

High Prevalence of False Chordae Tendinae in Patients Without Left Ventricular Tachycardia

SARAH K. GUALANO, M.D.,* STEVEN F. BOLLING, M.D.,† DAVID GORDON, M.D.,‡ ALLECIA WILSON, M.D.,‡ and DAVID S. BACH, M.D.*

From the *Department of Medicine, Division of Cardiology, †Department of Surgery, Section of Cardiac Surgery, and ‡Department of Pathology, The University of Michigan, Ann Arbor, Michigan

Background: Left ventricular (LV) false chordae tendinae (false chords) have been implicated as a source of idiopathic left (IL) ventricular tachycardia (VT). However, it is unknown whether pretest bias contributes to an apparent association with disease. The purpose of this study was to determine the prevalence of false chords on direct inspection of the LV endocardium.

Methods: In a prospective series, 75 hearts were examined to identify and characterize false chords, including 20 specimens examined at autopsy and 55 consecutive patients undergoing mitral valve surgery. Medical records were reviewed for history of VT, including ILVT.

Results: Of 75 patients whose hearts were studied, none had a history of ILVT and only 5 had a history of any VT. False chords were present in 34 of 75 (45%) hearts, including 13 of 20 (65%) at postmortem and 21 of 55 (38%) examined at surgery ($P = 0.07$). The prevalence of false chords was not different among patients with (3 of 5 [60%]) versus those without (31 of 70 [44% $p = 0.65$]) a history of VT ($P = 0.65$).

Conclusions: In this prospective anatomic series, the prevalence of LV false chords on autopsy and surgical inspection was approximately 45% among patients without ILVT. Previously reported associations of false chords with ILVT likely underestimated the prevalence of false chords in a normal population. (PACE 2007; 30:S156–S159)

false chords, idiopathic left ventricular tachycardia, ventricular tachycardia

Introduction

Left ventricular (LV) false chordae tendinae (false chords, false tendons, or pseudo-chords) have been implicated as a possible source of idiopathic left (IL) ventricular tachycardia (VT).^{1–5} In large part, this is due to the observation of false chords in patients with ILVT, and the belief that false chords are uncommon among individuals without ILVT. In one study, 15 patients with ILVT who underwent transthoracic or transesophageal echocardiography were found to have a structurally normal heart with the exception of presence of a false chord.¹ In contrast, that same study found false chords in only 34 of 671 (5%) patients referred for echocardiography for other reasons. One case report described a patient with paroxysmal VT of right bundle branch morphology and left axis deviation that was eliminated by surgical resection of a false chord.² Another report described a patient cured of ILVT after intraoperative photocoagulation of LV myocardium near a false chord.³ Another study implicated false chords by mapping ILVT close to a false chord in one patient.⁴

Because of their thin, linear structure, false chords may not be reliably visualized on echocardiography, especially if imaging is confined to standard views. Although it is possible that false

chords play a causative role in ILVT, it is also possible that the LV is more rigorously scrutinized in patients with this diagnosis. Therefore, pretest bias could contribute to a higher prevalence of false chords observed in patients with ILVT than in a general population of patients referred for echocardiography. However, the prevalence of false chords in the general population has not been well studied, with reported echocardiographic estimates between 0.3% and 46%.^{5–8} The purpose of the present study was to determine the prevalence of false chords on direct inspection of the left ventricle in patients without ILVT, with the hypothesis that false chords are a common anatomic finding and therefore may not be linked to ILVT.

Methods

Patient Population

The study included patients undergoing autopsy or mitral valve surgery at the University of Michigan between November 2005 and May 2006. In a prospective series, specimens were obtained at autopsy. The necropsy specimens were examined by incision of the lateral wall of the LV from mitral annulus to apex, allowing the direct visualization of the entire LV endocardium. In a separate group of patients undergoing clinically indicated mitral valve surgery, the LV endocardium was examined through the mitral orifice during surgery. For both surgical patients and autopsied hearts, the LV endocardium was inspected for false chords. Patient

Address for reprints: David S. Bach, M.D., L3109 Women's – 0273, 1500 E. Medical Center Drive, Ann Arbor, MI 48109. Fax: (734) 615-3025; e-mail: dbach@umich.edu

demographics were recorded, and medical history reviewed for history of heart disease, including ILVT or any VT. The protocol was reviewed and approved by the Institutional Review Board at the University of Michigan.

Characterization of False Chords

False chords were identified as linear fibrous strands within the LV (Fig. 1), extending from the LV wall to the papillary muscle, from wall to wall, or from papillary muscle to papillary muscle, without insertion on the mitral valve. This standardized definition as well as photographic examples were used to minimize interobserver variability between surgical and necropsy sources. Gross anatomic characteristics of false chords were recorded.

Statistical Analyses

Comparisons of continuous variables between groups were made using two-tailed unpaired Student's *t*-tests; comparisons of dichotomous variables were made using Fisher exact tests. Differences were considered significant with a 'P' value <0.05.

Results

Patients

During the 6-month study period, 75 hearts were examined for false chords, including 20 hearts at autopsy and 55 at the time of mitral valve surgery. No patient in either group had a history of ILVT. Patient characteristics are shown in Table I. For hearts examined at autopsy, causes of death are shown in Table II. For patients undergoing mitral valve surgery, the etiologies of mitral valve disease are shown in Table III.

Table I.

Patient Demographic Characteristics

	All Patients (n = 75)	Autopsy (n = 20)	Mitral Valve Surgery (n = 55)
Mean age (years)	58	52	60
Men	42 (56)	12 (60)	30 (55)
Caucasian	64 (85)	15 (75)	49 (89)
African American	9 (12)	4 (20)	5 (9)
Other	2 (3)	1 (5)	1 (2)
History of VT	5 (7)	1 (5)	4 (7)

Unless specified otherwise, values indicated numbers (%) of patients.

Table II.

Causes of Death of 20 Patients Whose Heart were Examined at Autopsy

	n
Pneumonia	4
Hepatic failure	3
Hematologic malignancy	3
Myocardial infarction	1
Giant cell myocarditis	1
Aortic dissection	1
Pulmonary embolism	1
Pulmonary fibrosis	1
Hemothorax	1
Infectious colitis	1
Intracranial hemorrhage	1
Prostate cancer	1

False Chords

The prevalence of false chords is shown in Figure 2. Although there was a trend toward more false chords identified at autopsy (13 of 20 [65%]) than at surgery (21 of 55 [38%]), this difference did not reach statistical significance (P = 0.07). False chords were present in 12 of 18 (67%) patients who suffered a noncardiac cause of death.

Ventricular Tachycardia

No patient had a history of ILVT and only 5 (7%) had a history of VT. The association of false chords and VT is shown in Figure 3. The prevalence of false chords was not different among patients with (3 of 5[60%]) versus those without (31 of 70[44%], p = 0.65) a history of any type of VT (P = 0.65).

Table III.

Etiology of Mitral Valve Disease in 55 Patients Who Underwent Mitral Valve Surgery

	n
Mitral prolapse	28
Ischemic cardiomyopathy	12
Nonischemic cardiomyopathy	6
Rheumatic heart disease	5
Endocarditis	3
Atrial septal defect	1



Figure 1. False chord identified at the time of autopsy.

Discussion

Prevalence of False Chords

In this prospective, anatomic study, the prevalence of false chords was approximately 45% in patients without ILVT. In contrast, previous reports based on echocardiographic imaging describe a population prevalence as low as 0.3%.⁶ The fine, filamentous nature of false chords makes them difficult to reliably detect echocardiographically. Pretest bias might explain the higher observed prevalence if echocardiographic imaging was performed with the specific intent to detecting false chords.

As expected, there was a difference between groups with respect to cardiac history since, by definition, all patients undergoing mitral valve surgery had a history of cardiac disease. However,

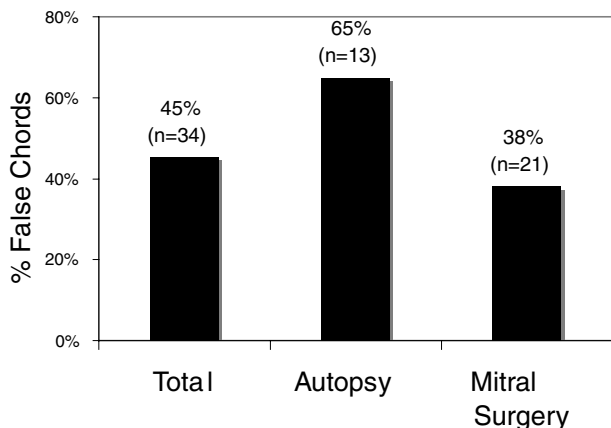


Figure 2. Prevalence of false chords. The difference between the autopsy and mitral surgery groups is not statistically significant ($P = 0.07$).

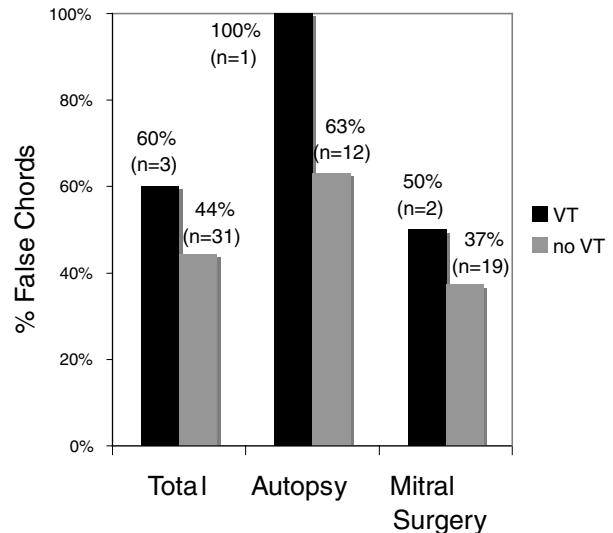


Figure 3. Association between false chords and ventricular tachycardia. There was no significant difference between the groups ($P = 0.65$, $P = 1.00$, $P = 0.63$, respectively).

VT was rare in both groups, and no patient in either group had a history of ILVT. The observed prevalence of false chords was similar in both groups, although there was a trend toward a higher prevalence among hearts examined at autopsy. While it is possible that the prevalence was different in each group (and would have become apparent in a larger study), it is more likely that greater LV exposure at autopsy facilitated endocardial visualization (and the detection of false chords) in contrast to more limited surgical inspection through the mitral orifice.

Association of False Chords with Ventricular Tachycardia

Despite the low prevalence of any VT, a large number of patients in both groups had one or more false chords. Since previous studies that implicated false chords in ILVT relied on a statistical association between their presence and the arrhythmia, the present study suggests that pretest bias may have caused an underestimation of the prevalence of false chords in patients without ILVT.

One might hypothesize that a subtype of false chords exists that causes ILVT. It remains to be confirmed that interventions that eliminate a false chord are a reliable treatment of ILVT. However, based on our observations of a high prevalence of false chords among patients without ILVT, the finding of a false chord in a patient without a history of ILVT appears to have no prognostic significance.

Study Limitations

Although prospective, this was an observational study. Because no patient had ILVT, no intervention was tested, and the prevalence of false chords was not compared between patients with versus without ILVT. Pathologic analyses of false chords were not performed; therefore, this study did not examine whether subtypes of false chords exist, or are of importance.

References

1. Thakur RK, Klein GJ, Sivaram CA, Zardini M, Schleinkefer DE, Nakagawa H, Yee R. Anatomic substrate for idiopathic left ventricular tachycardia. *Circulation* 2005; 93:497–501.
2. Suwa M, Yoneda Y, Nagao H, Sakai Y, Nakayama Y, Hirota Y, Kawamura K, et al. Demonstration of the reentrant circuit of verapamil-sensitive idiopathic left ventricular tachycardia: Direct evidence for macroreentry as the underlying mechanism. *Am J Cardiol* 1989; 64:1217–1220.
3. Gallagher JJ, Selle JG, Svenson RH, Fedor JM, Zimmern SH, Sealy WC, Robicsek FR. Surgical treatment of arrhythmias. *Am J Cardiol* 1988; 61:27A–44A.
4. Maruyama M, Tadera T, Miyamoto S, Ino T. Demonstration of the reentrant circuit of verapamil-sensitive idiopathic left ventricular tachycardia. *J Cardiovasc Electrophysiol* 2001; 12:968–972.
5. Pierard LA, Henrard L, Noel JF. Detection of left ventricular false tendons by two-dimensional echocardiography. *Acta Cardiologica* 1985; 40:229–235.
6. Sethuraman KR, Sriram R, Balachandar J. Left ventricular false tendons: Echocardiographic incidence in India and clinical importance. *Int J Cardiol* 1984; 6:385–387.
7. Nishimura T, Kondo M, Umadome H, Shimono Y. Echocardiographic features of the false tendons in the left ventricle. *Am J Cardiol* 1981; 48:177–183.
8. Cangelosi MM, Leggio F, Gaudio M, Stollo G, Martinez MR, Saporano A. The incidence and clinical significance of the echocardiographic finding of false chordae tendinae. *Annali Italiani di Medicina Interna* 1992; 7:102–105.

Conclusions

Using direct inspection of the LV endocardium at autopsy or at the time of mitral valve surgery, a high prevalence of false chords was observed among patients without ILVT. Previously reported associations of false chords with ILVT likely underestimated the prevalence of false chords in a normal population.