Vaccination and Health Maintenance Issues to Consider in Patients With Inflammatory Bowel Disease

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Abstract: Patients with inflammatory bowel disease (IBD) do not receive routine preventive care at the same rate as the general population. IBD places patients at increased risk for developing vaccine-preventable illnesses. This risk is further exacerbated by immunosuppressive therapy. This article highlights the necessary vaccinations for IBD patients and the timing of vaccination for immunosuppressed patients, and discusses the health maintenance needs and preventive care issues related to heart disease, smoking, osteoporosis, mental health, cervical cancer, and skin cancer.

Patients with inflammatory bowel disease (IBD) are at increased risk for developing vaccine-preventable illnesses. This risk is further exacerbated by the use of corticosteroids, immunomodulators, and biologic agents.[1] IBD patients do not receive routine preventive care at the same rate as patients without IBD.[2] Gastroenterologists should be familiar with the intricacies of preventive health within the IBD patient population. This article considers general health maintenance issues, including vaccinations, in patients with IBD.

Immune Response to Vaccination

The immune system in patients with IBD is dysregulated independent of disease activity. Immune dysregulation (eg, an increased risk of pneumococcal pneumonia in patients prior to the diagnosis of IBD[3]) occurs both in patients who are immunosuppressant-naive and immunosuppressant-experienced. Thus, it is important to view all patients with IBD as having an altered immune system. Patients with IBD who are immunosuppressed have a diminished immune response to vaccination compared with patients who are not on immunosuppressive therapy.[4-7] The level of immune response typically correlates with the degree of immunosuppression. For instance, a patient receiving high-dose corticosteroids or a combination of a thiopurine and a biologic agent has a greater degree of

immunosuppression compared with a patient receiving a short course of systemic corticosteroids or a low dose of methotrexate, 6-mercaptopurine, azathioprine, or monotherapy with a biologic agent.[8]

Vaccination Rates

Vaccination rates in patients with IBD are exceedingly low. A 2006 survey of 169 patients with IBD revealed that only 28% of patients reported receiving an annual influenza vaccination, and 9% reported receiving a pneumococcal pneumonia vaccine.[9] One explanation for these low immunization rates stems from a lack of knowledge on the part of gastroenterologists regarding the importance of vaccinating patients with IBD. A more recent survey from 2011 demonstrated that the majority of gastroenterologists felt that it was the role of the primary care physician to administer vaccinations, and that one-third of gastroenterologists would incorrectly administer a live vaccination to a patient on a biologic agent.[10] Gastroenterologists should be familiar with barriers to vaccination, including, but not limited to, general apathy among both patients and physicians, fears and concerns regarding the side effects of vaccination, and costs associated with storage and administration of vaccines. Other logistical barriers include the time constraints of an office visit, location of offices, and wait times to see a physician. The optimal time to obtain a vaccination history is during the initial office visit. Ideally, patients should be vaccinated when their disease is quiescent and prior to starting immunosuppressive therapy. If vaccinations are not offered in the gastroenterology clinic, clear recommendations should be provided to the patient's primary care physician. It should be noted that therapy for IBD should never be delayed in order to administer vaccines.

Inactivated Vaccines

Inactivated vaccines contain killed viral or bacterial microorganisms. Inactivation is accomplished with chemicals, heat, or radiation. Because inactivated vaccines do not contain live microorganisms, they typically produce a weaker immune response that often necessitates subsequent booster vaccinations.[11] All inactivated vaccines can be safely administered to patients with IBD, including those who are on immunosuppressive therapy (Table 1).

Influenza

Patients with IBD are at increased risk for developing influenza.[12] The influenza vaccine is available in 4 forms: a trivalent inactivated vaccine, a quadrivalent inactivated or activated vaccine, and a live intranasal vaccine. A recent retrospective study from a tertiary Australian IBD practice revealed that over a 12-month period, only 16% of patients with IBD were reminded to receive their annual influenza vaccine.[13] Patients with IBD should receive the influenza vaccine on a yearly basis. The live vaccine is no longer recommended by the Centers for Disease Control and Prevention (CDC) due to its decreased effectiveness as compared to the inactivated vaccine.[14] In particular, the live intranasal vaccine should be avoided in patients on immunosuppressive therapy, as well as in household members of such patients.

Pneumococcal Pneumonia

Patients with IBD have a higher risk of developing pneumococcal pneumonia compared to the general population, and may be at risk even prior to the development of IBD.[3] This risk is increased in patients taking biologic agents, corticosteroids, proton pump inhibitors, and narcotics.[15,16] Given these observations, and the fact that the majority of IBD patients may require immunosuppressive therapy, our institute offers the pneumococcal pneumonia vaccination series (pneumococcal polysaccharide vaccine [PPSV23] followed by pneumococcal conjugate vaccine [PCV13]) to all IBD patients regardless of immunosuppression. Recent guidelines published by the Advisory Committee on Immunization Practices (ACIP) recommend that patients with IBD who are on immunosuppressive therapy should receive a dose of PCV13, followed by PPSV23 2 to 12 months later.[17] If the patient has already received PPSV23, then he or she should receive PCV13 after 1 year. A second dose of PPSV23 should be administered 5 years after the first dose, and again at the age of 65 years if more than 5 years have elapsed since the previous dose.[17]

At our institution, we developed a 2-page educational form to give to patients in the waiting room that detailed the importance of vaccination, assessed vaccine status, and offered influenza and pneumococcal pneumonia vaccinations. This intervention increased vaccination rates for influenza from 23% to 47% and for pneumococcal pneumonia from 21% to 32%.[16] These rates were sustained for 18 months.[16]

Hepatitis A Virus

The incidence of hepatitis A virus has declined substantially since the introduction of childhood vaccination. However, hepatitis A virus remains the most common cause of viral liver disease worldwide.[18] Patients with IBD should have hepatitis A titers assessed for immunity; if they are nonimmune, the hepatitis A virus vaccination should be administered with a 2-dose regimen at 0 and 6 months.[1]

Hepatitis B Virus

More than 200 million individuals worldwide have serologic evidence of chronic hepatitis B virus.[19] Patients

Table 1. Inactivated Vaccines for Patients With IBD

Vaccine	Recommendation
Influenza	• All patients with IBD should be vaccinated seasonally with the intramuscular/intradermal inactivated influenza vaccine prior to starting immunosuppressive therapy.
Pneumococcal Pneumonia	• All patients with IBD should be vaccinated once with the PCV13 followed by the PPSV23 (first dose after 8 weeks if immunocompromised, or after ≥1 year if immunocompetent; second dose after 5 years; and third dose after 65 years of age). If previously vaccinated with the PPSV23, then the PCV13 should be administered at least 1 year after the PPSV23 in both immunocompromised and immunocompetent adults.
Hepatitis A Virus	• Check hepatitis A immune status at the patient's initial visit. If nonimmune to hepatitis A, vaccinate the patient with a 2-dose series (0 and 6 months).
Hepatitis B Virus	• Check hepatitis B immune status at the patient's initial visit. If nonimmune to hepatitis B, vaccinate the patient with a 3-dose series (0 months, and 1 and 6 months after first dose) and recheck titers 1-2 months after last vaccination. If the patient remains nonimmune, offer booster with a double dose of hepatitis B vaccine or offer combined hepatitis A/B vaccination.
Human Papilloma Virus	• All male and female IBD patients between the ages of 11 and 26 years should be vaccinated with the human papilloma virus vaccine with a 3-dose regimen. A 2-dose regimen is recommended in patients age 15 years and younger.
Meningococcal Disease	• Patients with IBD should be vaccinated with the meningococcal vaccine according to standard ACIP recommendations for the general population.
Tetanus, Diphtheria, and Pertussis	• All patients with IBD should be vaccinated with tetanus and diphtheria every 10 years. Tetanus, diphtheria, and pertussis should be substituted once for the tetanus and diphtheria vaccine to provide additional coverage for pertussis.
Herpes Zoster	• Vaccinate all patients over the age of 50 years with 2 doses of the adjuvant recombinant herpes zoster vaccine (Shingrix, GlaxoSmithKline) 2-6 months apart.

ACIP, Advisory Committee on Immunization Practices; IBD, inflammatory bowel disease; PCV13, pneumococcal conjugate vaccine; PPSV23, pneumococcal polysaccharide vaccine.

Adapted from Reich J, Wasan SK, Farraye FA. Vaccinating patients with inflammatory bowel disease. *Gastroenterol Hepatol (N Y)*. 2016;12(9): 540-546.

with IBD are at increased risk for developing hepatitis B virus infection. Risk factors include immunosuppressive therapy, blood transfusions, surgery, and travel to regions in which the virus is endemic.[20] The risk of reactivation is of particular importance in patients who have serologic evidence of previous hepatitis B virus exposure or ongoing infection. In a case series of 80 patients with Crohn's disease who received infliximab (Remicade, Janssen), 2 of 3 individuals who had hepatitis B surface antigen positivity developed severe hepatitis, and 1 of these patients died.[21] A recent systematic review and meta-analysis found a serologic response rate of 61% (defined by levels of hepatitis B surface antibodies >10 IU/L) to hepatitis B virus vaccination in patients with IBD.[22] Factors associated with poor serologic response included active IBD and use of immunosuppressive therapy.[22] All IBD patients should have their hepatitis B serology checked. For patients who are nonimmune, the hepatitis B virus vaccine series should be offered ideally before starting immunosuppressive therapy. An accelerated vaccination protocol may be appropriate for nonimmune patients beginning immunomodulators and biologic agents, and includes vaccination at days 0, 7, and 21 through 30 with a booster dose administered at 12 months.[23] Titers should then be reassessed 1 to 2 months after the last dose. In patients who do not mount a vaccine response (ie, levels of hepatitis B surface antibodies >10 IU/L), another 3-vaccine series should be administered.[24]

Human Papilloma Virus

Extensive evidence links human papilloma virus (HPV) to the development of cervical cancer.[25] A 2015 meta-analysis revealed that women with IBD who are on immunosuppressive therapy are at increased risk for developing cervical neoplasia.[26] When stratified by medication class, the risk was greatest for patients on immunomodulators, followed by corticosteroids and 5-aminosalicylic acids (5-ASAs).[26] Interestingly, anti–tumor necrosis factor agents were not associated with an increased risk of developing cervical dysplasia. The 9-valent HPV vaccine should be administered to all IBD patients between the ages of 11 and 26 years with a standard 3-dose regimen.

Table 2. Live Vaccines for Patients With IBD

Vaccine	Recommendation
Measles, Mumps, and Rubella	• Vaccinate all nonimmune patients with the measles, mumps, and rubella vaccine as long as they have not been on immunosuppressive therapy within the previous 3 months and there are no plans to start immunosuppressive therapy within the next 6 weeks.
Varicella Zoster Virus	• Vaccinate all nonimmune patients with the varicella zoster vaccine as long as they have not been on immunosuppressive therapy within the previous 3 months and there are no plans to start immunosuppressive therapy within the next 6 weeks.
Herpes Zoster	• Vaccinate all patients over the age of 60 years with the herpes zoster vaccine (Zostavax, Merck). Vaccination is safe in patients on low-dose immunosuppression but contraindicated in patients on biologic therapy or on corticosteroids. Do not vaccinate patients on high-dose immunosuppressive therapy within the past 3 months or who plan to start high-dose immunosuppressive therapy within the next 6 weeks.

IBD, inflammatory bowel disease.

Adapted from Reich J, Wasan SK, Farraye FA. Vaccinating patients with inflammatory bowel disease. *Gastroenterol Hepatol (N Y)*. 2016;12(9): 540-546.

New recommendations from the ACIP include a 2-dose regimen if vaccination is completed prior to age 15 years.[27]

Meningococcal Disease

Meningococcal disease is a serious and life-threatening disease characterized by systemic illness and severe meningitis. There are no data to suggest that patients with IBD are at increased risk for developing meningococcal disease; therefore, all IBD patients should receive the meningococcal vaccination series according to standard ACIP guidelines.[28] Prior to 2017, the ACIP recommended vaccination for individuals older than 10 years of age who are at high risk for meningococcal disease, including military recruits, patients traveling to endemic areas, patients living in college dormitories, patients with complement deficiencies, and asplenic individuals.[28] The ACIP extended these recommendations to include vaccination for all adolescents between 16 and 23 years of age.[28]

Tetanus, Diphtheria, and Pertussis

Data with respect to the immune response of patients with IBD to the tetanus toxoid are inconclusive. One study reported that patients with IBD have an impaired immune response to the tetanus booster,[29] whereas another study demonstrated a normal response.[30] A prospective, controlled trial conducted by Dezfoli and colleagues showed that tetanus and pertussis titers were lowest in patients on combined immunosuppressive therapy (biologic agent plus immunomodulator) as compared to patients on no therapy or 5-ASAs alone.[31] A single dose of the tetanus, diphtheria, and pertussis vaccine is recommended for patients between the ages of 11 through 64 years. A tetanus and diphtheria booster dose should then be administered every 10 years.[32]

Live Vaccines

Live vaccines are those in which an attenuated live virus or bacteria is introduced to generate an immune response. These vaccines typically produce a stronger immune response compared with inactivated vaccines. Clinicians caring for patients with IBD should be familiar with recommendations for live vaccinations, as they are often contraindicated in immunosuppressed patients (Table 2).[33]

Measles, Mumps, and Rubella

Patients with IBD whose vaccination history is unknown should have titers checked to confirm that they are immune to measles, mumps, and rubella (MMR). A recent study found that 13% of patients with IBD lacked immunity to measles.[34] The MMR vaccine is typically administered to children around the age of 1 year in a 2-dose series. If a patient with IBD is nonimmune, the MMR vaccine should be administered, although it is important to note that the MMR vaccine is contraindicated in patients who are taking immunosuppressive therapy or who plan to start immunosuppressive therapy within 6 weeks. In patients already receiving immunosuppressive therapy, vaccination should be delayed until the patient has been off immunosuppressive therapy for at least 3 months.[33] Family members of IBD patients on immunosuppressive therapy may be safely vaccinated with the MMR vaccine.

Varicella Zoster Virus

Patients with IBD are at increased risk for developing infections from the varicella zoster virus,[35] and this risk is further augmented by the use of immunosuppressive therapy. Fatal cases of varicella zoster virus infection have

been reported in patients with IBD.[36] A recent study among pediatric patients with IBD reported an increased risk of hospitalizations for both varicella zoster virus and herpes zoster infections.[37] All IBD patients should be tested for varicella zoster virus immunity; patients who are nonimmune should receive a 2-dose vaccine series at least 1 month prior to starting immunosuppressive therapy. Vaccination is safe if patients are on low-dose immunosuppressive therapy (ie, methotrexate, azathioprine, 6-mercaptopurine).[38] Household members of patients on immunosuppressive therapy may be safely vaccinated, although they should avoid contact with the IBD patient if the recipient develops a rash.[33]

Herpes Zoster

Herpes zoster (ie, shingles) is caused by reactivation of the varicella zoster virus. Herpes zoster typically occurs in adults over the age of 60 years and in patients who are immunocompromised.[39] Patients with IBD, especially those on immunosuppressive therapy, are at an increased risk for developing herpes zoster infections.[40] The ACIP currently recommends administration of the zoster vaccine to all patients over the age of 60 years, whereas the American College of Gastroenterology (ACG) practice guidelines recommend the vaccine in patients over the age of 50 years.[33,41] The CDC states that it is safe to administer the live zoster vaccine to patients on low-dose immunosuppressive therapy (ie, methotrexate, azathioprine, 6-mercaptopurine), although these patients may have a diminished immune response to the vaccine.[33,41,42] Biologic agents are considered to be high-level immunosuppression, and although live vaccines should be avoided in immunosuppressed patients, the package insert for vedolizumab (Entyvio, Takeda) states that patients on this agent may receive live vaccines if the benefits outweigh the risks.[43] A recent article by Côté-Daigneault and colleagues reviewed data suggesting that the administration of the zoster vaccine to patients on biologic agents is safe.[44] The Canadian National Advisory Committee on Immunization states that use of the live zoster vaccine in patients on biologic agents should be discussed on a case-by-case basis.[45] As with varicella zoster virus, household members of IBD patients may be vaccinated with the herpes zoster vaccine; if the recipient develops a rash, he or she should avoid contact with the IBD patient.[46]

A phase 3 trial demonstrated clinical efficacy of a herpes zoster subunit vaccine consisting of a single varicella zoster virus protein in an adjuvant system.[47] This recombinant vaccine theoretically should be safer in patients who are immunosuppressed, as the vaccine contains a single viral protein that cannot replicate. A trial is underway to evaluate the safety and immunogenicity of the herpes zoster subunit vaccine in renal transplant patients on chronic immunosuppressive therapy.[48] The herpes zoster adjuvant recombinant vaccine (Shingrix, GlaxoSmith Kline) was recently approved by the US Food and Drug Administration for use in adults 50 years and older.[49] Future work is needed to assess the safety and efficacy of this vaccine in immunosuppressed IBD patients.

Health Maintenance

Along with familiarizing themselves with vaccinating patients with IBD, gastroenterologists should have a firm understanding of the wide range of health maintenance issues this patient population encounters, including heart disease, smoking, osteoporosis, cervical cancer, skin cancer, and mental health (Table 3).

Heart Disease

It is understood that IBD is linked to an increased risk of cardiovascular disease.[50] A recent study found that although IBD itself was not associated with the traditional risk factors known to lead to heart disease (ie, obesity, dyslipidemia, diabetes, hypertension), an increased incidence of coronary artery disease was noted in these patients.[51] The increased risk of coronary artery disease is likely attributed to systemic inflammation. Similarly, IBD alone is not a risk factor for hypertension, but corticosteroids are a common cause of drug-induced hypertension; elevated blood pressure typically resolves with cessation of corticosteroids. In 2014, the Joint National Committee established new guidelines for treating hypertension.[52] Gastroenterologists should identify hypertension in patients with IBD and refer them to their primary care physician for further care.

Smoking

Smoking tobacco has been associated with the development of Crohn's disease[53] and has been shown to increase the risk of flares in patients with Crohn's disease, whereas smoking cessation is associated with a decreased risk of flares.[54] Patients with Crohn's disease who smoke are more likely to have disease progression, develop extraintestinal manifestations of IBD such as arthritis and/or arthropathy, require corticosteroids for therapy, and require surgery.[55,56] Patients with ulcerative colitis should be warned that smoking cessation may be associated with a flare in their colitis and that any change in symptoms should be promptly reported to their provider. A smoking history should be taken at every office visit, and all patients with IBD should be encouraged to stop smoking.

Osteoporosis

Patients with IBD are at increased risk for developing metabolic bone disease. This risk is higher in patients

Table 3. General Health Maintenance Measures to Consider in the IBD Patient

Health Issue	Recommendation(s)
Heart Disease	• Screen for hypertension in all IBD patients and refer to their PCP if blood pressure is elevated.
Smoking	• Assess smoking history at each visit and encourage cessation in all patients.
Osteoporosis	• Obtain DEXA in the following situations: – Cumulative use of corticosteroids for >3 months – Patients >60 years – Patients who are postmenopausal – Patients with a history of low-trauma fractures
Cervical Cancer	• Refer female IBD patients who are on immunosuppressive therapy for cervical cancer screening yearly.
Skin Cancer	• Counsel all patients on preventive measures to decrease sun exposure (ie, protective clothing, sunscreen with a sun protection factor of at least 30, avoidance of tanning beds). • Refer all patients with IBD to a dermatologist for skin cancer screening.
Mental Health	• Screen for mental health disorders at each office visit. • Refer patients to their PCP or mental health specialist if there are concerns for moderate-severe depression.

DEXA, dual-energy X-ray absorptiometry; IBD, inflammatory bowel disease; PCP, primary care physician.

with Crohn's disease as compared to ulcerative colitis, and is likely related to ileal involvement seen in Crohn's disease.[57,58] Osteoporosis is a common side effect of prolonged use of corticosteroids, and the risk of bone loss can be seen within a few months of corticosteroid use. Patients on corticosteroids are more likely to develop vertebral fractures despite normal bone mineral density.[59] Vitamin D deficiency is also widespread in patients with IBD; thus, vitamin D levels should be checked in all patients with IBD.[60] In patients with IBD who have an anticipated course of more than 7.5 mg/day of prednisone for more than 3 months, ACG practice guidelines recommend a bone mineral density assessment at baseline with a dual-energy X-ray absorptiometry scan in patients with conventional risk factors for abnormal bone mineral density.[33] In addition, patients over the age of 60 years, patients who are postmenopausal, and patients with a history of low-trauma fractures should be screened for osteoporosis.[61] Suspected metabolic bone disease should be discussed with the patient's primary care physician or endocrinologist.

Cervical Cancer

Cervical cancer is the third most common gynecologic malignancy in the United States. As noted previously, HPV is linked to most cases of cervical cancer.[62] Although data regarding an increased risk of cervical cancer in patients with IBD are conflicting, a 2015 meta-analysis revealed an increased risk of high-grade cervical dysplasia and cervical cancer in patients with IBD who are on immunosuppressive therapy as compared to the general population.[26] Unfortunately, compliance with cervical cancer screening in the IBD patient population is low. Therefore, it is incumbent upon gastroenterologists to ensure that their female patients with IBD who are on immunosuppressive therapy are referred yearly for cervical cancer screening.[61]

Skin Cancer

The 2 main types of skin cancer are melanoma and nonmelanoma skin cancer (NMSC), which includes squamous cell and basal cell carcinomas. Patients with IBD are at increased risk for developing melanoma[63] independent of immunosuppressive therapy use. Two studies suggested that anti–tumor necrosis factor therapy nearly doubled the risk of developing melanoma.[64,65] IBD itself has not been demonstrated to be an independent risk factor for the development of NMSC; however, a meta-analysis suggested that the risk of NMSC is increased with the use of thiopurines.[66] Conflicting data exist concerning whether the risk of NMSC returns to baseline after discontinuation of thiopurines.[66-68] Given the increased risk of skin cancer in the IBD patient population, it is important that all patients are counseled on preventive measures to decrease sun exposure, such as wearing protective clothing, using sunscreen with a sun protection factor of at least 30, avoiding tanning beds, and decreasing exposure to ultraviolet light. ACG guidelines recommend that all patients with IBD undergo screening for melanoma, and any patient taking a thiopurine agent should undergo screening for NMSC, especially if the patient is over the age of 50 years.[33]

Mental Health

A recent population-based study using the National Health and Nutrition Examination Survey database found that patients with IBD were nearly twice as likely (49% vs 23%) to report depressive symptoms as compared to non-IBD patients. IBD itself was a predictor of depressive symptoms; other predictors included older age and divorced, separated, or widowed status.[69] Gastroenterologists should be aware of the mental health effects of chronic illness on their patients and should regularly screen IBD patients for depression and anxiety. Screening for depression can be effectively accomplished with 2 questions: (1) Over the past month, have you felt down, depressed, or hopeless? (2) Over the past month, have you felt little interest or pleasure in doing things?[70] Gastroenterologists should refer patients to their primary care physician or to a mental health specialist if there are concerns for anxiety or depression.

Practical Strategies for Implementing Health Maintenance Recommendations in the Office

In our hospital-based adult gastroenterology practice, we typically obtain a full vaccination history during the first office visit, and administer appropriate vaccinations (eg, for hepatitis A virus, hepatitis B virus, pneumococcal pneumonia, influenza) at that time or at subsequent appointments. If vaccinations are not offered in a practice, the gastroenterologist should refer patients to their primary care physician or directly to a local pharmacy with a prescription for vaccine administration.

Numerous office measures can be utilized by both clinicians and patients to increase completion of health maintenance tasks. The ACG has an IBD vaccination checklist that patients can fill out for their records.[71] The Crohn's and Colitis Foundation[72] and Cornerstones Health[73] also have health maintenance checklists. With the advent of electronic health records, gastroenterologists are encouraged to send electronic messages to patients' primary care physicians reminding them about necessary vaccines that may not be available in a gastroenterology office.

Conclusion

Caring for patients with IBD remains complex and challenging. As treatment options continuously evolve, with increased use of immunomodulators and biologic agents in a larger subset of patients, gastroenterologists should maintain a concrete understanding of the health maintenance issues that routinely affect this patient population. Providers of patients with IBD should take an active role in assessing their patients' vaccination status and administering appropriate vaccinations or referring patients to their primary care physician with explicit recommendations for vaccinations.

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Future studies should address this application of narrow-band imaging to determine its usefulness. Other areas of research concern the use of narrow-band imaging to diagnose GERD in extraesophageal symptoms (eg, chronic cough; ear, nose, and throat conditions). Currently, a white-light endoscopy is negative in these patients. By using narrow-band imaging, we may increase the diagnosis of GERD in this patient population.

One of the important advances in this area has been that of better narrow-band imaging endoscopes, which are bright and provide better imaging. By using the second-generation narrow-band imaging endoscopes, we can potentially improve our diagnostic capability in patients with GERD. Large studies comparing this modality with conventional endoscopy are needed, especially in patients with atypical GERD, early GERD, or GERD with suspected dysplastic lesions.

Dr Reddy has no relevant conflicts of interest to disclose.

Suggested Reading

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