show ceiling effects for analgesia and respiratory depression. Buprenorphine has lower ceiling effect for respiratory depression, sedation, and subjective effects and yet it is more potent to morphine as analgesic and does not appear to exhibit ceiling effect for analgesia.1 Pentazocine has a lower ceiling effect for analgesia by acting on K1 receptors (dose 60 mg). In contrast to these drugs morphine has no ceiling effect for analgesia or respiratory depression. Codeine has a ceiling analgesic effect at 60 mg because of being a partial agonist at mu receptors. 2,3

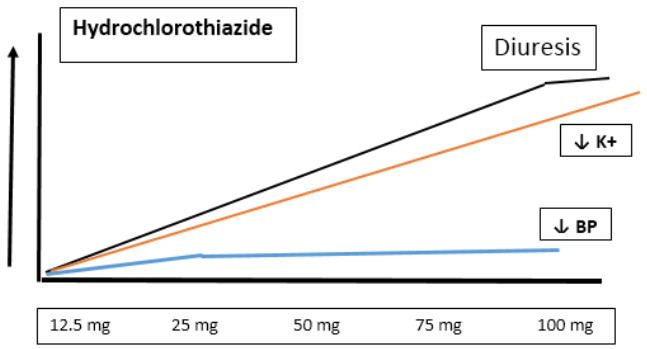
3: "Mucosal block" is an example of ceiling effect for iron absorption in the absence of anemia

4: BDZs (diazepam) have lower ceiling effect on respiratory depression as compared to barbiturate and this property determines clinical utility of BDZs.

5: NSAIDs (paracetamol, ibuprofen, naproxen and ketorolac) show ceiling effect for analgesia. A dose of 1000 mg paracetamol, 440 mg naproxen and 400 mg (as effective as 600 mg) of ibuprofen (1.2 Gm/day) would produce maximal analgesia and beyond that dose ADRs are seen. This ceiling effect may be attributed to maximum COX I/II inhibition (saturation) achieved in doses used therapeutically beyond which no further inhibitory activity is there. Thus, a plateau effect is seen. The risk of bleeding, however increases with dose increments.4

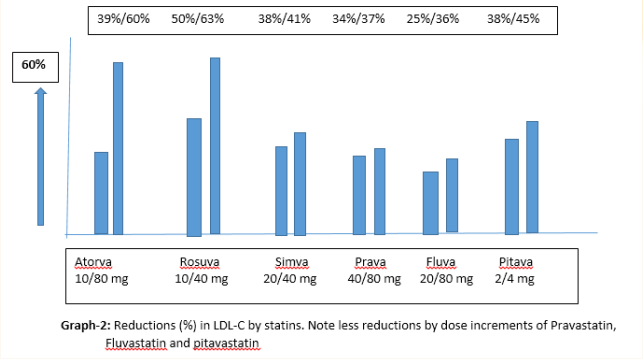
6: Thiazides (HCTZ and chlorthalidone) have lower ceiling effect for BP reduction (12.5 mg to 25 mg) than for hypokalemia (dose dependent). In a metanalysis by Peterzan et al metaregression of the effect of thiazides were estimated. The estimated dose of each of 3 drugs (bendroflumethiazide> chlorthalidone> hydrochlorothiazide) predicted to reduce systolic BP by 10 mm Hg was 1.4, 8.6, and 26.4 mg, respectively, and there was no evidence of a difference in maximum reduction of systolic BP

by high doses of different. The estimated doses of chlorthalidone and hydrochlorothiazide predicted to reduce diastolic BP by 4 mm Hg were 14.0 mg and 20.8 mg, respectively and bendroflumethiazide reduced DBP by > 4 mmHg at all doses.5 The maximal diuresis (ceiling effect) was obtained at a dose of 100 mg associated with ADRs (greater hypokalemia) [Graph-1 Representative]. Thus, thiazides have much lower ceiling effect for antihypertensive action and moderate ceiling effect for diuretic action. Furosemide, a high ceiling (high efficacy) diuretic, is less effective antihypertensive in normal renal function.



Graph-1: Dose response curve of HCTZ for BP reduction, hypokalemia and diuresis

7: The dose response curve for pravastatin, simvastatin and fluvastatin flatten in the upper part of dose range while for other statins it is linear (Fig-2). In practice, maximum dose recommended for atorvastatin is 80 mg and for rosuvastatin is 40 mg/day.



Graph-2: Reductions (%) in LDL-C by statins. Note less reductions by dose increments of Pravastatin, Fluvastatin and pitavastatin

8: **Other drugs**: Repeated use of alcohol produces tolerance due to induction of metabolizing enzymes. But, there is ceiling effect and beyond that further induction would not occur resulting in toxic manifestations. Domperidone has lower ceiling effect and is thus less efficacious

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Potassium-Competitive Acid Blocker (P-CAB): Vonoprazan

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Introduction

In about 60% of people, the stomach mucosal layer contains the bacteria H pylori.

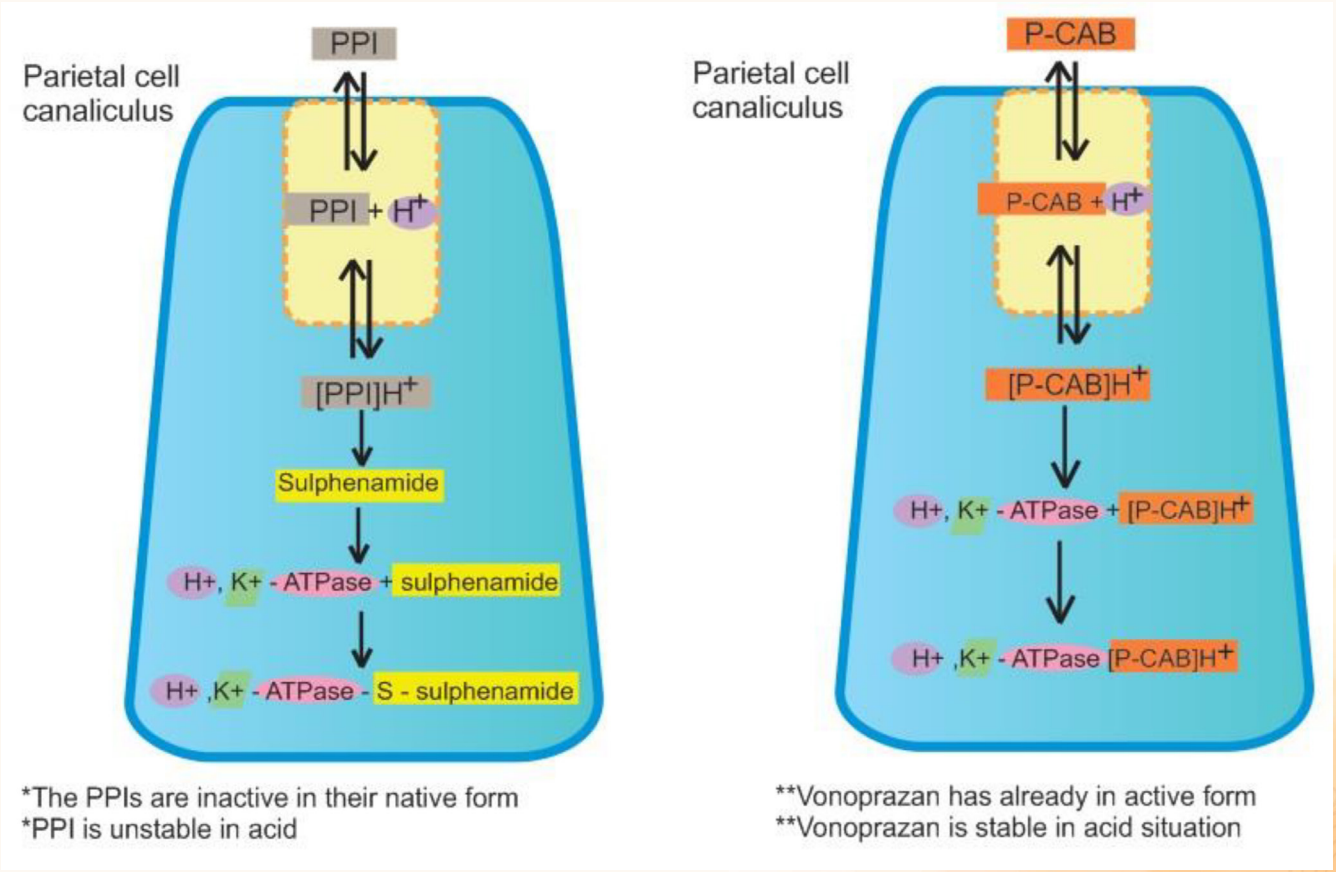
It is a contributing factor to gastric ulcers (GUs) and is linked to 90% of duodenal ulcers (DUs).[1] Understanding the growing demand for effective gastric acid-related disease treatment, a new-generation acid blocker Vonoprazan is being increasingly used and has been included in H. pylori eradication therapy.

Vonoprazan fumarate is available in dose of 10 mg and 20 mg. Vonoprazan is an innovative, oral Potassium-Competitive Acid Blocker (P-CAB) that is indicated for the treatment of reflux esophagitis, gastric and duodenal ulcers, gastric lymphoma, post-endoscopic resection of early-stage cancer, and Helicobacter pylori gastritis. It is also indicated as a preventive measure against low-dose aspirin or nonsteroidal anti-inflammatory (NSAID) drug-related gastritis.[2]

Mechanism of action

Vonoprazan is a potassium-competitive acid blocker (PCAB) that inhibits the H+, K+-ATPase enzyme system in a potassium-dependent way. Vonoprazan works by suppressing basal and stimulating gastric acid secretion at the secretory surface of gastric parietal cells.[3]

Although both Proton pump inhibitors(PPIs) and Vonoprazan inhibit the H+, K+-ATPase, PCABs have a different mechanism of action than PPIs. PPIs establish



a covalent disulphide bond with a cysteine residue on the H+, K+-ATPase, inactivating the enzyme, whereas PCABs inhibit K+ binding to the H+, K+-ATPase.[4] It provides several advantages over PPI's including acid stability, rapid onset, less variability due to CYP2C19 polymorphism. Unlike other medications it is acid stable and faster acting at proton pump. It is rapidly absorbed and peak plasma concentration is achieved within two hours and has a prolonged effect.[5]

Properties: Vonoprazan has time-independent pharmacokinetics, and steady-state concentrations are reached after 3 to 4 days.[6] After a single dosage of 20 mg, Vonoprazan has an apparent oral volume of distribution of 1001 L. The apparent oral volume of distribution of vonoprazan at steady state is 782.7 L.[7] Vonoprazan binds to plasma proteins with an 85% to 88% affinity in healthy people.[8] Multiple cytochrome P450 (CYP) isoforms, primarily CYP3A4, metabolize vonoprazan, with smaller amounts of CYP3A5, CYP2B6, CYP2C19, CYP2C9, and CYP2D6. Vonoprazan is also metabolized via sulfo and glucuronosyl-transferases; however, none of the metabolites have any pharmacological activity.[9]

The half-life ($t_{1/2}$) is 7 to 9 hours regardless of a meal.[10]

Adverse effects: Nasopharyngitis, diarrhoea, constipation, dyspepsia, headache and abdominal pain are among the common side effects of Vonoprazan. Serious side effects, which affect less than 2% of individuals, might include infections, bone fractures, blood disorders (such as anaemia and neutropenia), and abnormalities in the heart (such as QT prolongation).[11]

Scientific evidence

Vonoprazan have been found to be 400 times more effective than PPIs in many preclinical studies due to its pH stability. A prospective cohort study conducted in south Asia with cohort of 1,642 patients who were orally treated with Vonoprazan at doses of 10 mg or 20 mg, once or twice a day showed that 78.3% had better treatment compliance with therapy.[12]

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Finger Tip Unit (FTU)

Finger Tip is very commonly used to apply cosmetics and medicines. In medicine a fingertip unit is defined as the amount of ointment, cream or other semi solid dosages form Expressed from a tube with a 5 mm diameter nozzle applied from the distal skin crease the tip of the index finger of an adult. The distal skin crease is the skin crease over the joint nearest the end of the finger. 1 FTU is enough to treat an area of skin twice the size of the flat of an adult's hand with the fingers together, i.e. a hand print. Two FTUs are approximately equivalent to 1g of topical steroid. One handprint is 0.8% of the total body surface area, and one FTU covers approximately two handprints. As two FTUs are approximately equivalent to 1gm of topical solution, the Rule of Hand states that 4 hand areas is equal to two FTU which is equal to 1gm.

In the original study in the UK, one FTU weighed 0.49 gram in men and 0.43 gram in women. The area covered by one FTU was 312 centimeter square in men and 257 centimeter square in women. Very similar results were found in Mexico study .The weight of an active has been recalculated.In Japan, relating to use of 5 gram tubes of ointment with a much smaller sized nozzle diameter. The weight of ointment is less if the nozzle diameter is smaller than standard 5 mm. When a topical drug was used as a foam, the weight of an FTU was 52.5 microgram and the area covered by one foam FTU was less than that of a FTU of cream. The FTU is particularly useful when counseling patients with regards to the amount of tropical steroids cream they should be applying in order to minimize the side effects which are associated with their use.The FTU can also be used in children. The FTU concept has been used in central part of an education program for parents of children with atopic eczema.Dermatology Working Group in the UK and in Poland have recommended that guidance for use of topical corticosteroids in patient information leaflet should include clear, active instructions, preferably with images of a FTU and a chart to show the number of units required for specific areas of the body.USA guidelines of care for the management of psoriasis with Topical therapies include guidance of the amount to be used based on FTU. European guidelines for the treatment of atopic eczema recommend that application amount of topical anti-inflammatory therapy should follow the FTU rule. In the USA it has been recommended that active should be used as a part of the treatment plan and the amount of tropical anti-inflammatory therapy should follow the FTU rule. In the USA it has been recommended the FTU should be used as part of the treatment plan and communication with patients and caregivers of children with atopic asthma.So FTU has been used to standardize the amount of cream being applied in various clinical research studies in the UK, Belgium, Turkey, Iran, Pakistan, Malaysia and the USA, and even in India. FTU is an age old practice of application and easy way to use.

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DRESS associated with Amoxicillin use: A case report

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Abstract:

Drug reaction with eosinophilia and systemic symptoms (DRESS syndrome) is a relatively uncommon and life-threatening drug-induced hypersensitivity reaction. The exact pathogenesis of DRESS still remains unclear, but it has been documented on patients on carbamazepine, NSAIDs, sulfasalazine, allopurinol, in whom the syndrome was triggered after administration of amoxicillin. In this case report, we present a case of a 20-year-old patient, with no previous history of drug reaction, who presented with complaints of maculopapular rash, and facial edema for the past 5 days. He was receiving tablet amoxicillin for the treatment of folliculitis.

Keywords: DRESS, amoxicillin, adverse drug reaction

Introduction:

DRESS syndrome, a rare but serious drug reaction, can be triggered by medications like antiepileptics, antibiotics (including amoxicillin), and others such as allopurinol. Recently, mefenamic acid has also been flagged for potential risk. Amoxicillin may contribute to DRESS, especially in patients with prior intolerance to drugs like sulfasalazine. Cases of amoxicillin-induced DRESS in those without previous intolerance are uncommon, with mechanisms not fully understood. Early recognition, discontinuation of suspected drugs, and appropriate management are critical in treatment.

Case presentation:

A 20-year-old, male patient presented to the dermatology OPD with chief complaints of red itchy lesions over the entire body for 4 days. Additionally, he complained of fever, difficulty in swallowing, along with loose stools (2-3 episodes) for 4 days.

The patient had been consuming tablet amoxicillin 500 mg twice a day in view of folliculitis and developed these symptoms on the 5th day of the medication. Additionally, the patient had a history of consumption of egg around the same period.

Physical examination was remarkable for tender axillary and cervical lymphadenopathy, edema of the face, earlobes and lips along with maculopapular rash over the upper limbs, thorax and bilateral feet.

Laboratory reports revealed leucocytosis (16.0× 10^9/L) with eosinophilia (750 cells/mcL), LFT:- SGPT : 34.2U/L; SGOT : 15.8U/L; Total bilirubin: 1.51 mg/dL. HHH, Mantoux tests were sent which turned out to be negative. Over the next few days, his LFT worsened: - SGPT : 234.9 U/L and SGOT : 70.6U/L which was suggestive of systemic involvement. The biopsy report was inconclusive. The drug suspected to have caused the reaction was amoxicillin. A RegiSCAR score of 4 pointed towards the diagnosis of DRESS. The suspected drug was withdrawn and systemic (prednisolone) and topical glucocorticoids and antihistamines were rapidly initiated along with tablet Udiliv and multivitamins. The patient was discharged after a duration of 20 days after complete recovery.

Discussion:

DRESS syndrome presents with skin rash, multi-organ involvement, eosinophilia, and atypical lymphocytosis, though eosinophilia isn't obligatory for diagnosis. Its precise mechanism remains unclear, but theories suggest genetic susceptibility (specific HLA phenotypes), drug metabolism changes leading to toxic metabolite accumulation and T lymphocyte activation, and HHV-6 reactivation prompting T lymphocyte-mediated inflammation and tissue damage. RegiSCAR score is

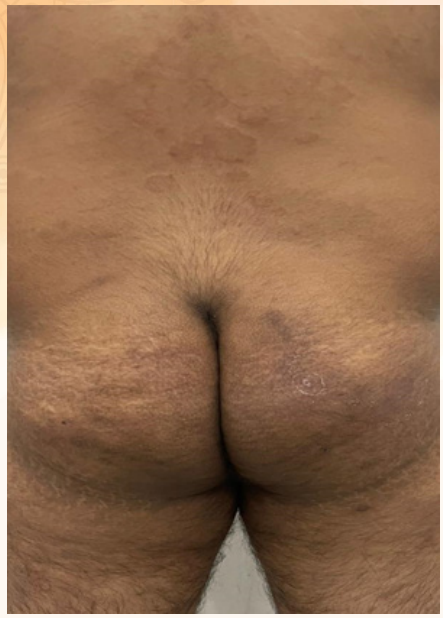

Figure 1: Scaling over B/L buttocks and maculopapular rash over the lumbar region.

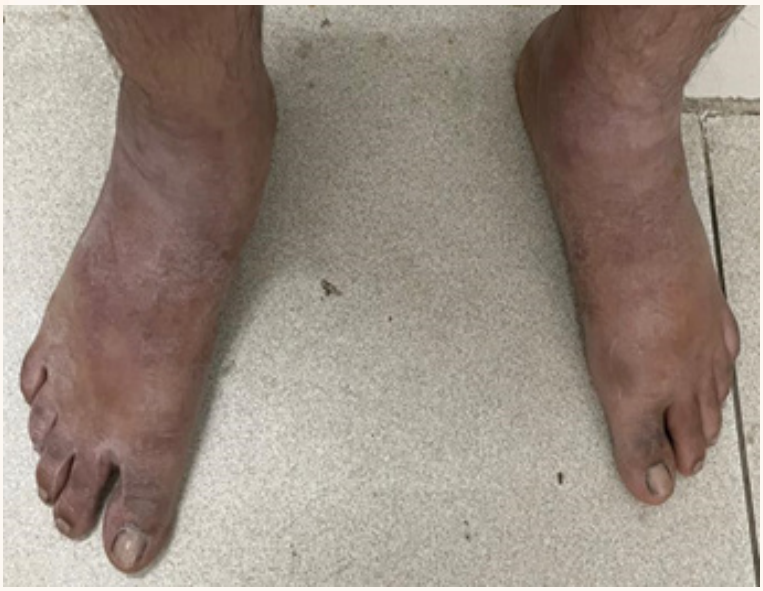

Figure 2: Scaling over B/L feet along with excoriation and edema.

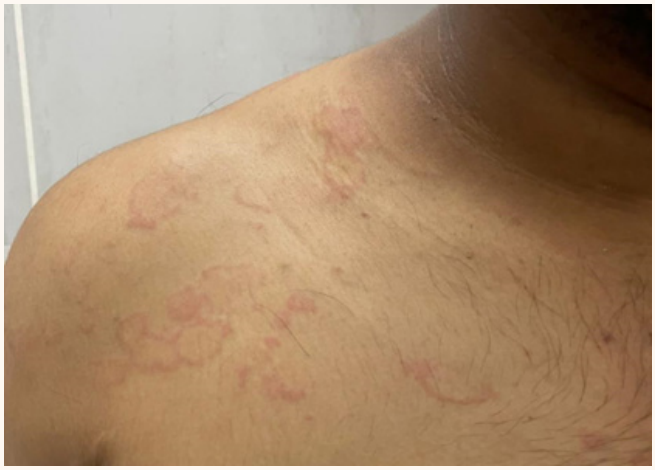

Figure 3: Shows scaling maculopapular rash over the thorax.

most frequently utilised to make a diagnosis where the suspected cases are classified as definite (score 6 and above), probable (score 4 and 5), possible (score 2 and 3), and no DRESS (score <2).

RegiSCAR score of 4 in our patient pointed towards the diagnosis of DRESS and amoxicillin was identified as the culprit after consumption of any other drug in and around the same period was ruled out. (Naranjo Causality Assessment Scale: Score : 6 : Probable)

Immediate discontinuation of the offending drug and aggressive management of local lesions along with systemic steroids or immunosuppressants along with supportive management remains the mainstay of treatment.

Conclusion:

Given the widespread use of antibiotics like amoxicillin, clinicians need to be made aware of the possibility of such medications causing serious adverse drug reactions and the importance of active reporting of these ADRs in case any such reaction is being encountered. In order to reduce the odds of running into such potentially fatal ADRs, prior history of reactions with any other medications should be stressed upon.

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FDA Approves Bexagliflozin (Brenzavvy) for Type 2 Diabetes Management

"The U.S. Food and Drug Administration approved a new sodium-glucose co-transporter 2 (SGLT2) inhibitor, Bexagliflozin (Brenzavvy), for oral use on January 20, 2023."

Drug Information: Bexagliflozin is a sodium-glucose co-transporter 2 (SGLT2) inhibitor. This transporter is responsible for reabsorbing the majority of glucose from the renal glomerular filtrate in the renal proximal tubule. By inhibiting SGLT2 in the proximal renal tubules, less glucose is reabsorbed, lowering the renal threshold for glucose and increasing its excretion in the urine thereby helps in lowering blood glucose levels.

Bexagliflozin (Brenzavvy) efficacy and safety for this new drug was studied in a randomized, double-blind, placebo-controlled, Phase III clinical trial was conducted in high-risk T2D patients. The trial enrolled 1700 participants with a median follow-up of 30 months. The primary endpoint results showed a placebo-corrected HbA1c reduction of 0.48%, a reduction in SBP of 3.0 mmHg, and a weight reduction of 2.7 kg. Brenzavvy significantly reduced the risk of major adverse cardiovascular events, occurring in 7.9% of participants receiving bexagliflozin compared to 10.1% of those receiving a placebo.

Prescriber's Information: Bexagliflozin is indicated as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus. The recommended dosage is 20 mg once daily. It is not recommended for patients with type 1 diabetes mellitus patients.

Adverse Effects: Common adverse reactions (occurring in >5% of patients) include female genital mycotic infections, urinary tract infections, and increased urination. Bexagliflozin though offers a new option for managing type 2 diabetes mellitus, as it is effective in reducing blood glucose levels, promoting weight loss, and positively affecting systolic blood pressure. However, it is not superior to other established SGLT2 inhibitor drugs in terms of overall efficacy and cardiovascular benefits. Despite this, Bexagliflozin should be prescribed as it provides a notable advantage in weight reduction, making it a valuable addition to the SGLT2 inhibitor class.

Other adverse effects may include hypoglycemia, especially when used with insulin or insulin secretagogues, and volume depletion leading to hypotension or acute kidney injury. Necrotizing fasciitis of the perineum (Fournier's Gangrene) has also been reported. It is contraindicated in patients with hypersensitivity to Bexagliflozin or any excipient in the medication.

Use in Specific Populations:

- Bexagliflozin is not recommended during second and third trimesters of pregnancy or during breastfeeding.
- Patients with renal impairment have higher adverse reaction rates due to reduced renal function.
- In Geriatric patients, this drug should be used cautiously due to an increased risk of adverse drug reactions related to volume depletion.
- Bexagliflozin is also not recommended for severe hepatic impairment patients.

Bexagliflozin though offers a new option for managing type 2 diabetes mellitus, as it is effective in reducing blood glucose levels, promoting weight loss, and positively affecting systolic blood pressure. However, it is not superior to other established SGLT2 inhibitor drugs in terms of overall efficacy and cardiovascular benefits. Despite this, Bexagliflozin should be prescribed as it provides a notable advantage in weight reduction, making it a valuable addition to the SGLT2 inhibitor class.

The following table provides a comparative analysis of SGLT-2 inhibitor drugs:

Feature	Canagliflozin	Dapagliflozin	Empagliflozin	Ertugliflozin	Bexagliflozin
Brand Names	Invokana	Farxiga	Jardiance	Steglatro	Brenzavvy
Mechanism of Action	Inhibits SGLT2	Inhibits SGLT2	Inhibits SGLT2	Inhibits SGLT2	Highly Selective SGLT2 inhibitor
Primary Indications	T2DM, CV risk reduction, Diabetic Kidney Disease	T2DM, Heart Failure with Reduced Ejection Fraction, CKD	T2DM, CV risk reduction, Heart Failure with Reduced Ejection Fraction, CKD	T2DM	T2DM
Dosing	100-300 mg daily	5-10 mg daily	10-25 mg daily	5-15 mg daily	20 mg daily
HbA1c Reduction	~0.77%	~0.8%	~0.8-0.9%	~0.7%	~0.48%
Weight Reduction	~2-3%	~2-3%	~2-3%	~2-3%	BEST Trial 2.65 kg at 48 weeks(~2.7%)
Renal Benefits	Yes	Yes	Yes	Yes	Yes
Side Effects	UTI, gental infections, volume depletion, fracture risk, ketoacidosis	UTI, genital infections, volume depletion, ketoacidosis	UTI, genital infections, volume depletion, ketoacidosis	UTI, genital infections, volume depletion, ketoacidosis	UTI, genital infections, volume depletion, increased urination, ketoacidosis
Contraindication	eGFR < 30 mL/min/1.73m^2	eGFR < 45 mL/min/1.73m^2	eGFR < 30 mL/min/1.73m^2	eGFR < 30 mL/min/1.73m^2	eGFR < 30 mL/min/1.73m^2

Table: Comparative analysis of SGLT-2 inhibitor drugs

(Reference - Ueda P, Svanström H, Melbye M, Eliasson B, Svensson AM, Franzén S, et al. Sodium glucose cotransporter 2 inhibitors and risk of serious adverse events: nationwide register based cohort study. BMJ. 2018 Nov 14;363. doi: 10.1136/bmj.k4365. PMID: 30429124; PMCID: PMC6233755)

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Potent Antidiabetic Agent In A Diabetic Zebrafish Model: Synthesis And Molecular Docking Studies Of New Aryl Imeglimin Derivatives

Introduction:

Diabetes mellitus (DM) is a persistent, progressive, and multifaceted disease characterized by elevated blood glucose levels. Type 2 diabetes mellitus is associated with a relative deficit in insulin mainly due to beta cell dysfunction and peripheral insulin resistance. Metformin has been widely prescribed as a primary treatment option to address this condition.

1,3,5-triazine is well known aromatic six-membered heterocyclic moiety and shows several biological and pharmacological properties. 1,3,5-triazines has a broad spectrum of biological activities including antibacterial, antifungal, antimalarial, anticancer, antiviral, anti-inflammatory, and antitubercular properties

IMEGLIMIN is the first novel drug of the GLIMIN class which contains 1,3,5-triazine core which is synthesized from metformin.

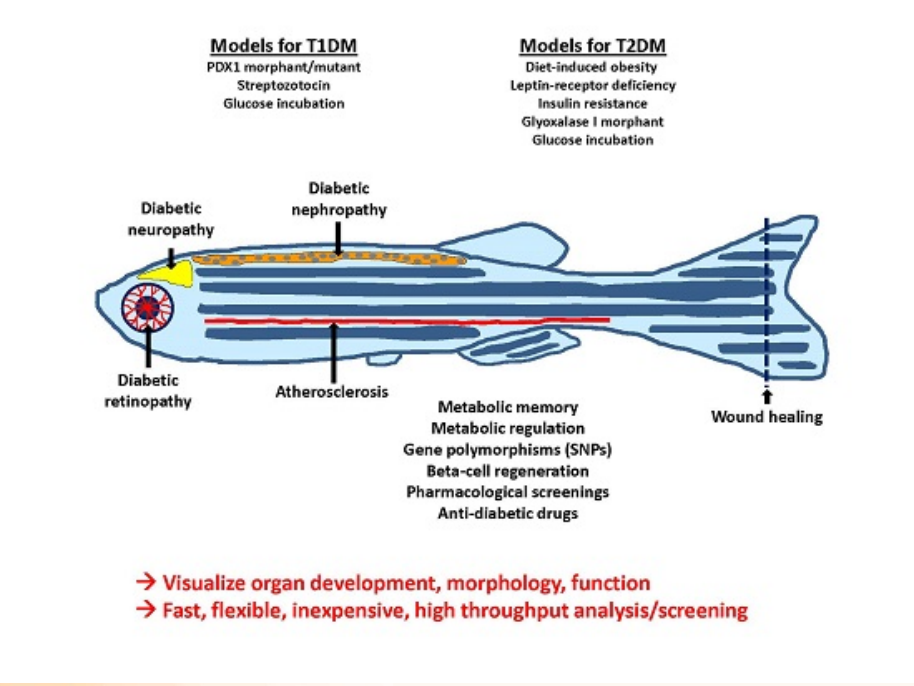
The drug acts via various mechanisms, including targeting mitochondria bioenergetics, increasing insulin secretion, & protecting the endothelial or beta cells' death from oxidative stress. Moreover, it demonstrated beneficial effects on the pancreas, liver, and skeletal muscles, which are adversely affected by diabetes mellitus.

Based on the previous data among various studies, several drugs that are used to treat the T2DM condition are often associated with various adverse effects, such as abdominal pain, hepatotoxicity, diarrhea, flatulence, and hypoglycemia. Therefore, owing to their lack of safety, unsatisfactory efficacy, and cytotoxicity, further investigation for new antidiabetic agents is a need of the hour.

Although imeglimin has not yet been approved by the United States Food and Drug Administration (FDA), imeglimin may provide a valuable new therapeutic option in the near future. In fact, imeglimin in itself has been shown to be more effective than metformin in various cases and has the potential to be used in various diseases.

Hence, imeglimin derivatives deserve further studies, especially in terms of anti-diabetic properties.

In exploring the potential of this approach based on the distinct and specific pharmacological advantages



of the imeglimin backbone (1,3,5-triazine scaffold), several novel and potent imeglimin derivatives by replacing methyl of imeglimin with different aromatic substituents and evaluated their antidiabetic activity on zebrafish diabetic model in vivo in this study.

Antidiabetic activity:

The anti-diabetic properties of the imeglimin derivatives **3(a–j)** were investigated on the zebrafish diabetic model at a concentration of 10 µM for 48 h. Metformin and imeglimin were used as the positive control (reference drugs)

The triazine core exhibited remarkable antidiabetic activities, sparking interest in further structure modifications as potential lead compounds for future investigations.

Docking simulation method:

Molecular docking simulations were done to investigate the binding modes and possible interactions of the synthesized compounds **3(a–j)** with the active sites of the SIRT1 and GSK-3β targets and compared them to the binding energies of metformin and imeglimin. Docking validation was done by re-docking the co-crystal ligands of the crystal structures of 1Q4L and 5BTR, and the RMSD values were lower than 2 Å, indicating the accuracy of the docking method.

Three compounds **3b**, **3e**, and **3g**, which showed high antidiabetic activity against the zebrafish diabetic model, were selected for docking studies to determine the possible interaction with SIRT1 and GSK-3β.

Conclusion:

The structure–activity relationship (SAR) study highlighted the significance of electron-donating groups on the aryl moiety of the target compounds in enhancing their antidiabetic activity.

The remarkable anti-diabetic potential of compounds 3b and 3g warrants further investigation of their efficacy and safety, making them promising candidates for the development of more effective and safer antidiabetic drugs.

These findings provide valuable insights for future research endeavors aimed at advancing diabetes treatment options.

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Lecanemab Approved for Treatment of Early Alzheimer's Disease

Lecanemab is an antibody intravenous (IV) infusion therapy that aims and removes beta-amyloid from the brain. It has received traditional approval from the U.S. Food and Drug Administration (FDA) to treat early Alzheimer's Disease(AD), including people living with mild cognitive impairment (MCI) or mild dementia due to Alzheimer's disease who have confirmation of elevated beta-amyloid in the brain. It lowers beta-amyloid in the brain and decreases cognitive and functional decline in people living with early Alzheimer's. The treatment will allow people to have more time to participate in daily life and live independently [1].

Alzheimer's disease is a progressive, unremitting, neurodegenerative condition that affects wide areas of the cerebral cortex and hippocampus. Abnormalities are usually first detected in the brain tissue that involves the frontal and temporal lobes, and then slowly progress to other areas of the neocortex at rates that differ considerably between individuals[2].

Alzheimer's disease is associated with the accumulation of insoluble forms of amyloidβ (Aβ) in plaques in extracellular spaces, as well as in the walls of blood vessels, and accumulation of the microtubule protein tau in neurofibrillary tangles in neurons[2].

The average duration of illness is 8–10 years, but the clinical symptomatic phases are preceded by preclinical and prodromal stages that typically extend over two decades. Sporadic Alzheimer's disease is the most common type and has a mean age of onset of 80 years. The main cause is the failure to clear Aβ peptide from the brain tissue[2]. A family history of affected close relatives is not uncommon in sporadic disease, but a small proportion (<1%) of patients have autosomal dominant inherited Alzheimer's disease (DIAD); this form has an early age of onset (mean age of ~45 years)[2].

Epidemiology

The descriptive epidemiology of Alzheimer's disease has been the subject of many studies over the past 30 years[2].Technologies for specific detection of Alzheimer's disease in living patients (as opposed to in post-mortem studies) are now becoming available (including molecular PET imaging and levels of biomarkers — Aβ and tau — in the CSF)[2]. The overall mean incidence of 1–3% is consistent with an overall prevalence of 10–30% in the population >65 years of age (given that the mean duration of Alzheimer's disease is 10 years)[3-6].

Current status of Lecanemab

The U.S.FDA granted Lecanemab accelerated approval on January 6, 2023, and Traditional Approval on July 6, 2023 for AD. Since July 2020, the Phase 3 clinical study (AHEAD 3-45) for individuals with preclinical AD is ongoing. AHEAD 3-45 is conducted as a public-private partnership between the Alzheimer's Clinical Trial Consortium that provides the infrastructure for academic clinical trials in AD and related dementias in the U.S. Since January 2022, the Tau NexGen clinical study for Dominantly Inherited AD (DIAD), that is conducted by Dominantly Inherited Alzheimer Network Trials Unit (DIAN-TU), led by Washington University School of Medicine in St. Louis, is ongoing [7].

How effective is Lecanemab for Alzheimer's Disease?

In a trial that involved 1,795 participants with early-stage, symptomatic Alzheimer's, lecanemab slowed clinical decline by 27% after 18 months of treatment compared with those who received a placebo. Study participants who received the treatment had a significant reduction in amyloid burden in imaging tests, usually reaching normal levels by the end of the trial. Participants also showed a 26% slowing of decline in a key secondary measure of cognitive function and a 37% slowing of decline in a measure of daily living compared to the placebo group[8].

Is Lecanemab safe?

The most common side effect (26.4% of participants vs. 7.4% in the placebo group) of the treatment is an

infusion-related reaction. The majority (96%) of these reactions were mild to moderate, and 75% happened after the first dose[8].

Another potential side effect associated with lecanemab was amyloid-related imaging abnormalities with edema, or fluid formation on the brain. This occurred in 12.6% of trial participants compared to 1.7% in the placebo group[8].

The medication's label includes warnings about brain swelling and bleeding and that people with a gene mutation that increases their risk of Alzheimer's disease are at greater risk of brain swelling on the treatment. The label also cautions against taking blood thinners while on the medication[8].

On July 2, 2024, the U.S. FDA approved a new drug Donanemab to treat Alzheimer's disease in adults with mild cognitive impairment or mild dementia. It is an anti-amyloid drug that is administered as an intravenous infusion every four weeks.

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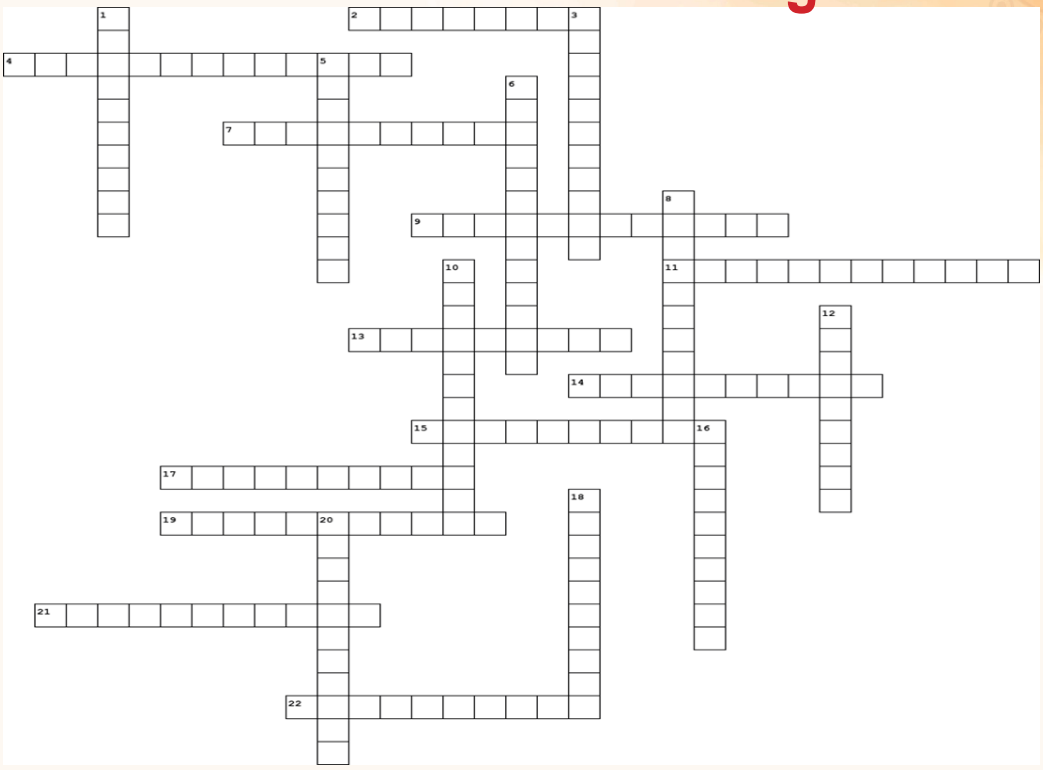
COOL CORNER

New drugs 2023-24



Across

2. - Major depression, deep and wide,
This drug helps balance, turns the tide. (8 letters)
4. - Type 2 diabetes, control the rise,
This drug helps keep sugars concise. (13 letters)
7. - Anemia in CKD patients, we amend,
This drug brings balance, helps to mend. (9 letters)
9. - COPD's grasp on breath so tight,
This drug helps lungs regain their might. (11 letters)
11. - Menopausal flushes, hot and severe,
This drug brings cool relief, makes it clear. (11 letters)
13. - Hyperoxaluria's burden we lift,
This drug provides a much-needed gift. (8 letters)
14. - Duchenne dystrophy, muscles degrade,
This drug strengthens, offers aid. (10 letters)
15. - Molluscum contagiosum's viral distress,
This drug clears skin, returns its finesse. (10 letters)
17. - Migraines strike with relentless pain,
This drug offers relief, clear and plain. (10 letters)
19. - Estrogen receptor in cancer's spree,
This drug blocks it, sets cells free. (11 letters)
21. - Leukemia's battle, cells run wild,
This drug brings order, so soft and mild. (11 letters)
22. - Myasthenia gravis, muscles so weak,
This drug gives strength, the cure we seek. (10 letters)

Down

1. - IgA nephropathy, proteins stray,
This drug helps guide them back in array. (9 letters)
3. - Polyneuropathy's grip we break,
Inherited amyloidosis is the stake. (11 letters)
5. - Postpartum blues, such a heavy load,
This drug clears the darkened road. (9 letters)
6. - A gliflozin for heart failure's plight,
This drug helps hearts beat strong and light. (14 letters)
8. - Rett syndrome's hold on children tight,
This drug brings freedom, joy, and light. (11 letters)
10. - Hypertension high, blood pressure fierce,
This drug brings calm, helps hearts persevere. (11 letters)
12. - For PNH, a blood disorder rare,
This drug helps patients, shows great care. (9 letters)
16. - NASH with fibrosis, liver's fight,
This drug heals, restores its light. (9 letters)
18. - Candidemia invades, fungal spread,
This drug fights infection, lifts the dread. (9 letters)
20. - Hyperhidrosis, sweat won't cease,
This drug brings dryness, soothing peace. (11 letters)

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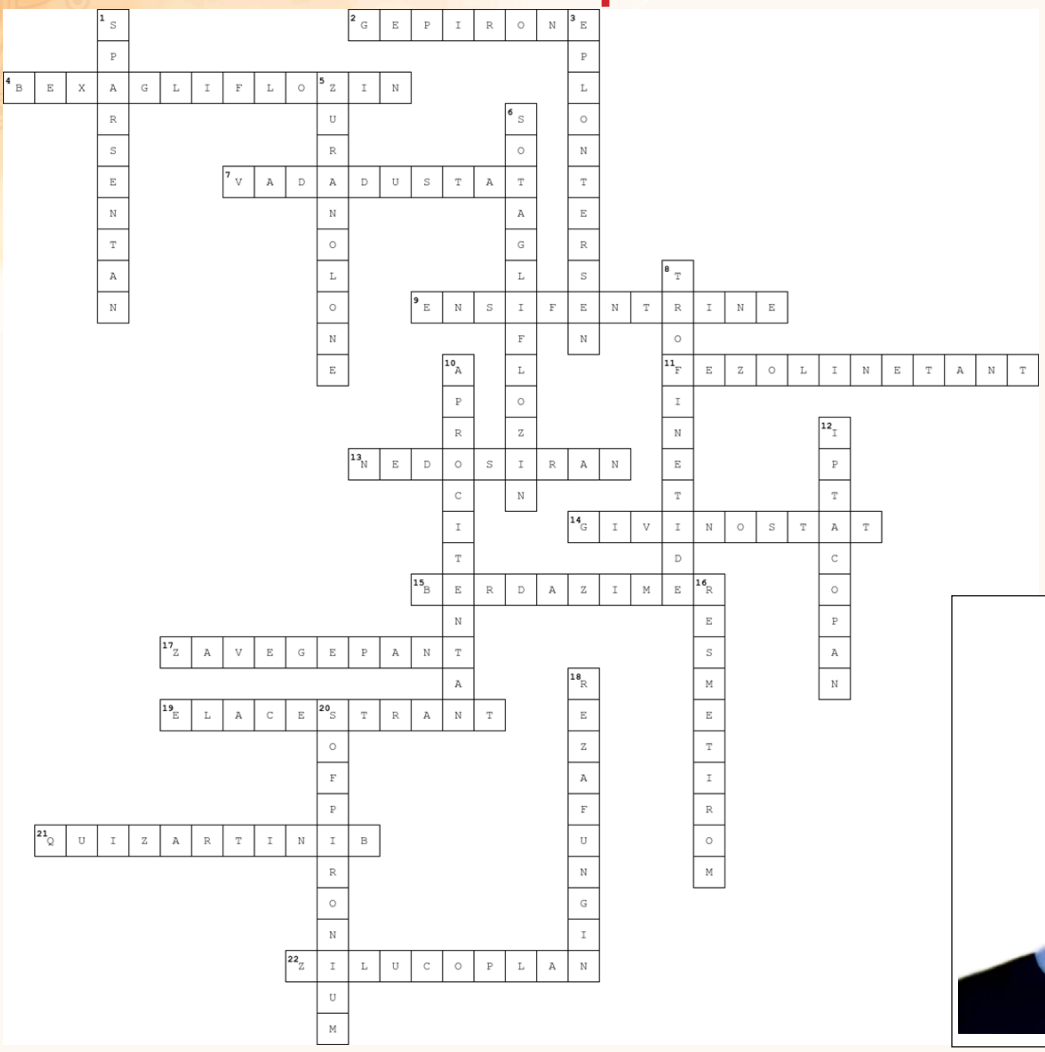
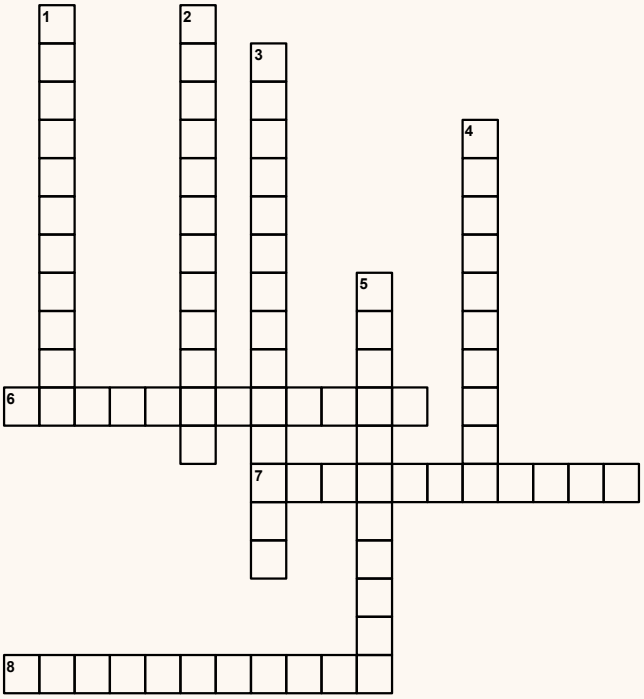
Answer of crossword puzzle



Rajni Narayan
MBBS II Year
JIPMER

Antihistamine Crossword Quest



Across

6.I am an active metabolite of first non-sedating second generation antihistaminics. I have no interaction with CYP3A4.

7.Inject histamine with this route to elicit triple response.

8.Antihistaminic banned due to Torsades de pointes

Down

1. Orally active H1 selective histamine analogue.

2. My dad is arachidonic acid, my brother mediates pain but I am associated with asthma.

3. I am first generation antihistaminic and my *off label* use is to stimulate appetite.

4. I am histaminergic receptor (H2) antagonist. I am also your friend when your stomach is in trouble.

5. I am an antihistaminic to help you in vertigo.

Solutions: Antihistamine Crossword Quest

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.

 # PGMER Dec 2023: P.G. students need to submit their thesis 6 months before the exams. Acceptance of thesis is necessary for the candidate to appear in the exams. Marks for thesis viva is given by external examiners during final MD examination.

 # Delamind & Bedaquiline approvals: Delamanid approved for children below 5 years for drug resistant TB. Bedaquiline receives full FDA approval for pulmonary MDR TB.

 # Metronidazole drug interaction with alcohol: Recent research have mentioned that Metronidazole is not associated with disulfiram like reaction when taken with alcohol.

 # Internal assessment of students of batch 2023: Internal assessment for batch 2023 is to be given under heads like Seminar and Research. For conducting seminars for 250 students we can make groups of five students each and dedicate some days of practical hours for this activity and for research we can take few lectures on basics of research ethics and publication, and we can take pre and post MCQ test and use these marks as internal assessment.

#Lack of assistance from PvPI: PvPI should be decentralized and fund should be placed directly to AMC with guidelines SOP's yearly target and responsibilities like other national programs.

#Akynzeo IV is a fixed dose combination of fosnetupitant (325 mg) and palonosetron (0.25 mg) and this is available as a ready to dilute IV injection. It is administered as a single infusion 30 minutes prior to the start of each chemotherapy cycle that helps prevent both acute and delayed phases of chemotherapy induced nausea and vomiting.

#**Validity of GCP certificate :** GCP certificate ranges from one to three years depending on who and how it was given.

#National Doctor's Day: July 1 we celebrate national doctors day it marks the birth anniversary and death anniversary of Dr. Bidhan Chandra Roy one of India's most renowned physicians. The theme for the celebration of national doctors day in 2024 is healing hands caring hearts.

#New appointments at NMC: Dr. B.N. Gangadhar appointed as chairperson of the National Medical Commission on 3rd July 2024. Doctor Sanjay bihari as the president of the medical assessment and rating board (MARB).

#Competencies given in NMC document: NMC document is a basic guideline. All universities and colleges can build upon it. The premise is that it is minimum that must be fulfilled and whatever is needed for comprehensive learning must be adopted by departments. They have specified minimum time. It will be for individual colleges to plan and implement, everything needed for our students holistic learning.

AMAZING DRUG MOLECULES: Drugs Which Acts By Inhibiting The Enzymes [Part -1]

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

ENZYME	DRUG
Dehydropeptidase I	Cilastatin
β - lactamase	Clavulanic acid, Sulbactam, Tazobactam
Angiotensin Converting Enzyme [ACE] [Kininase II]	Captopril, Enalapril, Lisinopril, Perindopril
Phospholipase A_2	Corticosteroids
Cyclooxygenase [COX]	NSAIDS
Cyclooxygenase -2 [COX-2]	Celecoxib, Etorcoxib, Parecoxib
PDE [Phosphodiesterase]	PDE-3: Amrinone [Inamrinone], Milrinone, Cilostazol PDE-4: Cilomilast, Roflumilast PDE-5: Sildenafil, Tadalafil, Vardenafil
5 - Lipoxygenase	Zileuton
α Glucosidase	Acarbose, Miglitol
Aldehyde DH	Disulfiram
Alcohol DH	Fomepizole
Carbonic anhydrase	Topiramate, Acetazolamide
GABA - Transaminase	Vigabatrin
Peripheral decarboxylase	Carbidopa, Benserazide
MAO - A	Moclobemide, Clorgyline
MAO - B	Selegiline
COMT	Entacapone, Tolcapone
Pyruvate ferredoxin oxidoreductase [PFOR]	Metronidazole, Nitazoxanide
Protease	Atazanavir, Fosamprenavir, Lopinavir, Ritonavir, Darunavir, Indinavir, Nelfinavir, Saquinavir, Tipranavir
Nucleoside Reverse Transcriptase	Abacavir, Clidanosine, Stavudine, Tenofovir, Zidoruoline, Emtricitabine, Lamivudine, Zalcitabine;
Non Nucleoside Reverse Transcriptase	Efavirenz, Nevirapine, Delavirdine, Etravirine,
Integrase	Raltegravir
DNA dependent RNA Polymerase	Rifampin, Rifabutin
Peptidyl Transferase	Dalfopristin

Dr. Madhavrao
Additional Professor
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References:

1. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 13th ed. New York: McGraw-Hill Education; 2018

Gujarat Summit 2024 Ahmedabad & National Pharmacokinetics Workshop 2024

Organized by GCS Medical College Hospital and Research Centre Ahmedabad

Under the aegis of National Association of Pharmacology and Therapeutics

Dr. Dimple Mehta
Members National Council
National Association of Pharmacology and Therapeutics &
Coordinator Gujrat Summit 2024

The Gujarat Summit 2024, held at GCS Medical College, Ahmedabad, on July 15th, 2024, was a pivotal event in the academic and professional development of Pharmacology residents and faculty members across Gujarat. Initially conceived as a two-day workshop on Pharmacokinetics by Dr. Vipul Chaudhari, Head of the Department of Pharmacology at GCS Medical College, the event quickly garnered overwhelming interest. Due to the high demand, the workshop was limited to third-year MD residents, resulting in the enrolment of 55 participants.

Dr. Chaudhari conducted the entire workshop single-handedly, delivering in-depth training on key Pharmacokinetic parameters essential for Pharmacologists. The success of the workshop, highlighted by positive feedback from both faculty and students, prompted Dr. Chaudhari to report the event's impact to the National Association of Pharmacology & Therapeutics (NAPT). Consequently, the event was elevated to the status of the Gujarat Summit 2024, where leaders in Pharmacology from Gujarat were recognized for their contributions.

Representing the National Association of Pharmacology & Therapeutics, Dr. C. M. Kamaal addressed the summit, sharing the Association's vision and goals. Dr. Dimple Mehta, Head of the Department of Pharmacology at

Swaminarayan Medical College, Kalol, and a member of NAPT's Executive Council, also played a key role in organizing the event.

The summit concluded with a felicitation ceremony, where nearly 35 senior and junior Heads of the Department of Pharmacology from various institutions were honored with shawls, mementos, and certificates. Additionally, all participating MD Pharmacologists received certificates of attendance, marking their engagement in this significant academic event.

The Gujarat Summit 2024 successfully fostered professional growth and collaboration among Pharmacologists, reinforcing NAPT's commitment to advancing the field through education and recognition.

GLIMPSES OF
Gujarat Summit 2024 Ahmedabad & National Pharmacokinetcs Workshop 2024

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.

NATIONAL ASSOCIATION OF PHARMACOLOGY AND THERAPEUTICS

Promoting Pharmacology and Therapeutics for a better tomorrow

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Rx FACTOR

A triennially published newsletter by National Association of Pharmacology & Therapeutics (all rights reserved).

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NATIONAL ASSOCIATION OF PHARMACOLOGY AND THERAPEUTICS

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