

Role of 3D echocardiography in assessment of other congenital heart disease in adults

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Disclaimer

All members of the Faculty have provided a declaration of potential or actual conflict of interest

Why 3DE makes the difference in ACHD?

Technique - related

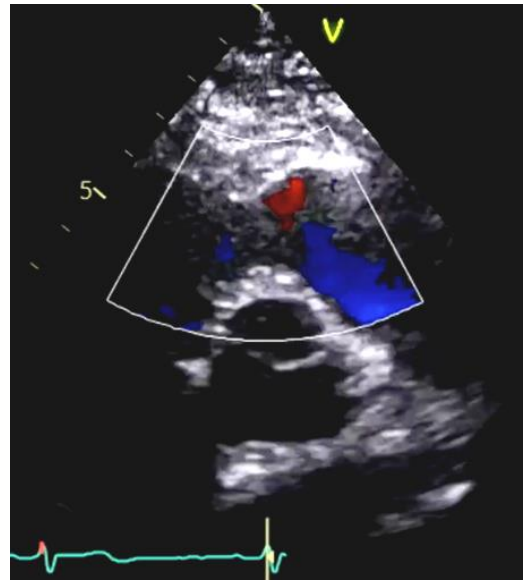
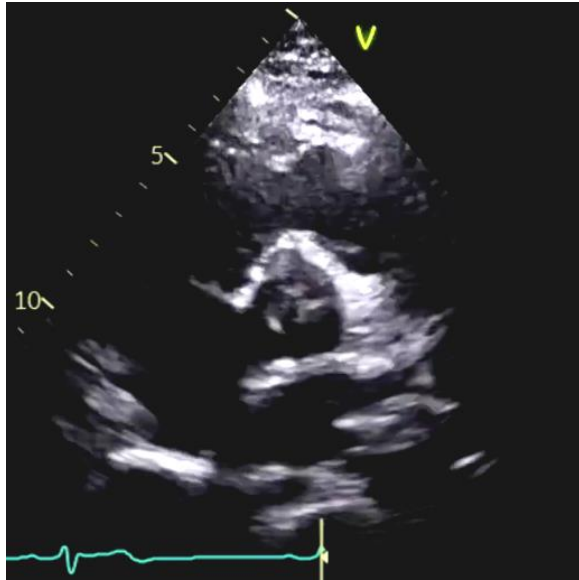
- Actual 3D acquisition and analysis from a single full-volume dataset
- Direct measurements, no calculations using geometric assumptions
- Anatomically accurate, en-face visualization of the valves/septae from both perspectives in the beating heart

Pathology - related

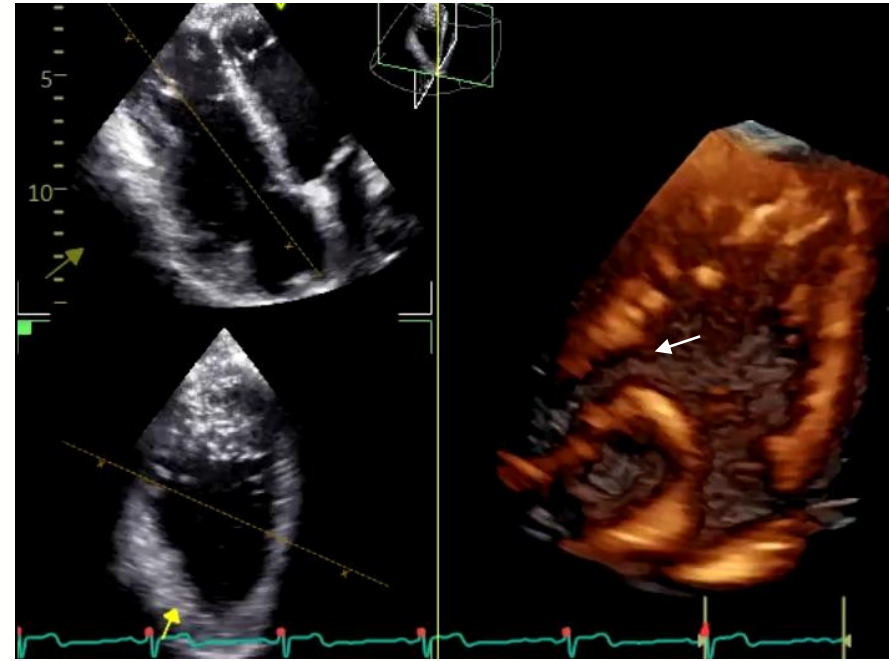
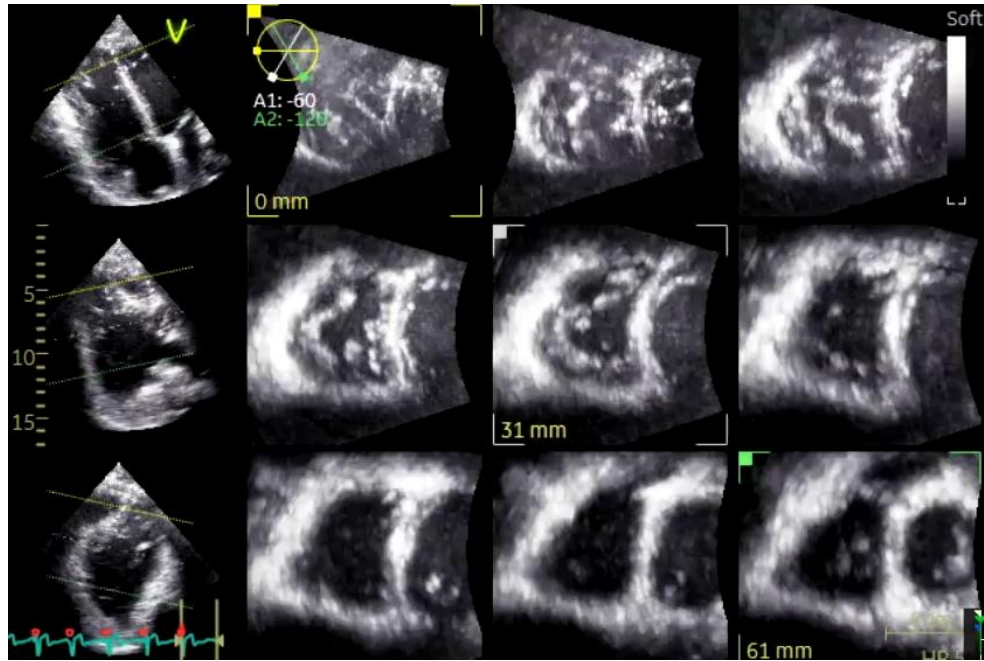
- RV is frequently the key player – accurate assessment is essential
- Complex lesions clear understanding of morphology is important
- Patients are generally younger with better acoustic window

Ventricles

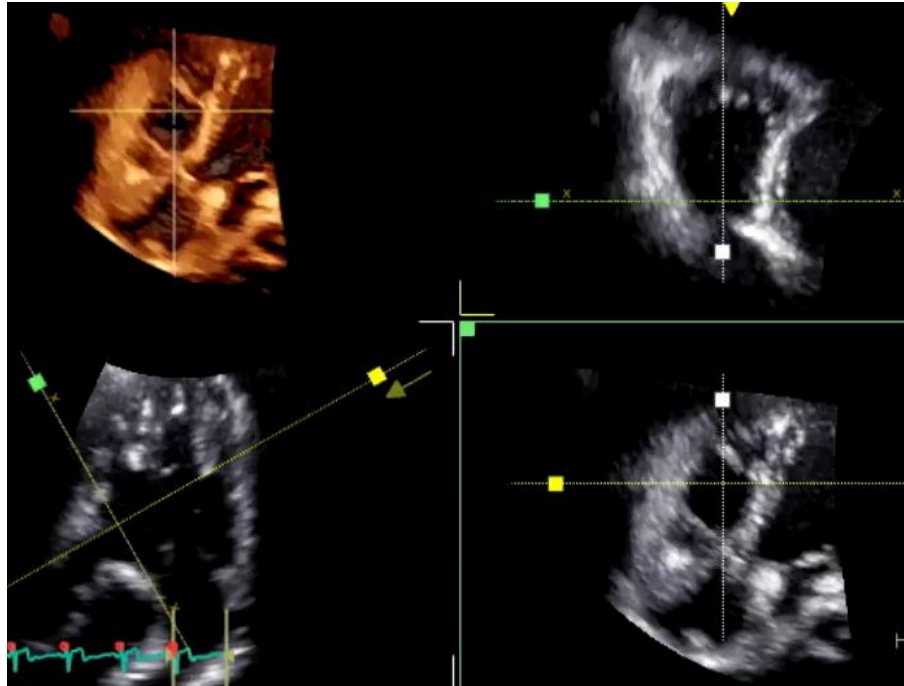
CASE 1: TOF repair, residual RVOTO



CASE 1: TOF repair, residual RVOTO

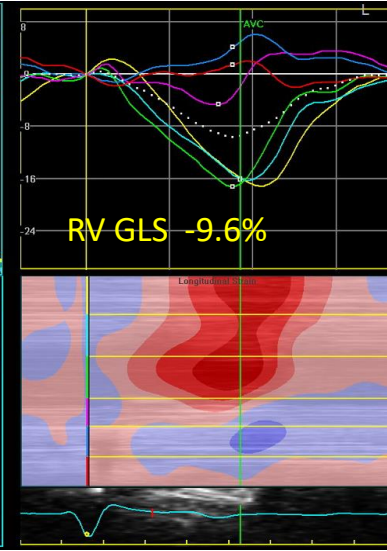
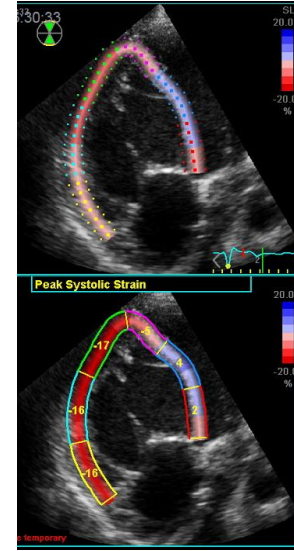
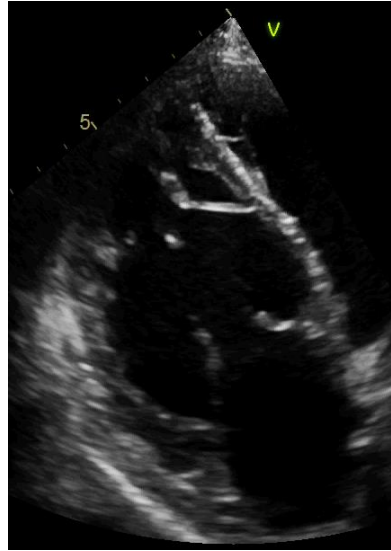
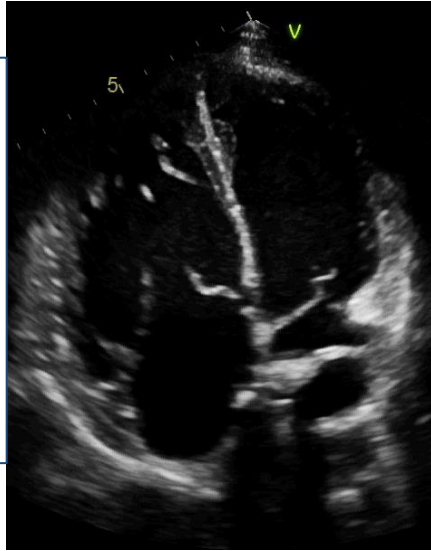


CASE 1: TOF repair, residual RVOTO

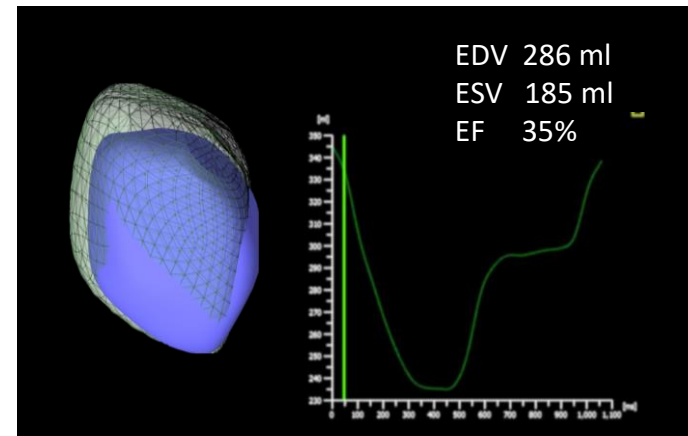


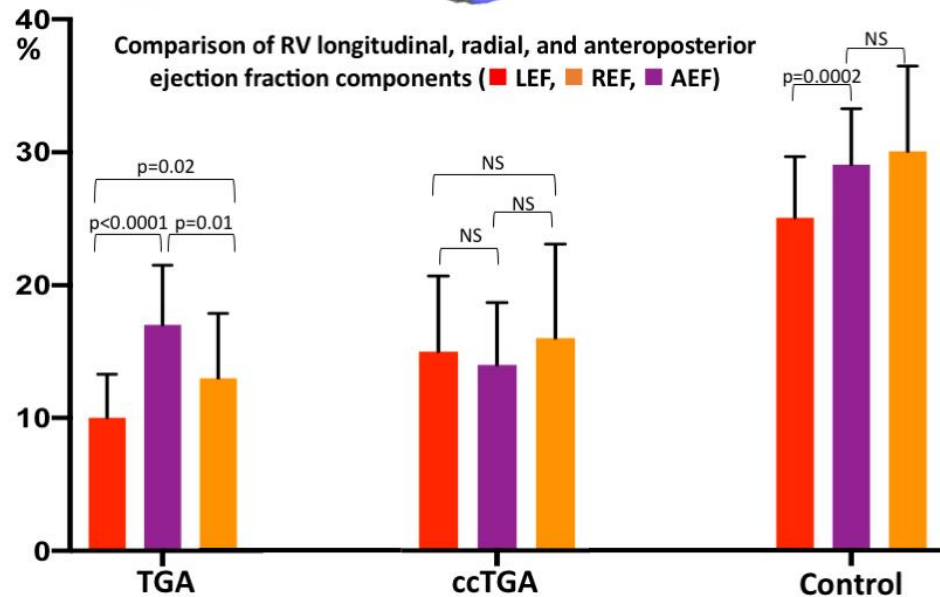
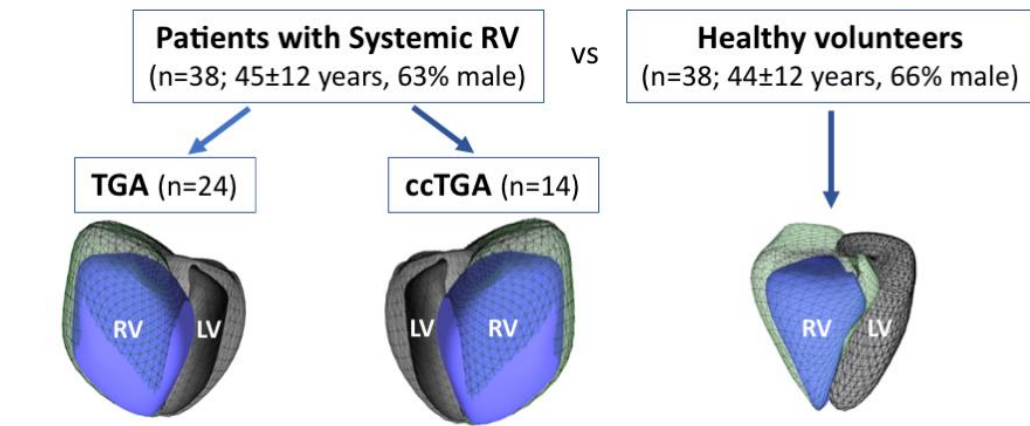
Case 2: Systemic RV systolic function

- 30 years female
- ht 172cm, wt 59kg
- TGA + Mustard
- Severely dilated SRV
- Severely reduced SRV systolic function



- SRV FAC 8%
- TAPSE 14mm
- RV GLS -9.6%
- 3DE EF 35%





Schematic representation of three major components of total RV pump function (ReVISION analysis of 3DE datasets)

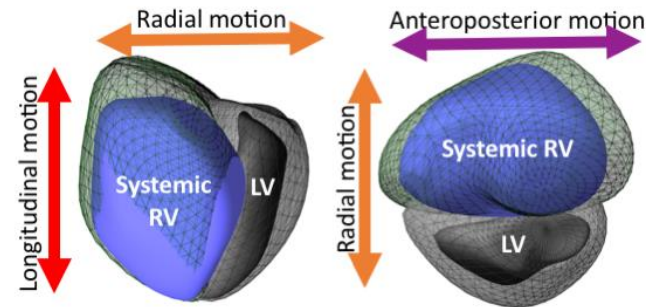
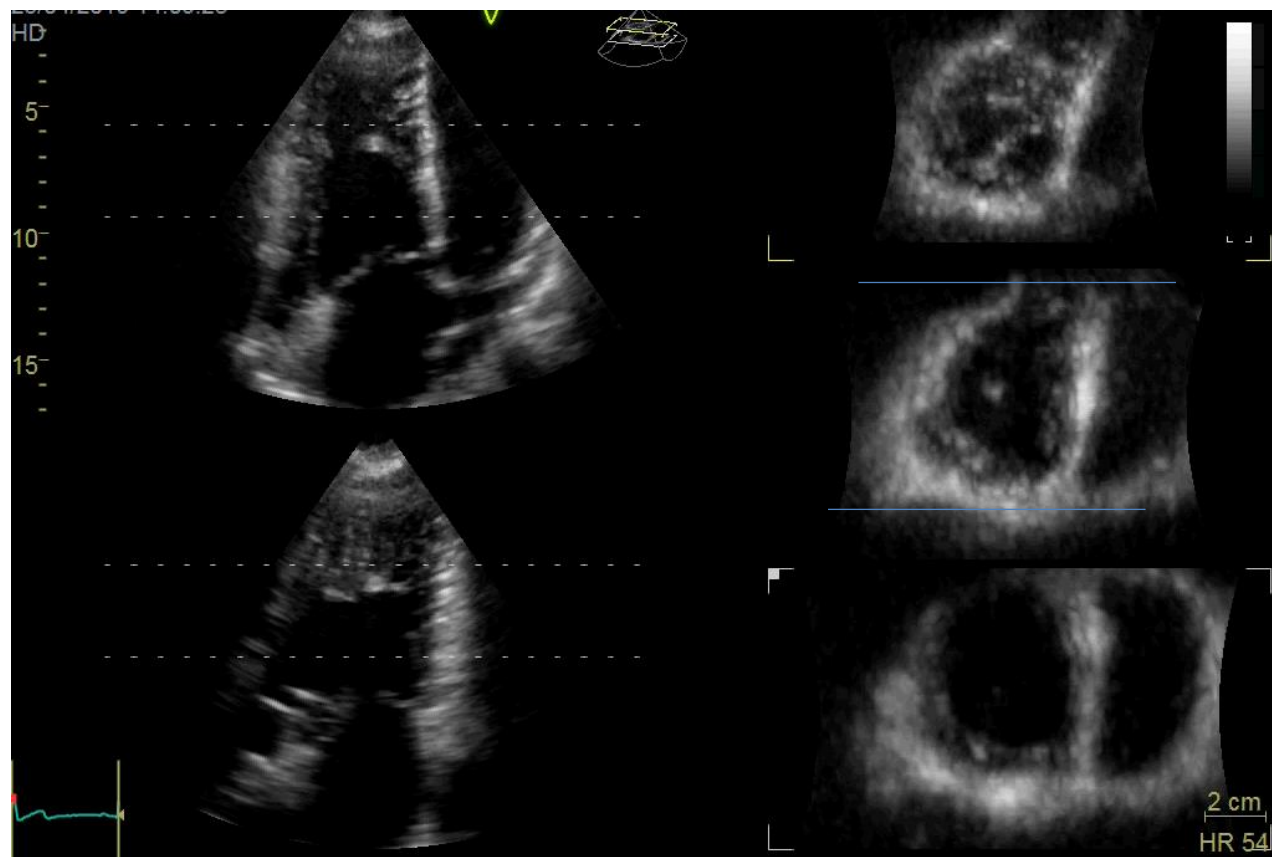


Table 3 Correlation of echocardiographic parameters of a systemic RV size and systolic function with BNP level

Parameter	Spearman correlation coefficient, rho	P-value
3D EF, %	-0.73	<0.0001
RV 4-chamber LS, %	0.70	<0.0001
RV free wall LS, %	0.63	0.0002
3D ESVi, mL/m ²	0.60	0.0003
FAC, %	-0.54	0.002
3D EDVi, mL/m ²	0.52	0.003
S', cm/s	-0.37	0.038
Basal diameter, cm	0.33	0.070
ESAi, cm ² /m ²	0.28	NS
EDAi, cm ² /m ²	0.28	NS
Mid diameter, cm	0.12	NS
TAPSE, mm	-0.09	NS

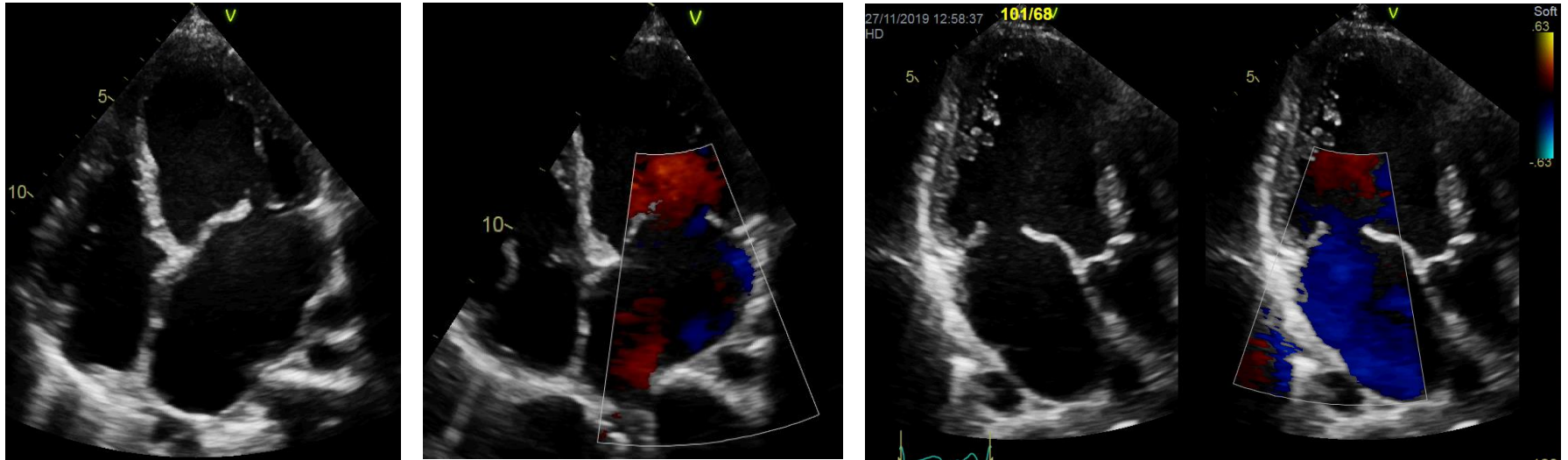


Valves

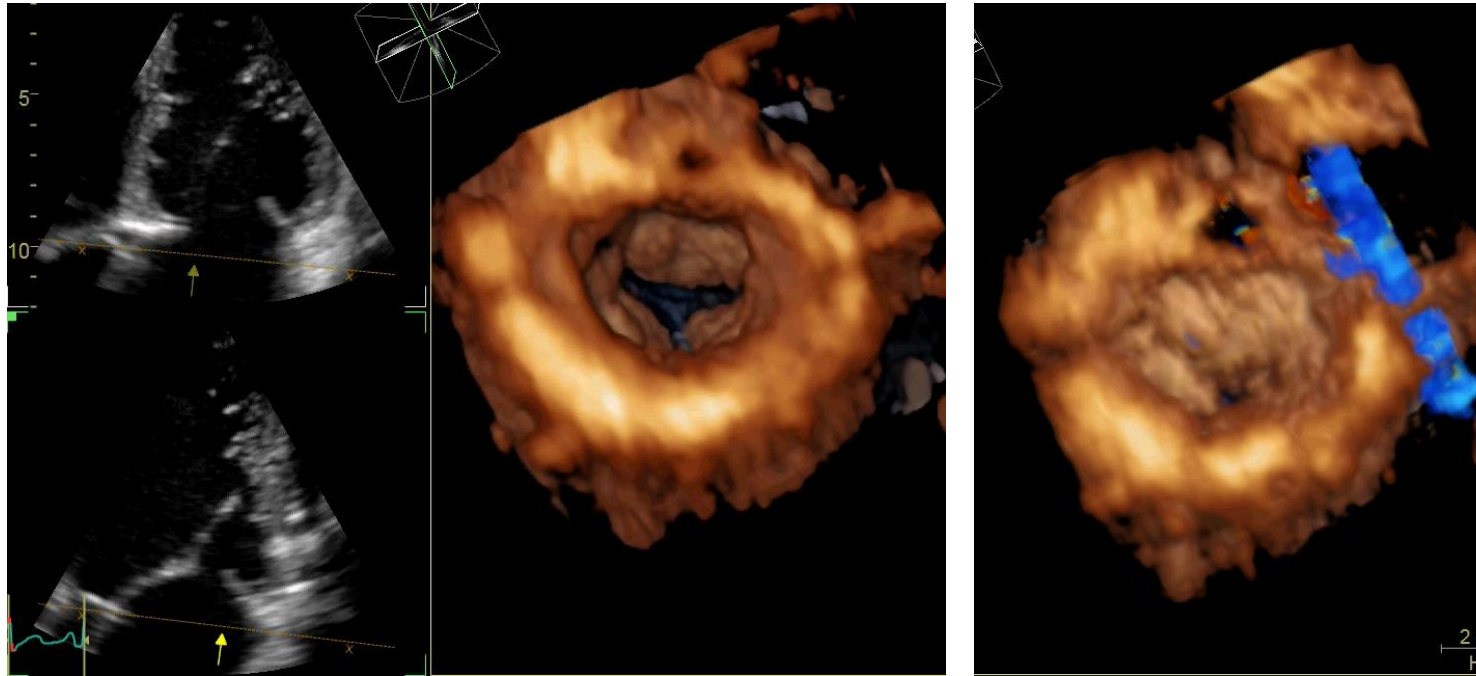
Valves

Case 3

- 25-year-old female patient
- History of ALCAPA and Takeuchi repair
- Mainly asymptomatic, slight dyspnoea while climbing 3 flights of stairs

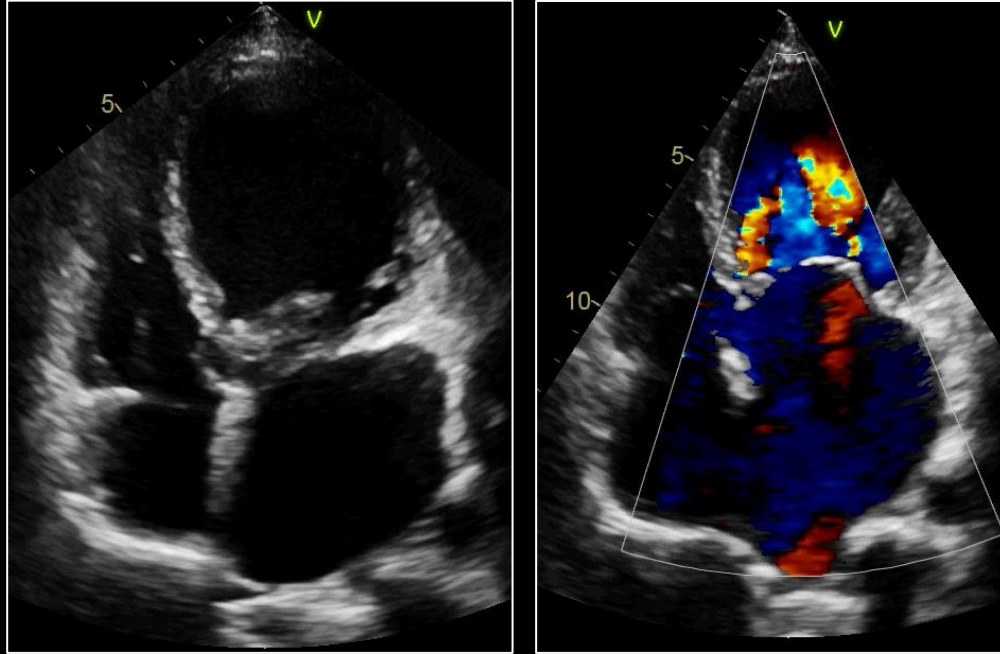


Case 3: Severe MR in a patient post ALCAPA repair

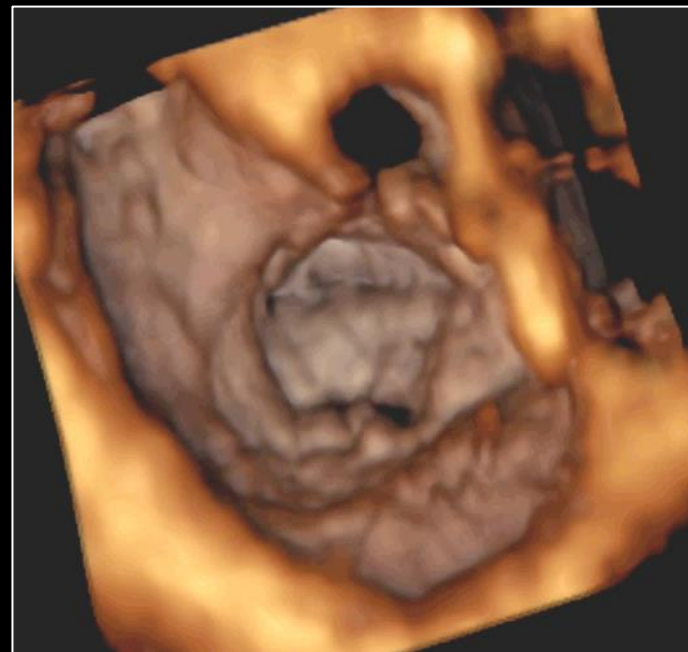
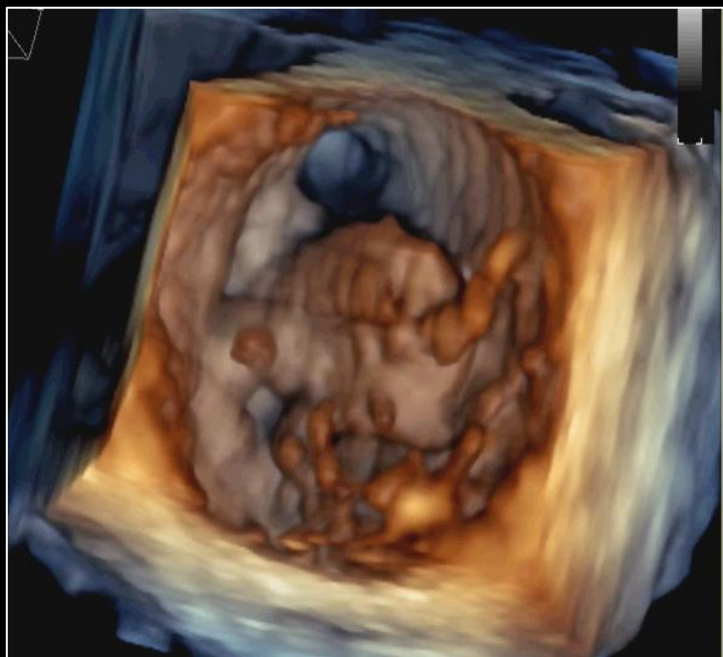


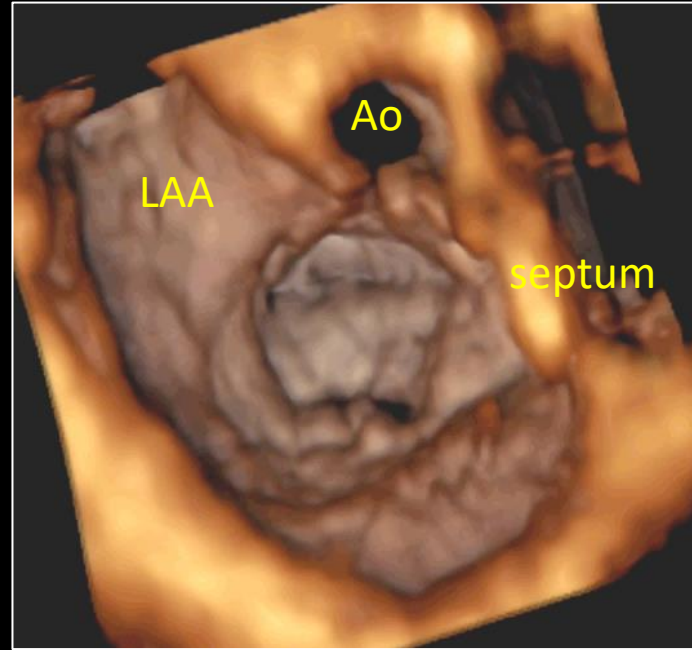
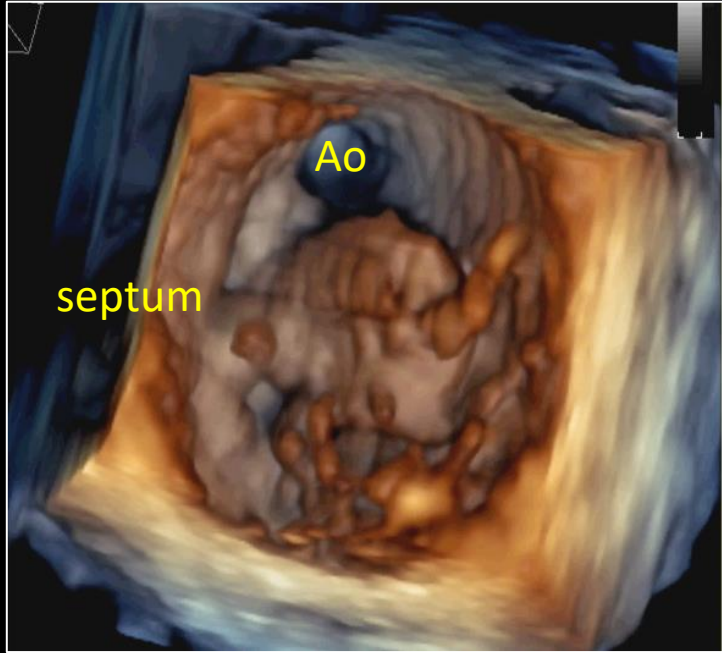
Cleft of posterior MV leaflet and severe organic MR

Case 4



A patient with AVSD and left AVV repair, severe left AVV regurgitation and AF

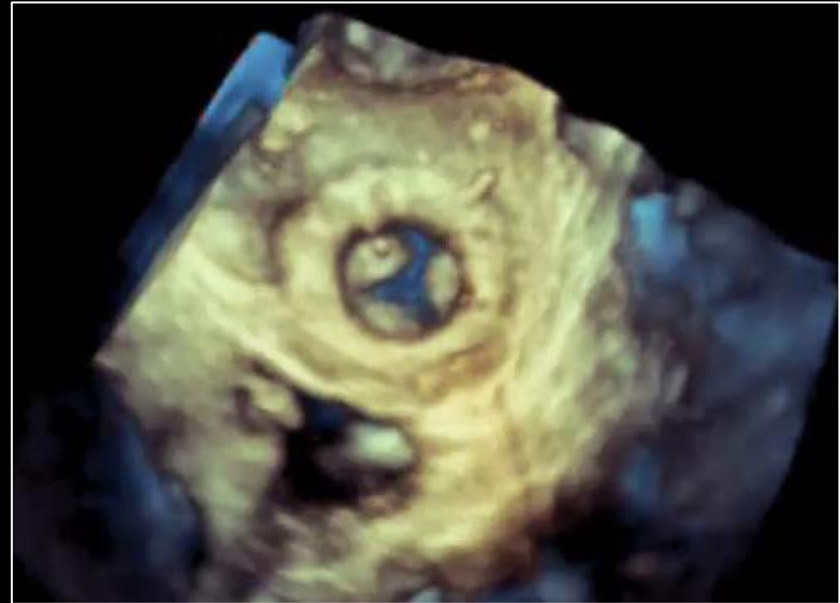
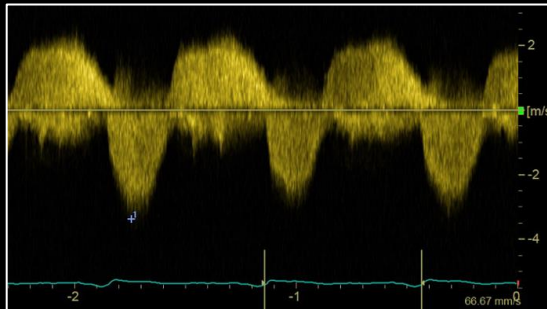
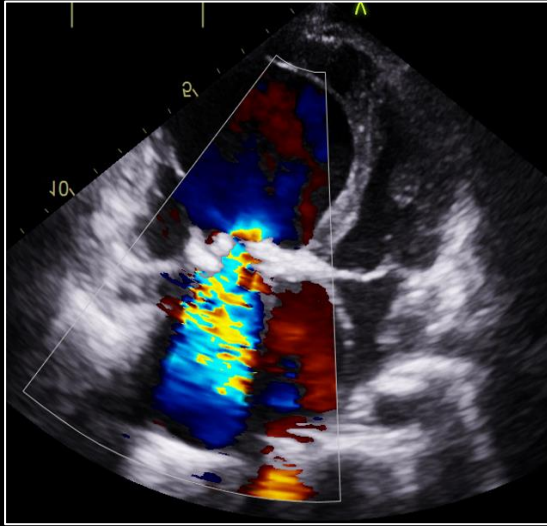




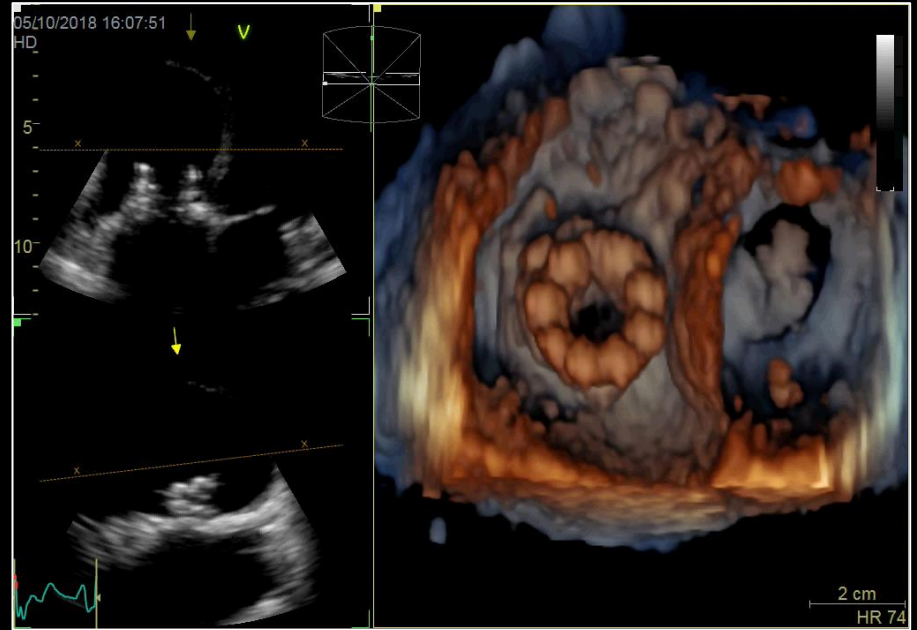
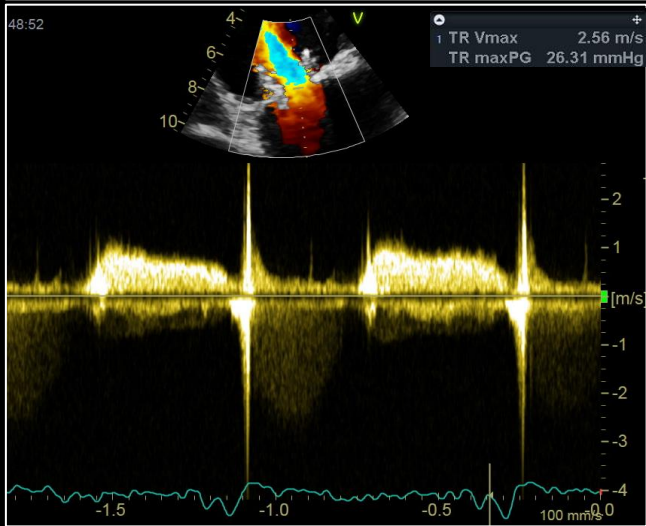
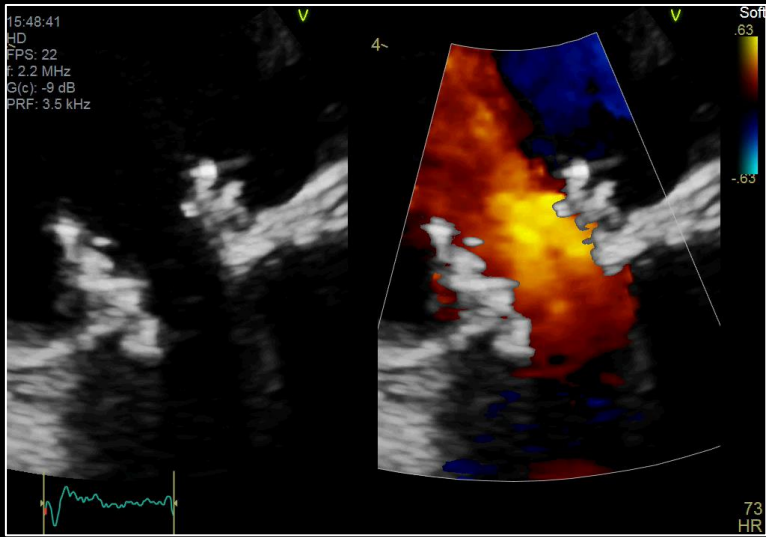
Double orifice left AVV, prolapse of anterior leaflet of anterior orifice and small flail of posterior leaflet; cleft closed

Case 5: assessment of prosthetic valves

- 14-year-old with Ebstein's anomaly
- Previous TVR and PVR: Carpentier-Edwards Perimount valves
- Severe TR, PR and RV failure

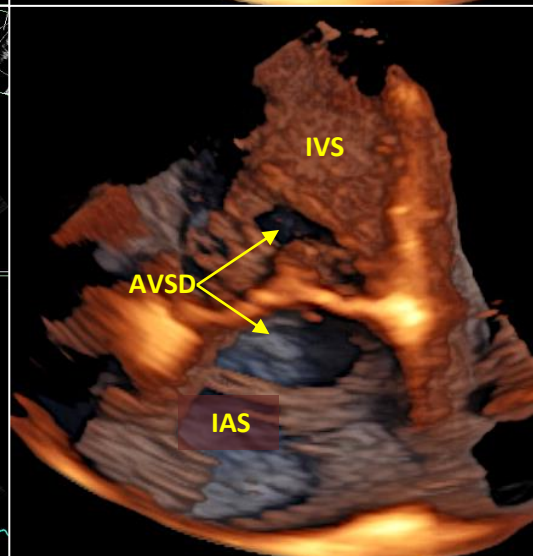
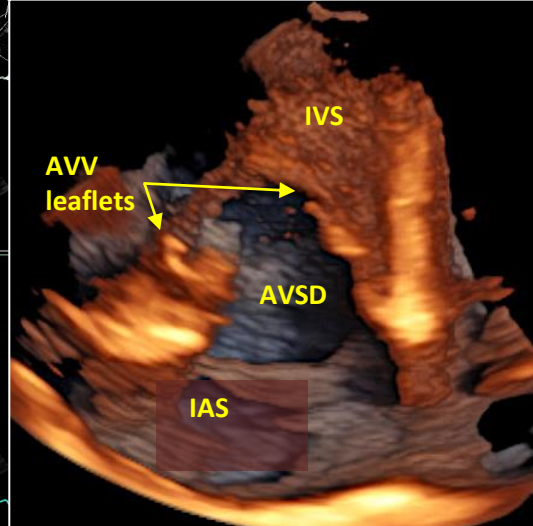
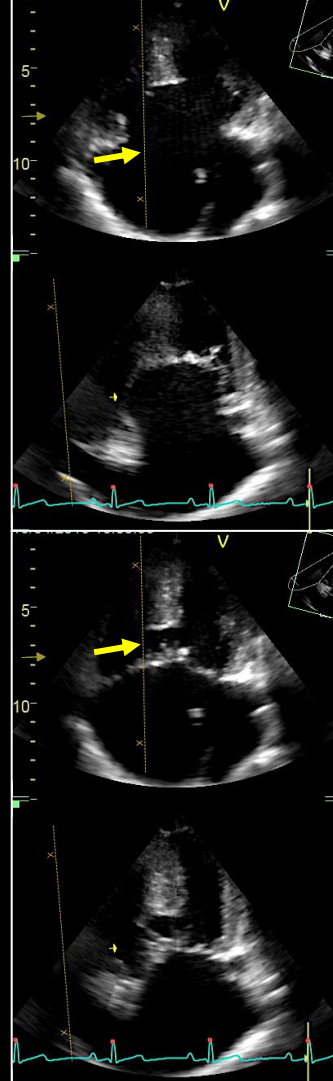
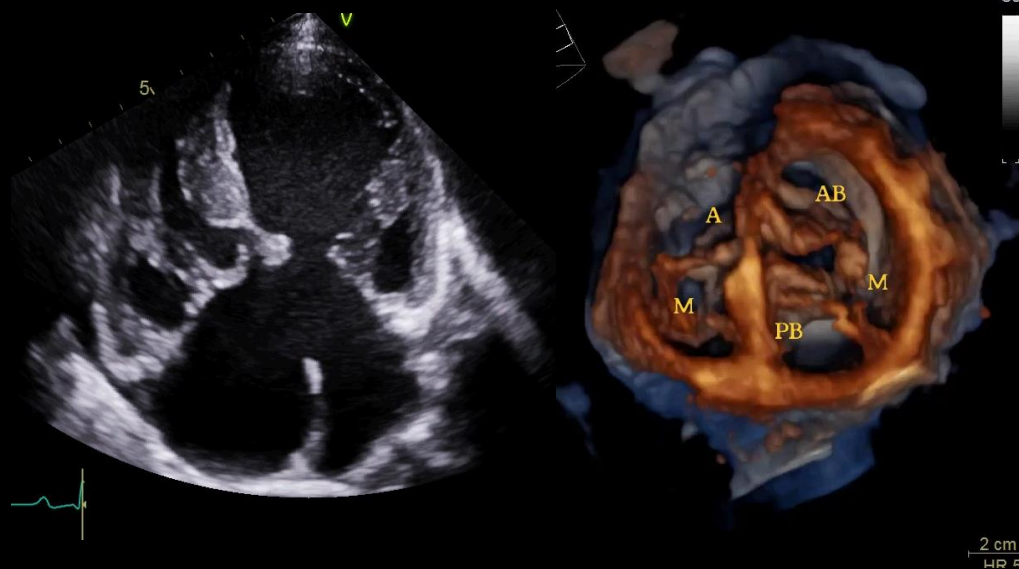


- Successful percutaneous TVR with Melody valve

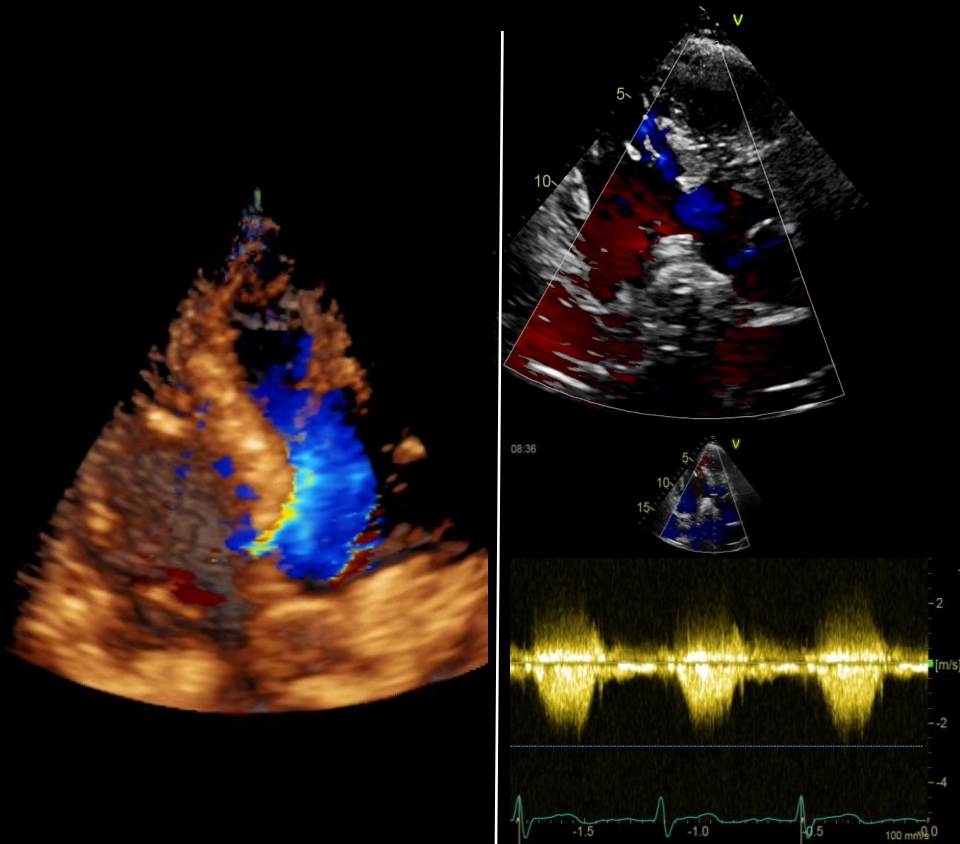


Septae

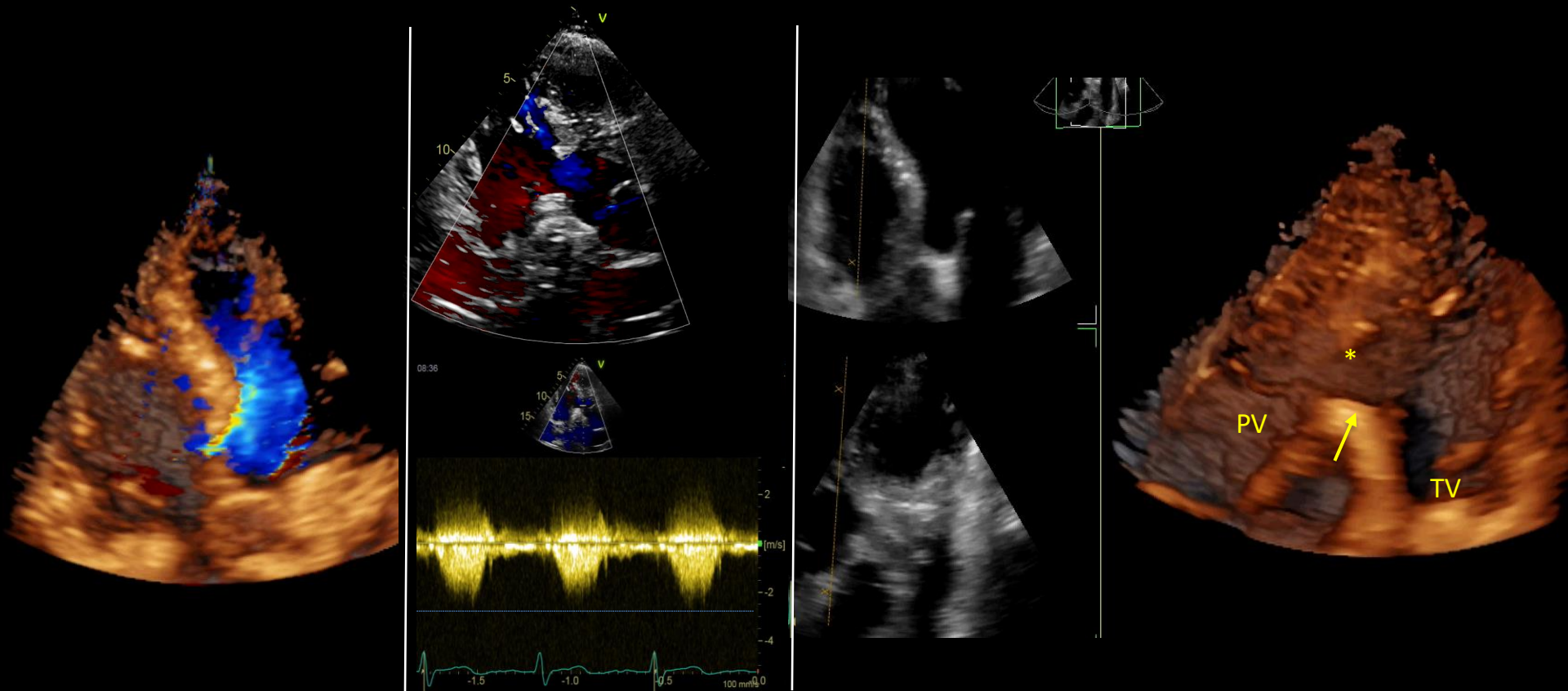
Case 6: A patient with AVSD



Case 7: a patient with VSD



Case 7: a patient with VSD



How to acquire the 3DE data sets according
to specific clinical needs in ACHD

Check list in 3DE data acquisition

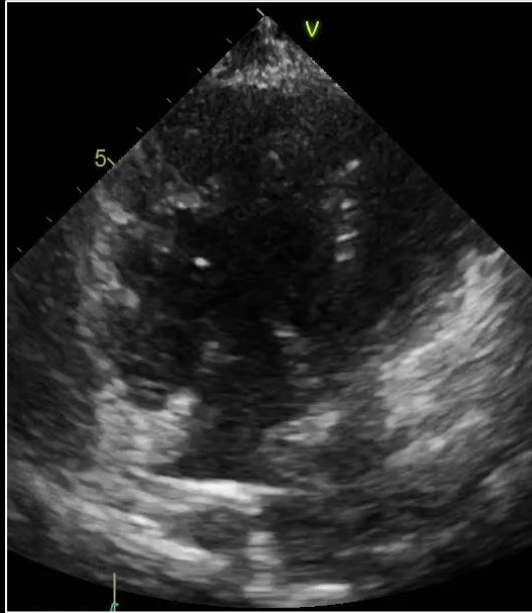


- Clear visualization of the structure of interest in 2D
- Adjust sector depth, width, and gain settings
- Include relevant adjacent structures
- Temporal resolution vs Spatial resolution; think of what is more important
- Check the ECG for upright R waves
- Use 3D color and 3D zoom when needed
- Remember, you still can get good 3DE data set even if your patient is in AF or not cooperating

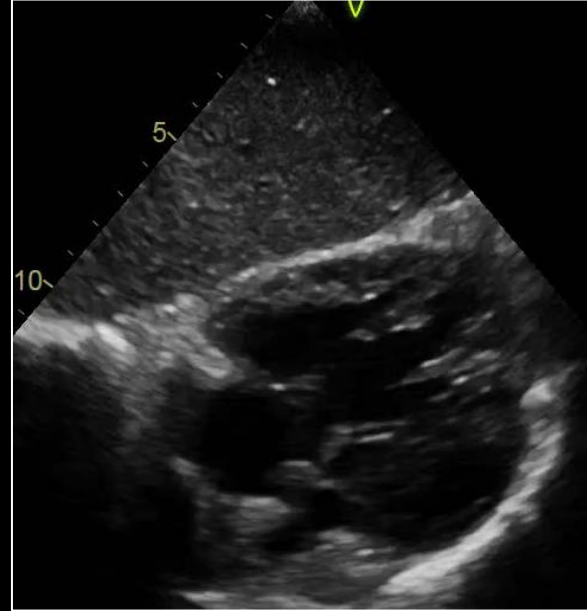
What if apical 4Ch view is suboptimal?

What if apical 4Ch view is suboptimal?

Apical 4Ch



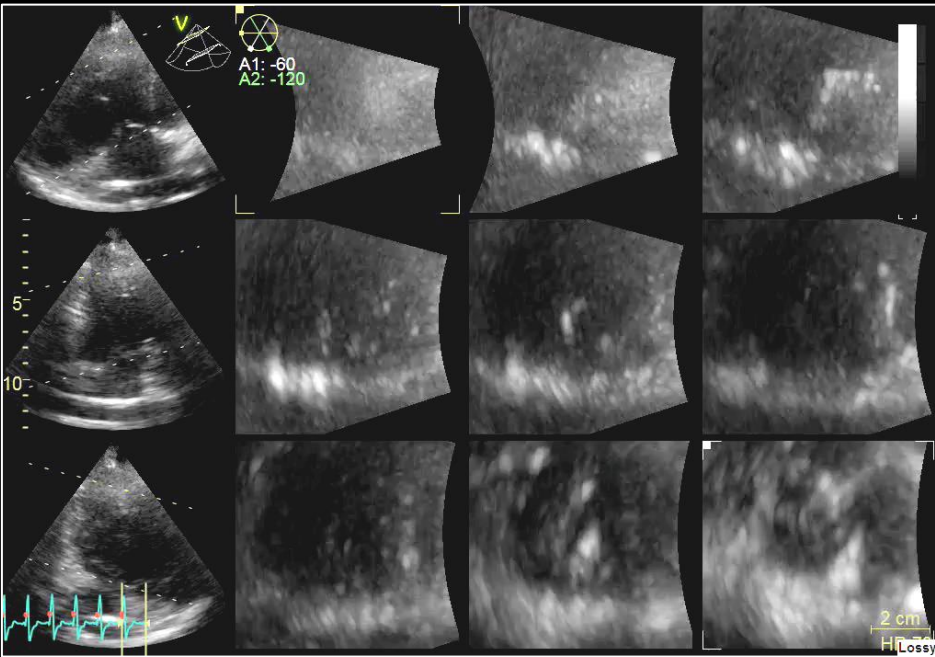
Subcostal



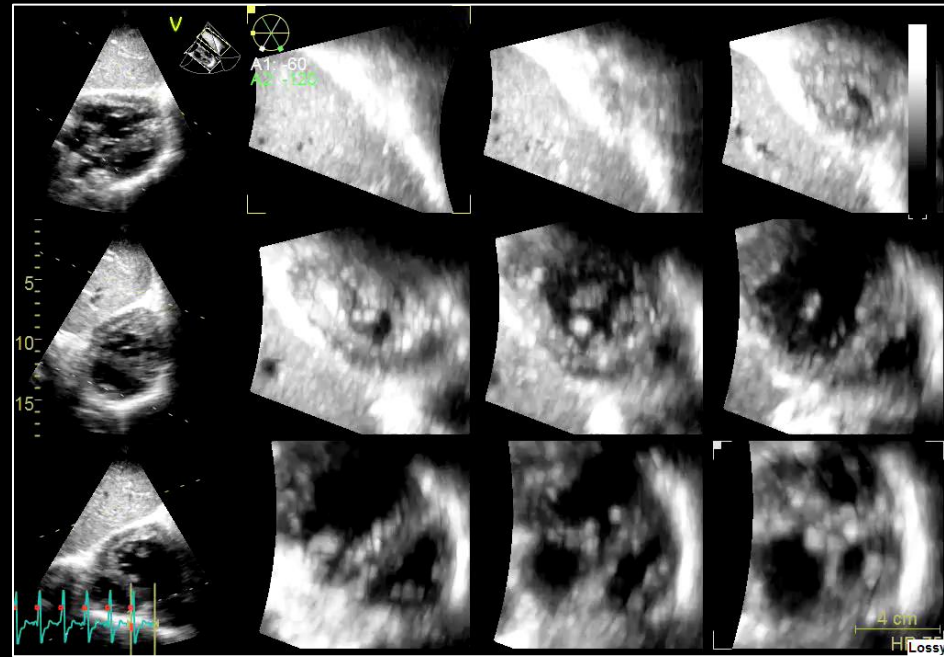
Fontan patient with dominant RV and hypoplastic LV

What if apical 4Ch view is suboptimal?

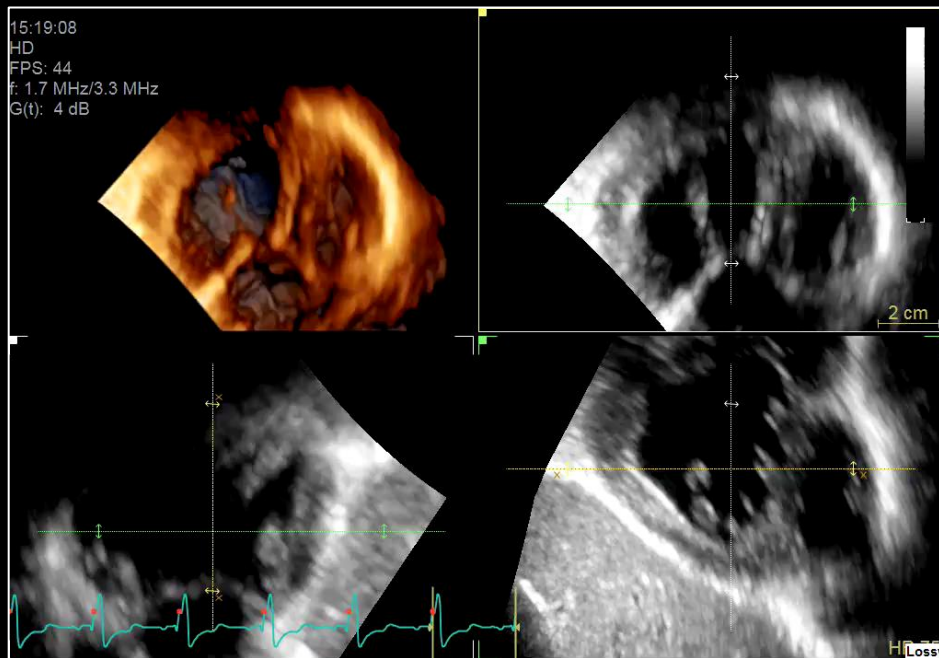
Apical 4Ch



Subcostal



Full volume data set from subcostal view



Global

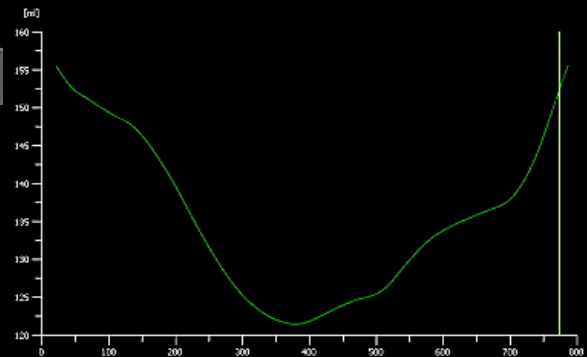
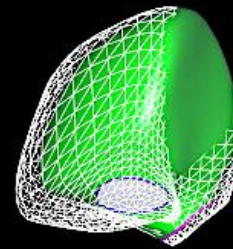
2D

EDV: 155.6 ml

ESV: 121.5 ml

SV: 34.2 ml

EF: 21.95 %

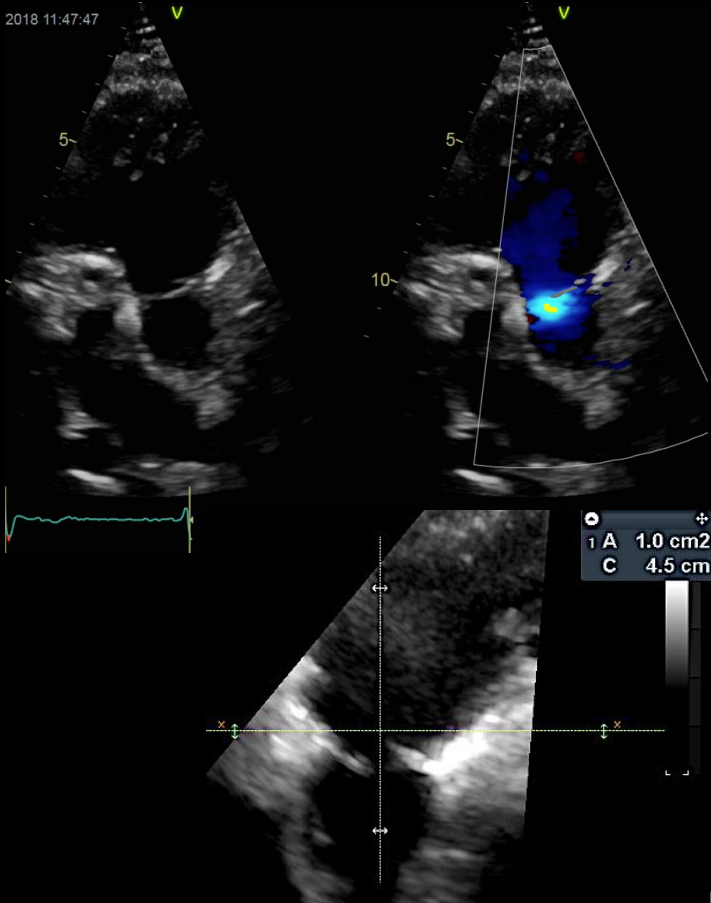


A study in paediatric patients with CHD has demonstrated that neither echo view had a consistently larger error in estimated of RV volumes when compared to CMR.

Few more things to remember

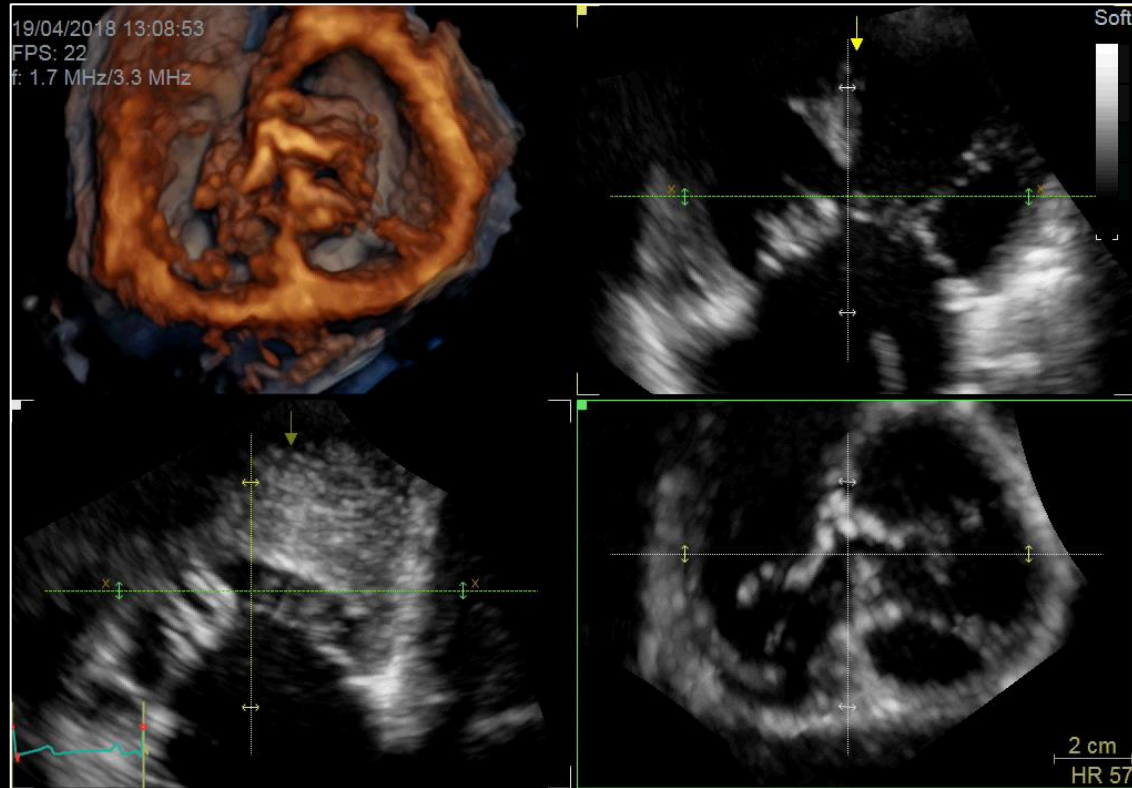
- Include relevant adjacent structures - it will help in postprocessing
- True defect vs drop-out artefact - 3D Color will help
- What if I am using multi-beat acquisition? - tricks to avoid stitching artefacts

1. Use 3D zoom or narrow sector and single beat acquisition



If your patient in AF or not able to cooperate:

2. Use retrospective multi-beat acquisition, reduce number of beats to 3-4 and ... and be patient



A patient with AVSD, common AVV and Trisomy 21

Strengths and limitations of 3DE in ACHD



Major advantages	<ul style="list-style-type: none">• The only echo technique allowing to assess RV volumes and EF• No geometric assumptions about ventricular shape and contraction pattern• Anatomically accurate, en-face visualization of the valves / septae from any perspective in the beating heart• Facilitate assessment of complex lesions• Additive prognostic value in congenital heart diseases
Major limitations	<ul style="list-style-type: none">• Need of stable cardiac rhythm and patients' cooperation• Requires good image quality

EACVI/ASE EXPERT CONSENSUS DOCUMENT

Three-dimensional Echocardiography in Congenital Heart Disease: An Expert Consensus Document from the European Association of Cardiovascular Imaging and the American Society of Echocardiography



John Simpson, MBChB, MD, FESC, Leo Lopez, MD, FASE, Philippe Acar, MD, PhD,
Mark K. Friedberg, MD, FASE, Nee S. Khoo, MBChB, H. Helen Ko, BS, ACS, RDMS, RDCS, RCCS, FASE,
Jan Marek, MD, PhD, FESC, Gerald Marx, MD, FASE, Jackie S. McGhie, Folkert Meijboom, MD,
David Roberson, MD, FASE, Annemien Van den Bosch, MD, PhD, Owen Miller, BMed, and
Girish Shirali, MBBS, FASE, *London, United Kingdom; Miami, Florida; Toulouse, France; Toronto, Ontario and*

THANK YOU FOR YOUR ATTENTION

