

A Case of Tick-Bite-Induced Red Meat Allergy

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ABSTRACT Delayed hypersensitivity disorders and food allergies are often challenging for the clinician and patient alike. A recent discovery of an IgE antibody specific to galactose- α -1,3-galactose, which is a carbohydrate abundantly expressed on cells and tissues of beef, pork, and lamb, adds one more tool to aid the clinician in making the appropriate diagnosis. A link has been discovered between the bite of the Lone Star Tick (*Amblyomma americanum*) and the development of sensitivity to galactose- α -1,3-galactose. With a high prevalence of Lone Star Tick populations inhabiting major U.S. Army Installations, and the type of duty required by our Service members, it could potentially affect susceptible individuals. We describe a case of an active duty soldier who went 4 years searching for this elusive diagnosis and connection and discuss why it should remain in the differential diagnosis when treating military health care beneficiaries.

CASE REPORT

A 33-year-old active duty male presented to clinic for a follow-up regarding recurring episodes of urticaria, palpitations, flushing, and itching after ingestion of red meat. The patient states he has had a total of 9 episodes of this type of reaction after the ingestion of beef for the past 48 months. The patient reported that a typical episode occurred approximately 5 to 8 hours after the ingestion of a beef product. Symptoms consisted of increased heart rate to 170–180 beats per minute, skin redness, lightheadedness, blurred vision, and shortness of breath. Duration of each episode was approximately 20 minutes and the symptoms would abruptly awaken the patient during sleep. All episodes resolved spontaneously. Avoidance of beef products was the only means found to prevent the episodes from occurring.

The patient's only medication was esomeprazole magnesium daily for gastroesophageal reflux disease, which was well controlled per patient report. Physical examination on the day of the encounter was unremarkable and routine labs: complete blood count, complete metabolic panel, hepatic function panel, and lipoprotein panel were all within the normal limits. In addition, 5-hydroxyindoleacetic acid and catecholamine labs to rule out carcinoid syndrome and pheochromocytoma, respectively, were also found to be within the normal range. The patient reported that he was previously seen by an allergist for a suspected meat allergy. Review of the medical record shows that standard skin prick testing to food allergens was negative with no wheal greater than 2 mm. He was also previously seeing gastroenterology for his gastroesophageal reflux disease, but no mention of the meat sensitivities was made in the notes. Biopsies and Bravo 48-hour pH testing were unremarkable showing only superficial gastritis.

After meeting with the patient and discussing his symptoms and previous workup, a literature search revealed the

experimental use of a new immunoassay for IgE to galactose- α -1,3-galactose (alpha-gal) that had been associated with red meat sensitivities.¹ Although the lab test had not yet been Food and Drug Administration (FDA) approved for diagnosis, it was well documented in the literature, so a request was made and authorization was granted to perform the test, 1 mL of ambient serum was sent to the performing lab, and the patient's assay returned 6.8 kU/L, making it a class 3 (high positive). The assay has been reported to be highly specific and reproducible, but exact values were not published¹ (Figure 1).

The patient was notified that his IgE returned elevated and a further exposure history was taken. The patient reported being stationed at Fort Campbell, Kentucky, for 8 years. The presence of IgE to alpha-gal has been uniquely associated with people who have been bitten by ticks.² The patient reports exposure to multiple tick bites while at Fort Campbell and before the onset of his symptoms. The patient reports upward of 7 tick bites during his time at Fort Campbell. The patient will continue avoidance of red meat for the time being, as the treatment for this hypersensitivity is still being investigated.

DISCUSSION

This is a case report of a Service member who sustained multiple tick bites over an 8-year period and subsequently developed an allergic reaction to red meat. The patient was able to associate his symptoms with the ingestion of red meat over a period of years, mainly by food avoidance, but he did not fully know what may have caused him to develop this sensitivity. After a positive alpha-gal immunoassay, the conclusion has been made that his symptoms are attributable to elevated IgE antibodies to alpha-gal.

In fact, research has also shown that tick bites, specifically by *Amblyomma americanum*, could perhaps be solely responsible for causing an increase in IgE to alpha-gal.² *A. americanum* is uniquely associated with symptoms of red meat hypersensitivity and the geographic range of *A. americanum* includes many military installations

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ASSAY RANGE

Class	IgE (kU/L)	Comment
0	<0.10	Negative
0/1	0.10-0.34	Equivocal
1	0.35-0.69	Low Positive
2	0.70-3.4	Moderate Positive
3	3.5-17.4	High Positive
4	17.5-49.9	Very High Positive
5	50.0-99.9	Very High Positive
6	≥100	Very High Positive

FIGURE 1. Alpha-gal IgE test ranges. (Adapted from the ViraCor-IBT Laboratories Web site.)

(Figure 2). Therefore, cases similar to this should lead to consideration of a tick-bite-induced red meat allergy and appropriate testing for accurate diagnosis should be pursued. Figure 2 shows the known habitat, according to the Centers for Disease Control and Prevention, of the *A. americanum* tick in relation to major Army installations.

Given the nature of Army training, there will inevitably be tick encounters during training exercises, physical training, and simply by living in areas where the *A. americanum* also resides. It is therefore important for clinicians and entomologists to be aware of this association between ticks and acquired meat hypersensitivity.

Diagnosis of red meat hypersensitivity can elude the differential diagnosis list given the average 4- to 6-hour delay in the onset of symptoms after meat ingestion.^{5,6} The addition of intradermal and/or fresh food skin prick testings could be considered to aid in diagnosis, especially if normal food allergy testing returns normal and clinical suspicion is high. These additional tests provide a more accurate wheal response to meats that may cause this hypersensitivity, as the alpha-gal carbohydrate is only found in fresh samples.⁵ The prevalence of this hypersensitivity is likely much higher than reported as the delay in symptoms may prevent patients and practitioners from making the association between meat ingestion and symptoms. Although lack of FDA approval for diagnostic testing for alpha-gal may preclude definitive diagnosis as few labs in the country are currently performing this immunoassay, clinical suspicion with a successful trial of food avoidance should suffice for diagnosis and management. However, education, awareness, and prevention counseling will be paramount for installation personnel, including health care providers, at installations within the range of *A. americanum* to prevent future cases.

In summary, with the location of major military installations in the natural habitat of the *A. americanum* tick, it is important for practitioners to be aware that there is a known hypersensitivity reaction to the ingestion of red meat that can occur after a bite from one of these ticks. The reaction consists of a spectrum of symptoms to include urticaria,



FIGURE 2. Known distribution of Lone Star Tick, and major Army installations noted with stars.^{3,4} (Data modified from Centers for Disease Control and Prevention Web site, and Pentagon Web site.)

tachycardia, tachypnea, and anaphylaxis.⁵ Although there is laboratory testing available for IgE hypersensitivity to alpha-gal, it is not FDA approved for diagnosis and is not widely available. However, keen clinical suspicion and a trial of red meat avoidance should be sufficient for management as there is currently no known treatment for this disorder. And as with most environmental and vector-borne diseases, education and prevention are key for decreasing the number of potential cases in the future.

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