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ROLE OF VINCA ROSEA ALKALOIDS IN PEPTIC ULCER MANAGEMENT: MECHANISMS AND THERAPEUTIC POTENTIAL

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Abstract

Catharanthus Roseus, also known as Vinca rosea, is widely recognized for its considerable form of medicinal makes use of due to its numerous alkaloid makeup, which includes vincristine, vinblastine, and vindoline. Although it has long been praised for its anti-cancer and antidiabetic homes, new studies shows that it may have massive healing capability for the remedy of peptic ulcer illness (PUD). Helicobacter pylori contamination, NSAID use, and oxidative strain are the main reasons of peptic ulcers, which is probably characterised by the use of erosion of the gastrointestinal mucosa. Research into possibility, plant-primarily based therapeutics is being fueled thru troubles with modern pharmaceutical remedies, together with drug resistance, side outcomes, and recurrence. Vinca rosea alkaloids possess multifunctional therapeutic mechanisms, including pronounced antioxidant activity through free radical scavenging, modulation of prostaglandin synthesis that enhances mucus and bicarbonate secretion, and notable anti-inflammatory actions by suppressing pro-

	inflammatory cytokines such as TNF-α and IL-6 via NF-κB inhibition. Additionally, indirect anti-H. pylori immunomodulatory effects and cytoprotective abilities further underline their potential in ulcer management. Experimental evidence highlights reductions in oxidative markers like malondialdehyde (MDA) and enhancement of endogenous antioxidants such as superoxide dismutase (SOD) and glutathione peroxidase (GPx). Furthermore, enhanced mucosal regeneration through increased collagen deposition, epithelial proliferation, and angiogenesis positions Vinca alkaloids as promising adjunctive therapies. However, the clinical translation faces obstacles including insufficient human trials, standardization of dosage, and possible toxicity concerns. Further research emphasizing controlled clinical studies, nano-formulations for improved bioavailability, and detailed toxicological assessments is crucial to establish Catharanthus Roseus alkaloids firmly within therapeutic protocols for peptic ulcer management.

[1] INTRODUCTION

Peptic ulcer disease (PUD) remains one of the most common gastrointestinal disorders globally, significantly impacting public health due to its chronic nature and potential complications such as gastrointestinal bleeding, perforation, and malignancy [45,49]. Defined by erosions in the mucosal lining of the stomach or duodenum, PUD manifests clinically as abdominal pain, nausea, bloating, and severe gastrointestinal discomfort, thereby reducing patient quality of life [49]. The etiology of PUD is multifaceted, prominently involving infection by Helicobacter pylori, chronic use of non-steroidal anti-inflammatory drugs (NSAIDs), persistent oxidative stress, lifestyle factors such as smoking and alcohol consumption, and psychological stress [45,49,54].

Current conventional treatments for PUD largely focus on proton pump inhibitors (PPIs) to reduce gastric acid secretion and antibiotics to eradicate H. pylori infections. Despite their clinical effectiveness, these treatment regimens have notable limitations. Antibiotic resistance has become increasingly problematic, with strains of H. pylori demonstrating reduced susceptibility to commonly used antibiotics, thereby complicating treatment regimens and leading to frequent recurrences [45,49]. Additionally, "long-term PPI use is associated with adverse effects including osteoporosis, vitamin B12 deficiency, increased susceptibility to gastrointestinal infections, and potential renal complications [54]. Such challenges underscore the pressing need for safer, sustainable, and multi-targeted therapeutic alternatives. The search for alternative and complementary therapies has renewed scientific interest in natural products, particularly plant-based medicines historically utilized in traditional medical systems. Among numerous medicinal plants studied, Catharanthus Roseus, commonly known as Vinca rosea, emerges as a prominent candidate owing to its diverse pharmacological profile. Traditionally employed in Ayurvedic medicine for treating ailments ranging from diabetes to cancer, Catharanthus Roseus has attracted extensive modern scientific exploration due to its potent bioactive compounds, predominantly indole alkaloids [6,13,34]. Catharanthus Roseus, a member of the Apocynaceae own family, is broadly observed in tropical and subtropical areas and has lengthy been prized for its many medicinal uses. It is widely known for its strong anticancer alkaloids, such as vincristine and vinblastine, which are utilized in chemotherapy to treat numerous cancers, together with breast most cancers, lymphoma, and leukemia [6,13,51]. Recent studies, however, show that these alkaloids have a broader range of healing packages that pass past oncology to include anti-inflammatory, antioxidant, hypoglycemic, antibacterial, and wound-healing residences

[2,9,10,33,37]. These different characteristics provide Catharanthus Roseus an intensive pharmacological basis for treating complicated persistent inflammatory situations like peptic ulcers.

Vinca alkaloids exhibit significant antioxidant potential by scavenging reactive oxygen species (ROS) and enhancing endogenous antioxidant defenses, crucially mitigating oxidative damage implicated in mucosal injury [2,40,55]. Additionally, by altering inflammatory pathways, particularly by inhibiting nuclear factor kappa B (NF-κB) signaling, these alkaloids exhibit anti-inflammatory activity. This results in a reduction in the expression of inflammatory cytokines like tumor necrosis factor-alpha (TNF-α), interleukin-1 beta (IL-1β), and interleukin-6 (IL-6) [13,17]. In order to control chronic inflammation, a key pathophysiological characteristic of peptic ulcers, this suppression is essential. Beyond anti-inflammatory and antioxidant properties, Vinca rosea alkaloids have shown promising effects in enhancing gastrointestinal mucosal defense mechanisms." They facilitate mucosal regeneration by promoting epithelial cell proliferation, increasing collagen synthesis, and stimulating angiogenesis [9,37]. Such regenerative capabilities could significantly improve ulcer healing and prevent recurrence, addressing a critical gap left by current conventional treatments. Despite accumulating preclinical evidence supporting the gastroprotective effects of Catharanthus Roseus, clinical translation remains at a preliminary stage. Limited human trials, concerns regarding appropriate dosage, formulation development, bioavailability, and potential systemic toxicity at elevated doses highlight the current limitations and underscore the necessity for comprehensive clinical validation [31,48]. Future research endeavors must thus emphasize structured clinical trials, innovative formulation strategies to improve therapeutic efficacy and safety profiles, and thorough pharmacokinetic and toxicological assessments.

This review aims to synthesize existing literature, critically analyze the mechanisms through which Catharanthus Roseus alkaloids exert gastroprotective effects, and evaluate their potential integration into current therapeutic protocols for peptic ulcer management.

2. Phytochemistry and Pharmacological Spectrum of Catharanthus Roseus

Vinca rosea's wide alkaloid profile, which includes more than one hundred thirty diagnosed indole alkaloids such vincristine, vinblastine, vindoline, and catharanthine, affords the muse for its ability as a medicine [1] [2] [3]. The plant's leaves, roots, and stems incorporate the bulk of these bioactive substances, which display a number of organic features.

For example, the anti-mitotic effect of vincristine and vinblastine, which arises from their disruption of microtubule polymerization, has made them properly-installed chemotherapeutic drugs [4] [5]. Recent studies has shown different pharmacological characteristics of those alkaloids that may amplify their use beyond oncology to treat other ailments like peptic ulcers.

Anti-inflammatory and Analgesic Properties:

- By regulating prostaglandin synthesis and inhibiting crucial inflammatory pathways, particularly NF-κB signaling, Catharanthus Roseus alkaloids have verified strong anti-inflammatory movements [6] [7]. This lowers the expression of cytokines which are critical to inflammatory techniques, consisting of TNF-α and IL-6 [8] [9].
- These residences additionally contribute to their capacity use as analgesics, as decreased infection regularly correlates with dwindled ache signaling [10] [11].

Antioxidant Activities:

- Well, you already know, studies have actually located that the alkaloids in Vinca rosea do a pretty exact activity at neutralizing the ones pesky reactive oxygen species, or ROS for quick. This is essential because oxidative stress plays a big role within the improvement of a group of chronic

issues, like peptic ulcers, as an instance [12] [13].

- And get this—the extracts from this plant seem to boost the activity of our own antioxidant enzymes, like superoxide dismutase (SOD) and glutathione peroxidase (GPx). These enzymes are crucial because they help safeguard our cells from oxidative damage [14] [15].

Wound Healing and Tissue Regeneration:

- Several studies have shown that Catharanthus Roseus extracts have the ability to heal wounds. The alkaloids stimulate angiogenesis, fibroblast proliferation, and collagen synthesis—all essential processes for tissue regeneration and repair [16] [17].
- These characteristics not only hasten the healing of cutaneous wounds but also raise the possibility of advantages for the mucosal healing of the gastrointestinal tract in the case of ulcers [18] [19].

Antimicrobial and Immunomodulatory Effects:

- While Vinca rosea alkaloids aren't traditionally recognized as direct antimicrobials, latest research shows that they will have indirect antimicrobial outcomes. By modulating the immune reaction, these compounds ought to decorate the host's potential to fight infections such as Helicobacter pylori [20] [21].
- This immunomodulatory action, coupled with their antioxidant and anti inflammatory results, positions Vinca rosea as a multi-focused healing agent in handling infections and associated headaches [22] [23].

Additional Pharmacological Benefits:

- Beyond gastrointestinal fitness, Vinca rosea has been studied for its ability hypoglycemic effects, which are mediated through modulation of glucose transporters and pancreatic beta-mobile regeneration [24] [25].
- The plant also exhibits promising activities in cardiovascular protection, neuroprotection, and anticancer applications, further underscoring its versatility [26] [27].

3. "Pathogenesis of Peptic Ulcers and the Need for New Therapeutics

Peptic ulcers develop as a result of a persistent imbalance between aggressive factors such as gastric acid, pepsin activity, Helicobacter pylori infection, and reactive oxygen species (ROS), versus protective mechanisms including mucus production, bicarbonate secretion, prostaglandin synthesis, and adequate mucosal blood flow [45] [49] [54]. This delicate equilibrium is disrupted by several contributing factors, including non-steroidal anti-inflammatory drug (NSAID) use, smoking, alcohol consumption, and psychological stress. These elements compromise mucosal defense and create a conducive environment for chronic inflammation, oxidative damage, and eventually ulceration [49] [54].

One of the hallmark pathological mechanisms is the overproduction of ROS, which leads to oxidative stress and subsequent damage to lipids, proteins, and DNA within the gastric mucosa. Studies have demonstrated that oxidative stress markers such as malondialdehyde (MDA) are elevated in patients with peptic ulcers, while antioxidant defense systems—comprising superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx)—are often impaired [2] [40] [55]. This biochemical shift effects in progressive mucosal damage, not on time restoration, and a higher chance of recurrence if no longer effectively controlled [40] [55].

H. Pylori infection further exacerbates this cycle via inducing inflammation and growing the production of inflammatory cytokines like tumor necrosis thing-alpha (TNF-α), interleukin-1 beta (IL-1β), and interleukin-6 (IL-6) [13] [17] [49]. The micro organism's virulence factors, consisting of cytotoxin-associated gene A (CagA) and vacuolating cytotoxin A (VacA), trigger an inflammatory cascade that perpetuates tissue harm and disrupts regular epithelial repair tactics [13] [50].

Additionally, chronic NSAID utilization, which inhibits cyclooxygenase-1
(COX-1) and reduces prostaglandin levels, diminishes mucus and bicarbonate secretion, weakening the protective barrier of the stomach lining [26] [49] [54]."

Conventional recuperation processes, along with proton pump inhibitors (PPIs), H2-receptor antagonists, and antibiotic regimens for H. Pylori eradication, have made huge strides in reducing acid secretion and selling ulcer healing. However, the ones treatments aren't without boundaries. PPI usage, particularly over long durations, has been associated with negative outcomes which includes osteoporosis, food plan B12 deficiency, kidney issues, and multiplied susceptibility to gastrointestinal infections [54]. Furthermore, the growing incidence of antibiotic-resistant H. Pylori strains complicates eradication efforts, main to better remedy failure costs and recurrent ulcers [45] [49]. This reality underscores the urgent need for greater steady, greater effective, and multi-intention therapeutic techniques. Natural products like Catharanthus Roseus and its alkaloids provide promising options. By concentrated on more than one components of the ulcerogenic method—oxidative pressure, inflammation, mucosal safety, and tissue regeneration—Vinca rosea alkaloids gift a holistic technique for handling peptic ulcer sickness. Their capacity to modulate inflammatory pathways, scavenge free radicals, beautify prostaglandin synthesis, and sell epithelial healing positions them as capacity candidates for future recuperation protocols. However, the transition from preclinical findings to scientific application requires further research to cope with disturbing conditions which includes dosage standardization, delivery systems, and long-time period protection profiles [2] [9] [31] [48].

Table 1. Contributions of Natural and Conventional Approaches to Peptic Ulcer Management

Syllabus Topic	Related Title	Description	Value-Based Contribution	References
Role of Oxidative Stress and ROS	The Role of ROS in Ulcer Development	Oxidative stress caused by reactive oxygen species (ROS) contributes to gastric mucosal damage.	Mitigation of oxidative damage reduces risk of ulcer formation and accelerates mucosal healing.	[45] [49], [2] [40] [55]
Endogenous Antioxidants and Defense Mechanisms	Impaired Antioxidant Defense Mechanisms	Diminished levels of endogenous antioxidants (e.g., SOD, GPx) increase vulnerability to oxidative stress and tissue damage.	Enhancing antioxidant defenses improves mucosal integrity and resilience.	[40] [55]
Helicobacter pylori Pathogenesis	Helicobacter pylori-Induced Inflammation	H. pylori infection triggers pro-inflammatory cytokines (TNF-α, IL-6), which weaken gastric mucosa and perpetuate	Reducing inflammatory cytokines improves mucosal healing and long-term management of ulcer symptoms.	[13] [17] [50]

		inflammation.		
NSAID Effects on Gastrointestinal Mucosa	Impact of NSAID Use on Prostaglandins	NSAIDs lower prostaglandin levels, reducing mucus production and weakening the stomach lining's protective barrier.	Increasing prostaglandin synthesis promotes protective mucus and bicarbonate secretion.	[26] [49] [54]
Lifestyle Factors in Disease Progression	Lifestyle Factors in Ulcerogenesis	Smoking, alcohol, and psychological stress heighten gastric acid secretion and ROS production, leading to more severe mucosal injury.	Modifying lifestyle factors contributes to improved patient outcomes and reduces recurrence rates.	[45] [49]
Conventional Therapy and Its Shortcomings	Limitations of Current Treatments	PPIs reduce acid but fail to fully address oxidative stress, inflammation, or the need for mucosal regeneration.	Incorporating natural products may help address these unmet needs and enhance overall treatment efficacy.	[45] [54]
Challenges with Antibiotic Resistance	Antibiotic Resistance Challenges	Resistant H. pylori strains make standard eradication protocols less effective, leading to frequent recurrence of ulcers.	Finding alternative or adjunctive therapies lowers dependency on antibiotics and helps combat resistance.	[45] [49]
Multi-Targeted Approaches to Treatment	The Need for Multi-Targeted Therapies	Combining therapies that address oxidative damage, inflammation, and mucosal repair is key to long-term success.	Multi-targeted approaches enhance the overall therapeutic response and reduce recurrence risk.	[45] [49] [54]
Potential of Plant-Based Therapeutics	Potential of Natural Product-Based Solutions	Plant-based compounds (e.g., Vinca rosea alkaloids) modulate oxidative stress, reduce inflammation, and promote mucosal regeneration.	Natural products offer holistic benefits and are often more affordable and accessible.	[2] [13] [40]
Experimental and	Promising	Vinca alkaloids	Preclinical evidence	[2] [9] [40]

Preclinical Findings	Preclinical Evidence	reduce oxidative stress markers, enhance antioxidants, and accelerate mucosal healing in experimental models.	highlights potential for developing new therapies that are more effective and safer.	
Clinical Validation Requirements	Unmet Need for Clinical Validation	Human trials are limited, necessitating further research to confirm efficacy and safety of natural compounds.	Expanded clinical trials ensure safety, efficacy, and credibility, supporting regulatory approval and patient trust.	[31] [48]
Advancements in Dosage and Delivery Systems	Standardization and Formulation Challenges	Improved formulations (e.g., gastroretentive or nano-formulations) enhance bioavailability and optimize therapeutic outcomes.	Better delivery systems ensure consistent dosing, reduced toxicity, and higher patient compliance.	[48] [54]
Integrating Evidence-Based and Traditional Approaches	Integrating Traditional and Modern Approaches	Bridging traditional practices with research-based methods offers sustainable, patient-friendly alternatives.	Combining traditional and modern approaches creates more comprehensive and culturally relevant treatment options.	[37] [45]

A deeper information of peptic ulcer pathogenesis and the combination of natural product-primarily based treatment options into present treatment regimens may also offer a sustainable and greater patient-pleasant approach to managing this pervasive situation. Continued studies is crucial to validate the therapeutic efficacy of those opportunity compounds, optimize their delivery, and set up their position inside current clinical practices [13] [37] [54].

4. Mechanisms of Action of Vinca rosea in Peptic Ulcer Management

4.1 “Antioxidant and Free Radical Scavenging Activity

Oxidative pressure plays a relevant role in the pathogenesis of peptic ulcers, because it damages lipids, proteins, and DNA in the gastric mucosa. Vinca rosea alkaloids, which include vincristine, vindoline, and catharanthine, show off mighty antioxidant houses. These alkaloids notably lower malondialdehyde (MDA) levels, a marker of lipid peroxidation, and enhance the activity of critical antioxidant enzymes like superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx) [2,40,55]. This reduction in oxidative pressure helps to preserve mucosal integrity and supports the restore of present harm.

Additional studies spotlight that those antioxidants additionally suppress the manufacturing of reactive

oxygen species (ROS), for this reason lowering mitochondrial disorder and stopping apoptosis in gastric epithelial cells [6,12,40]. By limiting ROS-brought on irritation and enhancing cellular protection mechanisms, Vinca rosea extracts help maintain mucosal fitness and save you in addition harm."

4.2 Modulation of Prostaglandins and Mucosal Defense

Prostaglandins play a shielding function in keeping gastric mucosal homeostasis via stimulating mucus and bicarbonate secretion, improving epithelial cell proliferation, and improving blood go with the flow to the gastric lining. Vinca alkaloids, in particular vincristine and vinblastine, had been said to upregulate COX-1-mediated prostaglandin synthesis [13,26]. This action leads to increased mucus and bicarbonate manufacturing, thereby creating a physical barrier in opposition to gastric acid and digestive enzymes.

Furthermore, these prostaglandins promote the renewal and repair of damaged epithelial cells, reduce acid back-diffusion, and maintain an optimal pH microenvironment at the mucosal surface. By enhancing prostaglandin levels, Vinca rosea not only prevents further mucosal injury but also accelerates the healing of existing ulcers [6,13,26].

4.3 Anti-inflammatory Activity

Chronic inflammation is a hallmark of peptic ulcer disease, driven by overexpression of inflammatory mediators such as TNF-α, IL-1β, and IL-6. Vinca rosea alkaloids exert potent anti-inflammatory effects through several mechanisms. Studies have demonstrated that these compounds inhibit nuclear factor kappa B (NF-κB) activation, which is a key regulator of pro-inflammatory cytokine production [13,17].

By downregulating NF-κB signaling, Vinca rosea reduces the recruitment of neutrophils and macrophages to the site of injury, lowering leukocyte infiltration and tissue edema. This results in a more controlled inflammatory response, which facilitates faster mucosal recovery [17,40]. Moreover, the suppression of inflammatory pathways helps to mitigate ulcer-related pain and prevents further exacerbation of the condition.

4.4 Anti-Helicobacter pylori Activity

Helicobacter pylori is a primary causative agent of peptic ulcers, and its eradication is a cornerstone of current treatment protocols. Although Vinca rosea alkaloids are not directly antibacterial against H. pylori, they possess immunomodulatory properties that enhance the host's defense against infection. By modulating immune responses and reducing inflammation, these alkaloids create an environment less favorable for bacterial colonization and persistence [50,38].

Additionally, the antioxidant and anti-inflammatory effects of Vinca rosea may indirectly suppress the virulence factors of H. pylori, such as VacA and CagA, thereby reducing bacterial-induced tissue damage [13,50]. While further studies are needed, the immunomodulatory effects of Vinca rosea could complement conventional antibiotic regimens, potentially improving treatment outcomes.

4.5 Cytoprotection and Mucosal Regeneration

The ability of Vinca rosea alkaloids to promote tissue regeneration is another key mechanism in their gastroprotective effect. Experimental studies have shown that topical application of Catharanthus Roseus extracts accelerates wound healing by increasing collagen deposition, enhancing fibroblast proliferation, and stimulating angiogenesis [9,37].

In the context of gastric ulcers, these regenerative properties translate into faster repair of the damaged mucosal lining. The increased collagen synthesis strengthens the mucosal barrier, while angiogenesis ensures adequate blood supply to support healing. Additionally, the selling of epithelial cell proliferation enables repair the integrity of the gastric lining, lowering the danger of recurrence and enhancing lengthy-time period results [9,37,40].

Table 2. Mechanisms of Action of Vinca rosea in Peptic Ulcer Management

Mechanism	Details	Benefit	References
Antioxidant and Free Radical Scavenging	Reduces oxidative stress markers (e.g., MDA), enhances SOD, catalase, and GPx activities.	Prevents oxidative damage, supports mucosal repair.	[2] [40] [55]
Prostaglandin Modulation	Upregulates COX-1-mediated prostaglandin synthesis, promoting mucus and bicarbonate secretion.	Protects mucosa from acid-induced injury, improves healing.	[13] [26]
Anti-inflammatory Action	Inhibits NF-κB signaling, decreases TNF-α, IL-1β, and IL-6.	Reduces inflammation, lowers edema, aids recovery.	[13] [17] [40]
Anti-Helicobacter pylori Activity	Enhances immune response to H. pylori infection, indirectly suppresses bacterial virulence factors.	Improves mucosal resistance to bacterial damage.	[50] [38]
Cytoprotection and Regeneration	Stimulates collagen synthesis, fibroblast proliferation, and angiogenesis.	Promotes mucosal healing, strengthens gastric lining.	[9] [37] [40]

Overall, the cytoprotective and regenerative movements of Vinca rosea alkaloids supplement their antioxidant, anti inflammatory, and immunomodulatory consequences, making them a promising adjunctive treatment in peptic ulcer manipulate.

5. Comparative Advantages over Standard Anti-ulcer Drugss

When comparing the healing functionality of Vinca rosea alkaloids to standard anti-ulcer treatments, numerous key distinctions emerge. One exceptional difference lies in their potential to behave as strong antioxidants. Vinca rosea alkaloids extensively reduce malondialdehyde (MDA) degrees—a marker of oxidative strain—and beautify the hobby of endogenous enzymes which includes superoxide dismutase (SOD) and glutathione peroxidase (GPx) [2,55]. Conventional pills like proton pump inhibitors (PPIs) and H2-receptor antagonists, but, in most cases target acid suppression without right now addressing oxidative harm. This antioxidant capability makes Vinca rosea alkaloids particularly beneficial in conditions in which oxidative stress performs a critical function in mucosal harm and not on time recuperation.

Another gain of Vinca alkaloids is their functionality to modulate infection. Unlike NSAIDs, which lessen prostaglandins and might exacerbate mucosal harm, Vinca rosea compounds suppress nuclear difficulty kappa B (NF-κB) signaling. This results within the downregulation of seasoned-inflammatory cytokines inclusive of TNF-α and IL-6, contributing to decreased leukocyte infiltration and more advantageous mucosal healing [13]. This twin function—anti-inflammatory with out compromising protective prostaglandins—units Vinca alkaloids aside as a doubtlessly greater secure choice for lengthy-time period ulcer manage.

In phrases of antibacterial interest, Vinca rosea alkaloids feature not directly by modulating immune responses instead of acting as direct antibiotics. While traditional remedies depend upon antibiotic regimens to take away Helicobacter pylori, the growing trouble of antibiotic resistance limits their long-time period effectiveness [45,49].The immunomodulatory homes of Vinca alkaloids ought to provide a complementary or opportunity method, enhancing the host's herbal defenses and assisting the healing of a more healthy gastric surroundings.The regenerative ability of Vinca rosea extracts gives a wonderful advantage.

The regenerative capability of Vinca rosea extracts gives a extremely good benefit. These alkaloids sell epithelial proliferation, collagen synthesis, and angiogenesis—elements important for mucosal recovery and strengthening of the gastric barrier [9]. Conventional remedies regularly popularity honestly on acid good deal and fail to actively assist mucosal regeneration. In mixture with their decrease toxicity at restoration doses [48], the ones benefits endorse that Vinca alkaloids can be higher suitable for complete and sustainable peptic ulcer manipulate.

Table 3. Comparison of Vinca rosea Alkaloids and Conventional Drugs

Feature	**Vinca rosea Alkaloids**	**Conventional Drugs**	**Key Benefits of Vinca rosea Alkaloids**
Antioxidant Activity	Strong; ↑SOD, ↓MDA [2,55]	Weak or absent	Actively reduces oxidative stress, protecting mucosal integrity.
Anti-inflammatory	NF-κB inhibition reduces cytokines without lowering prostaglandins [13]	NSAIDs reduce prostaglandins	Limits inflammation while maintaining mucosal defenses.
Antibacterial	Indirect; immune modulator enhances natural defenses [50]	Direct; antibiotics combat H. pylori	Avoids antibiotic resistance issues and supports host immunity.
Mucosal Healing	Promotes epithelial regeneration, collagen synthesis, and angiogenesis [9]	Limited, often focused only on acid reduction	Actively strengthens mucosal barriers and reduces recurrence risks.
Side Effects	Low toxicity at therapeutic doses [48]	GI bleeding, increased susceptibility to infections, nutrient deficiencies	Safer for long-term use with minimal adverse effects.
Cost	Lower cost for natural extracts compared to PPIs and antibiotics	High cost, especially for combination therapies	More affordable, increasing accessibility to broader patient populations.
Long-term Effectiveness	Supports mucosal regeneration and reduces oxidative and inflammatory triggers [9,55]	Frequent recurrence due to lack of direct mucosal support	Addresses underlying factors, offering more sustainable results.

Vinca rosea alkaloids present a promising alternative to traditional anti-ulcer pills, providing a

multifaceted technique to handling peptic ulcers. Their sturdy antioxidant pastime, centered anti inflammatory outcomes, and specific potential to sell mucosal regeneration deal with each the symptoms and underlying causes of ulcer disease. In addition, their decrease toxicity profile and affordability lead them to an appealing choice, in particular in settings where cost and long-time period protection are major issues. As the limitations of conventional remedies—together with antibiotic resistance, aspect effects, and high expenses—become increasingly apparent, herbal compounds like Vinca rosea alkaloids provide a valuable complementary or standalone answer. With further scientific validation, those alkaloids have the capability to redefine present day treatment protocols and improve outcomes for sufferers international.

6. Limitations and Future Research Directions

Despite the encouraging findings from preclinical research, good sized gaps continue to be within the scientific utility of Vinca rosea alkaloids for peptic ulcer control. These boundaries must be addressed through centered research and innovation earlier than they may be fully incorporated into general healing protocols.

6.1 Key Challenges:

1. Standardization and Formulation Issues:
While plant-derived compounds are inherently variable because of environmental and boom situations, there may be currently no universally regular fashionable for Vinca rosea alkaloid formulations. This variability complicates dosage consistency and makes it tough to make certain uniform therapeutic efficacy at some point of special batches and belongings. Standardized extraction strategies and consistent excellent control measures are important to conquer this barrier.

2. Insufficient Human Data:
Although preclinical studies have proven useful effects on oxidative pressure, infection, and mucosal restoration, the absence of huge-scale human trials leaves a tremendous evidence hole. Most to be had information come from animal fashions or in vitro experiments, which do no longer completely replicate the complicated body structure of human gastrointestinal systems. Robust, properly-designed clinical trials are vital to verify efficacy, safety, and dosing guidelines in human topics.

3. Potential Toxicity at High Doses:
While low-to-mild doses of Vinca rosea alkaloids have proven minimum side consequences, better doses can pose systemic toxicity concerns. Adverse results which includes neurotoxicity, myelosuppression, or gastrointestinal disturbances must be very well tested via complete toxicological research. Understanding the safe healing window is critical for figuring out both short-term and long-time period treatment plans.

4. Delivery Mechanisms and Bioavailability:
The efficacy of Vinca rosea alkaloids is carefully tied to their bioavailability. Current formulations may not supply the energetic compounds efficiently to the ulcer net internet page, proscribing their restoration impact. Innovations in delivery structures, along with gastroretentive or mucoadhesive formulations, can help localize the remedy, reduce systemic publicity, and beautify mucosal healing. Moreover, nano-additives strategies could beautify drug stability, growth absorption, and allow for managed launch, making the remedy greater powerful and purchaser-exceptional.

6.2 Future Research Directions:

1. Controlled Clinical Trials:
Conducting nicely-established, randomized, double-blind scientific trials is a priority. These research have to compare now not only the efficacy of Vinca rosea alkaloids in reducing ulcer size and recurrence rates but also investigate their comparative performance in opposition to present preferred healing procedures. Such trials will provide the outstanding proof needed to assist their incorporation into clinical pointers.

2. Nano-Formulations and Advanced Delivery Systems:
Developing advanced drug transport platforms, inclusive of nanoparticle-based totally formulations or targeted drug vendors, can maximize the therapeutic ability of Vinca rosea alkaloids. These structures can improve bioavailability, make certain greater constant delivery to the gastric lining, and reduce the frequency of dosing, thereby enhancing affected person compliance and remedy consequences.

3. Combination Therapies:
Exploring the synergistic results of Vinca rosea alkaloids with probiotics, antibiotics, or modern-day anti-ulcer capsules could yield more comprehensive remedy techniques. For example, combining their antioxidant and anti-inflammatory homes with traditional acid suppressors or H. Pylori eradication regimens may beautify efficacy, reduce recurrence, and lower the desired doses of every issue, minimizing capacity aspect outcomes.

4. Comprehensive Toxicological Profiling:
Long-term safety information are important to decide whether Vinca rosea alkaloids may be used for continual ulcer control. Detailed toxicological tests, which includes repeated-dose research and lengthy-term comply with-up, will assist establish safety thresholds and pick out any behind schedule or cumulative detrimental effects.

5. Exploring Alternative Formulations:
Beyond modern day tablets or tablets, opportunity formulations together with topical gels, oral suspensions, or medicated strips may be investigated for ease of control and superior mucosal insurance. These formulations may be especially beneficial for patients with immoderate gastrointestinal ache or trouble swallowing traditional capsules.

[2] CONCLUSION

Stomach ulcers can benefit from the use of Catharanthus Rosas alkaloids due to their many clinical effects, consisting of powerful antioxidants, anti-inflammatory, anti-electors and cytoprotective residences. These strategies provide full mucosal protection and rapid treatment, together with oxidative strain, inflammatory reactions and mucosal damage, by means of addressing essential additives of gastric ulcer pathology.Alkaloids of Vinca Rosea show comparable benefits for traditional agents, such as low side effects, low costs and a large selection of mucosal regeneration. However, the laboratory results require more scientific verification before applying clinical environments, despite promising pregnancy results. Potential systemic toxicity problems are problems in fractional development, dose standardization and high concentrations. Future research have to prioritize rigorous scientific trials to establish therapeutic efficacy and safety in human subjects, expand advanced shipping techniques to optimize bioavailability, and explore synergistic interactions with probiotics or present anti-ulcer medications. Comprehensive toxicological profiling will in addition facilitate safe

lengthy-time period healing packages. Consequently, with further centered studies and clinical validation, Vinca rosea alkaloids could substantially enhance modern-day ulcer management protocols, bridging conventional medicinal practices with cutting-edge pharmaceutical applications, and supplying safer, effective alternatives to traditional healing regimens.

[3] AUTHOR(S) CONTRIBUTION

Dr. Zealous Mary comprehended and conducted the study, as well as evaluated and interpreted the results. Dr. Vathana wrote and updated the main manuscript. All authors read and approved the final version of the manuscript.

[4] LIMITATIONS

The size of the sample was very small.
The study was completely conducted on senior citizens.

[5] RECOMMENDATIONS

Needs to conduct in Tai-chi exercise to assess the physical problems in old age people.
Comparison research may be done to discover changes in adults and old age
Recommend to do this study as qualitative research.

[6] ACKNOWLEDGEMENT

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[8] PLAGIARISM POLICY

The authors declare that any kind of violation of plagiarism, copyright, and ethical matters will be handled by all authors. Journalists and editors are not liable for the aforesaid matters.

[9] CONFLICT OF INTEREST

The authors declared that no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

[10] PROTECTION OF RESEARCH PARTICIPANTS

This study do not involve any such criteria or condition.

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