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New Drug Update

Vonoprazan: a promising advancement in proton pump inhibitor therapy

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ABSTRACT

Vonoprazan, a potent potassium-competitive acid blocker (P-CAB), has emerged as a potential therapeutic option for acid-related disorders, particularly gastroesophageal reflux disease (GERD) and peptic ulcer disease (PUD). This comprehensive review aims to provide an overview of the efficacy, safety profile, and clinical implications of vonoprazan based on current literature. Efficacy studies have demonstrated vonoprazan's superiority over proton pump inhibitors (PPIs) in achieving effective acid suppression, rapid symptom relief, and promoting mucosal healing in patients with GERD and PUD. Moreover, its long-lasting acid suppression properties offer protection against Helicobacter pylori (H. pylori) infection, presenting it as a potential alternative to traditional triple H. pylori eradication regimens. Safety evaluations reveal a favourable tolerability profile with minimal adverse effects and a lower risk of drug interactions compared to PPIs. However, concerns regarding long-term safety, such as hypomagnesemia and the potential for rebound acid hypersecretion, necessitate further investigation. Additionally, the role of vonoprazan in special populations, such as the elderly and those with renal impairment, warrants exploration. Overall, vonoprazan represents a promising advancement in acid suppression therapy, offering efficacy, safety, and potential advantages over traditional agents.

Keywords: Potassium-competitive acid blocker, Helicobacter pylori regimen, Proton pump inhibitors, Gastroesophageal reflux disease, Reflux esophagitis

INTRODUCTION

Helicobacter pylori (*H. pylori*) infects a large proportion of population worldwide with an incidence ranging from approximately 50% in underdeveloped countries to 10% - 20% in affluent ones.[1] A variety of gastrointestinal conditions, such as chronic gastritis, peptic ulcer disease, mucosa-associated lymphoid tissue lymphoma, and gastric ulcers, can be brought on by this bacterium species colonizing the human stomach. In recent times, antibiotic resistance in *H. pylori* has become a significant concern. The World Health Organization (WHO) has recognized *H. pylori* as one of the top twelve antibiotic-resistant bacteria, a fact that underscores the gravity of the issue and emphasizes the need for innovative approaches to combat this resilient pathogen.[2] The emergence of antibiotic resistance in *H. pylori* has made the treatment of this infection more complex and challenging. Conventional therapies, which usually consist of a combination of a proton pump inhibitor (PPI) and antibiotics (such as tetracycline, metronidazole, amoxicillin, and clarithromycin) have become less effective due to increasing rates of resistance.[3] This phenomenon has led to higher treatment failure rates and an increased chance of disease recurrence. In response to this challenge, the development of novel and efficient *H. pylori* infection treatment approaches is critically needed.

The gastroenterology community has taken a keen interest in Vonoprazan, a medication created as a substitute for

traditional proton pump inhibitors (PPIs). Vonoprazan is a medication that was created as a substitute for traditional proton pump inhibitors (PPIs). It targets gastrointestinal diseases caused by acid production and has a distinct mode of action. This review provides an overview view of Vonoprazan's clinical pharmacology, efficacy and safety profile, and possible future uses.

PHARMACODYNAMICS OF VONOPRAZAN

Vonoprazan is chemically known as 1-[5-(2-Fluorophenyl)-1-(pyridin-3-ylsulfonyl)-1H-pyrrol-3-yl]-N-methylmethanamine fumarate. Vonoprazan is a potassium-competitive acid blocker (P-CAB) that inhibits the H+ K+-ATPase enzyme in stomach parietal cells by competing with potassium. Since H+ K+-ATPase enzyme is considered as the acid (proton) pump, Vonoprazan is characterized as a type of gastric proton pump inhibitor. Vonoprazan, however, blocks the final step of acid production, thereby exhibiting a distinct mechanism compared to traditional proton pump inhibitors (PPIs). The inhibition of the H+ K+-ATPase pump by vonoprazan is through covalent binding and hence irreversible allowing it to provide sustained acid suppression (Figure 1).[4]

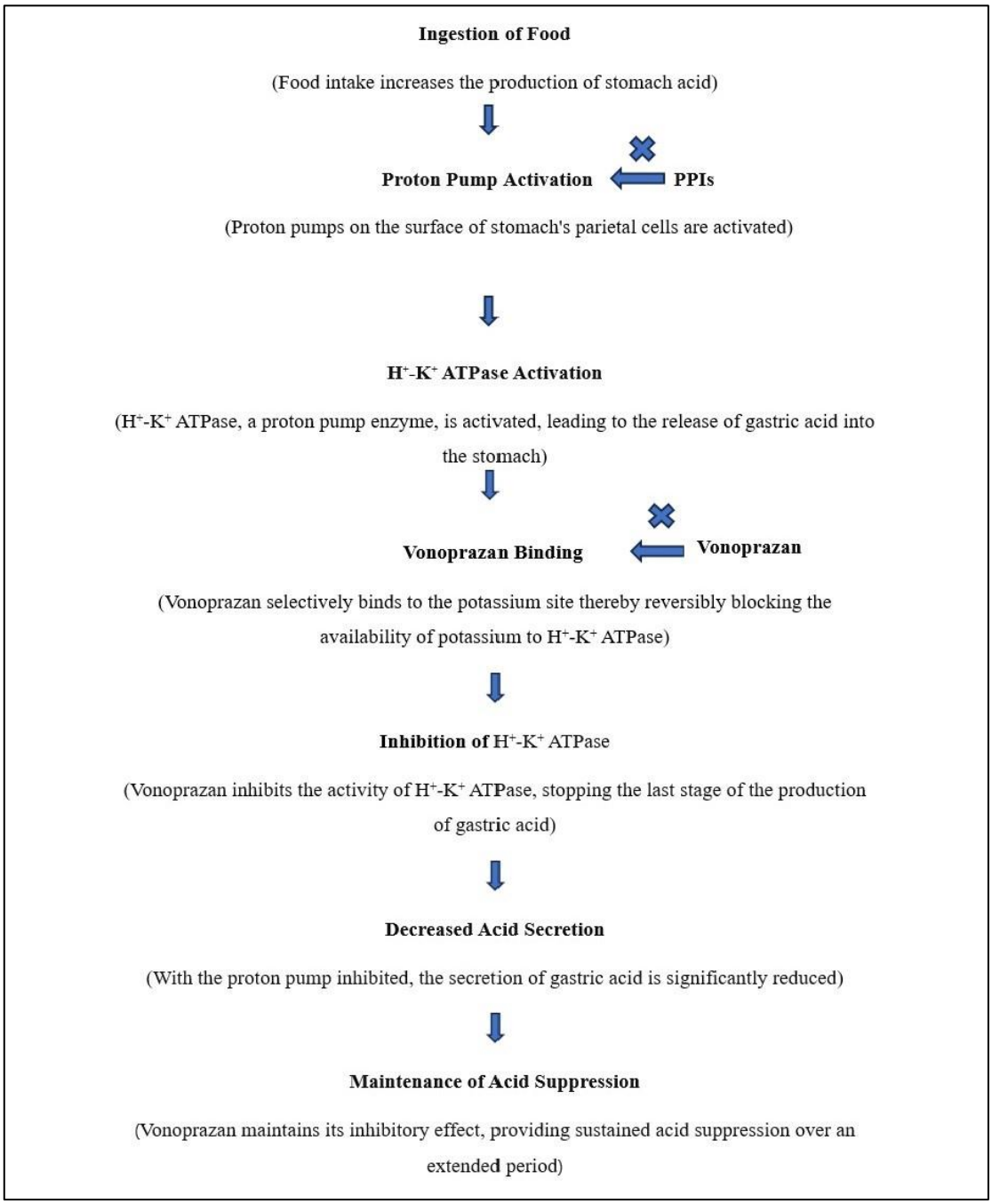

Figure 1: Schematic depiction of the mechanism of action of vonoprazan.

Table 1: Systematic review and meta-analysis on the effectiveness and safety of vonoprazan-based combination therapies in *H. pylori* eradication.

Study ID/ year of publication	Design / Aim	Number of studies/ patients (N)	Results	Strengths and limitations	Conclusion
Feng et al; 2023[18]	Meta-analysis of RCTs/ evaluate the efficacy and safety of vonoprazan-amoxicillin (VA) dual therapy for radically eradicating *helicobacter pylori* (*H. pylori*)	4 RCTs/2019 patients	The eradication rate of *H. pylori* in the VA dual regimen group was higher than that in the PPI-based (omeprazole or lansoprazole) triple therapy group. the incidence of adverse reactions in VA dual therapy was also lower than that in triple therapy.	The effectiveness and safety of VA dual therapy for eliminating *H. pylori* were thoroughly assessed in this study, which included four RCTs and two non-RCTs. The degree of publishing bias in language is questionable due to the dearth of literature in other languages	Compared with PPI-based triple therapy, VA dual therapy showed a better therapeutic effect, safety, and patient compliance rate for eradicating *H. pylori*, which should be used as a novel curative strategy in the future.
Zhang WL; 2023[19]	Systematic review and meta-analysis to investigate the efficacy and safety of vonoprazan/ amoxicillin dual therapy for *H. pylori* eradication.	5 studies with RCT and Cohort studies with 1,852 patients	The efficacy of vonoprazan/amoxicillin dual therapy was not inferior to that of triple therapy.	Due to data limitations, it was not possible to further assess the effectiveness of VA dual therapy in first- and second-line treatments for both RCTs and observational studies which may introduce potential bias. Studies were systematically analyzed for the safety and efficacy of VA dual therapy for *H. Pylori* eradication.	The efficacy of vonoprazan/amoxicillin dual therapy is non-inferior to vonoprazan-based triple therapy but superior to omeprazole or lansoprazole-based triple therapy and has less side effects.
Liu L; 2023[20]	Systematic review and meta-analysis of relevant literature to assess the safety and efficacy of vonoprazan dual therapy (VA) compared to vonoprazan-based triple therapy (VAC) and proton pump inhibitor (PPI)-based triple therapy in the eradication of Helicobacter pylori (*H. pylori*) infection.	5 RCT/1 Retrospective study. 1694 patients	The study found that none of the empiric therapies, including VA, VAC, and PPI-based triple therapy, achieved high cure rates (>90%) among treatment-naïve patients. However, VAC was identified as the most effective therapy, followed by VA and PPI-based triple therapy.	This network meta-analysis includes research of high quality. All randomized controlled trials were accompanied by high-caliber observational studies with seven stars. Only six studies Differences in population diversity and geographic variations in antibiotic resistance patterns for *H. pylori* infection	The comparative safety ranking showed VA ranked first, whereas PPI triple therapy was the least safe regimen. These findings should guide the selection of the most effective and safe treatment and conduct additional studies to determine the place of vonoprazan dual versus triple therapies in patients with *H. pylori* from various countries across the world
Rokkas T; 2021[21]	A network meta-analysis to compare the effectiveness of multiple different first-line treatment regimens for Helicobacter pylori infection.	68 RCTs giving a total of 92 paired comparisons with 22,975 patients randomized to 8 first-line regimens.	Overall, vonoprazan triple therapy was the most effective, whereas standard triple therapy was the least efficacious regimen, reflecting high percentages of antibiotic resistance.	Accurate and thorough global data on the relative effectiveness of all available first-line dual, triple, and quadruple treatments were acquired. This network meta-analysis's primary drawback is that the majority of the included randomized controlled trials did not give the necessary data to analyze *H. Pylori* resistance to antibiotics, which prevented the pertinent sub-group analysis.	The comparative effectiveness ranking results showed that Vono-triple therapy was the best regimen showing the highest SUCRA value, whereas standard triple therapy was the least efficacious regimen

Vonoprazan may selectively concentrate in the parietal cells in both the resting and stimulated states and hence suppresses both basal as well as stimulated gastric acid secretion. It achieves a higher level of acid control compared to traditional PPIs, making it an attractive option for acid-related disorders. In contrast to conventional inhibitors of the proton pump (PPIs), which need an acidic environment to be active, vonoprazan can inhibit acid secretion in both acidic and non-acidic conditions.[5]

Vonoprazan has been demonstrated to raise gastric pH levels more effectively and for a longer duration than some conventional PPIs. It has also demonstrated efficacy in promoting the healing of gastric and duodenal ulcers, as well as in preventing nonsteroidal anti-inflammatory drug (NSAID)-induced gastroduodenal injury. Vonoprazan has shown promise in *H. pylori* eradication therapy, achieving higher eradication rates compared to some traditional PPI-based regimens.[6]

PHARMACOKINETICS OF VONOPRAZAN

Vonoprazan is acid stable and absorbed relatively rapidly after oral administration, with peak plasma concentrations (Cmax) reaching within 1-2 hours. The absorption of vonoprazan is not considerably impacted by food consumption, distinguishing it from some traditional PPIs which require an empty stomach for optimal absorption.[6] Vonoprazan has high pKa (>9) which promotes the drug's accumulation in the canalicular space of parietal cells. Vonoprazan has a moderate volume of distribution, indicating that it distributes well into tissues beyond the bloodstream. It is primarily bound to plasma proteins, particularly albumin. In the liver, vonoprazan undergoes very little metabolism. The majority of the administered dose is excreted unchanged in the urine.[7] Cytochrome P450 enzymes play a minor role in the metabolism of vonoprazan. The primary route of elimination for vonoprazan is renal excretion. It dissociates slowly from its target (elimination half-life of vonoprazan of approximately 6-8 hours), allowing for once-daily dosing.[8]

CLINICAL EFFICACY OF VONOPRAZAN

H. pylori eradication

In a single-center, open-label, randomized controlled trial, 160 treatment-naïve patients with *H. pylori* infection were randomized in a 1:1 ratio to either the RBAC group (rabeprazole 10 mg, bismuth potassium citrate 220 mg, amoxicillin 1000 mg, and clarithromycin 500 mg twice daily, for 14 days) or the VA group (vonoprazan 20 mg twice daily and amoxicillin 750 mg four times daily). The VA group's *H. pylori* eradication rate was statistically not inferior to that of the RBAC group, according to noninferiority analyses ($Z=3.78$, $p<0.0001$ in ITT; $Z=4.80$, $p<0.0001$ in mITT; and $Z=4.60$, $p<0.0001$ in PP analysis).[9] Few systematic reviews and metanalyses have also assessed the effectiveness and safety of vonoprazan-based combination therapies in *H. pylori* eradication (Table 1).

Treatment of gastroesophageal reflux disease

In a study by Shinozaki et al, vonoprazan treatment was administered to 47 patients with symptomatic Gastroesophageal Reflux Disease (GERD) who were able to withstand proton pump inhibitors. After one year of vonoprazan treatment, both erosive and non-erosive GERD patients saw a considerable and long-lasting improvement in their symptoms; there was reduced feelings of postprandial anxiety and epigastric pain.[10]

Table 2: Vonoprazan: Indications for use and the corresponding dosage recommendations.

S.No.	Indication	Dosage recommendations
1.	Treatment of gastric ulcer and duodenal ulcer	20 mg orally daily (gastric ulcer: 8 weeks; duodenal ulcer: 6 weeks)
2.	Reflux esophagitis	Treatment: 20 mg orally daily for 4-8 weeks; Prevention of recurrence or relapse: 10/20 mg orally daily (as maintenance therapy).
3.	Prevention of recurrent duodenal or stomach ulcers linked to the use of aspirin or other non-steroidal anti-inflammatory drugs	10 mg orally daily
4.	Adjunct therapy for Helicobacter pylori eradication	Triple therapy: 20 mg of vonoprazan,1000 mg of amoxicillin hydrate, and 400 mg of clarithromycin each given twice daily for 14 days. Dual therapy: 20 mg vonoprazan twice daily (morning and evening) plus amoxicillin 1000 mg, three times a day (morning, mid-day, and evening) for 14 days

Healing of duodenal and gastric ulcers

In a randomized controlled trial, Miwa et al recruited using double-dummy blinding, patients aged 20 years or older with at least one endoscopically proven gastric ulcers (GU) or duodenal ulcers (DU) (≥5 mm white coating) were randomized in a ratio of 1:1 was given either vonoprazan (20 mg) or lansoprazole (30 mg) for either six (DU study)

or eight (GU study) weeks. The primary outcome was percentage of patients with healed GU or DU confirmed by endoscopy. The ulcer-healing qualities of vonoprazan were demonstrated with 20 mg dosage having tolerability profile comparable to that of lansoprazole 30 mg, also both the drugs were equally effective for treating duodenal ulcers and gastric ulcers.[11]

Prevention of nonsteroidal anti-inflammatory drugs induced gastroduodenal injury

A phase 3 24-week multicentric, randomized, double-blind, active-controlled study was conducted among outpatients (n=642) on long-term non-steroidal anti-inflammatory drugs (NSAID) medication who were at risk of peptic ulcer recurrence; this was followed by another phase 3 ≥28-week multicentre single-blind, parallel-group extension study. The patients received either 10 mg or 20 mg of vonoprazan or 15 mg of lansoprazole once daily. Vonoprazan showed promise in preventing NSAID-induced gastroduodenal injury; the drug provided effective protection against gastrointestinal damage caused by NSAIDs due to its rapid onset of action and sustained decrease of acid.[12]

INDICATIONS

Table 2 enlists various indications along with dosage recommendations for the use of vonoprazan.[13]

SAFETY PROFILE OF VONOPRAZAN

Vonoprazan is generally well tolerated and has a safety profile similar to that of conventional PPIs. Headache, diarrhea, and stomach pain are common side effects that are usually minor and temporary. Research has demonstrated a low frequency of severe adverse events, suggesting that it has a good safety profile for use in clinical settings.[14]

CLINICAL PHARMACOLOGY OF VONOPRAZAN

Contraindications

Vonoprazan triple or dual therapy should not be administered to patients who are known to have hypersensitivity reactions to any of their components which includes vonoprazan, amoxicillin (or other β-lactam antibiotics like penicillin and cephalosporins), or clarithromycin. Vonoprazan is contraindicated when used concurrently with medications containing rilpivirine, an antiretroviral drug used in the treatment of HIV infection due to potential drug interactions.

Additional contraindications for vonoprazan triple or dual therapy include the conditions where other components of the combination packs are contraindicated.[15]

Warnings and precautions

QT prolongation

Clarithromycin, one of the components of vonoprazan triple therapy, has been linked to the prolongation of the QT interval and, in rare instances, to arrhythmias. Spontaneous reports during post-marketing surveillance have noted cases of torsades de pointes, some of which have resulted in fatalities so, it is advisable to avoid vonoprazan triple therapy in patients with known QT interval prolongation, and ventricular arrhythmia, including torsades de pointes. Individuals taking medications that are known to prolong the QT interval (e.g., pimozide). Patients with ongoing conditions that predispose to arrhythmias, such as untreated hypokalemia or hypomagnesemia, clinically significant bradycardia, or those on certain antiarrhythmic drugs (e.g., quinidine, procainamide, amiodarone). Elderly patients may be at increased risk of drug-related QT interval changes.[16]

Hepatotoxicity

Clarithromycin, a component of vonoprazan triple therapy, has been associated with hepatic dysfunction, including elevated liver enzymes, and various forms of hepatitis. While this hepatic dysfunction is often reversible, severe cases leading to liver failure and, in rare instances, fatalities have been reported. If signs of hepatitis appear, discontinuation of the vonoprazan triple therapy is advised.[16]

Severe cutaneous adverse reactions

Severe cutaneous adverse reactions (SCAR), such as Stevens-Johnson syndrome and toxic epidermal necrolysis, have been documented with the use of the ingredients found in vonoprazan triple (vonoprazan, amoxicillin, and clarithromycin) and dual therapy (vonoprazan and amoxicillin). Additionally, drug reactions with eosinophilia and systemic symptoms (DRESS) and acute generalized exanthematous pustulosis (AGEP) have been associated with amoxicillin and clarithromycin components. Prompt discontinuation of the vonoprazan therapy is recommended upon the first indication of SCAR or other signs of hypersensitivity, and further evaluation is considered.[16]

Clostridioides difficile-associated diarrhea

Clostridioides difficile-associated diarrhea (CDAD) has been linked to the use of acid-suppressing therapies and nearly all antibacterial agents, including amoxicillin and clarithromycin which are components of vonoprazan dual and triple therapy. CDAD should be considered in patients presenting with diarrhea post-antibacterial use. If confirmed, discontinuation of vonoprazan is advised, alongside appropriate fluid/electrolyte management, protein supplementation, antibacterial treatment for C.difficile, and potential surgical evaluation.[16]

Rash in patients with mononucleosis

A significant percentage of mononucleosis patients receiving amoxicillin, a component of vonoprazan therapy can develop an erythematous skin rash. Therefore, the use of vonoprazan dual and triple therapy is cautioned against in patients with mononucleosis.[16]

Use in pregnancy and lactation

Based on findings from preclinical and observational studies in pregnant women with the use of clarithromycin, the use of vonoprazan triple therapy is not recommended in pregnant women except in clinical circumstances where no alternative therapy is appropriate.

There is insufficient information regarding the presence of vonoprazan in human breast milk. However, studies in rats have shown that vonoprazan and its by products are detectable in rat milk. Notably, liver injury was observed in the offspring of rats that were given oral vonoprazan during pregnancy and lactation, at levels of exposure comparable to or higher than the maximum recommended human dose. Given the likelihood that a drug present in animal milk may also be present in human milk, hence caution is advised. Due to the potential risk of liver-related adverse effects observed in animal studies with vonoprazan, it is recommended that women discontinue breastfeeding and discard their breast milk for the duration of treatment with vonoprazan triple therapy or vonoprazan dual therapy, as well as for 2 days following the completion of therapy.[16,17]

Drug interactions

Drug interactions are possible when taking vonoprazan alongside other medications. Vonoprazan is a weak CYP3A inhibitor and so may increase exposure to sensitive CYP3A4 substrates. Vonoprazan reduces intragastric acidity which may decrease the absorption of antiretroviral drugs (e.g., rilpivirine, atazanavir) or other drugs (e.g., iron salts, erlotinib, dasatinib, nilotinib, mycophenolate mofetil, ketoconazole/itraconazole) leading to changes in safety and its effectiveness. Vonoprazan may reduce plasma concentrations of clopidogrel's active metabolite and may cause a reduction in platelet inhibition. It may increase the exposure of CYP2C19 substrate drugs (e.g., citalopram, cilostazol). Strong or moderate CYP3A inducers decrease vonoprazan exposure, which may reduce its efficacy.[18]

The use of vonoprazan dual and triple therapy may lead to elevated serum chromogranin A (CgA) levels due to decreased gastric acidity. This increase in CgA levels can yield false-positive results in diagnostic assessments for neuroendocrine tumors. Assessment of CgA levels should occur at least 14 days after treatment completion, with repeat testing recommended if initial levels are high.[19,20]

Recommended monitoring

Hepatic and renal function should be assessed; ECG should be monitored in patients predisposed to or with risk factors for QT prolongation. Before initiating therapy, pregnancy status must be verified in women of reproductive potential.[21]

Product availability and storage

Vonoprazan triple pack is a combination of three drugs including vonoprazan 20 mg, 500 mg of amoxicillin, and 500 mg of clarithromycin tablets.

Vonoprazan dual pack is a combination of two medicines, 20 mg tablet of vonoprazan and 500 mg of amoxicillin.

Vonoprazan 10 mg and 20 mg film-coated tablets.

These medicines should ideally be stored at room temperature between 20°C and 25°C (68°F and 77°F). They can be briefly exposed to temperatures ranging between 15°C to 30°C (59°F to 86°F), but protection from direct light should be ensured.[22]

CONCLUSION

Vonoprazan's distinct pharmacological profile including quick onset of action and sustained inhibition of acid production make it a promising treatment option for a variety of gastrointestinal disorders. Furthermore, the once-daily dosing simplicity may greatly improve patient compliance and treatment adherence as a whole. Because of its unique method of action and ongoing research into potential new applications, vonoprazan offers a remarkable chance to completely transform the treatment of gastrointestinal disorders linked to acid reflux. By offering more useful and effective treatment options as the body of data increases, vonoprazan is in a good position to significantly improve patient care. The trajectory from present applications to prospective future applications suggests that vonoprazan holds the potential to revolutionize the standard of care in gastroenterology and usher in a new era of precision and efficacy in the treatment of acid-related illnesses.

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REFERENCES

1. Wang X, Teng G, Dong X, Dai Y, Wang W. Efficacy and safety of vonoprazan-amoxicillin dual therapy for Helicobacter pylori first-line treatment: a single-center, randomized, controlled trial. Therap Adv Gastroenterol. 2023;16:17562848231190976.
2. Suzuki S, Gotoda T, Kusano C, Ikehara H, Ichijima R, Ohyauchi M, et al. Seven-day vonoprazan and low-dose amoxicillin dual therapy as first-line

Helicobacter pylori treatment: a multicentre randomised trial in Japan. Gut. 2020;69(6):1019-26.
3. Murakami K, Sakurai Y, Shiino M, Funao N, Nishimura A, Asaka M, et al. Vonoprazan, a novel potassium-competitive acid blocker, as a component of first-line and second-line triple therapy for Helicobacter pylori eradication: a phase III, randomised, double-blind study. Gut. 2016;65(9):1439-46.
4. Haruma K, Kinoshita Y, Yao T, Kushima R, Akiyama J, Aoyama N, et al. Randomised clinical trial: 3-year interim analysis results of the VISION trial to evaluate the long-term safety of vonoprazan as maintenance treatment in patients with erosive oesophagitis. BMC Gastroenterol. 2023;23(1):139.
5. Yang E, Ji SC, Jang IJ, Lee S. Evaluation of CYP2C19-Mediated Pharmacokinetic Drug Interaction of Tegoprazan, Compared with Vonoprazan or Esomeprazole. Clin Pharmacokinet. 2023;62(4):599-608.
6. Li J, Lv L, Zhu Y, Zhou Z, He S. A modified 14-day dual therapy with vonoprazan and amoxicillin amplified the advantages over conventional therapies for eradication of helicobacter pylori: a non-inferiority clinical trial. Infect Drug Resist. 2023;16:5637-45.
7. Chen S, Shen W, Liu Y, Dong Q, Shi Y. Efficacy and safety of triple therapy containing berberine, amoxicillin, and vonoprazan for Helicobacter pylori initial treatment: A randomized controlled trial. Chin Med J (Engl). 2023;136(14):1690-8.
8. Peng X, Chen HW, Wan Y, Su PZ, Yu J, Liu JJ, et al. Combination of vonoprazan and amoxicillin as the first-line Helicobacter pylori eradication therapy: a multicenter, prospective, randomized, parallel-controlled study. Clin Exp Med. 2023;23(7):4011-9.
9. Hu Y, Xu X, Liu XS, He C, Ouyang YB, Li NS, et al. Fourteen-day vonoprazan and low- or high-dose amoxicillin dual therapy for eradicating Helicobacter pylori infection: A prospective, open-labeled, randomized non-inferiority clinical study. Front Immunol. 2023;13:1049908.
10. Lu L, Wang Y, Ye J, Han Y, Lou G, Li Y, et al. Quadruple therapy with vonoprazan 20 mg daily as a first-line treatment for Helicobacter pylori infection: A single-center, open-label, noninferiority, randomized controlled trial. Helicobacter. 2023;28(1):e12940.
11. Sue S, Kondo M, Sato T, Oka H, Sanga K, Ogashiwa T, et al. Vonoprazan and high-dose amoxicillin dual therapy for Helicobacter pylori first-line eradication: A single-arm, interventional study. JGH Open. 2022;7(1):55-60.
12. Yang F, Yu B, Qin L, Dai X. A randomized clinical study on the efficacy of vonoprazan combined with amoxicillin duo regimen for the eradication of Helicobacter pylori. Medicine (Baltimore). 2023;102(41):e35610.
13. Shinozaki S, Osawa H, Hayashi Y, Miura Y, Lefor AK, Yamamoto H, et al. Long-term vonoprazan therapy is effective for controlling symptomatic proton pump inhibitor-resistant gastroesophageal reflux disease. Biomed Rep. 2021;14(3):32.
14. Kim YI, Lee JY, Kim CG, Park B, Park JY, Choi J, et al. Ten-day bismuth-containing quadruple therapy versus 7-day proton pump inhibitor-clarithromycin containing triple therapy as first-line empirical therapy for the Helicobacter pylori infection in Korea: a randomized open-label trial. BMC Gastroenterol. 2021;21(1):95.
15. Lin Y, Xu H, Yun J, Yu X, Shi Y, Zhang D. The efficacy of vonoprazan combined with different dose amoxicillin on eradication of Helicobacter pylori: an open, multicenter, randomized clinical study. Ann Transl Med. 2022;10(18):987.
16. Yu J, Lv YM, Yang P, Jiang YZ, Qin XR, Wang XY. Safety and effectiveness of vonoprazan-based rescue therapy for Helicobacter pylori infection. World J Gastroenterol. 2023;29(20):3133-44.
17. Ashida K, Honda Y, Sanada K, Takemura Y, Sakamoto S. The safety and effectiveness of vonoprazan-based Helicobacter pylori eradication therapy; a prospective post-marketing surveillance. Expert Opin Drug Saf. 2019;18(12):1255-61.
18. Feng JH, Cheng J, Lao YJ, Huang K, Mou JL, Hu F, et al. The efficacy and safety of vonoprazan–amoxicillin dual therapy in eradicating helicobacter pylori: A systematic review and meta-analysis. Eur J Med Res. 2023;28(1):272.
19. Zhang WL, Lin BS, Li YY, Ding YM, Han ZX, Ji R. Efficacy and safety of Vonoprazan and amoxicillin dual therapy for helicobacter pylori eradication: A systematic review and meta-analysis. Digestion, 2023;104(4):249-61.
20. Liu L, Li F, Shi H, Nahata MC. The efficacy and safety of Vonoprazan and amoxicillin dual therapy for helicobacter pylori infection: A systematic review and network meta-analysis. Antibiotics. 2023;12(2):346.
21. Rokkas T, Gisbert JP, Malfertheiner P, Niv Y, Gasbarrini A, Leja M, et al. Comparative Effectiveness of Multiple Different First-Line Treatment Regimens for Helicobacter pylori Infection: A Network Meta-analysis. Gastroenterology. 2021;161(2):495-507.e4.
22. Drug Trials Snapshots: Voquezna Triple Pak, Voquezna Dual PAK. Available at: https://www.fda.gov/drugs/drug-approvals-and-databases/drug-trials-snapshots-vonoprazan-triple-pak-vonoprazan-dual-pak. Accessed on 3 January 2024.

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