BRIEF OBSERVATION

THE AMERICAN JOURNAL of MEDICINE®

Acute Nonrheumatic Streptococcal Myocarditis: STEMI Mimic in Young Adults

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ABSTRACT

BACKGROUND: Mimicking ST-segment elevation myocardial infarction upon presentation, acute nonrheumatic streptococcal myocarditis is a treatable etiology of myocarditis which has only been infrequently reported.

METHODS: Patients were identified through a retrospective query of electronic medical records over a 17-year period (January 1994 to December 2010). We describe a case series of acute nonrheumatic streptococcal myocarditis complicating pharyngitis in young adults.

RESULTS: Nine patients were identified; 89% were male, patients had an average age of 28.6 years, and 56% and 22% had confirmed group A and group G streptococcus, respectively. Latency from pharyngitis to chest pain averaged 3.1 ± 1.1 days. No patients met the revised Jones criteria for acute rheumatic fever. All 9 patients (100%) presented with ST-segment elevations on electrocardiography and elevated cardiac biomarkers. Average peak creatine kinase was 934 U/L (normal < 400 U/L), creatine kinase-MB was 82 ng/mL (normal < 6.9 ng/mL), and troponin T was 2.30 ng/mL (normal < 0.03 ng/mL). Six patients underwent coronary angiography, which revealed no obstructive culprit lesions. Cardiac magnetic resonance imaging confirmed myocarditis in 3 patients and was used to document resolution in follow-up for 2 patients. All patients had a complete clinical recovery.

CONCLUSIONS: Acute nonrheumatic streptococcal myocarditis is an under-recognized and treatable cause of ST-segment elevation and chest pain in young adults with a history of recent pharyngitis. Etiopathology extends beyond Lancefield group A streptococcus and includes group G streptococcal infection. Cardiac magnetic resonance may be useful in confirming the diagnosis and documenting the resolution.

 • *The American Journal of Medicine (2012) 125, 1230-1233*

KEYWORDS: Myocarditis; Pharyngitis; Streptococcal infection; ST-segment elevation myocardial infarction

After epidemics among US service members post-World War II, Dr T. Duckett Jones delivered a schema for the diagnosis of acute rheumatic fever in 1944. What famously became regarded as the "Jones criteria" codified an association between antecedent streptococcal pharyngeal infection and nonsuppurative sequelae, such as carditis, arthralgia, chorea, or rash. Although future iterations of the criteria would add echocardiographic and laboratory parameters,[1] the fundamental concept of rheumatic disease as a sequel to untreated group A streptococcus infection was established.

Contemporaries of Jones, Gore and Saphir,[2] conducted an autopsy study of 1402 patients in 1947 in whom they identified 12 cases of myocarditis in the setting of acute streptococcal tonsillitis that did not fit the Jones criteria. They described these cases as *nonrheumatic* because they occurred during or just days after a streptococcal infection, rather than the 2- to 3-week latency period classically observed with acute rheumatic fever. Since then, acute nonrheumatic streptococcal myocarditis has been identified by a handful of authors as a clinically distinct entity, with different symptoms, time course, and pathophysiology from acute rheumatic fever.[3-9] This entity remains infrequently

Funding: None.

Conflict of Interest: None.

Authorship: All authors had access to the data and played a role in writing this manuscript.

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0002-9343/$ -see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.amjmed.2012.06.016

reported and is likely under-recognized in clinical practice. We summarize a series of 9 patients.

MATERIALS AND METHODS

We retrospectively reviewed all cases of acute nonrheumatic streptococcal myocarditis over a 17-year period (January 1994 to December 2010). Patients were identified using a hospital-wide database containing admission, discharge, and associated diagnoses. Search terms included any combination of *tonsillitis, acute tonsillitis, infective tonsillitis, peritonsillitis, pharyngotonsillitis, suppurative tonsillitis, streptococcal tonsillitis, streptococcal sore throat, group A streptococcal infection,* or *strep pharyngitis* and *chest pain, acute myocarditis,* or *acute pericarditis.*

CLINICAL SIGNIFICANCE

- Acute nonrheumatic streptococcal myocarditis is an under-recognized cause of ST-segment elevations in young patients.
- A history of sore throat preceding chest pain should elicit further workup with testing for group A or G streptococcus.
- Acute nonrheumatic streptococcal myocarditis responds favorably to conventional antibiotic therapy and has excellent long-term clinical prognosis.
- Cardiac magnetic resonance imaging is useful in gauging myocarditis severity and documenting resolution.

RESULTS

Nine patients with acute nonrheumatic streptococcal myocarditis were identified; 89% were male, and the average age was 28.6 years. No patients had a history of cardiovascular disease or rheumatic fever. Key clinical characteristics are presented in **Table 1** with a summary in **Table 2**. The majority of patients (78%) had streptococcal pharyngitis confirmed via microbiologic testing at Massachusetts General Hospital; microbiologic assay results were not available for review in 2 patients who were transferred from outside centers. Two patients (22%) had throat cultures positive for group G streptococcus, whereas the remaining patients had group A streptococcus.

All 9 patients presented with a chief symptom of substernal chest pain. The average latency period from pharyngitis to onset of chest pain was 3.1 days. No patients met the revised Jones criteria for acute rheumatic fever. Antistreptolysin O or anti-DNAse B titers were tested in 3 patients, and no significant elevations were noted. Electrocardiograms showed ST-segment elevations of varying distributions, and cardiac biomarkers were elevated (**Table 2**). Transthoracic echocardiography was performed in all patients. The average left ventricular ejection fraction was 56% ± 7.7%, and wall motion abnormalities were identified in 3 patients.

Most patients (66%) underwent cardiac catheterization, with no culprit coronary lesions identified. Three patients also underwent cardiac magnetic resonance (CMR) imaging with results consistent with myocarditis according to the Lake Louise criteria[10] (**Figure 1A**). All patients made a complete clinical recovery after antibiotic therapy as reported in the limited follow-up (2 patients were lost within 3 months, and other patients have been followed 1-8 years). In 2 patients in whom follow-up CMR imaging was performed, regression of edema and abnormal delayed enhancement was confirmed (**Figure 1B**). In patients in whom other follow-up imaging (eg, transthoracic echocardiography, treadmill-exercise testing) was performed, no significant abnormalities were noted. No patients required antibiotic prophylaxis for acute rheumatic fever, and no late sequelae of rheumatic heart disease were reported.

DISCUSSION

We present the largest single-center case series of acute nonrheumatic streptococcal myocarditis in the United States.

Table 1 Clinical Characteristics of Individual Patients

Age, y	Sex	Throat Culture	Chest Pain	Latency*	ECG Distribution	Peak TnT
16	M	GGS	+	2	Anterolateral STE	1.06
20	M	NA	+	3	Diffuse STE	3.58
20	F	GGS	+	2	Inferolateral STE	1.67
22	M	GAS	+	2	Inferior STE	2.01
26	M	GAS	+	3	Diffuse STE	1.13
31	M	GAS (R)	+	3	Inferior STE	2.90
37	M	GAS (R)	+	4	Lateral STE	NA†
39	M	NA	+	5	Lateral STE	1.58
47	M	GAS	+	4	Inferolateral STE	4.46

ECG = electrocardiogram; GAS = group A streptococcus; GGS = group G streptococcus; NA = not available; R = rapid antigen testing; STE = ST-segment elevation; TnT = troponin T.

*Latency: days from pharyngitis to onset of chest pain.

†Troponin assay not yet commercially available at the time of this patient's presentation.