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THE RELATIONSHIP BETWEEN HELICOBACTER PYLORI INFECTION AND THE DEVELOPMENT OF GASTRIC CANCER

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ABSTRACT

Gastric cancer is an important health problem, and Helicobacter pylori (H. pylori) infection is one of its most important preventable risk factors. Most infected individuals will not develop cancer, but persistent infection may cause chronic inflammation and progressive damage to the gastric mucosa. Over time, these changes can create an environment that favors gastric carcinogenesis. This narrative review discusses the relationship between H. pylori and gastric cancer, focusing on chronic inflammation, bacterial virulence factors, cellular damage, precancerous lesions, and the possible preventive effect of eradication therapy. The topic is clinically relevant because H. pylori is common, can be diagnosed, and can be treated. Current evidence supports eradication as an important preventive measure, although the benefit varies according to the patient's risk profile and the stage of gastric mucosal damage.

Keywords: Helicobacter pylori; gastric cancer; chronic gastritis; carcinogenesis; eradication.

INTRODUCTION

Gastric cancer has a complex origin and develops through the interaction of genetic, environmental, and inflammatory factors. Among the known risk factors, Helicobacter pylori has a particularly important role because the infection is common and potentially treatable. H. pylori is strongly associated with non-cardia gastric cancer and is considered a major preventable cause of this disease.[1,2]

From a medical student perspective, this relationship is especially relevant because it connects a very common infection with a serious long-term outcome. H. pylori is often discussed in relation to dyspepsia, peptic ulcer disease, and gastritis, but its importance goes further. When infection persists for years, continuous inflammation may progressively change the gastric mucosa and increase the probability of malignant transformation.[1,3]

Importantly, infection does not mean that cancer will develop. Most infected people never develop gastric cancer. The final outcome depends on several factors, including bacterial characteristics, host susceptibility, age, smoking, diet, and the pattern and severity of gastric inflammation.[1,4]

The aim of this article is to explain, in a clear and clinically oriented way, how H. pylori may contribute to gastric cancer and why recognizing and treating the infection can be considered an opportunity for cancer prevention.

METHODS

This narrative literature review was based mainly on PubMed-indexed studies addressing H. pylori, gastric carcinogenesis, bacterial virulence, precancerous gastric lesions, and eradication therapy. The 2025 review by Duan et al. was used as the main recent reference and was complemented by prospective research and recent meta-analyses.[1,3,5]

FROM CHRONIC INFECTION TO GASTRIC CANCER

H. pylori is able to colonize the stomach and persist despite the host immune response. This persistent interaction produces chronic gastritis. The inflammatory response can damage gastric epithelial cells and stimulate repeated cycles of injury and repair. Over many years, this process may contribute to oxidative stress, DNA damage, abnormal cell signaling, and changes in the tissue microenvironment.[1,4]

A useful clinical model is the progression from chronic gastritis to gastric atrophy, intestinal metaplasia, dysplasia, and, in some patients, gastric cancer. This sequence is not inevitable, but the presence of advanced mucosal changes indicates greater risk. In a prospective study of 1,526 Japanese patients, gastric cancer developed in infected patients but not in those without H. pylori infection. Severe gastric atrophy, corpus-predominant gastritis, and intestinal metaplasia were associated with higher risk.[3]

The bacterium itself also matters. Different H. pylori strains have different pathogenic characteristics. Virulence factors such as CagA and VacA can intensify inflammation and interfere with normal cellular functions. CagA is particularly important because it can alter intracellular signaling and influence processes related to proliferation, cell polarity, and inflammatory responses.[1,4]

Recent research describes several signaling pathways involved in H. pylori-associated carcinogenesis, including NF-κB, STAT3, and Wnt/β-catenin. These pathways are related to inflammation, cell survival, proliferation, and tissue remodeling. Oxidative stress and DNA damage may further increase genomic instability.[1] These mechanisms help explain why a chronic infection can become relevant to cancer development even though the initial condition is simply bacterial colonization.

HOST AND ENVIRONMENTAL FACTORS

The risk of cancer is not determined by H. pylori alone. Host genetic factors may modify the inflammatory response, while smoking, dietary habits, age, and other environmental exposures can influence disease progression. This multifactorial process explains why patients with the same infection can have very different clinical outcomes.[2,4]

For clinicians, this distinction is important. A positive H. pylori test should not be presented to the patient as a diagnosis of cancer. Instead, it should be understood as the identification of a modifiable risk factor that deserves appropriate management.

ERADICATION AND CANCER PREVENTION

One of the most clinically relevant aspects of the H. pylori–gastric cancer relationship is the possibility of prevention. If persistent infection contributes to carcinogenesis, eliminating the bacterium should reduce future risk. Evidence accumulated over the last decades supports this concept, although the size of the benefit depends on the population studied and the condition of the gastric mucosa.[2,5]

A 2025 systematic review and meta-analysis by Ford et al. included randomized trials and observational studies and found a lower risk of gastric cancer after H. pylori eradication. Among randomized trials involving H. pylori-positive individuals without gastric neoplasia, eradication was associated with a relative risk of 0.64 for gastric cancer. The analysis also found a reduction in gastric cancer mortality among infected individuals without previous neoplasia.[5]

Another recent meta-analysis evaluated patients with intestinal metaplasia or dysplasia. Eradication was associated with a lower risk of gastric cancer in the pooled analysis, supporting treatment even when precancerous changes are already present. However, advanced mucosal damage may not be completely reversible, so eradication should not be considered a guarantee that cancer risk disappears.[6]

Treatment success also depends on antimicrobial resistance, previous antibiotic exposure, and the regimen selected. Therefore, good clinical management involves more than simply prescribing antibiotics. It requires an appropriate diagnostic strategy, an effective eradication regimen, and confirmation of treatment success when indicated.

These findings illustrate an important principle of preventive medicine. A physician may identify and treat a risk factor years before a malignant disease becomes clinically apparent. In this sense, H. pylori management is not only treatment of an infection; it can also be part of cancer prevention.

PUBLIC HEALTH AND CLINICAL RELEVANCE

H. pylori has a substantial contribution to the global burden of non-cardia gastric cancer.[2] Because the infection is treatable, strategies for testing and eradication may have an important role in populations with a high prevalence of infection or gastric cancer. At the same time, prevention should be individualized according to the patient's risk factors and gastric findings. A balanced explanation is essential. H. pylori is common, whereas gastric cancer is much less common. Therefore, the purpose of identifying the infection is not to create fear, but to remove a modifiable risk factor and recognize patients who may need additional follow-up.

CONCLUSION

The relationship between H. pylori and gastric cancer is long-term and multifactorial. Persistent infection may maintain chronic inflammation and promote oxidative stress, DNA damage, and abnormal cellular signaling. Bacterial virulence factors, host characteristics, and environmental exposures influence whether these changes progress toward precancerous lesions and, eventually, cancer.[1,4]

For medical practice, the key message is that H. pylori represents a modifiable risk factor. Current evidence indicates that eradication therapy can reduce the incidence of gastric cancer in infected individuals, although the benefit is not identical for every patient and may be limited when advanced mucosal lesions are already established.[5,6]

Understanding H. pylori therefore goes beyond memorizing its association with gastritis or peptic ulcers. It is also a practical example of preventive medicine: identifying a common infection today may help reduce the probability of a serious disease in the future. For future physicians, this reinforces the importance of evidence-based treatment, patient education, and long-term prevention.

REFERENCES

1. Duan Y, Xu Y, Dou Y, Xu D. Helicobacter pylori and gastric cancer: mechanisms and new perspectives. J Hematol Oncol. 2025;18(1):10. doi:10.1186/s13045-024-01654-2.

2. Plummer M, Franceschi S, Vignat J, Forman D, de Martel C. Global burden of gastric cancer attributable to Helicobacter pylori. Int J Cancer. 2015;136(2):487-490. doi:10.1002/ijc.28999.

3. Uemura N, Okamoto S, Yamamoto S, Matsumura N, Yamaguchi S, Yamakido M, et al. Helicobacter pylori infection and the development of gastric cancer. N Engl J Med. 2001;345(11):784-789. doi:10.1056/NEJMoa001999.

4. Servetas SL, Bridge DR, Merrell DS. Molecular mechanisms of gastric cancer initiation and progression by Helicobacter pylori. Curr Opin Gastroenterol. 2016;32(1):7-13. doi:10.1097/MOG.0000000000000248.
5. Ford AC, Yuan Y, Park JY, Forman D, Moayyedi P. Eradication therapy to prevent gastric cancer in Helicobacter pylori-positive individuals: systematic review and meta-analysis of randomized controlled trials and observational studies. Gastroenterology. 2025;169(2):261-276. doi:10.1053/j.gastro.2024.12.033.
6. Fu Q, Yu H, Liu M, Chen L, Chen W, Wang Z, et al. Effect of Helicobacter pylori eradication on gastric cancer risk in patients with intestinal metaplasia or dysplasia: a meta-analysis of randomized controlled trials. Front Microbiol. 2025;16:1530549. doi:10.3389/fmicb.2025.1530549.