

**EAE Teaching Course
Bucharest, 2010**

RV Function An Echo Update

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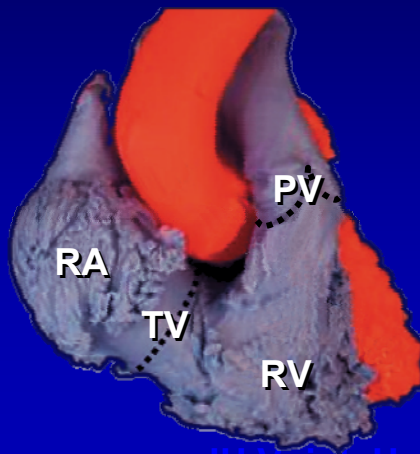
Right Ventricle

Structure & Function

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RV Anatomy

threepart structure

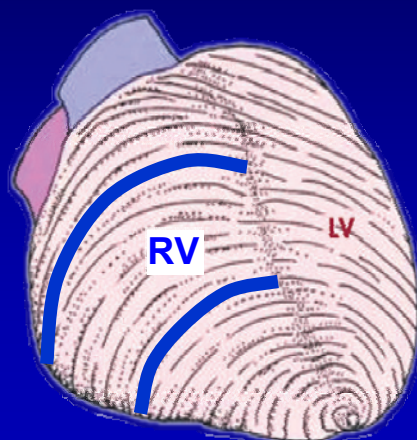


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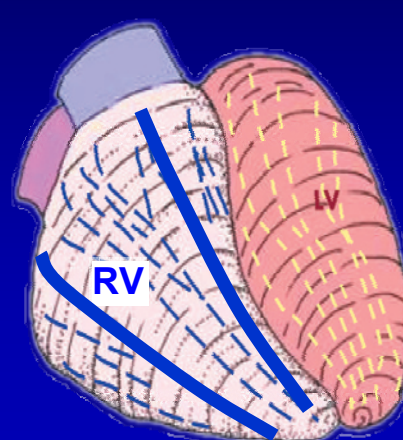
Ho, Heart 2006

Fibre Direction

epicardial



endocardial

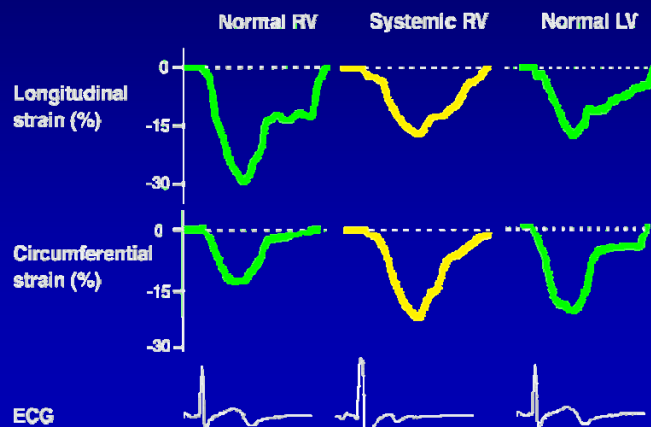


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Ho, Heart 2006

RV Function

longitudinal vs. circumferential function



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Pettersen, JACC 2007

RV Function

under normal conditions:

- **pump for a low impedance circulation**
pumps against 1/6 of systemic resistance
1/6 of LV mass, 3-4mm wall thickness
- **EDV / ESV** **ca. 150 / 60 ml**
EF **ca. 60%**

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RV Function

impairment due to:

- **acute / chronic loading**
reduced function, dilatation, hypertrophy
- **ischemia**
involved in 40-50% of inferior infarctions
- **interventricular interaction**
LV elevated enddiast. pressures, constriction

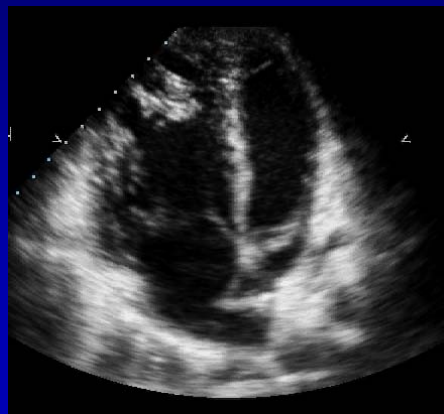
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Loading the Right Heart

volume load
(PV regurgitation)



pressure load
(D-TGA)



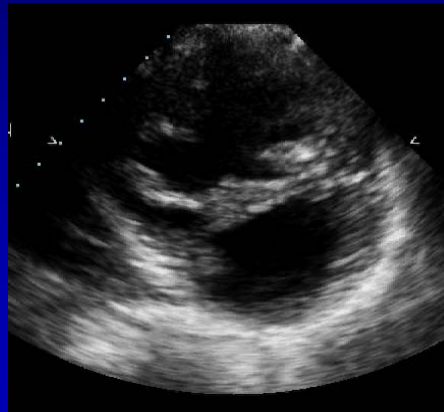
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Loading the Right Heart

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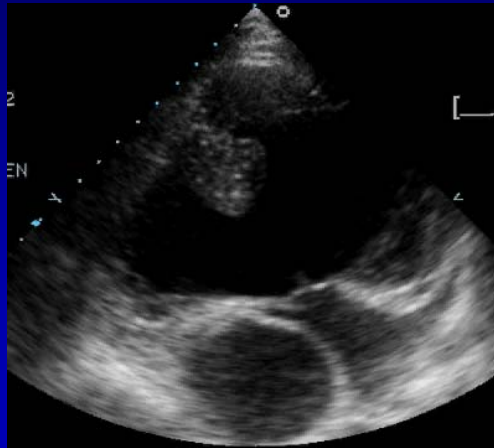
Right Ventricular Function

Does it matter ?

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Does RV Function Matter ?

univentricular Heart, Fontan circulation



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Does RV Function Matter ?

RV function in heart failure patients



Study:

377 heart failure patients
NYHA II-IV
mean EF 22%

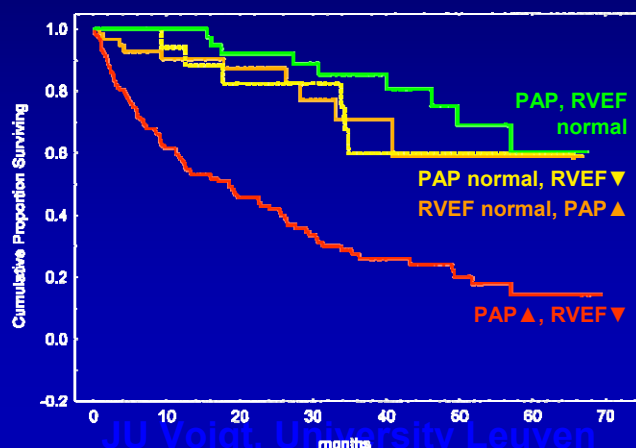
- right heart cath
- 17±9 months follow up

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Ghio, JACC 2001

RV Function Matters !

RV function vs. outcome



Ghio, JACC 2001

Right Ventricular Function

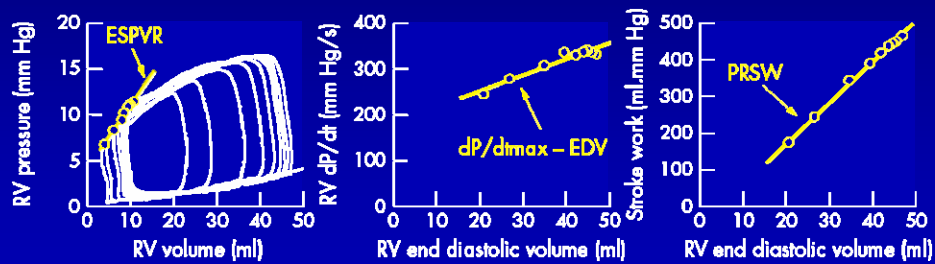
Conventional Indicators of RV function.

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RV Function Assessment

gold standard: pressure-volume-loops

load dependence - always relate to load



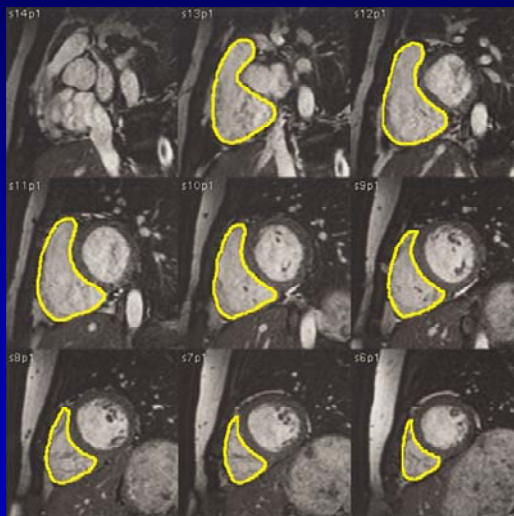
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Bleeker, Heart 2006

RV Function Assessment

EF as surrogate
„gold standard“

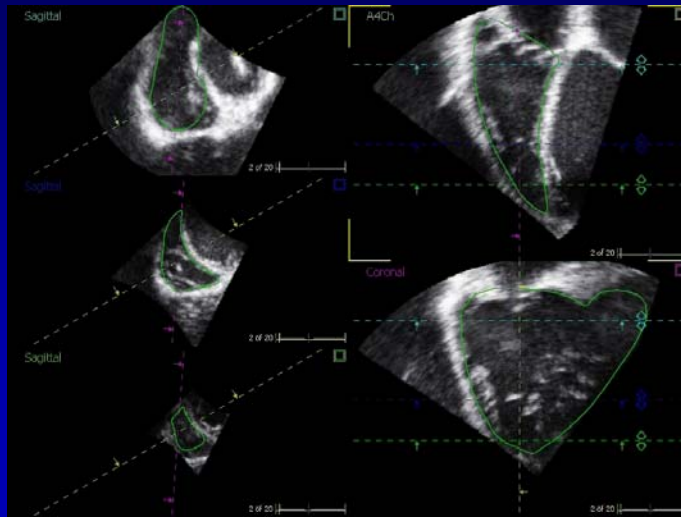
by MRI



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Alfakih, J MRI 2003

RV Function Assessment



3D echo

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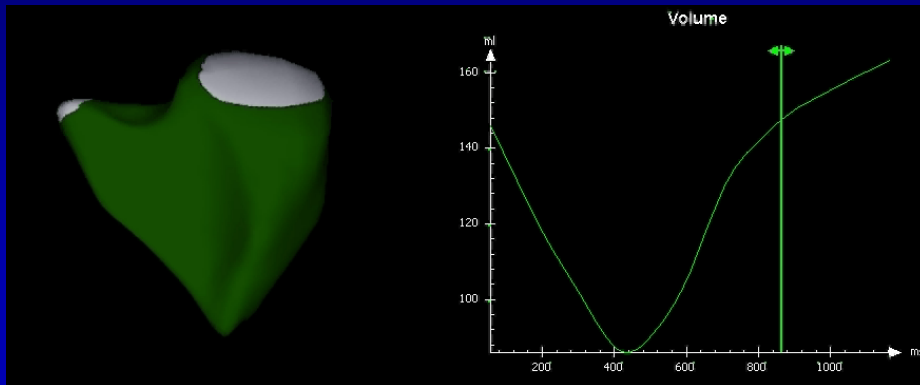
A La Gerche, Leuven

RV Function Assessment

3D echocardiography

RV reconstruction

RV volume curve

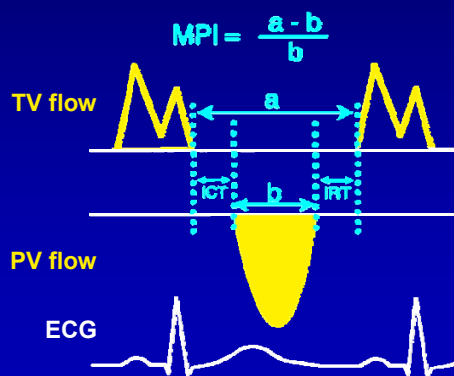


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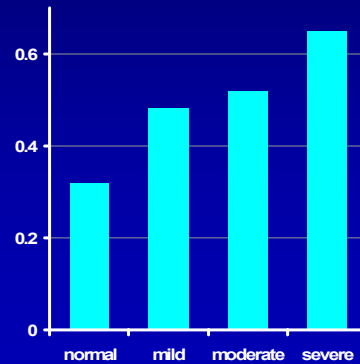
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RV Function Assessment

„myocardial performance index“ (Tei index)



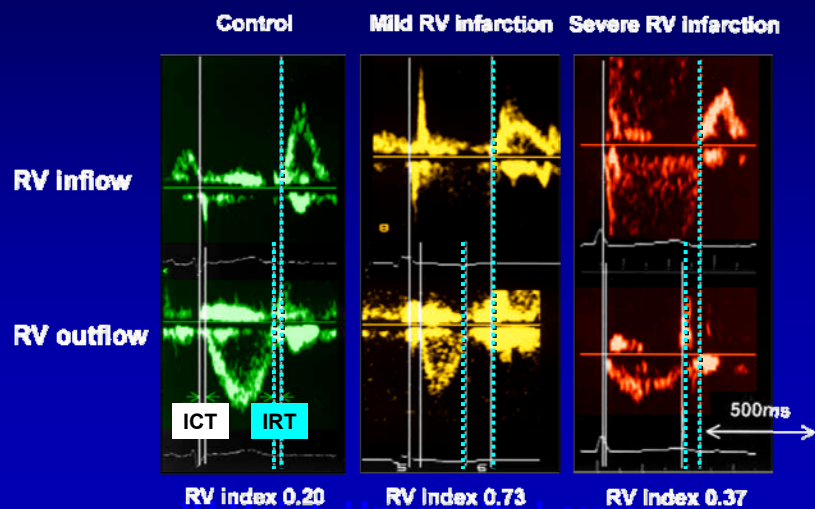
Tei index in RV dysfunction



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Eidem, JASE 1998

Pseudonormalized Tei Index

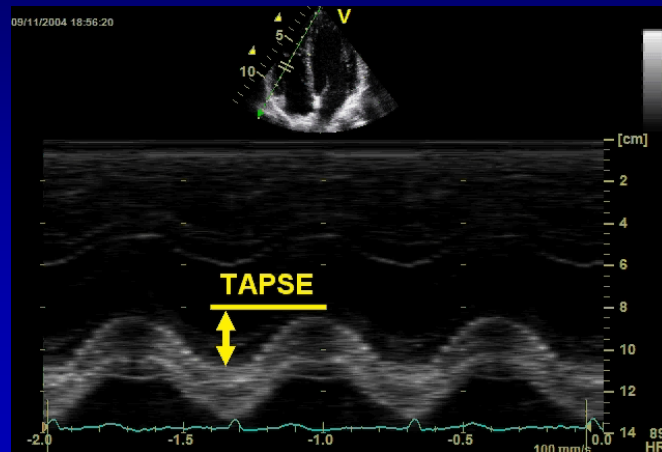


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Yoshifuku, AJC 2003

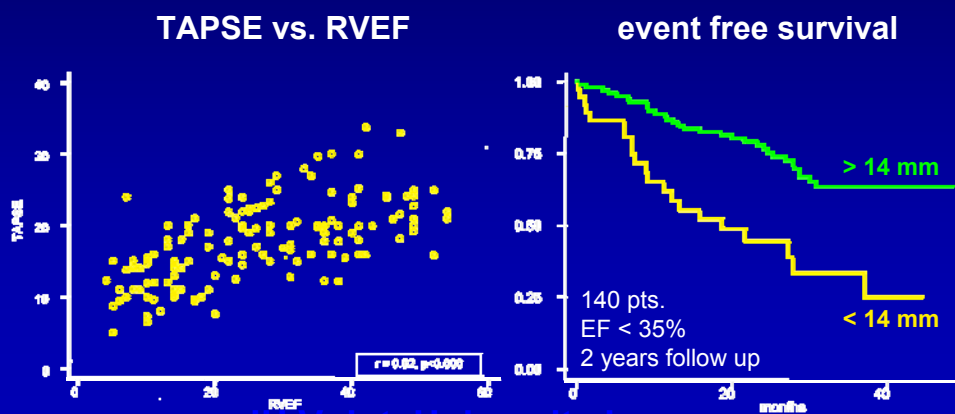
RV Function Assessment

tricuspid anular plane systolic excursion



RV Function Assessment

tricuspid anular plane systolic excursion



Ghio, AJC 2000

TAPSE = RV Function ?

changes after pulmonic TEA

preop

1 week postop

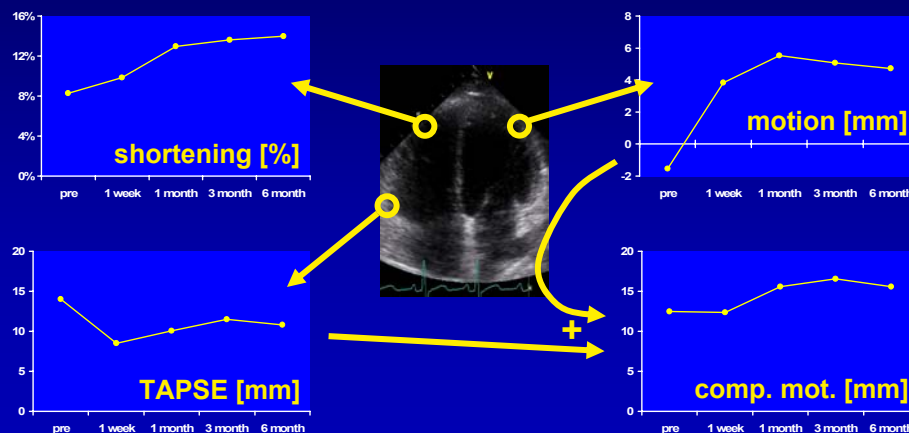


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S. Giusca, Heart 2009

TAPSE = RV Function ?

changes after pulmonic TEA



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S. Giusca, Heart 2009

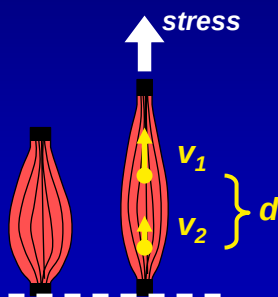
Right Ventricular Function

Strain / ~Rate

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Strain Rate Imaging

tissue deformation properties



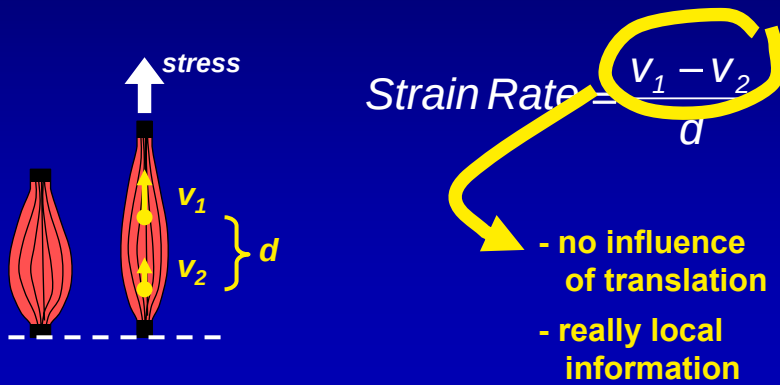
$$\text{Strain Rate} = \frac{v_1 - v_2}{d}$$

$$\text{Strain} = \int \text{Strain Rate} \cdot dt$$

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Strain Rate Imaging

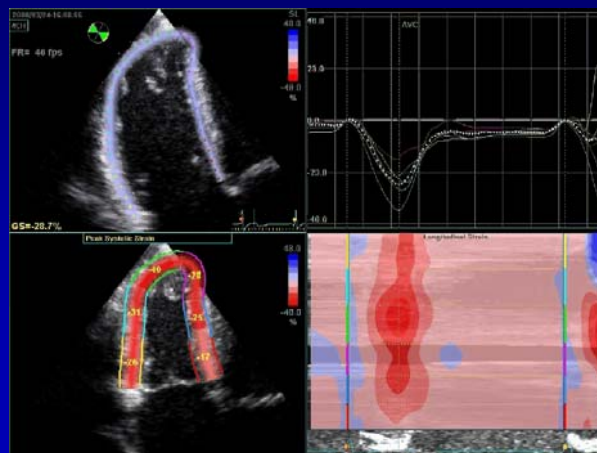
velocity gradient calculation



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Strain Rate Imaging

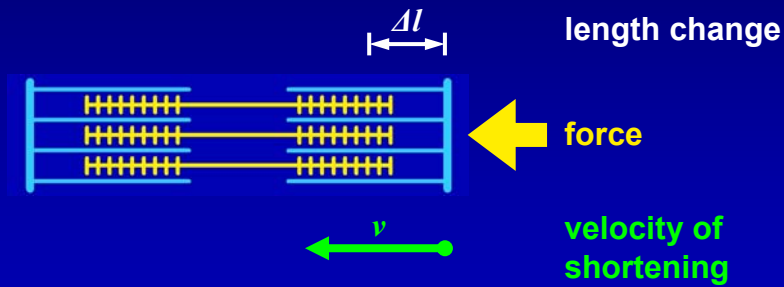
speckle tracking based strain



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Describing Muscle Function

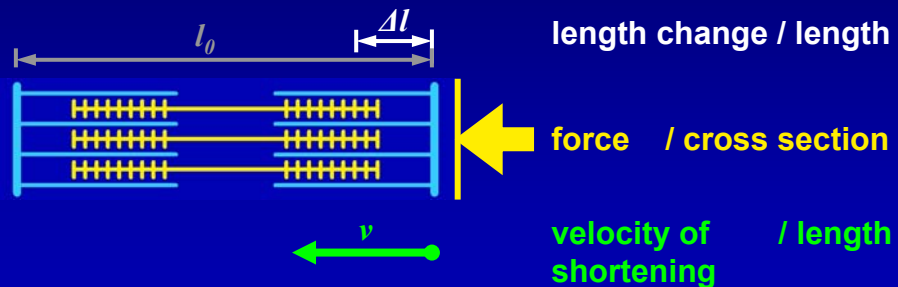
absolute variables



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Describing Muscle Function

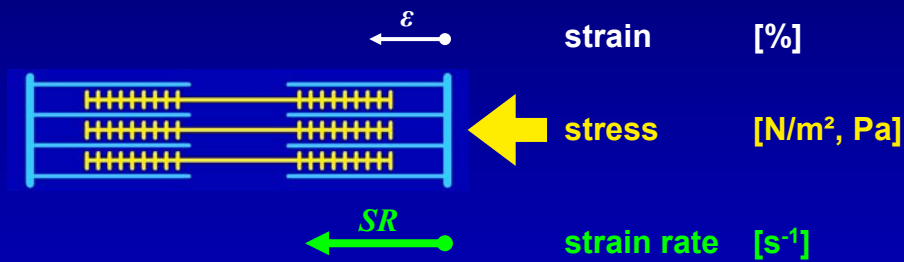
relative variables



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Describing Muscle Function

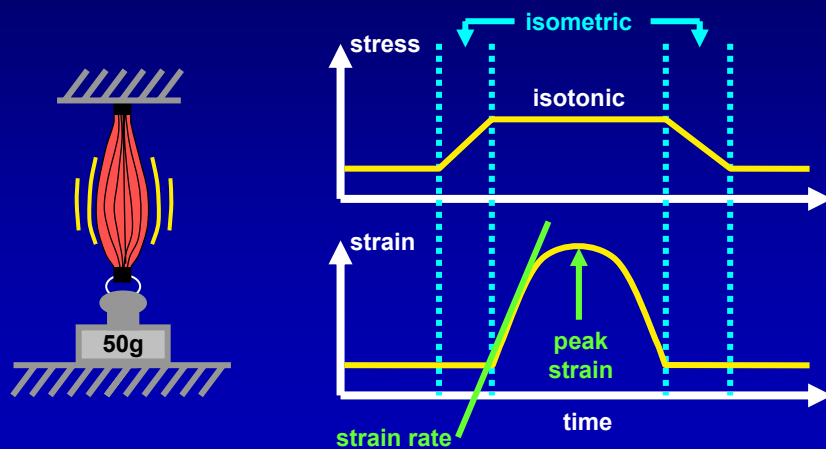
relative variables



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Describing Muscle Function

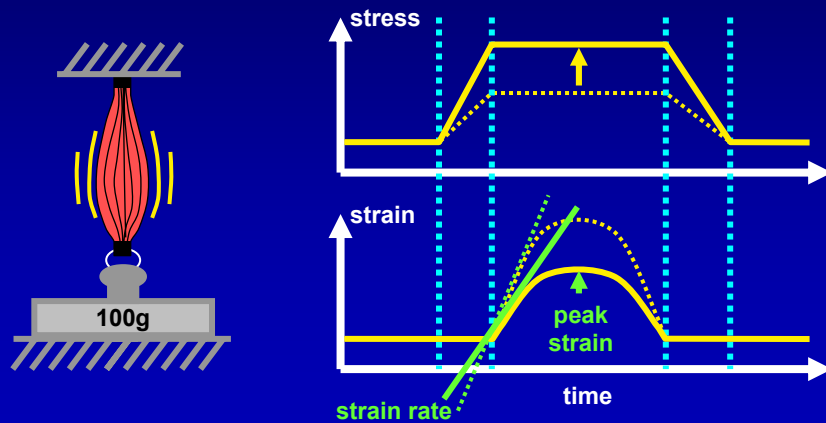
afterloaded contraction



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Describing Muscle Function

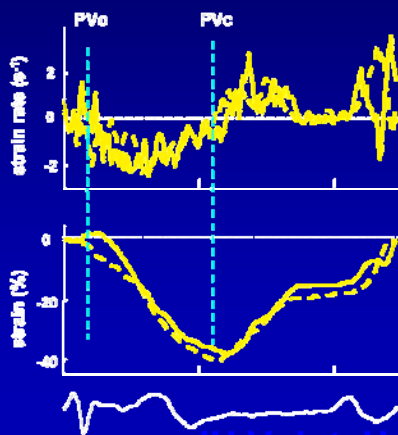
afterloaded contraction



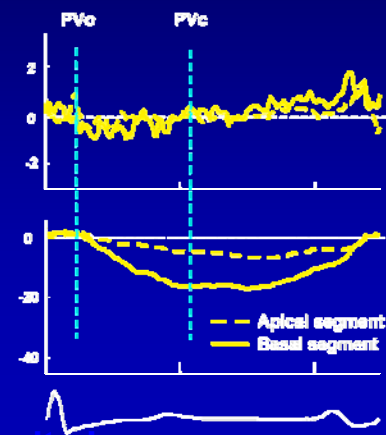
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RV Function Assessment

normal



PHT

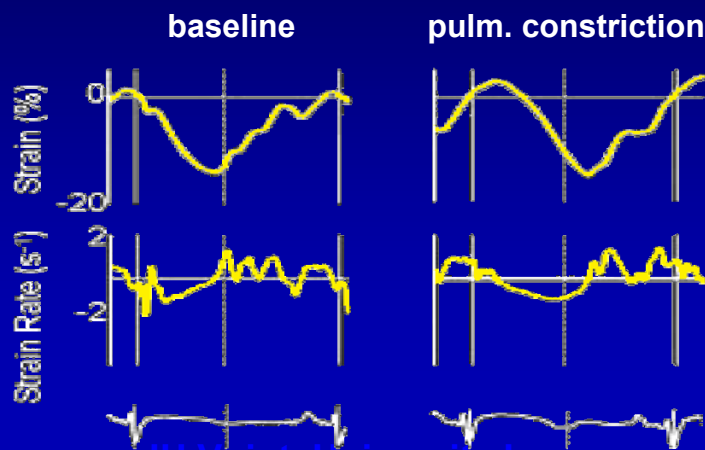


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Dambrauskaitė, J Am Soc Echo 2007

RV Function Assessment

acute afterload increase

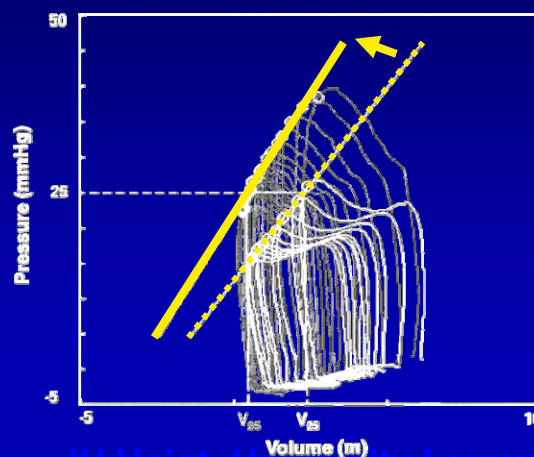


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Jamal, Am J Physiol 2003

RV Function Assessment

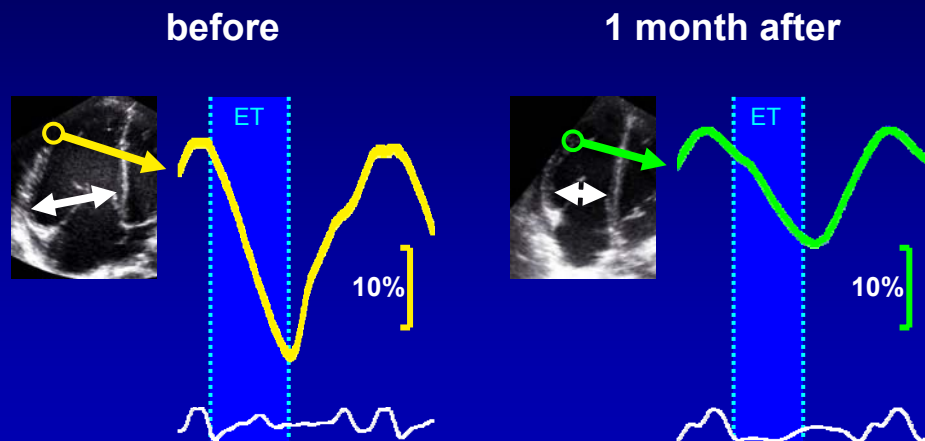
acute afterload increase



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De Vroomen, Am J Physiol 2000

Preload Decrease after ASD Closure



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A. Van den Bruaene, Am J Physiol 2003

Summary

Right ventricular function is complex and difficult to evaluate.

RV ejection fraction may be estimated by MRI or Echo.
Tei index and TAPSE need caution.

Strain rate imaging is a good estimator of regional RV function

Besides invasive gold standards, all parameters are subject to geometry and reflect loading conditions.

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Further Reading



European Journal of Echocardiography (2010) 11, 81–96
doi:10.1093/ejehocardiography/jep234

REVIEW PAPER

The echocardiographic assessment of the right ventricle: what to do in 2010?

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Jurcut, EJE 2010