

## LV dilation: Wall stress

Short one this week. Wall stress can be described by Laplace's Law which is simplified to:

$$\sigma = Pr/2h$$

Where  $\sigma$  is wall stress, P is the pressure within the cavity, r is the radius of the cavity, and h is wall thickness. This explains why patients with excessive pressure within the cavity (e.g. pulmonary hypertension, aortic stenosis, systemic hypertension) develop ventricular hypertrophy, also called concentric hypertrophy. The increase in wall thickness helps offset the increase in wall stress caused by the elevated intracavitary pressure.

Laplace's law also explains why LV dilation can be a challenge for the body to deal with. Volume overload conditions such as aortic regurgitation or depressed ejection fraction often result in increasing left ventricular end diastolic volume as the body attempts to maintain adequate forward flow. This is also referred to as eccentric hypertrophy: enlargement of the chamber without thickening of the muscle. The problem, as can be seen from Laplace's law, is that wall stress and LV radius are directly correlated, so increasing the chamber size increases wall stress which increases oxygen consumption.

