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Echocardiographic assessment of feline false tendons and their relationship with focal thickening of the left ventricle

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KEYWORDS
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Abstract *Background:* False tendons (FTs) are string-like structures in the left ventricle. A FT might produce focal thickening at its insertion region of the left ventricle, which could be mistaken for focal hypertrophic cardiomyopathy.
Objectives: To perform a prospective, echocardiographic follow-up examination of feline FTs and compare the wall thickness at the FT insertion region and a normal region without FTs at both examinations.
Animals: One hundred twenty-eight cats with one or multiple FTs without other cardiac abnormalities or systemic disease.
Methods: Measurements of the interventricular septum at end-diastole at a region with and without FT insertion were performed using two-dimensional echocardiography at both examinations and compared statistically using a Student's *t*-test.
Results: The follow-up interval ranged from 5 to 110 months (mean, 33 months). Myocardial wall segments with FT insertions were significantly thicker compared with neighboring wall regions in the long axis, but not in the short-axis views obtained. Comparing the wall thickness of follow-up examinations with the initial examination, revealed a significant growth of both FT and non-FT segments. However, differences in growth between the FT region and region without FTs were not statistically different.
Conclusions and clinical importance: Many normal cats have FTs, associated with focal thickening compared with neighboring regions. This thickening can increase over time, proportionate to growth in other (non-FT) segments. The association

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of such thickening with an FT and the absence of disproportionate growth in this segment over time suggests that these segments are simply thicker related to FT insertion.

Abbreviations

FT	false tendon
HCM	hypertrophic cardiomyopathy
IVS	interventricular septum
IVSd	interventricular septum at end-diastole
LV	left ventricle

Introduction

False tendons (FTs) are defined as single or multiple, fibrous or fibromuscular bands crossing the left ventricle (LV) unassociated with the atrioventricular valve [1,2]. First mentioned in 1893 [3], their appearance has raised further interest with the development and improvement of echocardiography [1,2,4–6]. In humans, a possible correlation of FTs with murmurs and ventricular arrhythmias has been discussed [7–9].

In cats, excessive FTs and singular large FTs have been associated with heart failure and cardiac malfunction [10–12]. Furthermore, cats with hypertrophic cardiomyopathy (HCM) with obstruction have a higher prevalence of FTs in the LV outflow tract compared with cats with HCM without obstruction [12]. However, it remains uncertain what impact one or multiple FTs have on the LV in healthy cats and whether they are a cause or consequence of heart disease, or simply a cofinding, has yet to be determined.

Human studies have shown that FTs can be difficult to distinguish from the LV endocardium when these strands run parallel to the interventricular septum (IVS) and might lead to artifactual measurements of both septal thickness and LV dimension [13–15]. In people, FTs have also been described to mimic focal thickening at their insertion region possibly leading to the erroneous diagnosis of focal HCM [16]. Applying this observation to cats, it is possible that an FT might provoke focal thickening near its insertion point (or origin, depending on the perspective). If this hypothesis is true in the feline population, an FT insertion could lead to an erroneous diagnosis of focal HCM, with unintended consequences of exclusion from breeding programs or false-positive clinical diagnosis. Whether indicative of normal anatomic variation or focal disease, changes over time in segments of FT insertion would be of clinical relevance, especially if disproportionate wall thickening was identified with aging. Thus far it is unknown if any such changes occur over time.

Therefore, the aim of this study was to compare the cardiac wall thickness of regions with and without FT insertion at both the initial and the follow-up examinations. We hypothesized that the measurements of the FT insertion regions would remain similar at follow-up and that this focal thickening should not be mistaken with focal HCM.

Material and methods

The database was screened for cats with a prior physical and echocardiographic examination at the cardiology department of the Clinic of Small Animal Medicine at the Ludwig-Maximilians-University in Munich, Germany. Those cases revealing single or multiple FTs in the absence of any relevant systemic disorders, definitive cardiac abnormalities or congestive heart failure were considered as putative cases for the study. The owners of these cats were contacted, and invited to return with their cat for a follow-up examination. If the cat was still alive when the owner was contacted, an invitation for a prospective follow-up examination was extended. Examinations obeyed the principles of the German Animal Welfare Act.

Cardiac examinations

Cats underwent a physical examination followed by standard echocardiography using an ultrasound

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