CASE-BASED REVIEW

Celiac Disease: Diagnosis and Management
Case Study and Commentary, Conor G. Loftus, MD, and Joseph A. Murray, MD

INSTRUCTIONS
The following article, “Celiac Disease: Diagnosis and Management,” is a continuing medical education (CME) article. To earn credit, read the article and complete the CME evaluation form on page 350.

OBJECTIVES
After participating in the continuing education activity, primary care physicians should be able to:
1. Identify the common clinical manifestations of celiac disease
2. Develop an algorithmic approach to the patient with suspected celiac disease
3. Understand key components of the gluten-free diet
4. Develop a long-term plan for managing a patient with celiac disease
5. Identify at-risk groups that should be screened for celiac disease

Until recently, celiac disease was considered uncommon in the United States, with an estimated prevalence of 1 case per 4800 persons [1]. With the availability of new, accurate serologic tests and a greater awareness of its presentations, celiac disease is now recognized as a much more common condition [2]. As many as 1 in 120 to 300 persons in both Europe [3–5] and North America [2] may have celiac disease. Many of these are clinically silent cases identified by screening serology or small bowel biopsy. In most series, there is a female preponderance. The familial prevalence of this disease is approximately 5% to 20% in first-degree family members of a patient with celiac disease.

Long-standing untreated celiac disease may be associated with the development of potentially life-threatening complications such as enteropathy-associated T-cell lymphoma or carcinoma of the oropharynx, esophagus, and small bowel [6,7]. Because accurate serologic tests are now available, some have suggested that at risk first-degree relatives and patients with diabetes mellitus should be screened for celiac disease [8,9].

The increasing use of serologic testing and screening of at-risk groups will lead to further increases in the number of patients being identified with celiac disease. This article highlights the rising prevalence of both clinically silent and overt cases of celiac disease in the primary care setting and reviews important points in the diagnosis and management of celiac disease for the primary care physician.

CASE STUDY
Initial Presentation
A 35-year-old woman presents to her primary care physician complaining of fatigue and shortness of breath.

History and Physical Examination
The patient had been well until 2 months prior to presentation. At that time, she noted that she was fatigued during the day despite sleeping well at night. At first she attributed the symptom to the fact that her children were on summer vacation, but when she noted that she was becoming short of breath while walking up stairs, she made an appointment to see her physician. The patient has no significant past medical history and is not taking any medications. She states that the duration and frequency of her menstrual periods are normal. Her appetite is good, she has not lost weight, and has not experienced abdominal pain, bloating, or diarrhea.

Physical examination reveals a pale white woman who appears well-nourished. Height is 148 cm, and weight is 51 kg with a body mass index of 22.37. The abdomen is soft and nontender without mass or hepatosplenomegaly. The remainder of the examination is also unremarkable.

Laboratory Testing
Laboratory findings include a hemoglobin of 8.6 g/dL with a mean corpuscular volume of 67.8 fL. The ferritin level is 3 µg/L. Stools are negative for occult blood. Blood smear reveals hypocromasia and microcytosis as well as target cells and Howell-Jolly bodies (Table 1).

From the Division of Gastroenterology and Hepatology, Mayo Clinic, Rochester, MN.
What are the clinical manifestations of celiac disease?

### Clinical Presentation

Celiac disease has a wide spectrum of gastrointestinal and extraintestinal manifestations. While most cases of celiac disease are diagnosed in adulthood, age at presentation may range from 6 months to over 85 years. Approximately 20% of cases occur in patients older than 60 years of age.

Infants with celiac disease usually present between the ages of 4 and 24 months with impaired growth, diarrhea, and abdominal distension. Symptoms begin gradually after the introduction of cereals into the diet, and a decrease in the velocity of weight gain may precede weight loss in this setting. Older children with severe untreated celiac disease may present with pubertal delay, short stature, iron deficiency anemia, or rickets. In adults, celiac disease is typically associated with symptoms of malabsorption, including diarrhea, steatorrhea, anemia, vitamin deficiency, and weight loss. However, 50% of adult patients do not have clinically significant diarrhea.

Overt evidence of malabsorption may be absent in patients with partial villous atrophy. Such patients are likely to have more atypical presentations, especially monosymptomatic presentations such as fatigue, depression, arthralgias, milk intolerance, osteomalacia, or osteoporosis, and iron deficiency anemia. A very high level of clinical suspicion needs to be maintained to recognize these cases.

Several studies have shown that there is frequently significant delay, often measured in years, between patient presentation and the diagnosis of celiac disease. Abdominal discomfort and bloating are common and often lead to a mistaken diagnosis of irritable bowel syndrome.

Celiac disease may present during pregnancy or postpartum, and the diagnosis should be considered in pregnant women in whom severe anemia develops. Occasionally, celiac disease may manifest as dermatitis herpetiformis. This intensely pruritic papulovesicular eruption on the extensor surfaces is only seen in a minority of patients with celiac disease, but 70% to 80% of patients with the rash have coexisting damage in the intestine.

### Diagnostic Approach

The diagnostic tests of choice as well as an algorithmic approach to the diagnostic workup of a patient with suspected celiac disease are outlined in Figure 1. Laboratory test abnormalities, as a result of deficiency states secondary to small intestine inflammation and damage, are often the first clue to a diagnosis of celiac disease. Such deficiency states most commonly involve iron, folate, calcium, and the fat-soluble vitamins A, D, E and K. Vitamin B₁₂ deficiency may be seen in as many as 40% of newly diagnosed cases of celiac disease. A complete blood count and blood smear are useful. The blood count will frequently reveal anemia with or without microcytosis. Target cells and Howell-Jolly bodies on blood smear, as found in the case patient, may suggest associated hypocellularity. Vitamin deficiencies are reflected in decreased serum levels of free retinol (vitamin A), A-tocopherol (vitamin E), and 25-hydroxyvitamin D. A prolonged prothrombin time due to vitamin K deficiency is very
rare but should be corrected before small bowel biopsy is performed. Such abnormalities in isolation are nonspecific, and their cause needs to be substantiated with further testing.

The best noninvasive tests for celiac disease are the highly sensitive and specific serologic markers, including IgA antiendomysial antibody, IgA and IgG antigliadin antibodies, and tissue transglutaminase antibody. Tests for these markers are used to evaluate patients with suspected disease, monitor adherence and response to gluten-free diet, and screen patients with possible atypical presentations [15]. The available serologic tests demonstrate variable sensitivity and specificity (Table 4) [16–18]. Prior to testing, it is important that patients not reduce their gluten intake as the antibody levels can drop rapidly. Our experience and the literature support the IgA tissue transglutaminase antibody as the most useful single serologic test for celiac disease [19]. Tissue transglutaminase is the autoantigen recognized by the antiendomysial antibody. Because this test is highly specific (91% to 98%), false-positive results are rare but false-negative results may occur in patients with mild enteropathy, children younger than 2 years, patients with selective IgA deficiency, and those with partially treated celiac disease (dietary noncompliance).

Although the IgA and IgG antigliadin antibodies are sensitive tests, they are less specific than both the tissue

### Table 2. Spectrum of Clinical Presentations of Celiac Disease

<table>
<thead>
<tr>
<th>Common Features</th>
<th>Less Common Features</th>
<th>Associated Conditions</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>General</td>
<td>IgA deficiency</td>
<td>Refractory sprue</td>
</tr>
<tr>
<td>Iron-deficiency anemia</td>
<td>Short stature</td>
<td>Type 1 diabetes mellitus</td>
<td>Small bowel T-cell lymphoma</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Delayed puberty</td>
<td>Autoimmune thyroid disease</td>
<td>Adenocarcinoma of oropharynx, esophagus, small bowel</td>
</tr>
<tr>
<td>Weight loss</td>
<td>Fatigue</td>
<td>Sjögrens syndrome</td>
<td>Ulcerative jejunoileitis</td>
</tr>
<tr>
<td>Steatorrhea</td>
<td>Gastrointestinal</td>
<td>Microscopic colitis</td>
<td>Collagenous sprue</td>
</tr>
<tr>
<td>Bloating</td>
<td>Recurrent aphthous stomatitis</td>
<td>Rheumatoid arthritis</td>
<td>Dementia</td>
</tr>
<tr>
<td>Lactose intolerance</td>
<td>Recurrent abdominal pain</td>
<td>Down syndrome</td>
<td>Benign strictures</td>
</tr>
<tr>
<td>Children</td>
<td>Abnormal liver blood tests</td>
<td>IgA nephropathy</td>
<td>Pancreatic insufficiency</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Vomiting</td>
<td></td>
<td>Gastroparesis</td>
</tr>
<tr>
<td>Failure to thrive</td>
<td>Constipation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal distension</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Folate-deficiency anemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Osteoporosis or osteopenia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vitamin K deficiency (prolonged prothrombin time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thrombocytosis (hypoplasenism)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arthralgia, arthropathy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Infertility</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Neuropathy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dental enamel defects</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dermatitis herpetiformis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Diagnostic Tests for Celiac Disease

<table>
<thead>
<tr>
<th>Specific Tests</th>
<th>Nonspecific Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serology</td>
<td>Laboratory tests for deficiency states</td>
</tr>
<tr>
<td>Tissue transglutaminase antibody IgA</td>
<td>Iron, folate, B₁₂ deficiency</td>
</tr>
<tr>
<td>Endomysial antibody IgA</td>
<td>Hypoalbuminemia</td>
</tr>
<tr>
<td>Gliadin antibody IgA/IgG</td>
<td>Vitamin A, D, E, K deficiency (fat-soluble vitamins)</td>
</tr>
<tr>
<td>Histology (increasing severity)</td>
<td>Hypocalcemia</td>
</tr>
<tr>
<td>Normal biopsy</td>
<td>Tests of absorption</td>
</tr>
<tr>
<td>Increased intraepithelial lymphocytes</td>
<td>Bone densitometry</td>
</tr>
<tr>
<td>Decreased villous height with increased crypt depth, subtotal villous atrophy</td>
<td>Class II HLA genotyping (may help exclude patients if DQ2 or DQ8 is absent)</td>
</tr>
<tr>
<td>Total villous atrophy*</td>
<td></td>
</tr>
</tbody>
</table>

Response to gluten-free diet

*This lesion is characteristic of but not diagnostic for celiac disease. It may also be seen with severe giardiasis, tropical sprue, infantile food sensitivities, graft versus host disease, chronic ischemia of the small intestine, and Ig deficiencies.
transglutaminase and the antiendomysial antibody tests [20]. The lower specificity may lead to frequent false-positive results in normal individuals, particularly in patients with other causes of inflammation within the gastrointestinal tract [21]. However, the IgA antigliadin test is particularly important in children younger than 2 years of age, while testing for the IgG antigliadin antibody is most important in the 2% to 10% of patients with coexisting celiac disease and selective IgA deficiency. In this setting, an alternative approach is to measure total IgA levels, and if these are deficient, to then measure IgG antiendomysial antibodies as a special request.

In practice, if either the endomysial or tissue transglutaminase antibody is positive, no further serologic testing is usually required. The diagnosis is confirmed with small bowel biopsy. The gold standard test for diagnosis of celiac disease is small bowel biopsy and histologic evaluation by an experienced pathologist. At least 3 substantial endoscopic biopsies should be taken from the second or third portions of the duodenum to avoid the architectural distortion caused by Brunner’s glands or peptic duodenitis more proximally. Histologically, celiac disease is characterized by increased intraepithelial lymphocytes, crypt hyperplasia, increased plasma cells and lymphocytes in the lamina propria, and in severe cases, total villous atrophy (Figure 2). Patients with mild focal involvement of the proximal small bowel are likely to have few overt symptoms, while those with extensive enteropathy may present with more pronounced diarrhea, weight loss, and steatorrhea.

Serologic Testing and Biopsy

The results of serologic testing for IgA antiendomysial, IgA antigliadin, and IgG antigliadin antibodies are positive (Table 5). Tissue transglutaminase antibody testing is also positive. Esophagogastroduodenoscopy with small bowel biopsy confirms the presence of partial villous atrophy in association with increased intraepithelial lymphocytes and crypt hyperplasia. The physician makes a diagnosis of celiac disease.

- What is the treatment for celiac disease?
Treatment

Once a diagnosis of celiac disease has been established, as with any newly diagnosed chronic disease, the initial step in management is patient education. The combined efforts of an actively interested, optimistic physician and an experienced dietitian will prove invaluable in this respect. As a means to encourage ongoing education, patients should be advised to join both local and national celiac support groups.

The cornerstone of managing patients with celiac disease is the gluten-free diet. The goal of the gluten-free diet is to achieve healing and maintain health through the adoption of a well-balanced, interesting dietary lifestyle that avoids gluten. In the setting of celiac disease, gluten is defined as any protein-containing derivative of the offending grains (Table 6). Hidden sources of gluten are frequently present in what would otherwise appear to be “safe” foods. Patients should be instructed that if they are in doubt, they should inquire whether a food has any ingredients derived from or processed with wheat, barley, rye, or oats. There are a number of grains that are safe in celiac disease; a sample list of foods that are safe in patients with celiac disease is provided in Table 7. The issue with oats is somewhat controversial, and they may not in fact be toxic to patients with celiac disease. However, because it is difficult to obtain oats that are not contaminated with gluten-containing grains, oats should be avoided in all patients with newly diagnosed celiac disease until remission is achieved on a gluten-free diet. Then, up to 2 oz per day of pure uncontaminated oats, if available, may be reintroduced to the diet if the patient has no ill effects [12]. Within 2 weeks of commencing a gluten-free diet, approximately 70% of patients will note symptomatic improvement [22]. If a patient has no response to the diet, the most common explanation is noncompliance [23].

Dairy products may need to be restricted initially because patients with untreated celiac disease often have secondary lactase deficiency. After 3 to 6 months of a strict gluten-free diet, adequate mucosal healing should have taken place to allow for gradual reintroduction of dairy products.

Specific nutritional supplementation frequently will be required in patients with celiac disease. The most common deficiency states are iron, folate, vitamin B12, calcium, and the fat-soluble vitamins A, D, E, and K. Bone density should be measured at the time of diagnosis to evaluate for secondary osteoporosis or osteomalacia. Adequate replacement is ensured with 1000 to 1500 mg of calcium and 400 to 800 IU of vitamin D per day in adults. Patients with osteoporosis should also be advised to get adequate daily exercise (walking or

Table 4. Serologic Tests for Untreated Celiac Disease

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity, %</th>
<th>Specificity, %</th>
<th>Cost, $†</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgA Endomysial</td>
<td>75–90</td>
<td>98–100</td>
<td>170</td>
</tr>
<tr>
<td>IgA Tissue TransG*</td>
<td>91–98</td>
<td>91–98</td>
<td>67</td>
</tr>
<tr>
<td>IgA Antigliadin</td>
<td>62–100</td>
<td>58</td>
<td>61</td>
</tr>
<tr>
<td>IgG Antigliadin</td>
<td>53–90</td>
<td>60–94</td>
<td>61</td>
</tr>
</tbody>
</table>

*IgA tissue transglutaminase antibody.
†Costs were estimated from Medicare usual and customary fees per procedure code plus facility fee.

Table 5. Results of Serologic Tests

<table>
<thead>
<tr>
<th>Reference Range</th>
<th>Result</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25 = negative</td>
<td>Gliadin antibody IgG 71*</td>
<td>Gliadin antibody IgA 144.8*</td>
</tr>
<tr>
<td>&lt; 25 = negative</td>
<td>Endomysial antibody IgA Positive titer</td>
<td></td>
</tr>
<tr>
<td>30 units = positive</td>
<td>Tissue transglutaminase antibody IgA 25 units</td>
<td></td>
</tr>
<tr>
<td>20–30 units = weakly positive</td>
<td>&lt; 20 units = negative</td>
<td></td>
</tr>
</tbody>
</table>

*A abnormal.
jogging 1 to 2 miles per day) and to avoid tobacco and alcohol. Consideration should be given to hormone replacement therapy in menopausal women with celiac disease. Patients with secondary hyposplenism should also receive pneumococcal vaccination and should be advised to seek prompt medical evaluation for any suspected infection.

Initiation of Gluten-Free Diet

The physician informs the patient of the diagnosis and advises her to begin a strict gluten-free diet. The physician explains the importance of adherence to this diet and refers the patient to a dietitian who will assist her with food selection. She is prescribed ferrous sulphate 325 mg twice daily in light of the iron deficiency anemia. Bone densitometry reveals significant osteopenia and the patient is also started on elemental calcium (1500 mg daily) and vitamin D (800 IU daily). Pneumococcal vaccination is administered due to evidence of hyposplenism.

At a follow-up visit 12 weeks later, the patient reports feeling well with no fatigue or shortness of breath. Complete blood count reveals a hemoglobin of 12.9 g/dL with a mean corpuscular volume of 83.6 fL. Tissue transglutaminase antibody testing is repeated and is now found to be negative.

The patient is doing well clinically and small bowel biopsy is not repeated. The importance of maintaining the gluten-free diet is again reinforced. Iron replacement therapy is discontinued. Calcium and vitamin D replacement is maintained, and a follow-up bone densitometry is scheduled to be performed 1 year after the initial scan.

- How is the well patient with stable celiac disease managed?

Management of Patients with Stable Disease

Managing the patient with chronic stable celiac disease again emphasizes the importance of maintaining dietary compliance. Periodic nutritional review and monitoring is provided on an ongoing basis by the enthusiastic physician and the experienced dietitian. A well-balanced diet is designed with emphasis on carbohydrates, protein, adequate calories, and calcium intake.

Once a diagnosis of celiac disease has been established and a gluten-free diet instituted, the serologic markers used for diagnosis are useful for monitoring response as well as adherence to the diet. With dietary compliance, the levels of IgA endomyosal and tissue transglutaminase antibodies diminish within 6 weeks, and by 6 months both may be undetectable [24]. The IgG antigliadin antibody is more persistent and may be present a year after starting gluten restriction. Serologic tests that were abnormal at diagnosis should be followed to normality. Thereafter, further serologic testing is only indicated to rule out dietary noncompliance. With regard to histologic follow-up, some advocate biopsies to normality and every 5 years thereafter to monitor for continued healing.

The physician should maintain a heightened awareness for the potential development of related conditions or complications. Patients should also be educated with regard to warning symptoms and signs such as abdominal pain, weight loss, vomiting, recurrent diarrhea, and anemia; the onset of any of these should prompt further evaluation. Autoimmune diseases such as type 1 diabetes mellitus [25] and autoimmune thyroiditis [26] occur more commonly in patients with celiac disease. The prevalence of celiac disease in patients with diabetes mellitus is approximately 3% to 8% [25]. For this reason, consideration should be given to screening all newly diagnosed insulin-dependent diabetics for celiac disease using the tissue transglutaminase antibody test. The duration of gluten exposure is associated with higher prevalence of coexisting autoimmune conditions, which is an additional reason for the early diagnosis and treatment of celiac disease [27].

The development of hypoalbuminemia, anemia, recurrent steatorrhea, weight loss, abdominal pain, fevers, or
malaise in a previously stable patient should prompt a search for neoplasm. T-cell lymphoma of the small bowel may present with either a return of malabsorptive symptoms or as a surgical emergency with obstruction, perforation, or, rarely, bleeding. Prognosis for complicating lymphomas presenting with a surgical abdomen is better than for those presenting with insidious return of symptoms [28]. Malignancy is more common in patients older than 40 years. The risk for developing malignancy diminishes with the duration of dietary compliance. Adenocarcinoma of the oropharynx, esophagus, and small bowel is also seen with increased frequency in patients with celiac disease [29].

Osteoporosis may develop in patients with celiac disease, particularly in those with delayed diagnoses and those noncompliant with a gluten-free diet. If bone densitometry done at diagnosis is abnormal, a follow-up scan is recommended within 1 year. With reversal of the malabsorption state, patients may experience a rise in cholesterol levels or excessive weight gain. A lipid profile should be checked after approximately 1 year of dietary compliance.

Long-term management of celiac patients should also include a family review for symptoms of celiac disease and screening of first-degree relatives. While screening is not generally accepted to date, increased awareness of the prevalence of the disease in association with sensitive new serologic tests may lead to its future acceptance as a means for detecting early or presymptomatic disease in family members and others at risk for celiac disease.

12 Years Later

 Twelve years after being diagnosed with celiac disease, the patient presents with cramping abdominal pain and weight loss. A small bowel X-ray examination is performed, revealing moderate dilation of the duodenum in association with an apple-core type lesion in the proximal jejunum. Computed tomography (CT) scan of the abdomen confirms the presence of a stricture in the proximal jejunum associated with marked wall-thickening suggestive of tumor. There is no evidence of metastatic disease.

- What is the role of imaging studies in celiac disease?

Radiologic testing is of little use in the initial evaluation of patients with suspected celiac disease. However, small bowel contrast X-ray and CT scanning of the abdomen should be considered in patients with refractory disease and in patients with suspected complications such as lymphoma, carcinoma, strictures, or ulcerative jejunoileitis. As occurred in the case patient, the small bowel X-ray series may reveal dilation of the proximal small bowel, strictures, or a mass lesion. Abdominal CT findings suggestive of celiac disease include splenic atrophy, ascites, and lymphadenopathy, while localized small bowel wall thickening may suggest the presence of lymphoma or carcinoma [30].

Further Evaluation

The patient undergoes an extended upper endoscopy, which reveals a tight stricture in the jejunum. Following dilatation of this stricture, a neoplastic mass is identified in
the proximal jejunum. The patient undergoes exploratory laparotomy, resection of the involved jejunum, and end-to-end jejunoojejunostomy. Pathology confirms the presence of an invasive adenocarcinoma forming a polypoid mass associated with a stricture. The resection margins are negative, and regional lymph nodes are not involved with metastatic disease. The patient has an uneventful postoperative recovery and is discharged home on a strict gluten-free diet.

• What is refractory celiac disease?

Refractory Disease

Refractory celiac disease is a diagnosis of exclusion defined by persistent symptoms of malabsorption despite a strict gluten-free diet for at least 6 months with continued villous atrophy on duodenal biopsy. Refractory disease, which affects 5% of patients with celiac disease, can be a particularly challenging problem. A detailed dietary review should be performed to determine whether the diet is fully gluten-free [23]. Tests for antiendomysial and antigliadin antibodies should be negative; a positive result suggests noncompliance with the dietary restrictions. Patients with refractory disease are often elderly and are at high risk for development of complicating complications such as enteropathy-associated T-cell lymphoma, ulcerative jejunoileitis, and collagenous sprue. As many as 75% of these patients harbor an associated T-cell lymphoma, ulcerative jejunoileitis, and colitis or coexistence of complications such as enteropathy-related complications. The resection margins are negative, and regional lymph nodes are not involved with metastatic disease. The patient has an uneventful postoperative recovery and is discharged home on a strict gluten-free diet.

Summary

Celiac disease is much more prevalent than previously recognized. Increased awareness among physicians and the availability of sensitive and specific serologic tests have led to the identification of many mild and clinically silent cases of celiac disease. These cases are frequently identified in the primary care setting, highlighting the importance of maintaining a high degree of clinical suspicion for celiac disease.

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References


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5 4 3 2 1

I was provided with new information pertinent to my practice. [ ] [ ] [ ] [ ] [ ]
I reaffirmed a specific skill or knowledge. [ ] [ ] [ ] [ ] [ ]
This article will help with clinical decision making. [ ] [ ] [ ] [ ] [ ]
Relevant clinical outcomes are addressed. [ ] [ ] [ ] [ ] [ ]
The case is communicated in a manner that kept my interest. [ ] [ ] [ ] [ ] [ ]
The case presentation is realistic and effective. [ ] [ ] [ ] [ ] [ ]
I could easily interpret the tables and figures. [ ] [ ] [ ] [ ] [ ]
My attitude about this topic changed in some way. [ ] [ ] [ ] [ ] [ ]

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________________________________________________________________________________________________________

Part 2. Please complete the following sentence.
As a result of reading this case study, I . . .
[ ] see no need to change my practice.
[ ] will seek more information before modifying my practice.
[ ] intend to change the following aspect(s) of my practice: (Briefly describe)
________________________________________________________________________________________________________
________________________________________________________________________________________________________

Signature: ____________________________ Date: ____________________________

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