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MILAN
SEPTEMBER
21 & 22, 2023



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Nightmare in valvular heart disease: *A patient with MR and TR*

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FACULTY DISCLOSURE

I have no financial relationships to disclose

2 nightmares:

MR & TR

Case 1

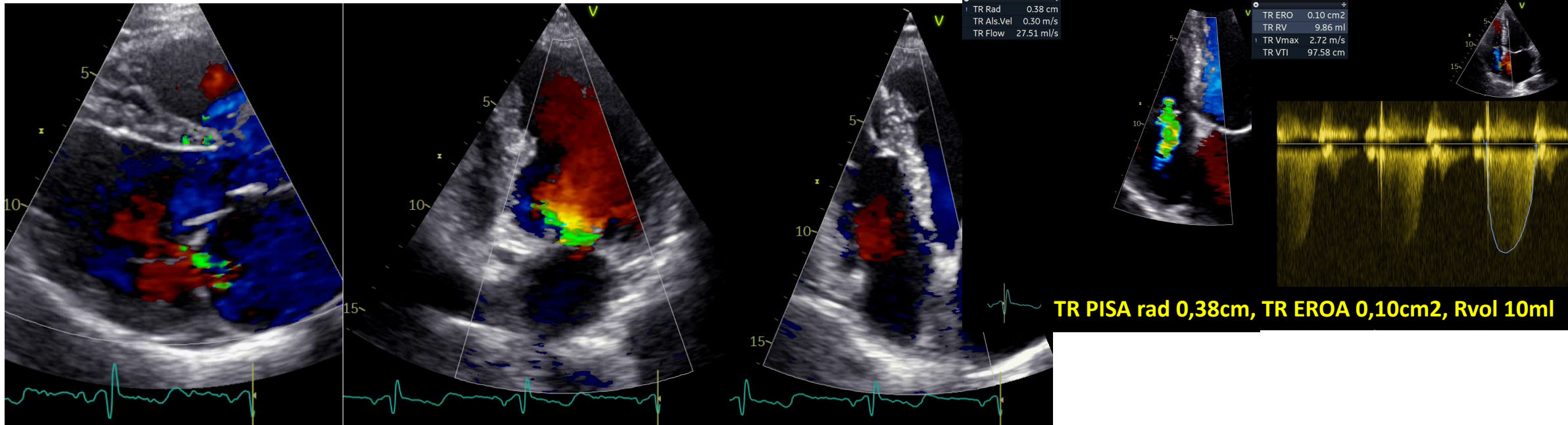
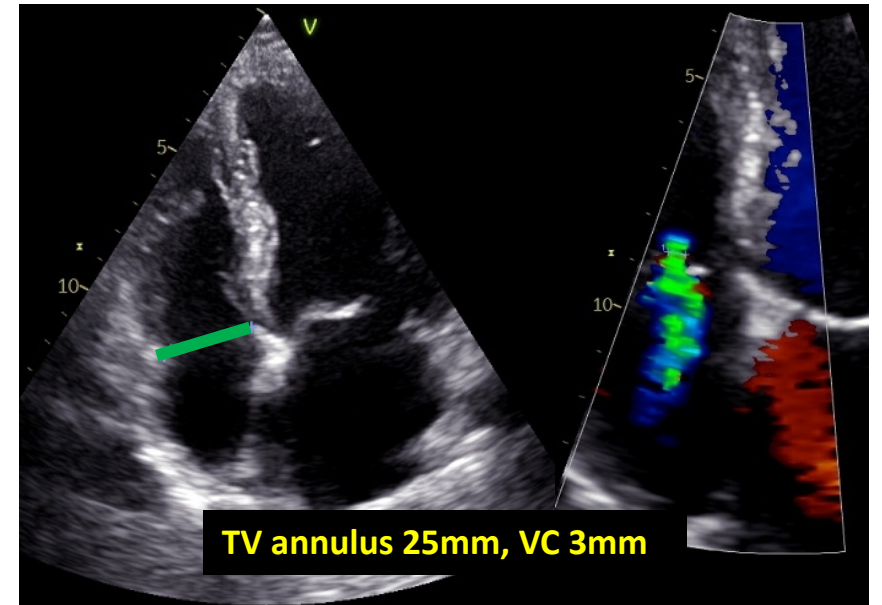


MR & **TR**

Case 2

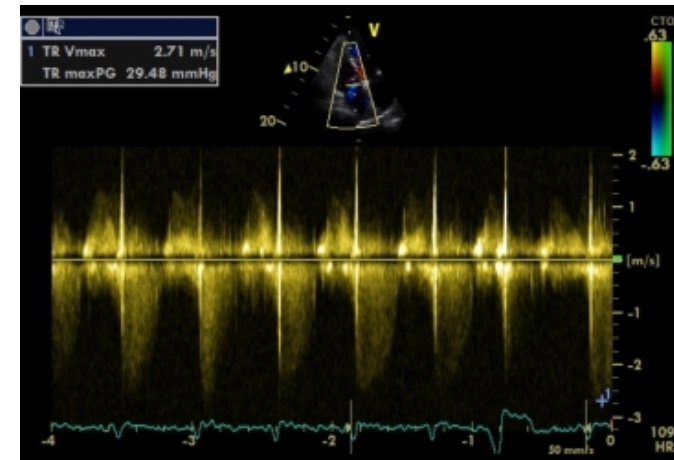
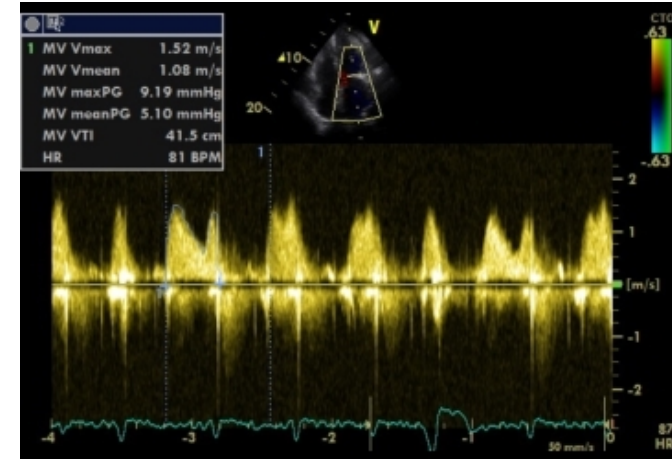
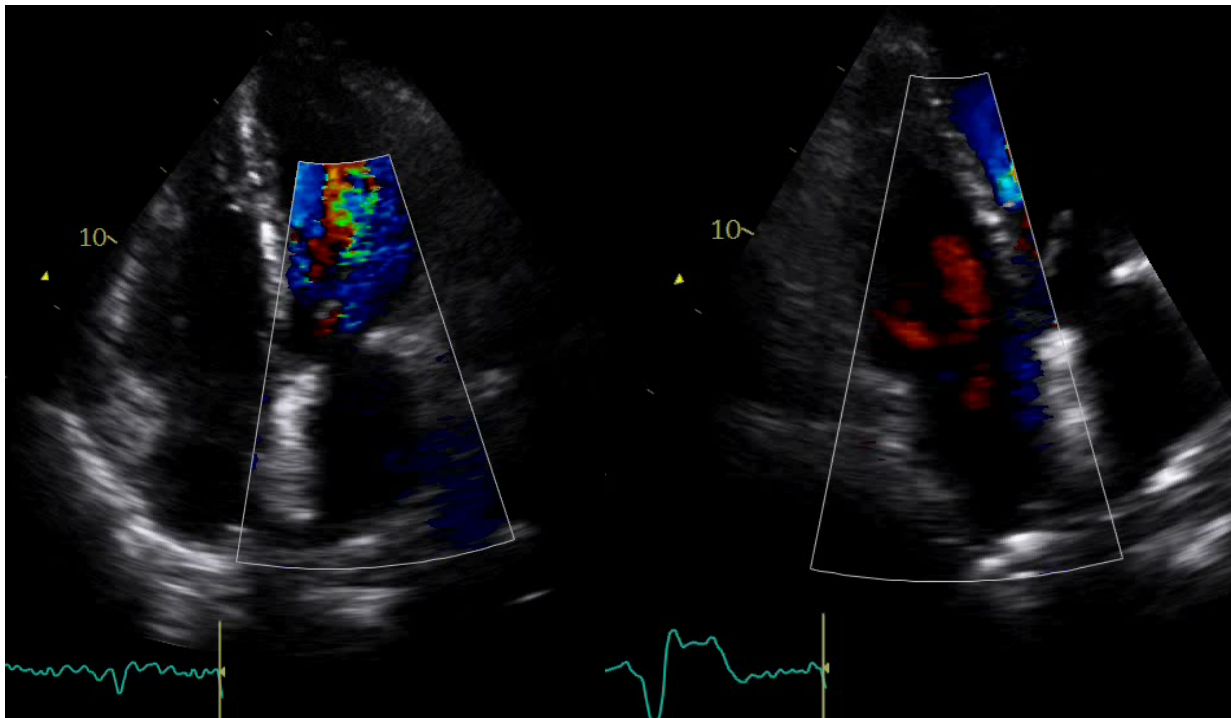
Case 1: female, 1965.

- Symptomatic severe primary MR due to A2 prolapse
- Mild TR
- Referred for surgical MV repair in 2014



Case 1

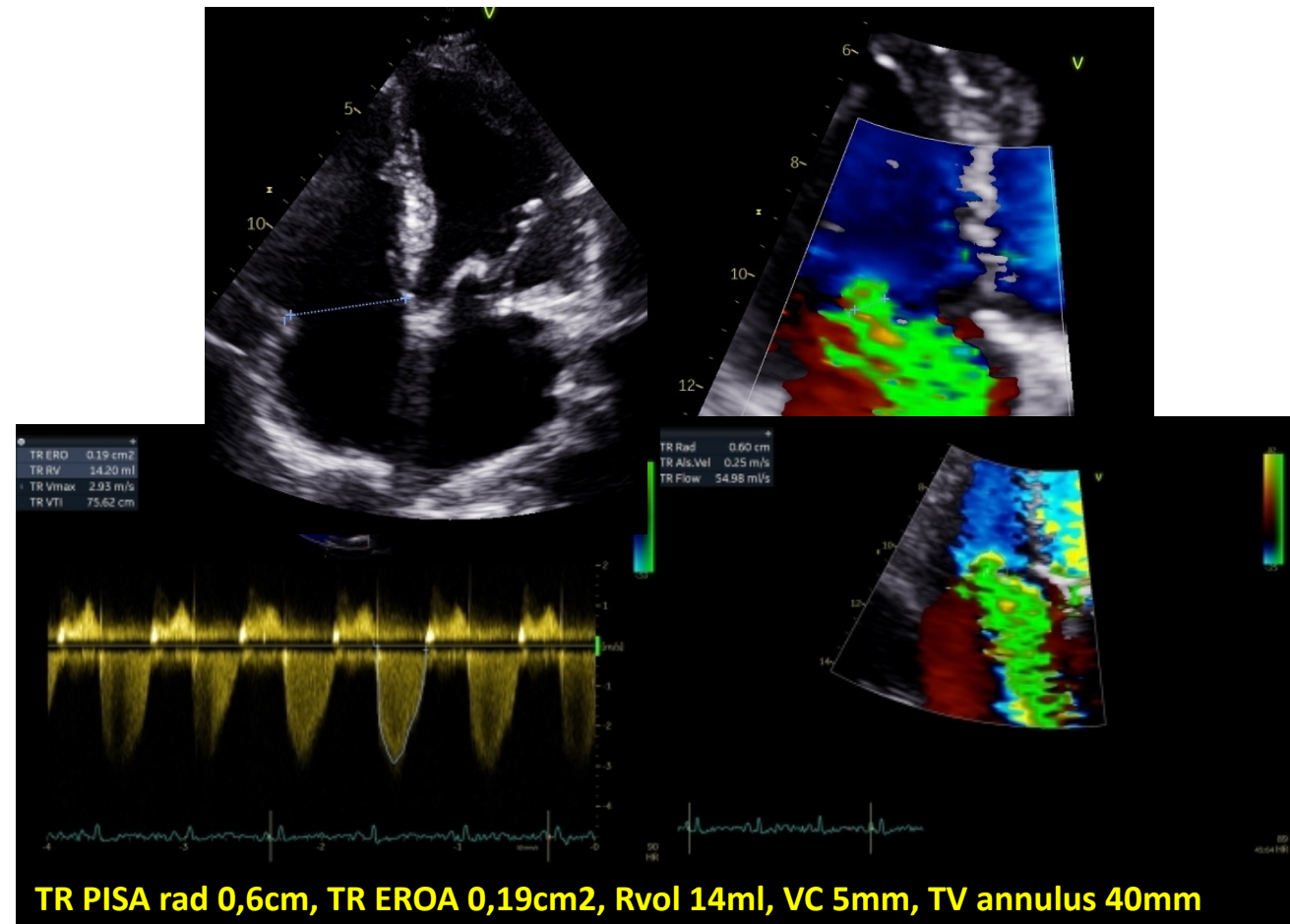
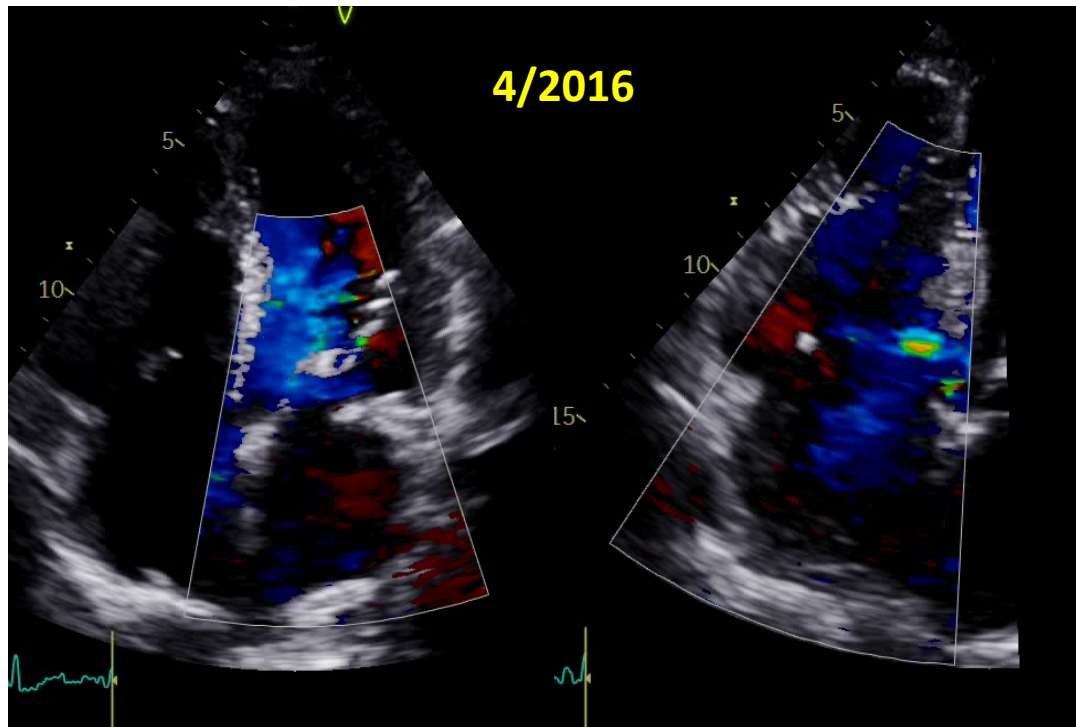
- 1/2015- MV annuloplasty + A2/A3 neochordae
- After surgery, mild TR



Case 1

TR progression at 1y-FU:

- severe TR, triangular jet, EROA 0,19cm², Rvol 14ml, PAPs 50mmHg
- Right-heart cath: mPAP 15mmHg, PCWP 6mmHg, RAP 8mmHg, TPG 9mmHg, PVR 2,3WU, CI 2,1L/min/m²



Grading TR severity...looking back

Table 9 Echocardiographic criteria for grading severity of tricuspid regurgitation

| Qualitative | |
|---|---|
| Tricuspid valve morphology | Abnormal/flail |
| Colour flow regurgitant jet | Very large central jet or eccentric wall impinging jet ^a |
| CW signal of regurgitant jet | Dense/triangular with early peaking |
| Semiquantitative | |
| Vena contracta width (mm) | >7 ^{a,b} |
| PISA radius (mm) | >9 ^c |
| Hepatic vein flow ^c | Systolic flow reversal |
| Tricuspid inflow | E-wave dominant $\geq 1\text{m/s}^d$ |
| Quantitative | |
| EROA (mm ²) | ≥ 40 |
| Regurgitant volume (mL/beat) | ≥ 45 |
| Enlargement of cardiac chambers/vessels | RV, RA, inferior vena cava |

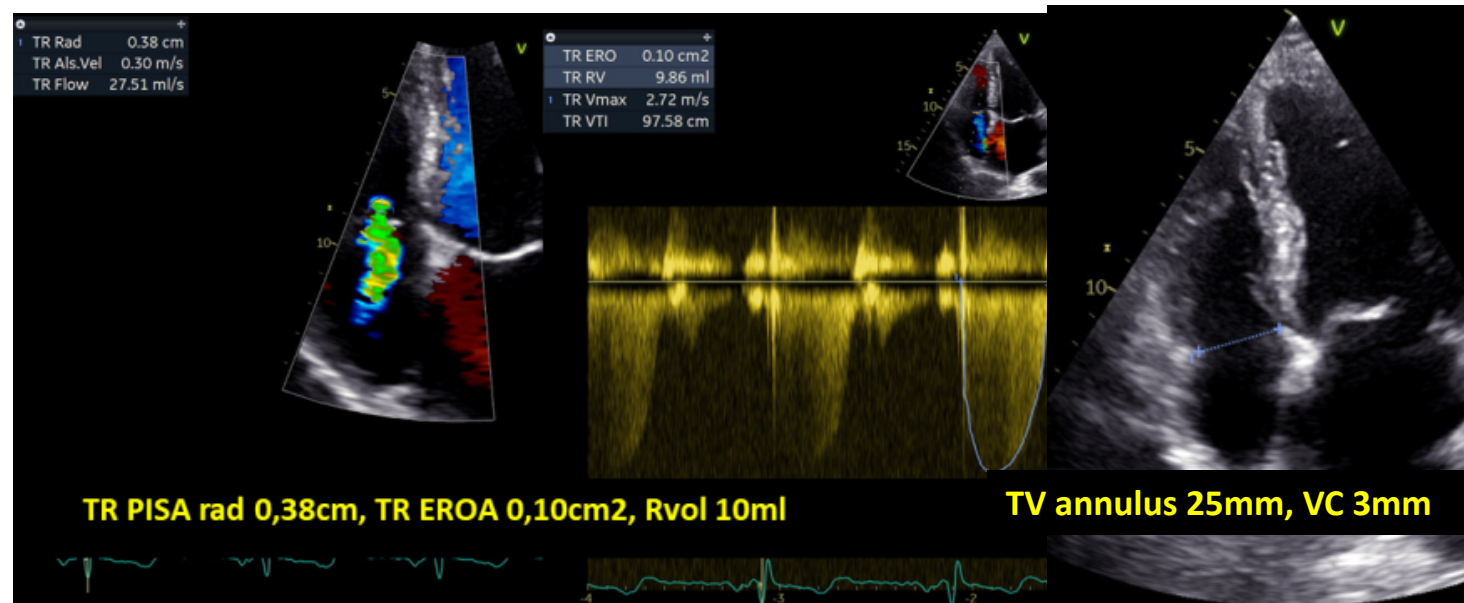
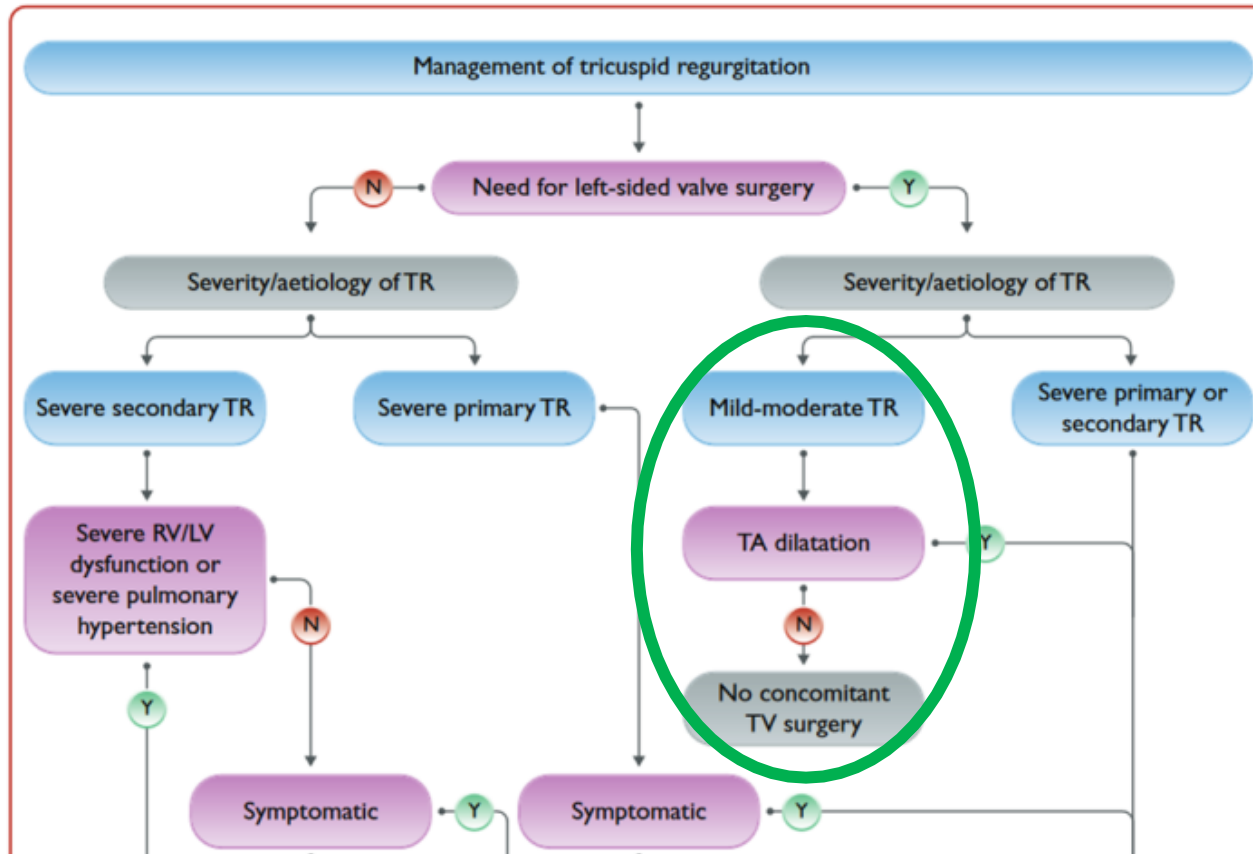


Table 1 Proposed expansion of the 'Severe' grade

| Variable | Mild | Moderate | Severe | Massive | Torrential |
|--|---------------------|-----------------------|-----------------------|------------------------|----------------------------|
| VC (biplane) | <3 mm | 3-6.9 mm | 7-13 mm | 14-20 mm | ≥ 21 mm |
| EROA (PISA) | <20 mm ² | 20-39 mm ² | 40-59 mm ² | 60-79 mm ² | ≥ 80 mm ² |
| 3D VCA or quantitative EROA ^a | | | 75-94 mm ² | 95-114 mm ² | ≥ 115 mm ² |

Indications for TR surgery



Surgery is recommended in symptomatic patients with isolated severe primary tricuspid regurgitation without severe RV dysfunction.

I

C

Surgery should be considered in patients with moderate primary tricuspid regurgitation undergoing left-sided valve surgery.

IIa

C

Surgery is recommended in patients with severe secondary tricuspid regurgitation undergoing left-sided valve surgery.^{423–427}

I

B

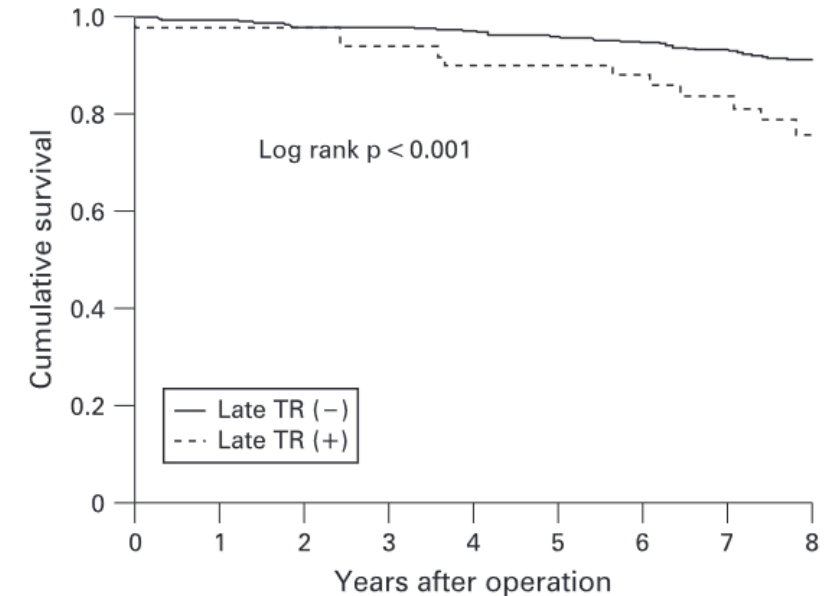
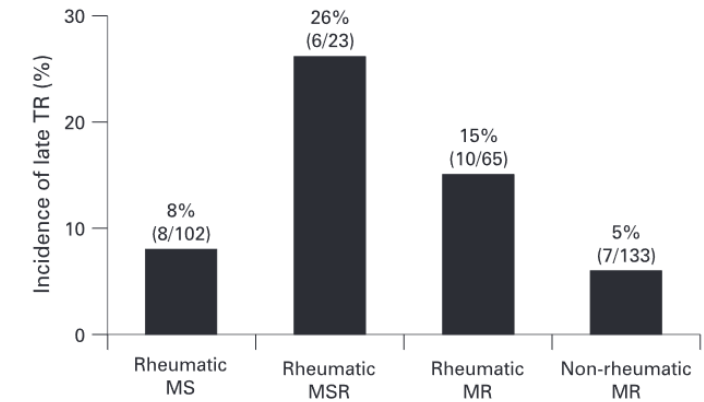
Surgery should be considered in patients with mild or moderate secondary tricuspid regurgitation with a dilated annulus (≥ 40 mm or > 21 mm/m² by 2D echocardiography) undergoing left-sided valve surgery.^{423,425–427}

IIa

B

Late TR after left-sided valve surgery

- Overall incidence **7.7%** (638pts)
- Independent risk factors for the development of late significant TR
 - age
 - female gender
 - rheumatic etiology
 - atrial fibrillation
 - peak pressure gradient of TR at follow-up
- During a mean clinical follow-up of 24 months patients who developed late TR had a significantly **lower 8-year event free survival** rate (71% vs 91%, $P > .001$).



Song H et al. Heart 2009.

- TR= independant prognostic factor associated with mortality

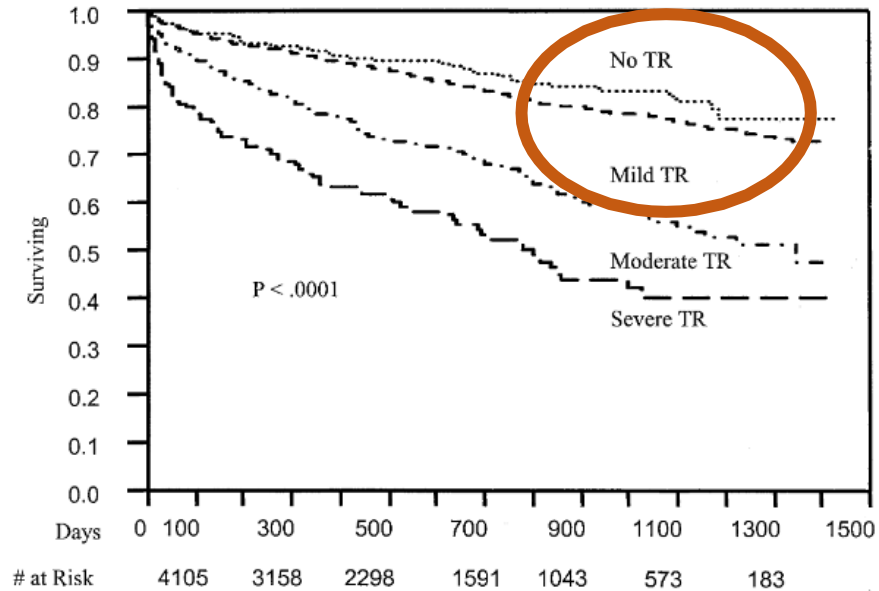
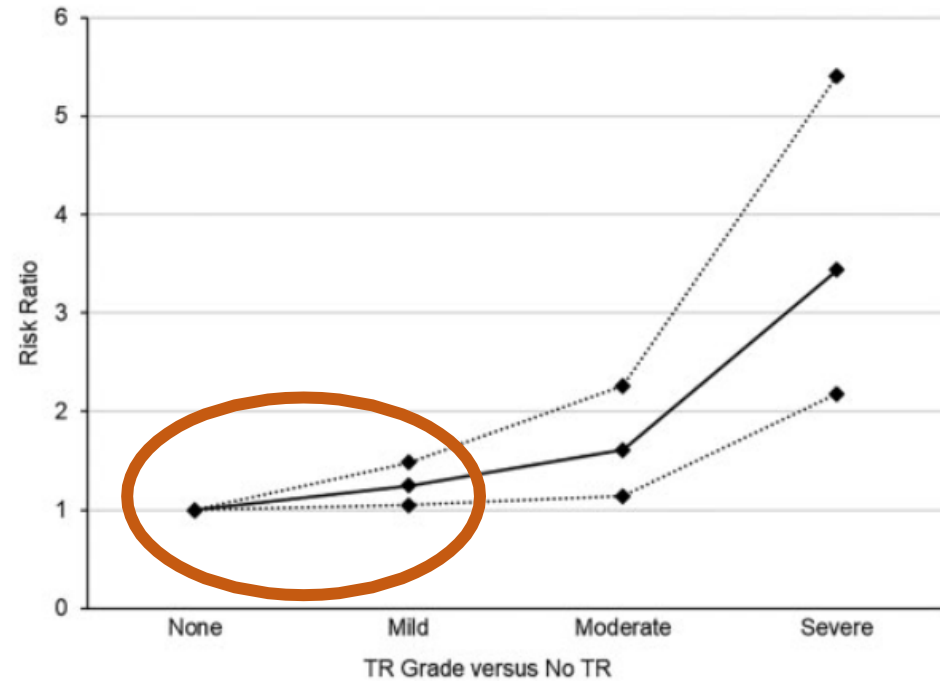


Figure 1. Kaplan-Meier survival curves for all patients with tricuspid regurgitation (TR). Survival is significantly worse in patients with moderate and severe TR.



ORIGINAL ARTICLE

Concomitant Tricuspid Repair in Patients with Degenerative Mitral Regurgitation

J.S. Gammie, M.W.A. Chu, V. Falk, J.R. Overbey, A.J. Moskowitz, M. Gillinov, M.J. Mack, P. Voisine, M. Krane, B. Yerokun, M.E. Bowdish, L. Conradi, S.F. Bolling, M.A. Miller, W.C. Taddei-Peters, N.O. Jeffries, M.K. Parides, R. Weisel, M. Jessup, E.A. Rose, J.C. Mullen, S. Raymond, E.G. Moquete, K. O'Sullivan, M.E. Marks, A. Iribarne, F. Beyersdorf, M.A. Borger, A. Geirsson, E. Bagiella, J. Hung, A.C. Gelijns, P.T. O'Gara, and G. Ailawadi, for the CTSN Investigators*

- 401 pts DMR surgery
- TV annuloplasty for moderate TR or less than moderate TR+ TA dilation
- At 2y FU: better outcome, less TR progression and more PM in TA+ group

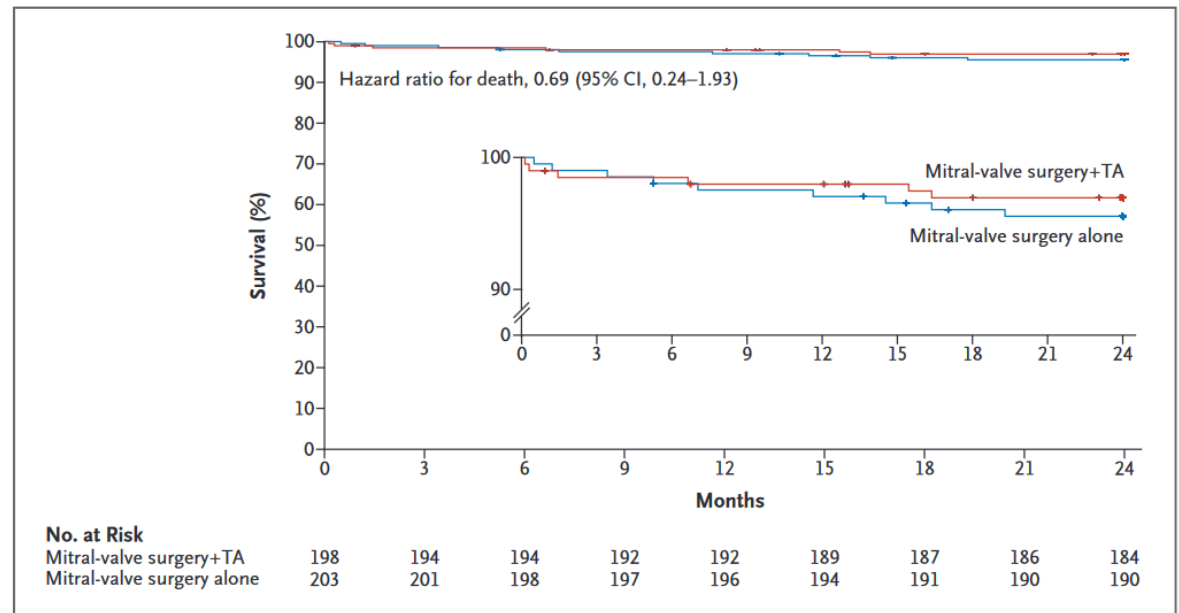
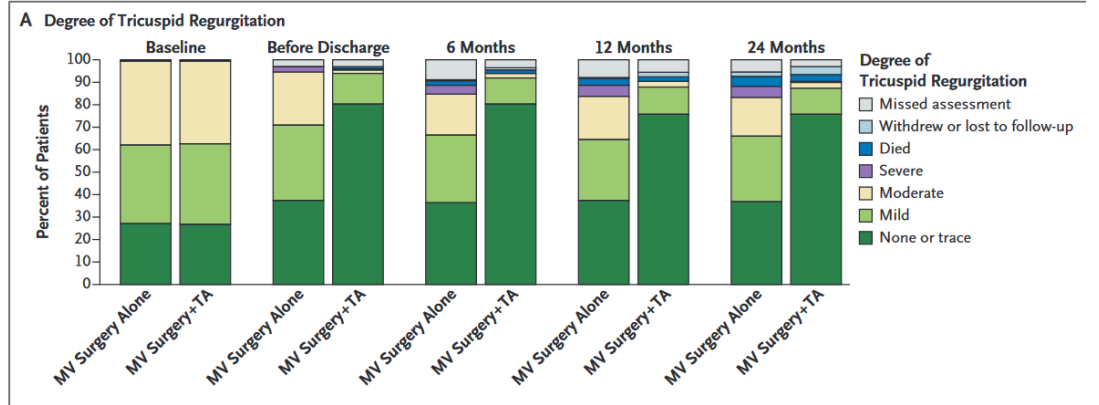


Figure 1. Overall Survival.

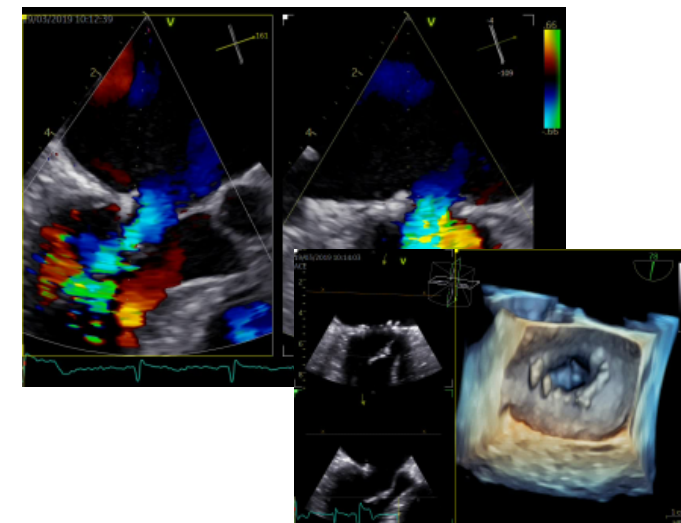
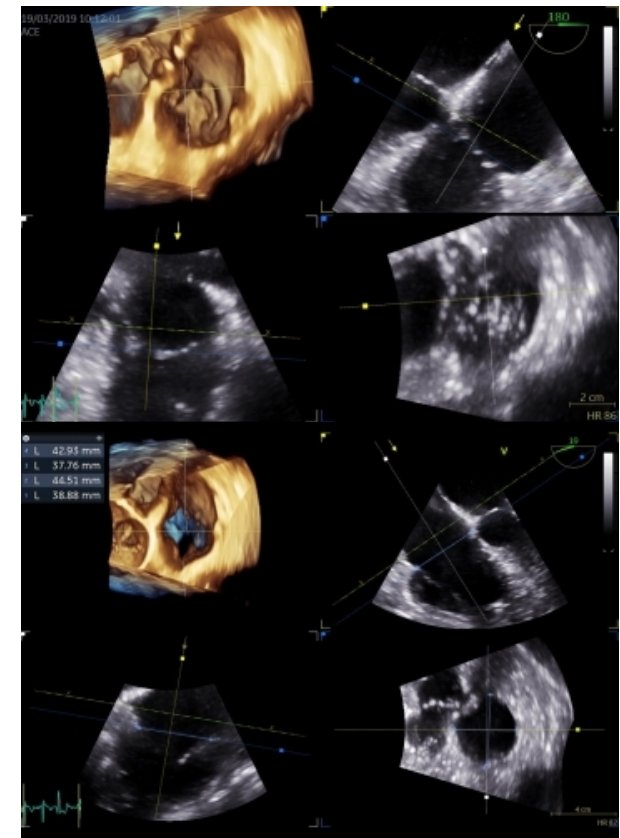
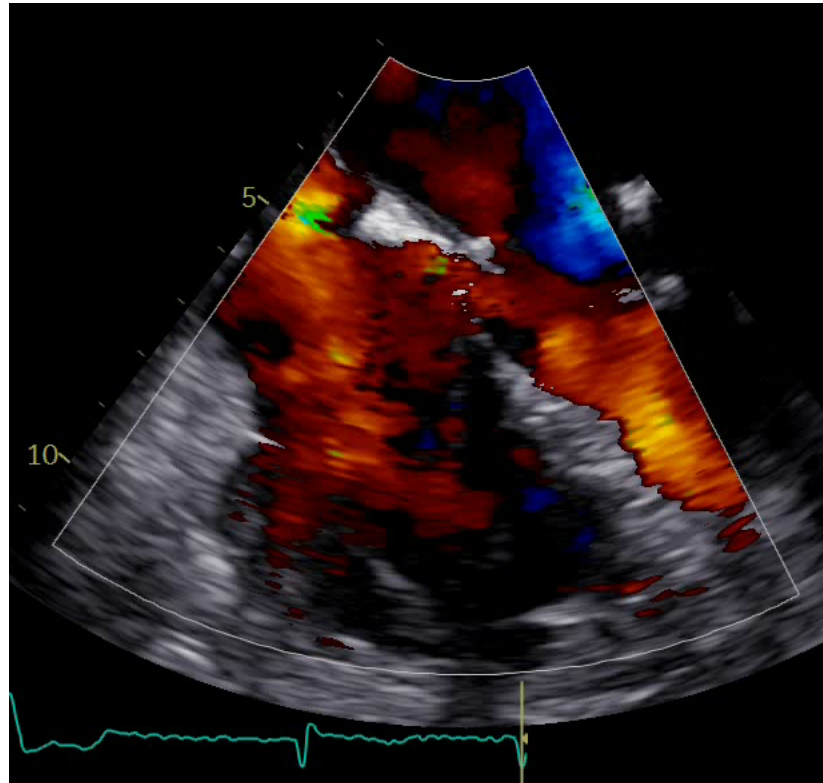
Shown are Kaplan–Meier estimates of overall survival during the 2 years after randomization among patients with moderate or less-than-moderate tricuspid regurgitation who were undergoing mitral-valve surgery alone or surgery with placement of a tricuspid annuloplasty (TA) ring. The inset shows the same data on an expanded y axis. The tick marks indicate censored data.

Case 1

2019:
Symptoms

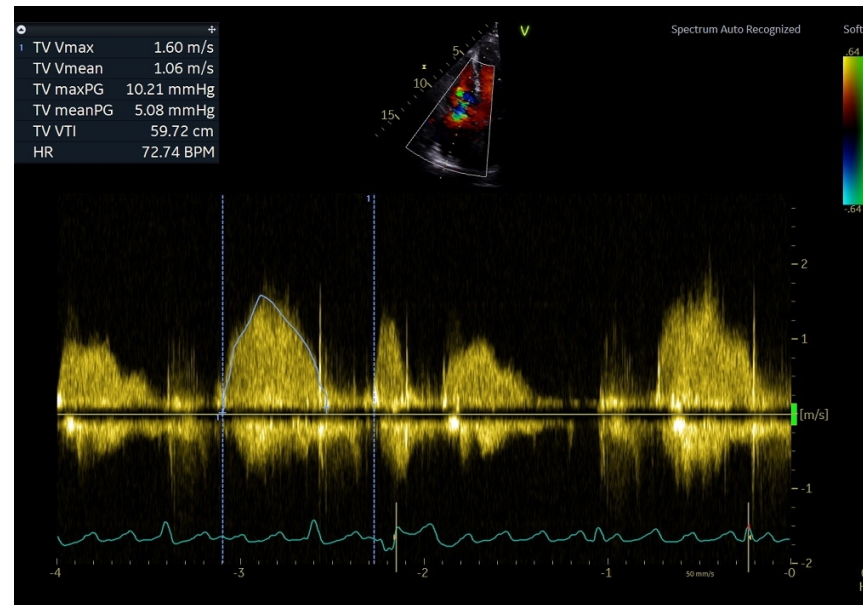
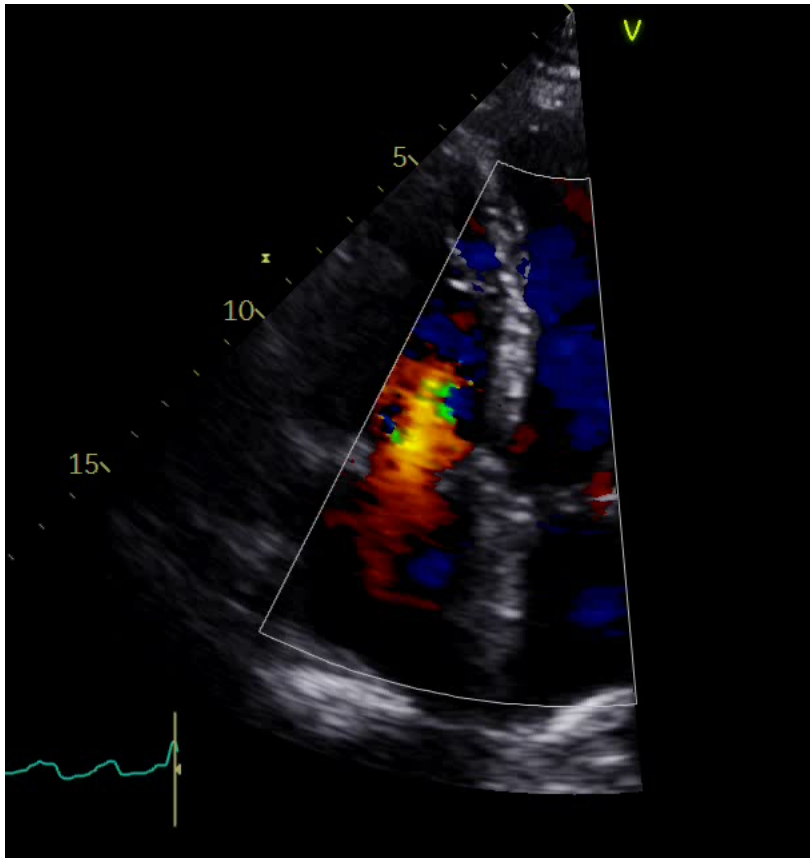


TOE



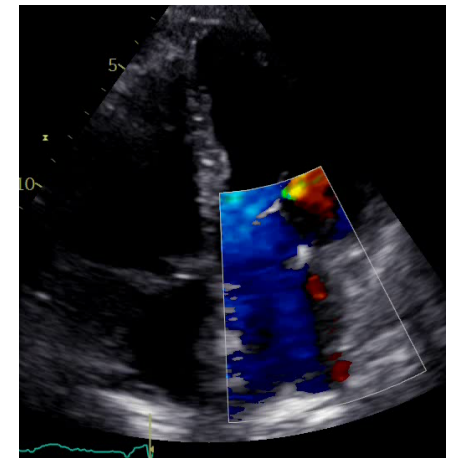
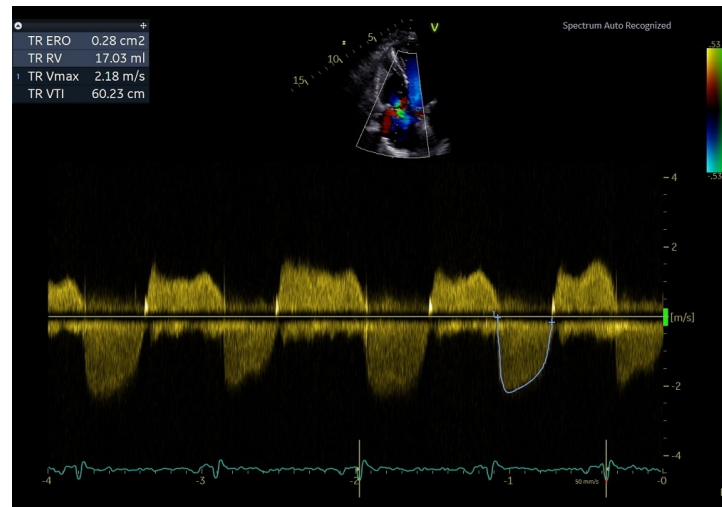
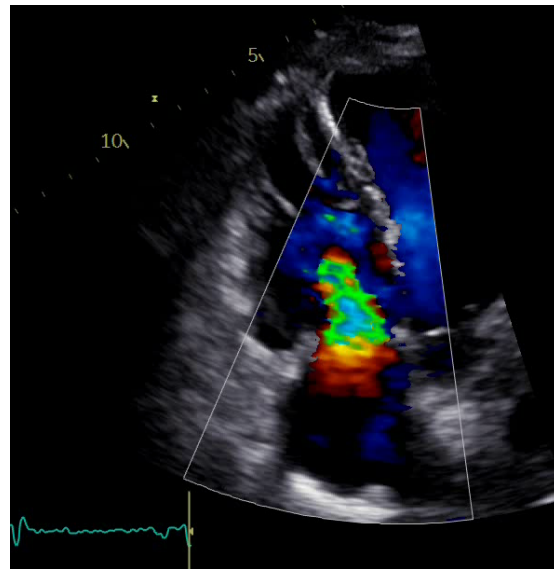
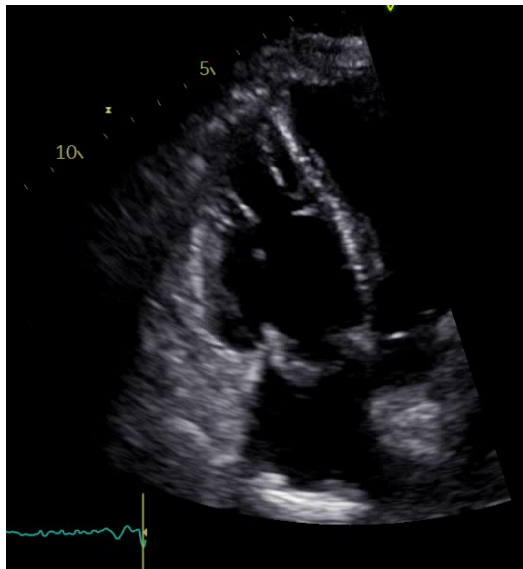
Case 1

- 2/2020: TVR biolog (SJM Biocor 31mm)

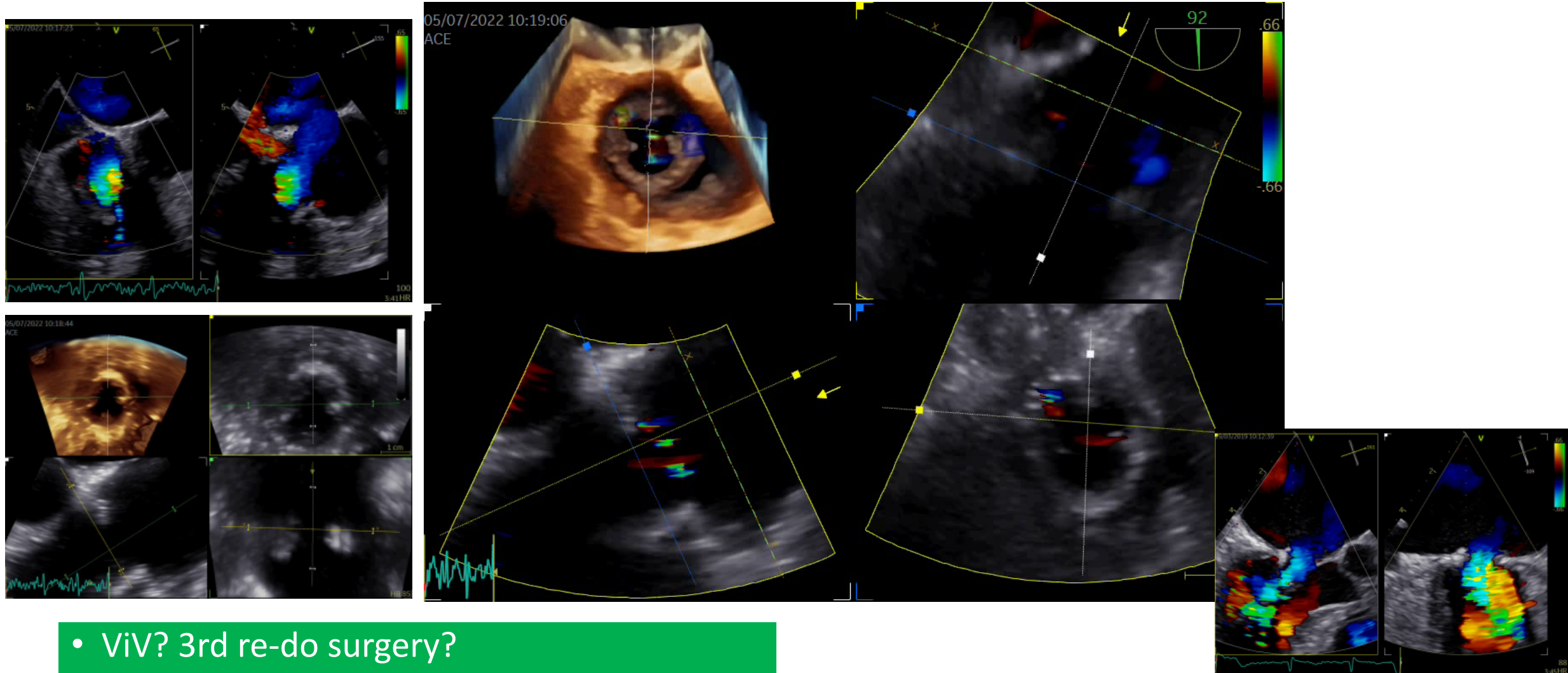


Case 1

- 4/2022- smptoms!!
- Treadmill stress test 4,8MET, VO2 18ml/kg/min, NTproBNP 630
- Biolog valve degeneration – severe TR (EROA 0,28cm², Rvol 17ml, mPG 4-5mmHg)
- Right heart cath: RAP 13mmHg, PAP 21/7mmHG, PCWP 5mmHg, CI 1,38L/min/m², PVR 2,9 WU, TPG 8mmHg

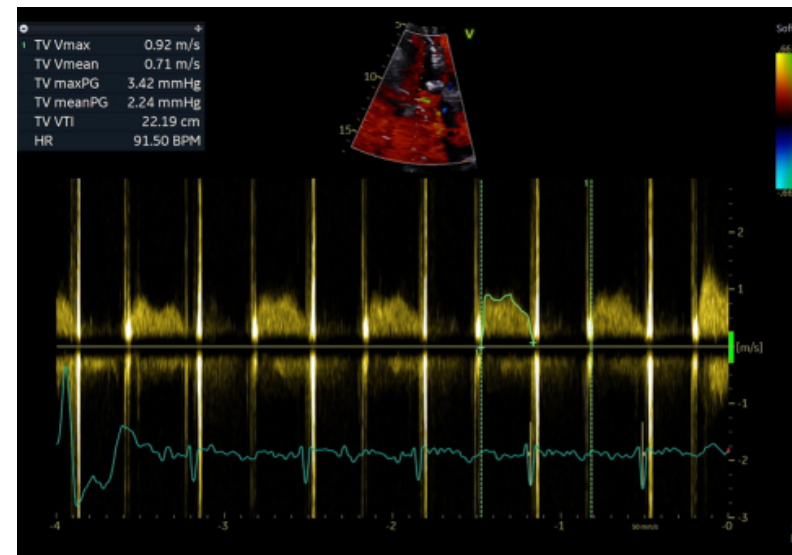
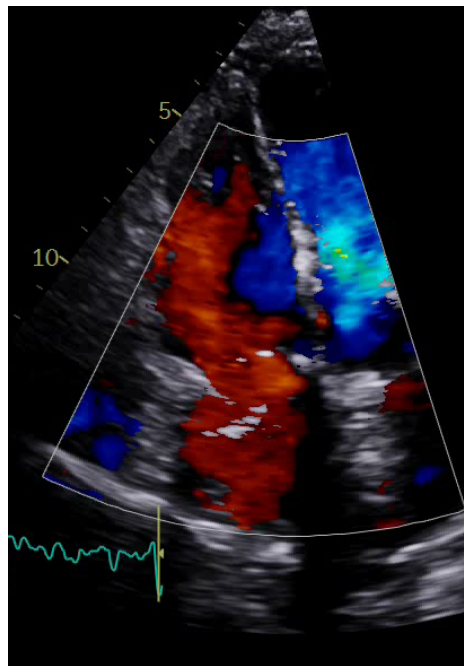
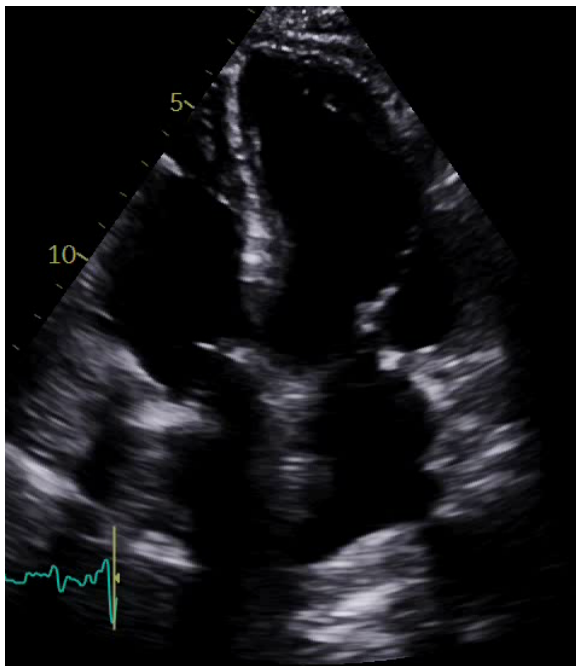


Case 1- TOE



Case 1

- 6/2023: TVR mech SJM 29mm

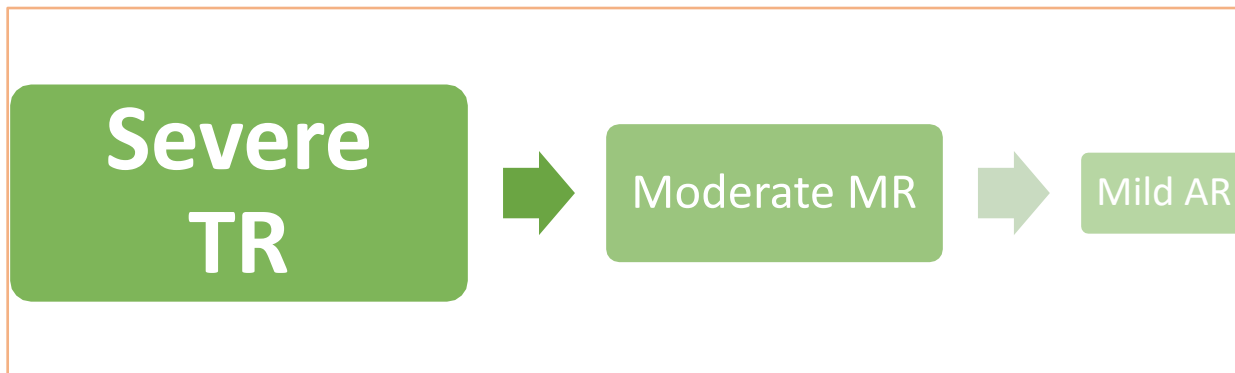


Questions case 1

1. TV annuloplasty in every left-sided valve surgery?
2. Decision on concomitant surgery based on TV annulus dimension/ TR severity or TR mechanism/etiology?
3. Prosthetic valves? Biolog versus mech?
4. What can determine TR progression over time after left-sided valve surgery?
5. TEER – more loose or strict criteria – not treating the mechanism?
6. Dealing with long-term complications – durability?, ES implantation?

Case 2: female 1942.

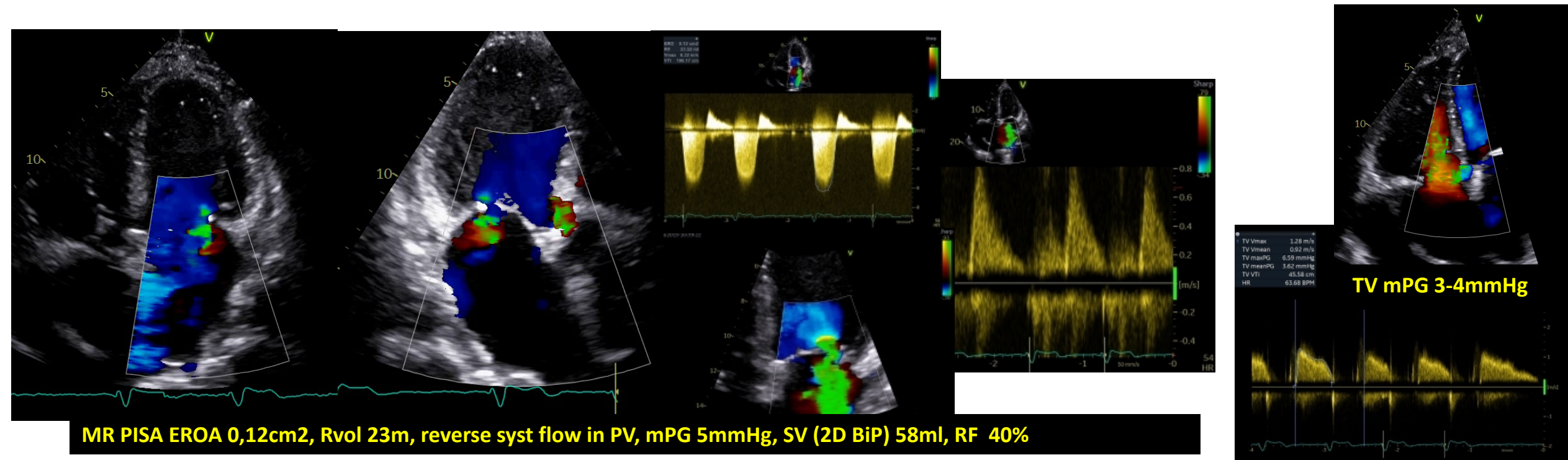
- 1993 - AFib, mild MR, AR and TR
- 9/2018 - HF symptoms (NYHA IIIa), NTproBNP 979
- **TTE (local hospital)**: moderate MR (EROA 0,09cm², Rvol 18ml), torrential TR, LVEF 60%
- **TOE (local hospital)**: Severe TR – central/septal jet, reattractive septal leaflet, posterior leaflet prolaps. Mild AR. Moderate central MR (EROA 0,12cm², RVol 24ml)
- **Right-heart cath**: RAP 27/9 (19)mmHg, PAP 40/18 (25)mmHG, PCWP 18mmHg, CI 1,89L/min/m², PVR 2,04 WU



- Referred for cardiac surgery

Case 2

- 4/2019 TVR bioprosthesis (Hanckok II 33mm) (failed reconstruction)
- Difficult postoperative period – pericardial effusion/pericardiocentesis, AFC pseudoaneurysm/endovascular treatment
- **Postoperative TTE: MR!** - calcified, thickened and shortened cusps, restricted posterior leaflet, posteriorly directed jet, MV annulus 41mm. PISA measurement – underestimation. Mild AR, AVA 1,28cm²

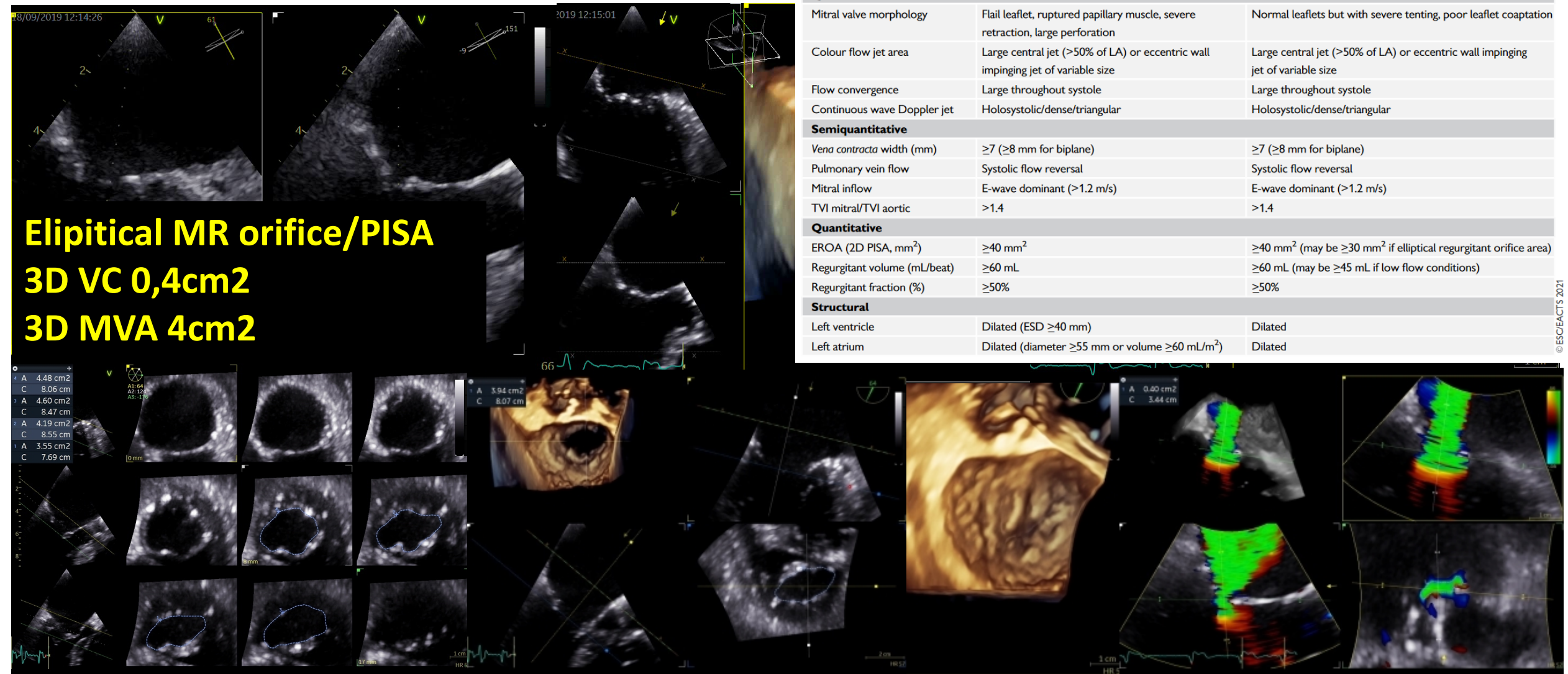


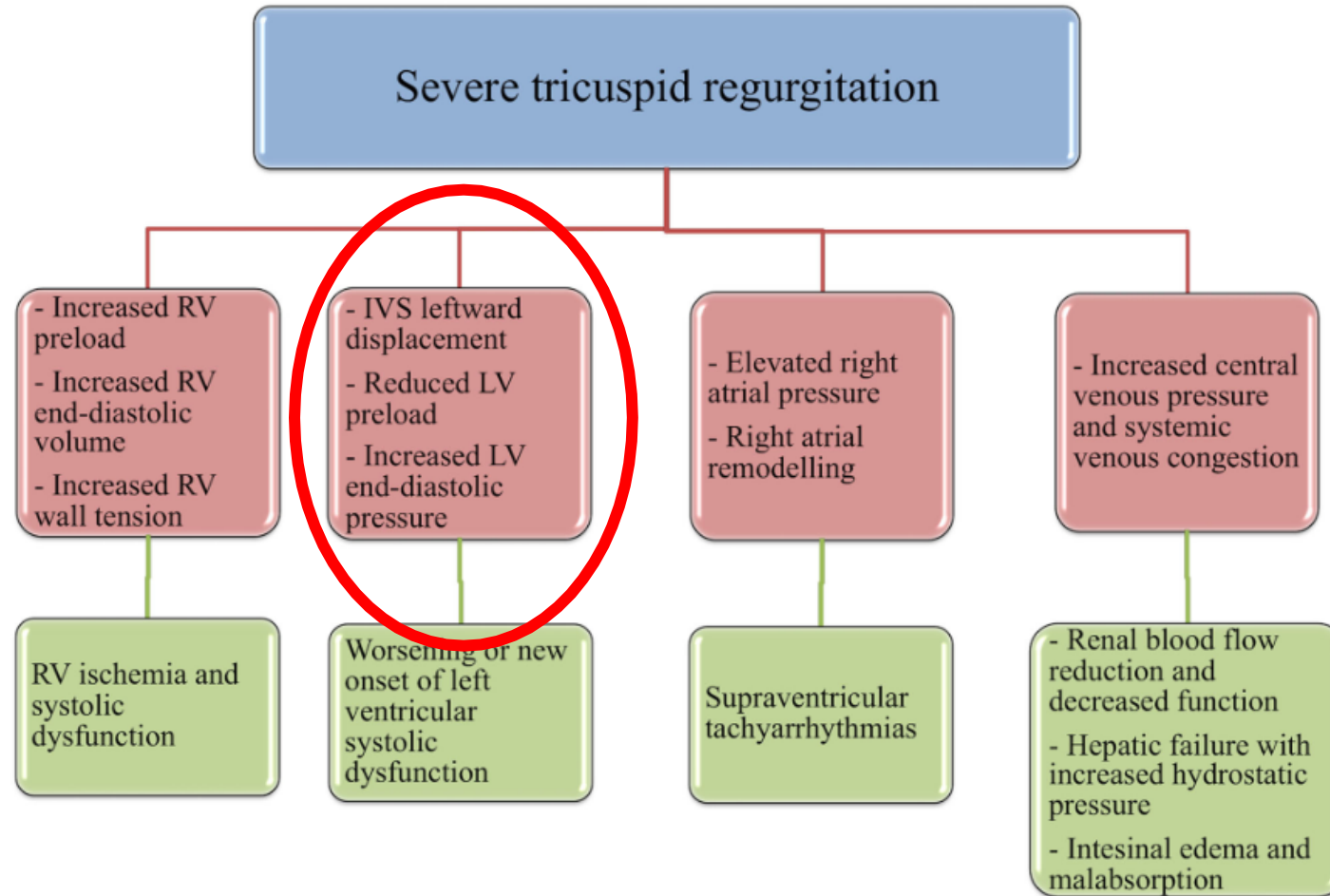
Case 2: postop TOE

Table 7 Severe mitral regurgitation criteria based on 2D echocardiography

| | Primary mitral regurgitation | Secondary mitral regurgitation |
|--------------------------------|---|---|
| Qualitative | | |
| Mitral valve morphology | Flail leaflet, ruptured papillary muscle, severe retraction, large perforation | Normal leaflets but with severe tenting, poor leaflet coaptation |
| Colour flow jet area | Large central jet (>50% of LA) or eccentric wall impinging jet of variable size | Large central jet (>50% of LA) or eccentric wall impinging jet of variable size |
| Flow convergence | Large throughout systole | Large throughout systole |
| Continuous wave Doppler jet | Holosystolic/dense/triangular | Holosystolic/dense/triangular |
| Semiquantitative | | |
| Vena contracta width (mm) | ≥ 7 (≥ 8 mm for biplane) | ≥ 7 (≥ 8 mm for biplane) |
| Pulmonary vein flow | Systolic flow reversal | Systolic flow reversal |
| Mitral inflow | E-wave dominant (>1.2 m/s) | E-wave dominant (>1.2 m/s) |
| TVI mitral/TVI aortic | >1.4 | >1.4 |
| Quantitative | | |
| EROA (2D PISA, mm^2) | ≥ 40 mm^2 | ≥ 40 mm^2 (may be ≥ 30 mm^2 if elliptical regurgitant orifice area) |
| Regurgitant volume (mL/beat) | ≥ 60 mL | ≥ 60 mL (may be ≥ 45 mL if low flow conditions) |
| Regurgitant fraction (%) | $\geq 50\%$ | $\geq 50\%$ |
| Structural | | |
| Left ventricle | Dilated (ESD ≥ 40 mm) | Dilated |
| Left atrium | Dilated (diameter ≥ 55 mm or volume ≥ 60 mL/ m^2) | Dilated |

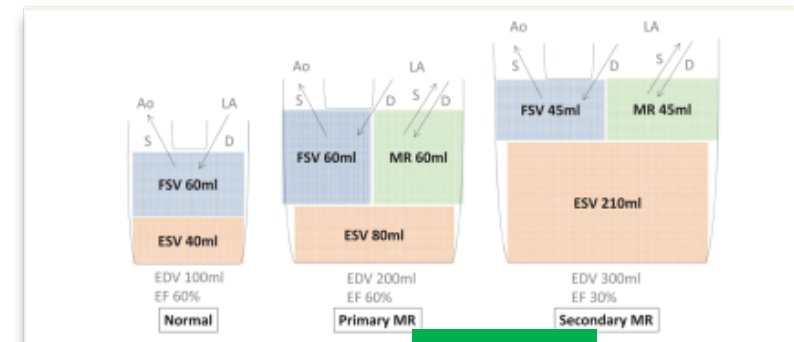
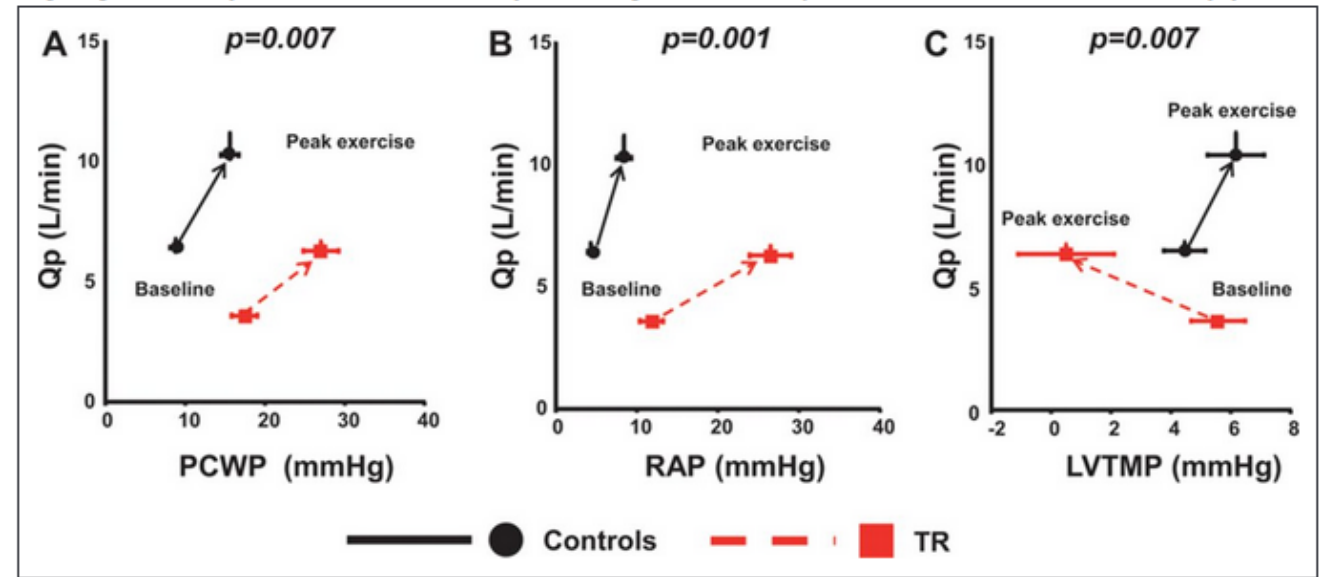
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MR severity may vary with hemodynamics

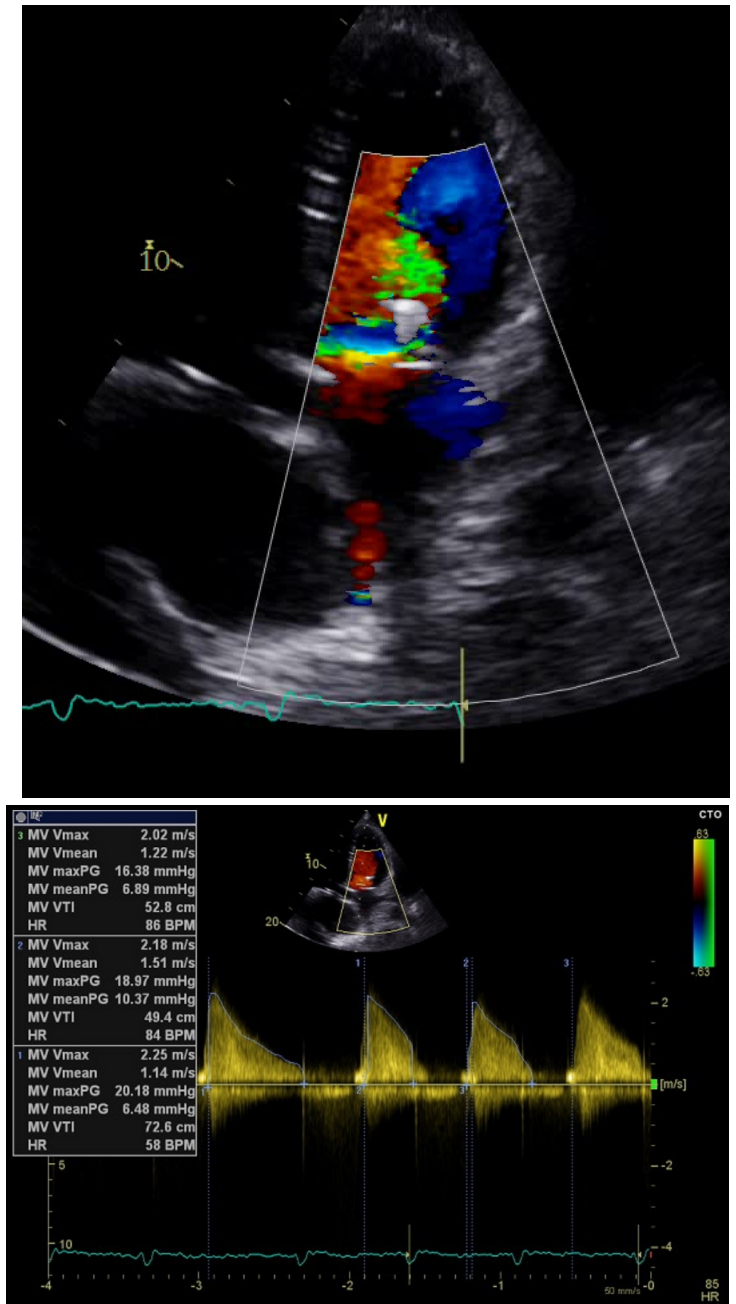
- Cardiomyopathies
- General anesthesia
- Hypovolemia
- Proximal lesions/preload
- Different studies report dramatic downgrading for all etiologies of MR except flail leaflet due to ruptured chordae



RF 50%

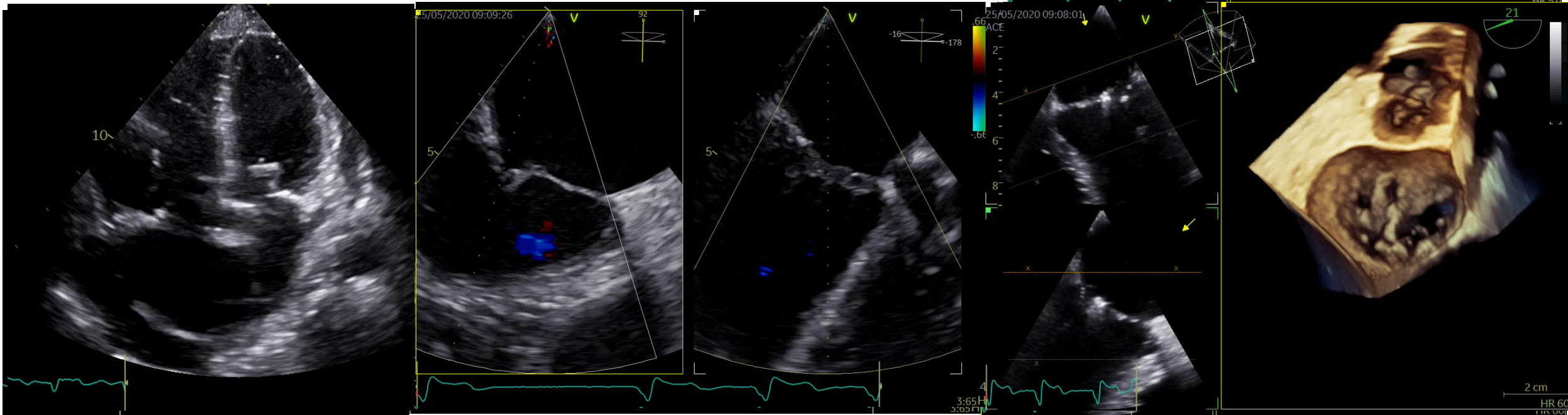
Case 2

- 12/2019 HF despite high-dose diuretic – patient denied surgery
- Short posterior leaflet, borderline MVA and mPG
- 12/2019 TEER (MitraClip NTR x1)
- mean PG 6-10mmHG!! + moderate residual MR



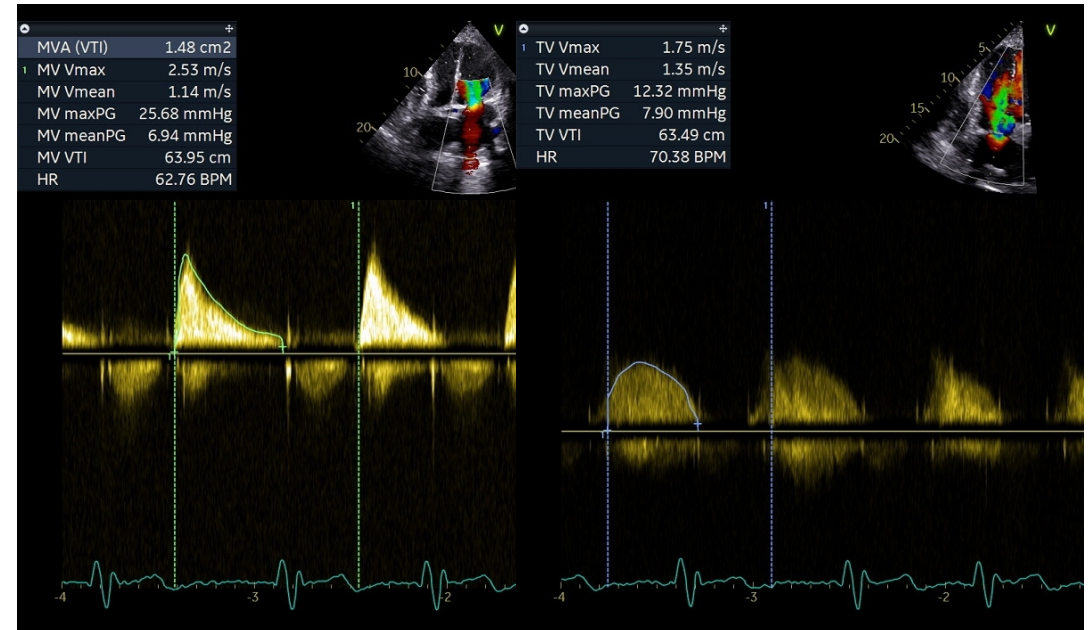
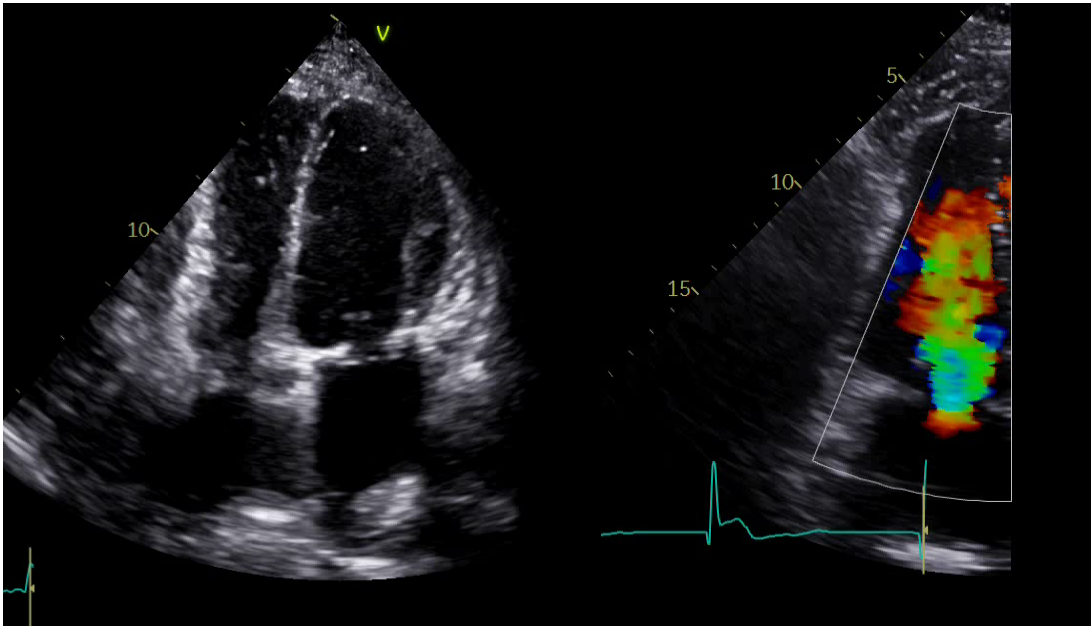
Case 2

- 1/2020 – HF again!! - Dependent on iv diuretics
- MV mPG 9-10mmHg, mPG TV 7-8mmHg
- Patient denied re-do surgery until 5/2020



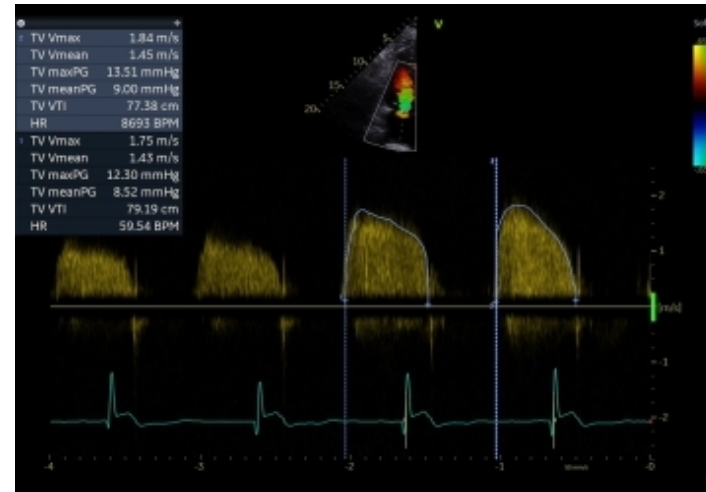
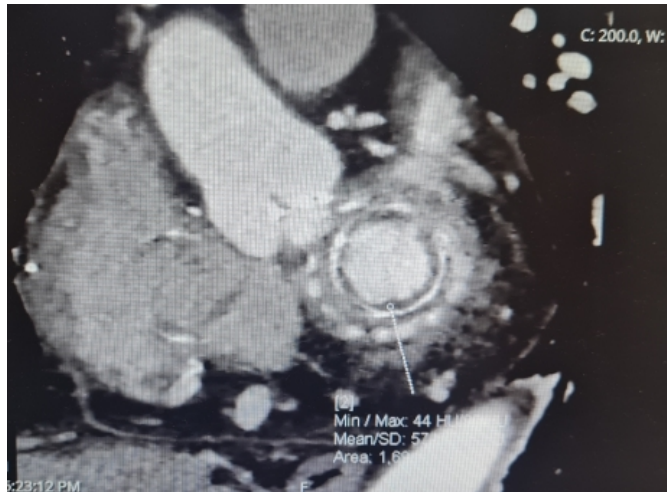
Case 2

- CMR 6/2020 –LV EDV 101ml/m², LVEF 40%; RV EDV 180ml/m², RV EF 29%; moderate AR (RF 30%), no TR, valve in oblique atypical position, moderate MR
- Right heart cath: mPAP 38mmHg, mRAP 20mmHg, PCWP 25mmHg, PVR 4,2 WU, CI 1,8L/min
- 6/2020 re-do TVR biolog (SJM Biocor 29mm) – mPG 8mmHg, MVR biolog (SJM Biocor 29mm) – mPG 7mmHg
- 12/2021 – permanent PM on epicardial lead



Case 2

- 3/2022 mild symptoms!
- Echo: TV mPG higher! (8-10mmHg), MV mPG 6mmHg, AVA 1,57cm², DVI 39%, moderate AR
- CT – pannus – NOAC switched to warfarin – no change
- Right-heart cath: RAP 14mmHg, pap 36/20mmHg, PCWP 16mmHg, CI 1,4/Min/m², PVR 3,7 WU, TPG 10mmHg
- Follow-up



Questions case 2

1. Grading severity of MR in TR? 3D VC?
2. Role of right heart catheterisation?
3. Volume optimisation prior decision on intervention?
4. Can surgical technique on TA have an impact on MA?
5. Decision based on etiology?
6. Dealing with long-term complications – durability?, ES implantation?

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Thank You!

Questions case 1

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What could we have done better?

Questions case 1

1. Grading severity of MR in TR? 3D VC?
2. Role of right heart catheterisation?
3. Volume optimisation prior decision on intervention?
4. Can surgical technique on TA have an impact on MA?
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