Functional Mitral regurgitation

4/7 echo meeting Dr.蕭如豐

- not of the mitral valve itself
- but of the supporting left ventricular (LV) structures
- Distortion of normal ventricular geometry results in failure of normal systolic leaflet coaptation and consequent regurgitation

Prevalence

- 50% of patients within 30 days of MI
- patients with NSTEMI, the prevalence was similar at 42%
- moderate or severe in 12%, (1/3 no audible murmur)
- presence of Q waves, the location of the infarct, and the extent of CK elevation did not predict MR.

Prognostic significance

- severity of MR ↑ ↓ in-hospital mortality and long-term outcome
- moderate or severe MR => heart failure and death ↑
- anything more than mild functional MR has important prognostic implications

Pathology

- Complex and nature dynamic during the cardiac cycle
- Results from:

  1. leaflet tethering as a result of distorted geometry,

  2. reduced closing forces as a result of impaired ventricular function

  3. dyssynchronous contraction of the papillary muscles

  4. dilation of the mitral annulus =>orifice ↑

- Using Carpentier's classification, functional MR can result from type I, type II, or most commonly type IIIb dysfunction

- Type I: leaflet perforation (infective endocarditis) or more frequently by annular dilatation
- Type II: Excessive leaflet mobility accompanied by displacement of the free edge of one or both leaflets beyond the mitral annular plane (mitral valve prolapse)
- Type III:

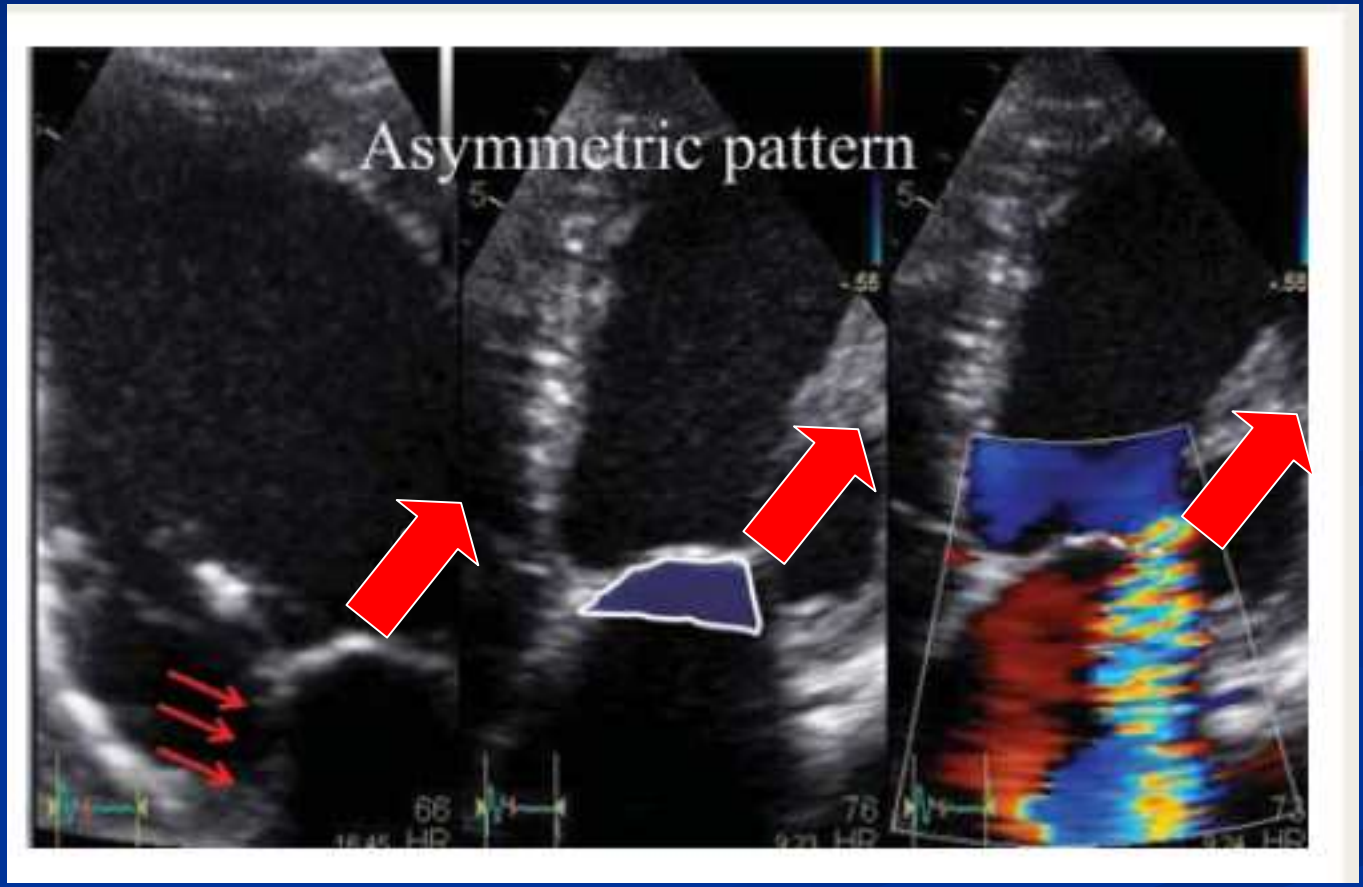
  type IIIa implying restricted leaflet motion during both diastole and systole due to shortening of the chordae and/or leaflet thickening such as in rheumatic disease,

  type IIIb when leaflet motion is restricted only during systole

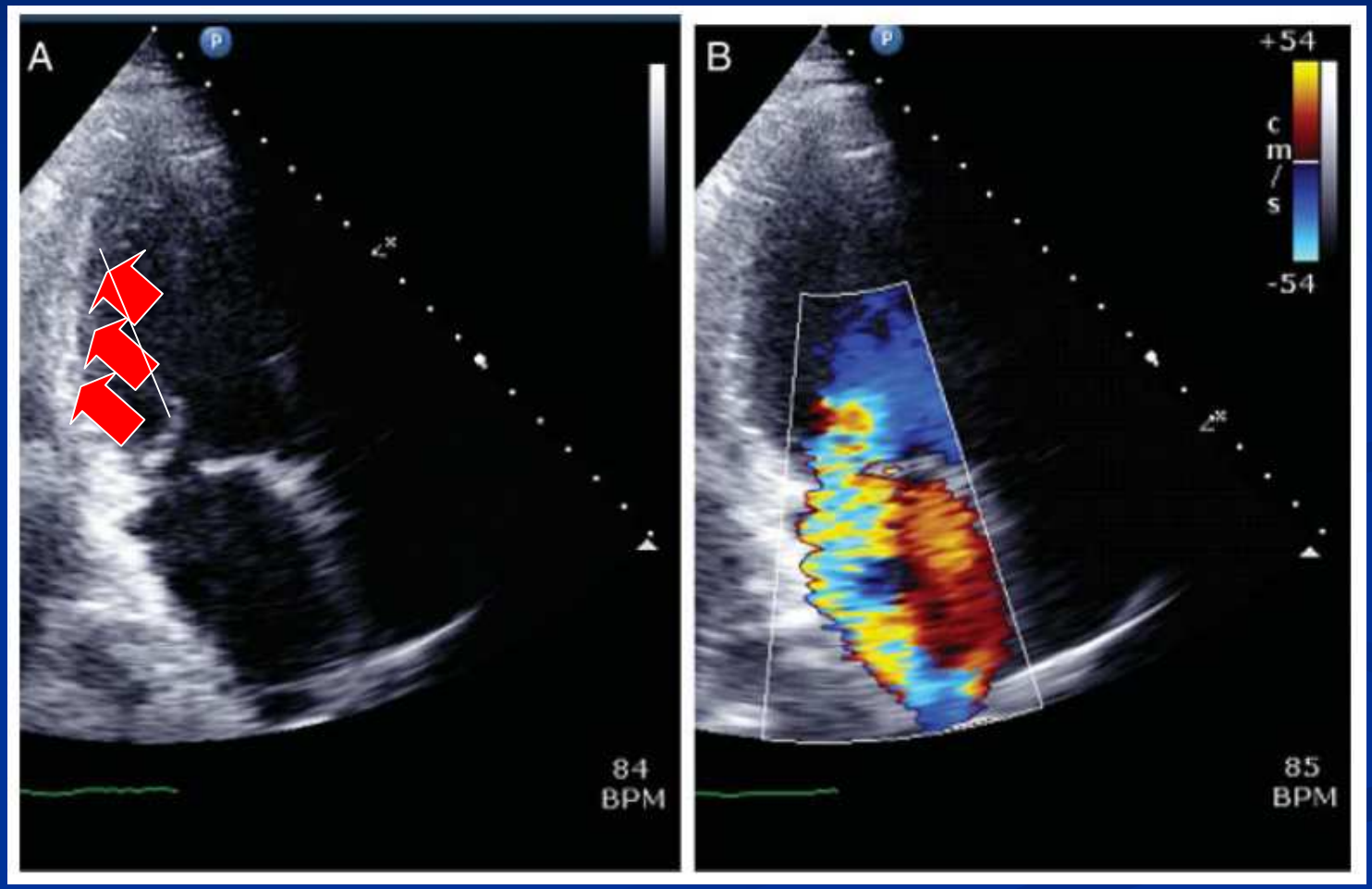
Leaflet tethering: local vs. global remodelling

- inferoposterior myocardial infarction

local



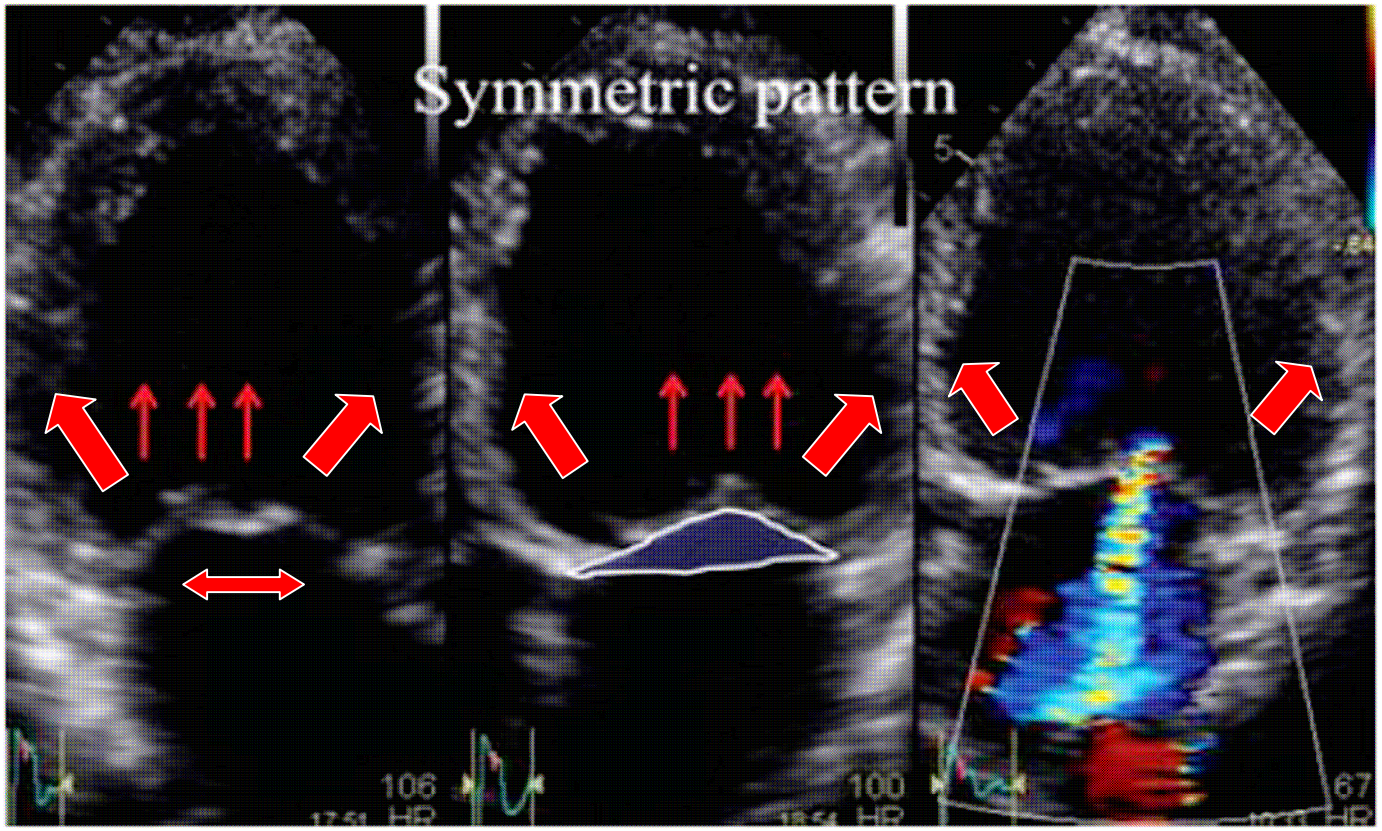
local



global

- Both papillary muscles are displaced posteriorly and apically to a similar extent with marked apical displacement of the coaptation line and resultant ‘tenting’ of the leaflets
- dilation and flattening of the mitral annulus

global



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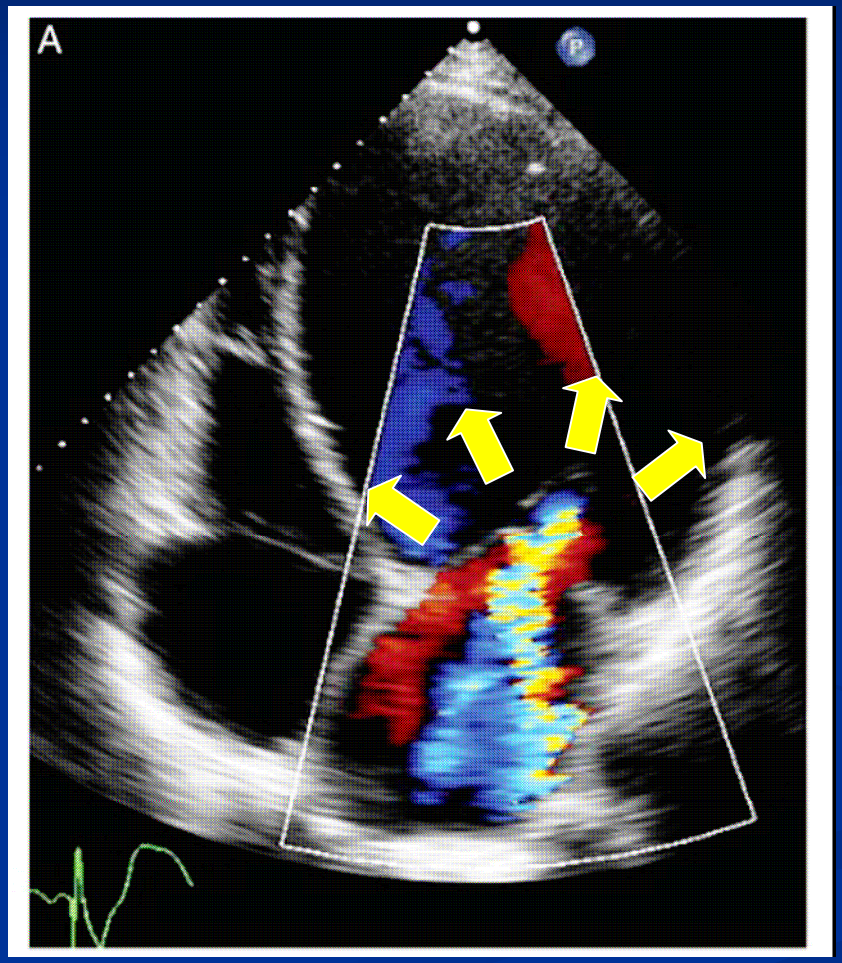
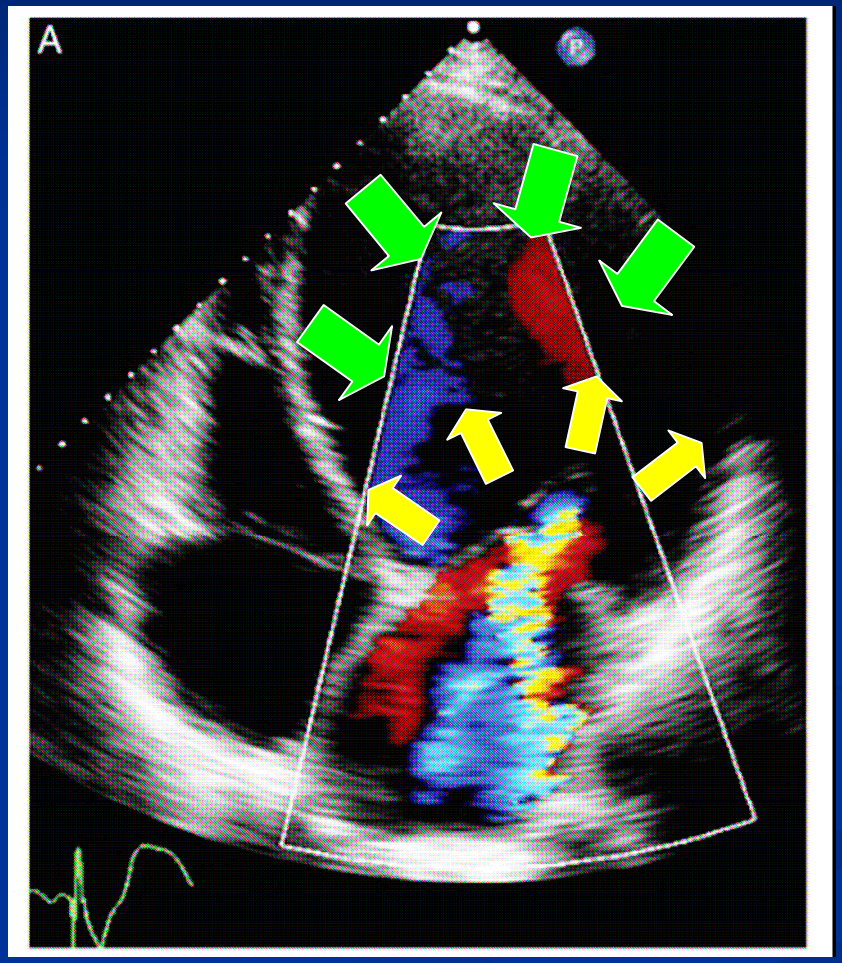


Closing forces

- the systolic contraction of the ventricular myocardium driving blood against the valve and pushing the leaflets together

global



Left ventricular dyssynchrony

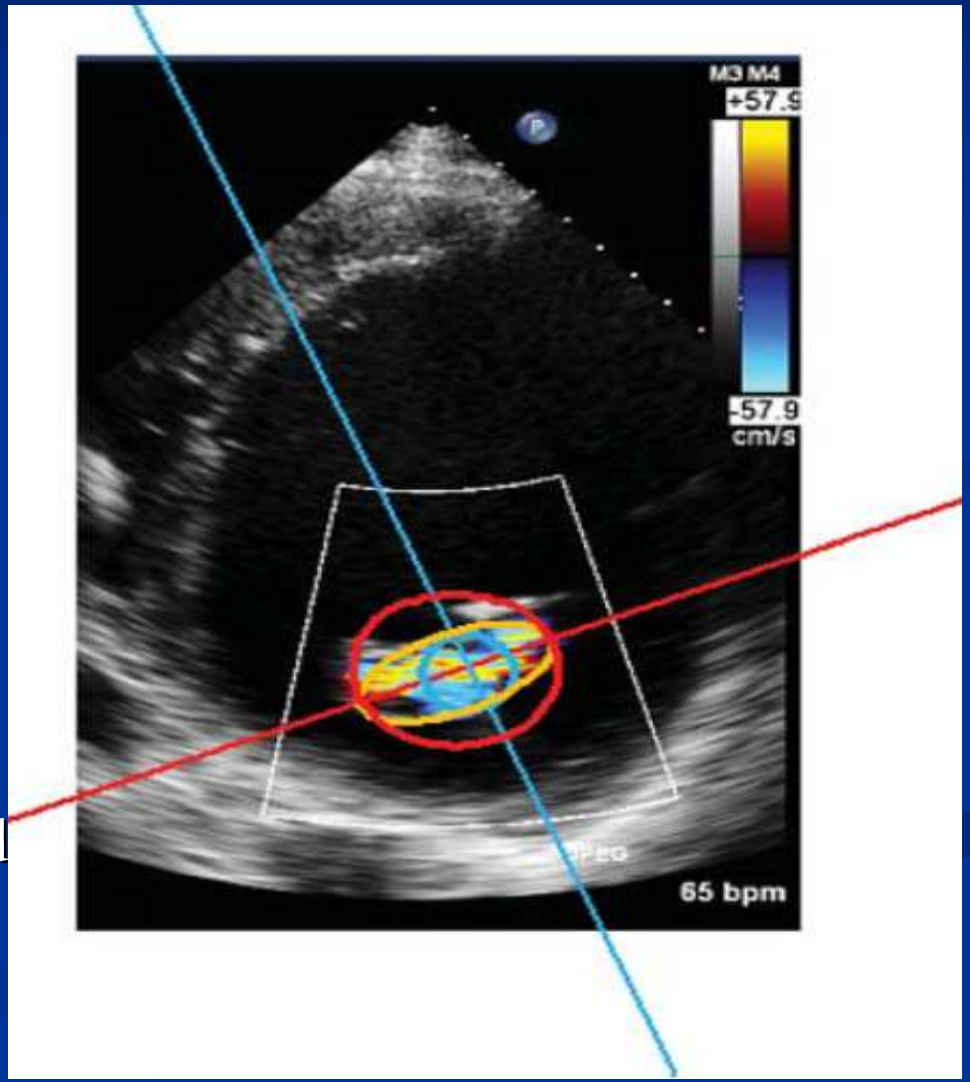
- disco-ordinate contraction of the papillary muscles → dynamic tethering of the leaflets
- Mechanistic studies: dyssynchrony is less important than remodelling and structural tethering
- but in selected patients, CRT does reduce the severity of functional MR

Dynamic nature

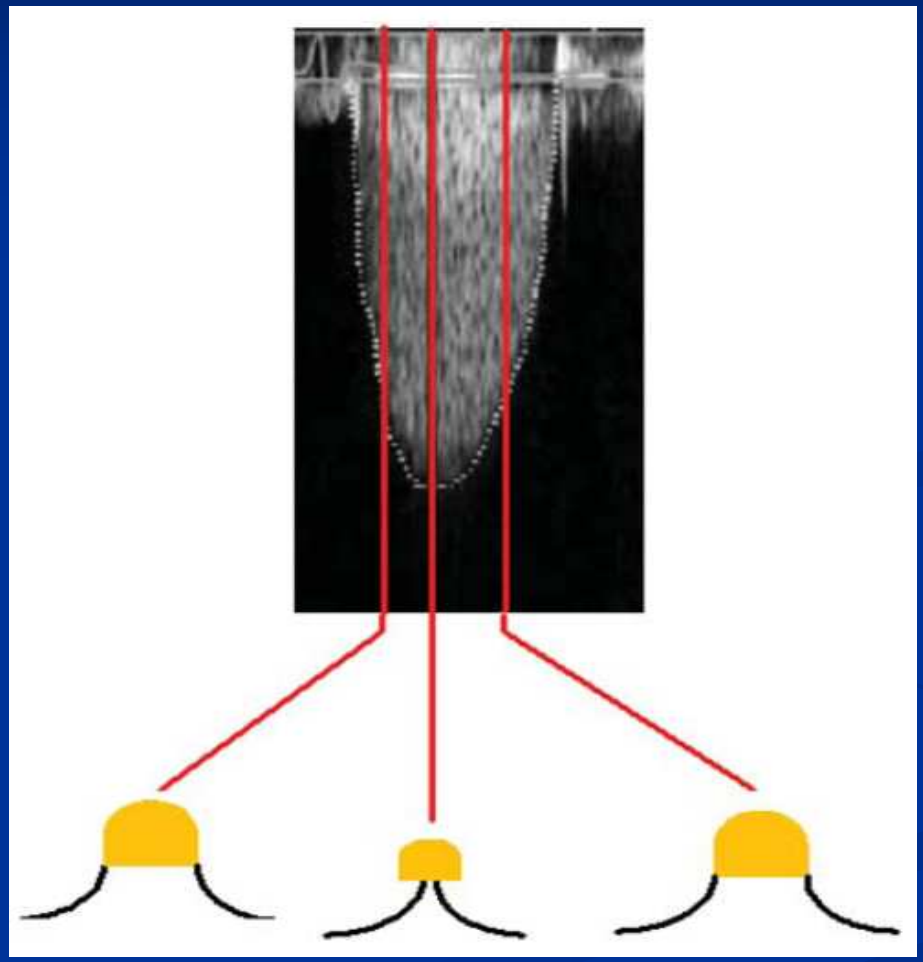
- ventricular loading conditions
- during the cardiac cycle
- general anaesthesia ↓
- during exercise ↑

Pitfalls in the quantitative echocardiographic assessment

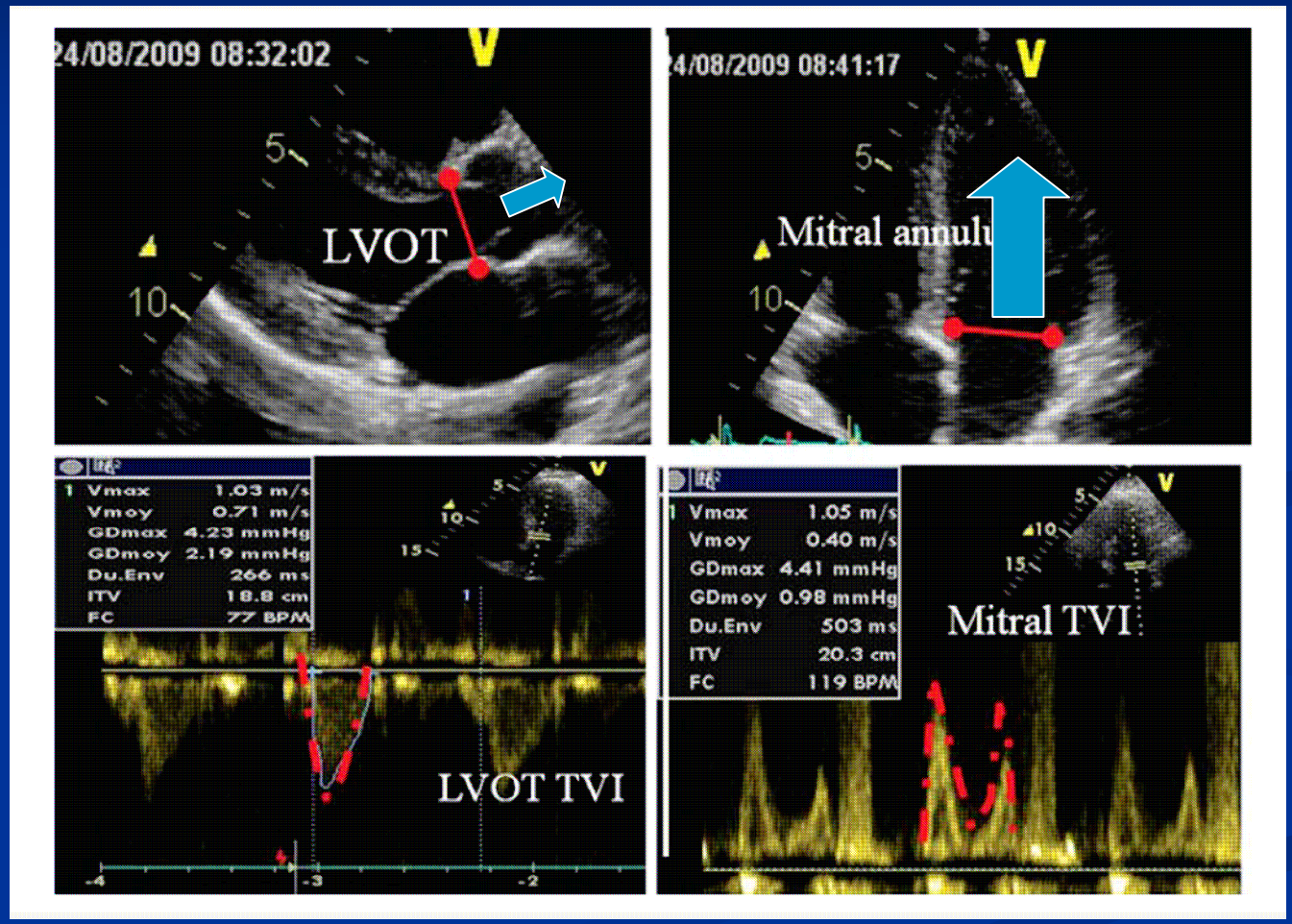
- Non-circular orifices
- 2D echo
- 3D echo
- the mean of the vena contract in the apical two- and four-chamber views correlates well with real-time 3D echo assessment
- separate vena contracta of multiple jets cannot be added



Dynamic mitral regurgitation during the cardiac cycle



Alternative methods of quantification



Stress echo

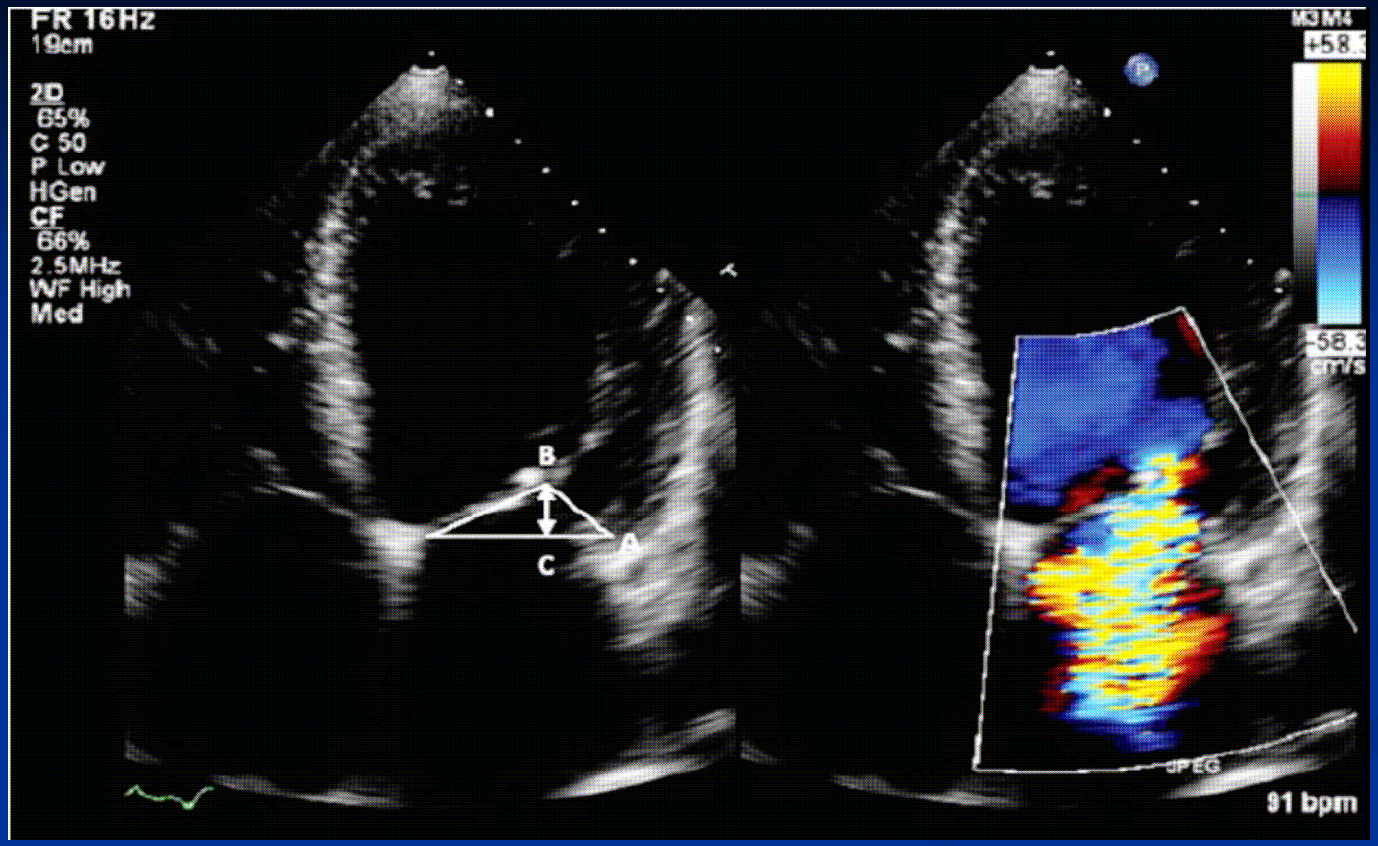
- determine the extent of viable myocardium that might recover with revascularization, medical treatment, or possibly resynchronization

Exercise echo

- An exercise-induced increase in ERO of ≥13 mm^2 is associated with increased morbidity and mortality
- where the degree of exertional dyspnoea is out of keeping with the extent of LV dysfunction or degree of regurgitation at rest;
- where there is pulmonary oedema without an obvious cause
- where surgical revascularization is being undertaken in those with moderate ischaemic MR at rest when the development of severe MR on exercise might prompt the addition of a mitral valve repair procedure

Table 2 **Echo reporting in functional mitral regurgitation**

Left ventricle morphology and function
LV volumes, shape, and ejection fraction
Extent and localization of wall motion abnormalities including thinning consistent with scar
If indicated
Dyssynchrony
Contractile reserve for identification of hibernating or stunned myocardium
Deformation imaging for identification of hibernating or stunned myocardium
Mitral valve morphology
★ Coaptation depth
★ Tenting area (ideally volume)
★ Extent of tethering and posterior leaflet tethering angle > or < 45% (A4C view)
★ Annular dimension (mid systole in A4C view)
★ Direction of jet (or jets)
Severity
Caution to the dynamic nature of MR (NB loading conditions)
Non-circular or multiple orifice
Multiple or complex jets
Quantify is possible (see text)
Other features
Left and right atrial size (volumes)
RV function
PA pressure
Severity of TR



coaptation depth ≥1 cm

tenting area ≥1.6 cm^2

posterior leaflet angle >45%

➔predict significant recurrent MR after annuloplasty

- when dealing with functional MR as moderate MR potentially has greater importance than it has in patients with organic MR