

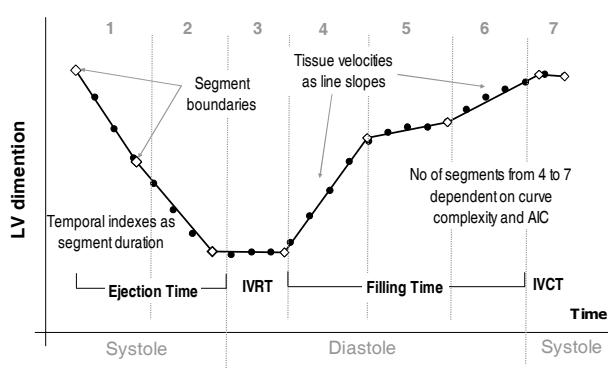
# LV HEMODYNAMIC PERFORMANCE QUANTIFICATION AT BASAL AND MID-VENTRICULAR LEVEL IN MICE WITH HEART FAILURE

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## Introduction

Tissue Doppler imaging-derived assessment of diastolic myocardial velocities, considered as gold standard diastolic diagnostic method, are measured at the mitral annulus [1], whereas CMR-based single-slice imaging protocols (e.g. with beta-adrenergic stimulation) are routinely carried out at a mid-ventricular level considered as a repeatable slice localization [2-3]. The goal was to assess and compare cardiac temporal and hemodynamic indexes of LV at basal and middle short-axis levels from high time resolved *cine* CMR-based images. Detailed parameterization was based on division of the cardiac cycle into linear segments for better insight into developing heart failure in murine Tgαq\*44 experimental model of dilated cardiomyopathy.



## Material and methods

Two groups of Tgαq\*44 mice at the age of 2 and 8 months and two groups of age-matched control FVB mice with EF>60% (N=10;6;10;9 respectively) were measured *in vivo* at mid-cavity (papillary muscles level) and basal (just below mitral valve) level of LV using IntraGate FLASH at 9.4T (TE 1.5ms, TR 4.3ms, FA 17°, FOV 30mm, matrix size 256, slice thickness 1.0 mm). *Cine* images were reconstructed up to 60 movie frames per cardiac cycle (temporal resolution: 1.8 ms to 2.9 ms). LV time-area curves were modeled using piecewise linear regression by decomposing curve into simple lines where number of regression segments were chosen according to the Akaike Information Criterion value among several models [4] (left-side figure). Temporal cardiac performance indexes as: isovolumic relaxation (IVRT) and contraction (IVCT), ejection (ET) and filling (FT) time were assessed as a duration of the corresponding segments [% of R-R]. Early (eFR) and atrial (aFR) filling velocities were assessed as the lines slopes [1/ms].

## Results

Comparison between strains in temporal indexes shown: prolongation of IVRT in young Tgαq\*44 mice as compared to aged-matched control at basal level (Fig.A) without visible changes at middle level (Fig.B) and shortening of FT at both levels. The same comparison for 8 months old mice shown successive alternation in most indexes except IVRT at base and ET at both levels. FT and IVCT are also changing with the age at basal level between TG-2m and TG-8m (Fig.A). All indexes in FVB mice unchanged with the time (similar pattern as for FVB-2m, not shown at the figures). Myocardial filling velocities shown: significant increase of eFR at the middle level as compared to the basal in both strains but significantly only in FVB mice (Fig.C;\*) and an increase between young and old mice only at basal level, slight decrease of aFR in both strains with higher values at the base (not shown).

## Discussion

The results presented may indicate progressive diastolic dysfunction in Tgαq\*44 mice between aged 2 and 8 months (preserved cardiac output and EF>60%) and systolic dysfunction at the age of 8 months (prolonged IVCT and reduced FT period). Prolongation of isovolumic periods cause the entire diastole duration (early and atrial) is becoming more and more limited, so the rate of deformation of the wall must be increased to keep LV cardiac output.

## Conclusions

Precise quantification based on high frame rate *cine* images at the base combined with efficient parameterization method gives better insight into LV temporal performance. Cardiac parameters from basal level seems to be more sensitive than the midventricular and earlier show subtle changes in LV relaxation in Tgαq\*44 mice with preserved EF.

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