Accounting for nearly 75% of all cardiovascular disease in canines, myxomatous valve disease in dogs is a much more prevalent pathology than in humans. It is becoming increasingly important for veterinary science to understand the biological and mechanical impacts of this disease. Myxomatous mitral valves disease (MMVD) is the most common acquired and progressive heart disease and the most common cause of congestive heart failure in small breed dogs. The American College of Veterinary Internal Medicine consensus guidelines (2019) describes 4 basic stages of MMVD: A - identifies dogs at high risk for developing heart disease; B - identifies dogs with structural heart disease but that have never developed clinical signs caused by heart failure; C - denotes dogs with either current or past clinical signs of heart failure caused by MMVD; D - refers to dogs with end-stage MMVD in which clinical signs of heart failure are refractory to standard treatment. In stage D we observe several complications: chordae tendineae rupture, pulmonary hypertension and left atrium rupture. In one retrospective study, chordae tendineae rupture was diagnosed in 16% of dogs with degenerative mitral valve disease. Myxomatous mitral valves are characterized by a disorganization of structural components of the leaflets (including significant collagen and glycosaminoglycans accumulation) and weakening of the chordae tendineae. The changes in leaflet composition and mechanics due to progressive degradation are know but histological and mechanical changes in chordae tendineae have not yet been evaluated. The chordae tendineae are columnar structures unique to the mitral and tricuspid valves. During the cardiac cycle, the chordae tendineae interface mechanically with the valve, papillary muscles, and (indirectly) the ventricular wall in response to intrinsic and extrinsic stimuli.

We do not know how the histological and structural remodelling in chordae tendineae takes place during the stages of MMVD and how this remodelling affects the mechanical function of chordae tendineae. The maximum stretch that the chordae tendineae can sustain has not been quantified in healthy dogs and dogs with MMVD. Therefore, it is necessary to establish the individual maximum resistance of the chordae tendineae to stretching, which will enable the prediction of resistance during the left ventricular systole and risk of chordae tendineae rupture.

The aim of study is to evaluate of the histological and structural remodelling of mitral valve chordae tendineae, the traction resistance of chordae tendineae and the correlation of histological/structural and mechanical changes with the stage of MMVD.

The detailed project plan and purposes:

1. The necropsy of animals enrolled in the study to confirm the stage of MMVD and to isolate chordae tendineae
2. A static uniaxial tensile test to evaluate the strength characteristics of chordae tendineae
3. A histologic examination to evaluate changes in fibres arrangement and glycosaminoglycans chordae tendineae affected by MMVD
4. An immunohiostochemical examination to analyse the difference in protein amount between healthy and diseased chordae tendineae
5. Quantitative evaluation of extracellular matrix components: collagen, elastin, fibronectin, galectin-3 and glycosaminoglycans in chordae tendineae

The results of this studies will contribute to the development of novel therapeutic strategies for animal heart failure patients.