

How to implement 3DE in the Echolab: from routine to the heart team and to the cathlab

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Eindhoven



Why not? Which are the problems?

- Equipment
- Personnel
- Organizational
- Financial



- **Minimum requirements for echo laboratory (TEE):**
 - Minimum room size (20m²)
 - Approved echo equipment
 - Cleaning and sterilization equipment
 - Resuscitation equipment (including oxygen supply)
 - Monitoring of BP, HR and ECG, SO₂

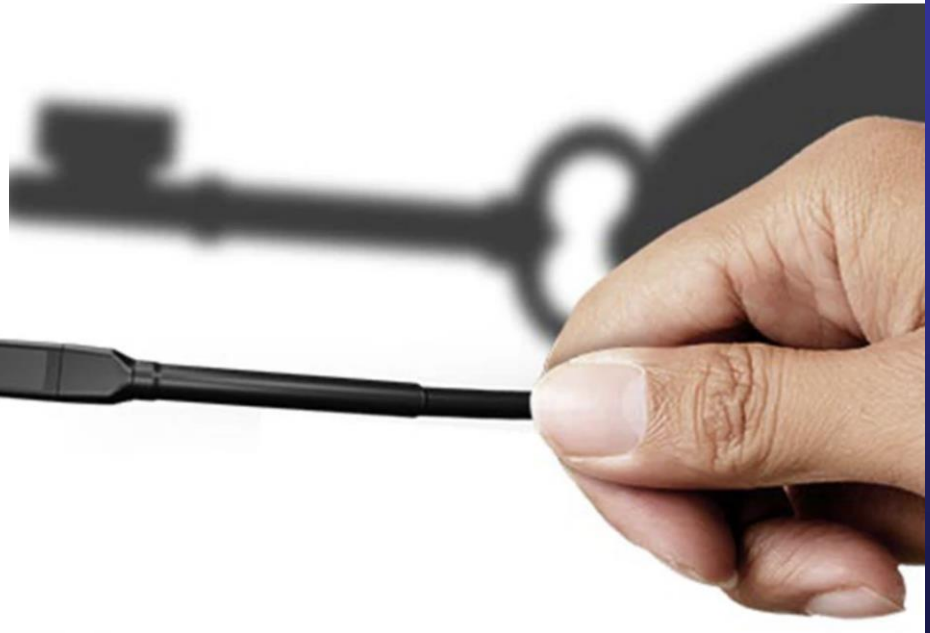
Table I Studies required to achieve competence/undertake accreditation of various organizations and their re-accreditation requirements, together with web source

| Organization | Studies | Exam | Re-accreditation (studies/CME) |
|---|----------------------------|------|---|
| EAE/EACTA accreditation, www.escardio.org | 125 (75 if TTE accredited) | Yes | 50 studies/year and 30 h CME over 5 years |
| ACC/ASE guidance, http://www.asefiles.org/COCATS.pdf | 125 (TOE) 150 (Intraop) | N/A | – |
| NBE TOE accreditation, www.echobords.org | 300 | Yes | After 10 years; >50 in 2 of last 3 years; 15 h CME in last 3 years |
| ACTA; BSE accreditation; www.bsecho.org | 125 (75 if TTE accredited) | Yes | After 5 years; 40 studies/year and 15 h CME over 5 years |





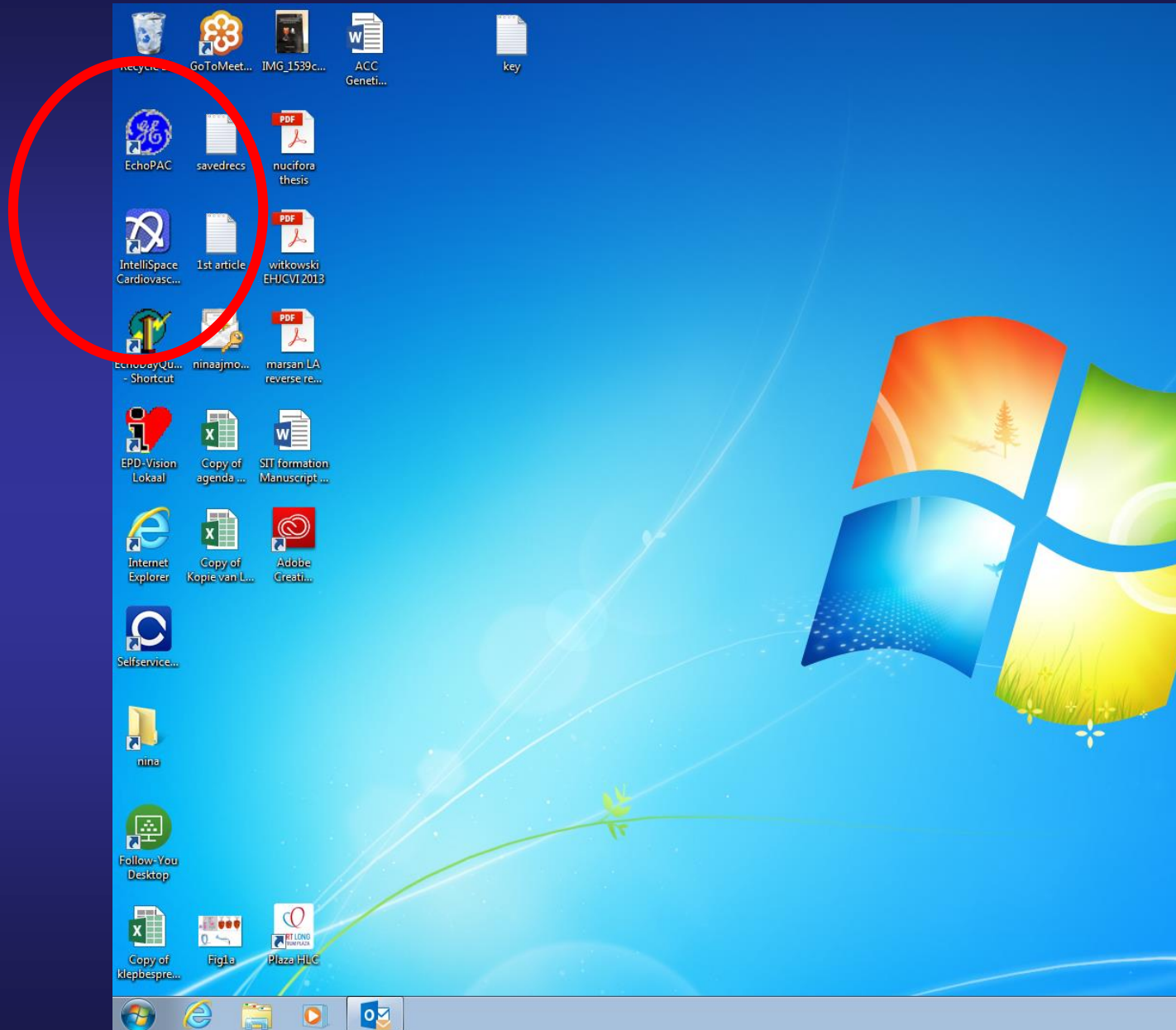
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- Different vendors: different acquisition workflow, different way of display, different cropping techniques
- Implementation in one echo laboratory



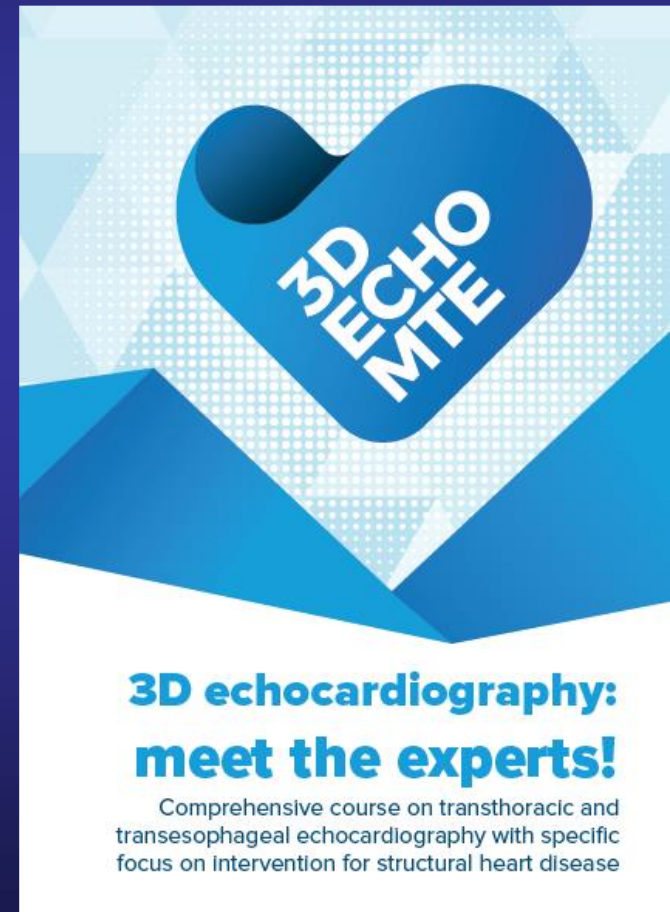
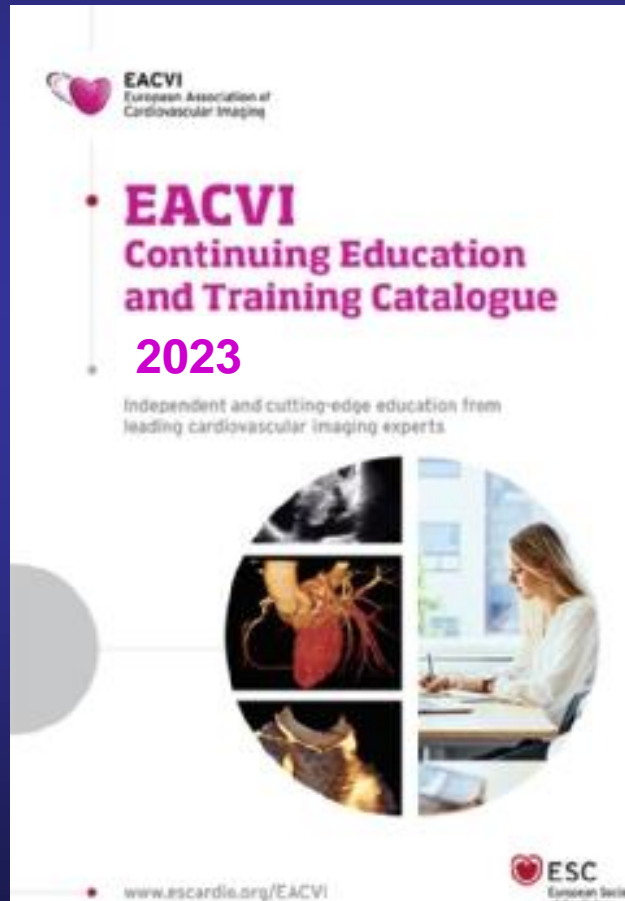




- **Specific contract for equipment and software**
- **Adequate image storage:**
 - one examination from 300 MB to 1.5 GB



- Continue improving and therefore continue education and training of cardiologist and sonographers



Recommendations for transoesophageal echocardiography: EACVI update 2014

Frank A
Gilbert
and Mauro
Ducimet
Document



ESC

European Society
of Cardiology

European Heart Journal - Cardiovascular Imaging (2023) **24**, e119–e197
<https://doi.org/10.1093/ehjci/jead090>

EACVI DOCUMENT

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Three-dimensional transoesophageal echocardiography: how to use and when to use—a clinical consensus statement from the European Association of Cardiovascular Imaging of the European Society of Cardiology

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Rebecca Hahn⁴, Mauro Pepi⁵, Nina Ajmone Marsan⁶, Nina Wunderlich⁷,
Leyla Elif Sade⁸, Erwan Donal ⁹, Jose-Luis Zamorano¹⁰, Bernard Cosyns¹¹,
Mani Vannan¹², Thor Edvardsen ^{13,14}, Alain Berrebi¹⁵, Bogdan A. Popescu¹⁶,
Patrizio Lancellotti ¹⁷, and Roberto Lang¹⁸

BAV

Images A and B

Normal aortic valve with three-leaflet valve in diastole (image A) and in systole (image B); N, non-coronary leaflet; R, right coronary leaflet; L, left coronary leaflet.

Images C and D

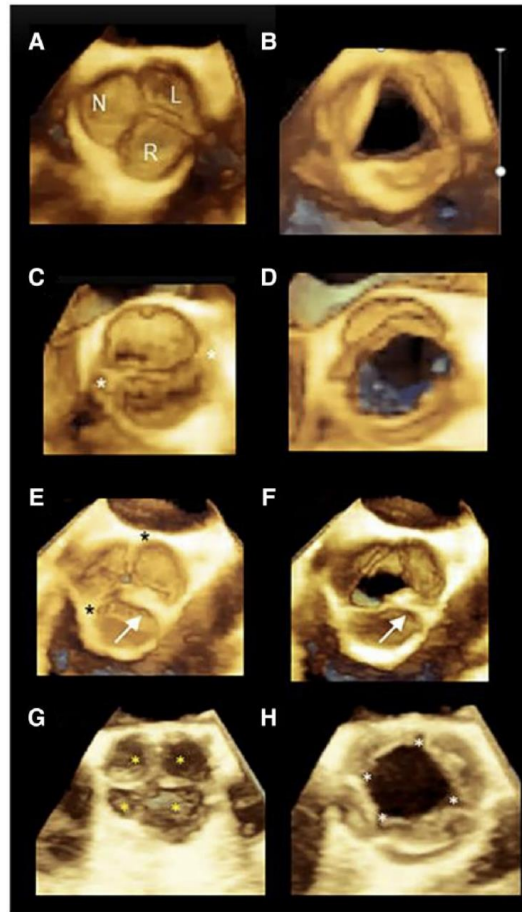
Bicuspid valve with two sinuses and two commissures (asterisks) in diastole (image C) and in systole (image D). This phenotype is described as 'two-sinus type' (antero-posterior phenotypes). No raphe is visible.

Images E and F

In the 'fused type', two of three cusps appear fused within three distinguishable sinuses and three commissures (asterisks) in diastole (image E) and in systole (image F). The arrow points to a fibrous ridge (raphe) between the fused cusps. The presence of raphe and the symmetry of the fused type phenotypes are key aspects that need to be described.

Images G and H

Quadricuspid valve in diastole (image G) and in systole (image F). The yellow asterisks mark the four leaflets in diastole. The white asterisks mark the four commissures in systole.



Images

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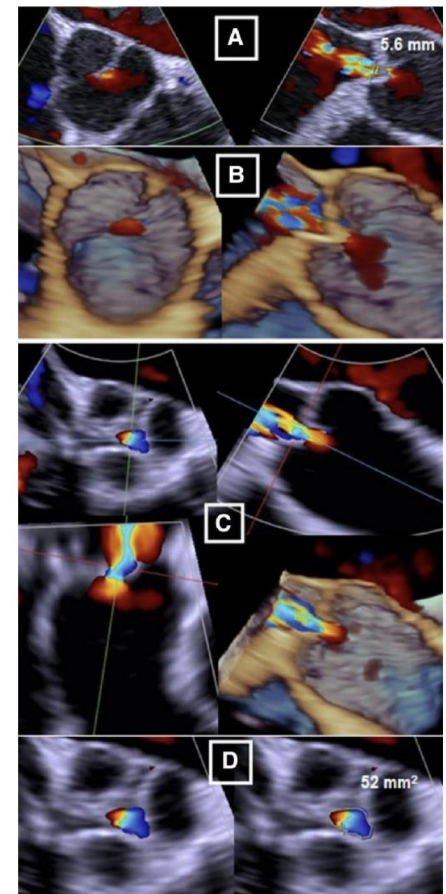


Table 2 Protocol for transthoracic 3D echocardiography

Protocol For Three-Dimensional Transthoracic Echocardiography

| Aortic Valve | Left Ventricle/Right Ventricle | Pulmonic Valve |
|--|---|--|
| Parasternal long-axis view with and without color (narrow angle and zoomed acquisitions) | Apical four-chamber view (narrow and wide angle acquisition) Please note that the image must be tilted to place the right ventricle in the center of the image for right ventricular acquisition | Parasternal right ventricular outflow tract view with and without color (narrow angle and zoomed acquisitions) |
| Mitral Valve | Interatrial and Interventricular Septum | Tricuspid Valve |
| Parasternal long-axis view with and without color (narrow angle and zoomed acquisitions) | Apical four-chamber view (narrow angle and zoomed acquisitions) | Apical four-chamber view with and without color (narrow angle and zoomed acquisitions) |
| Apical four-chamber view with and without color (narrow angle and zoomed acquisitions) | | Parasternal right ventricular inflow view with and without color (narrow angle and zoomed acquisitions) |

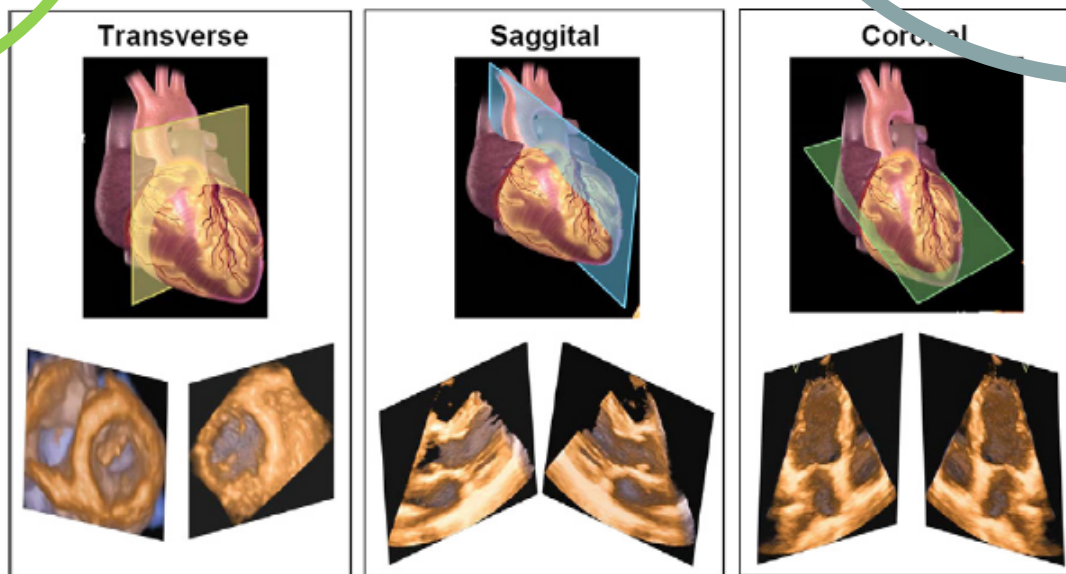

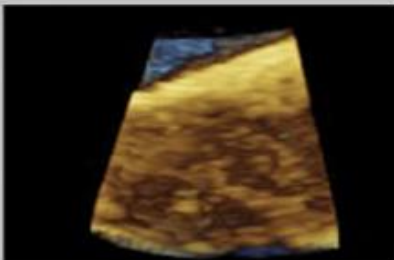

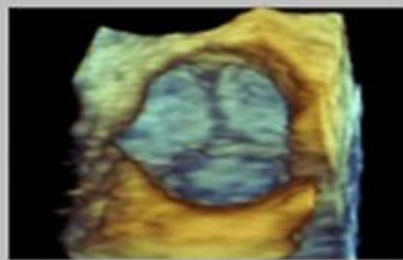
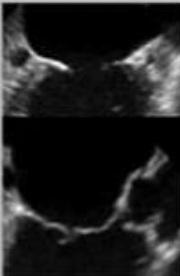
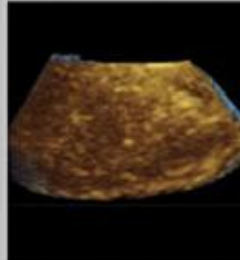

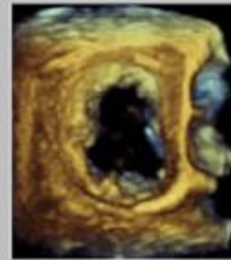



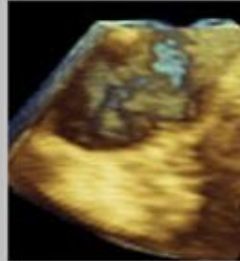

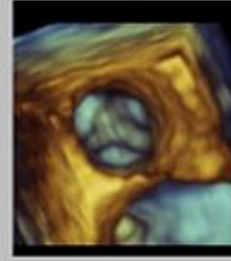

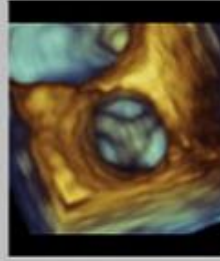


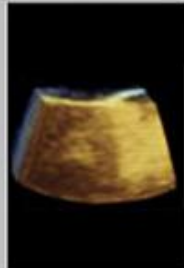

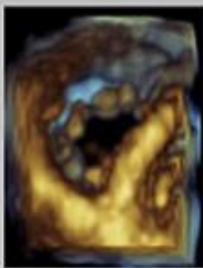




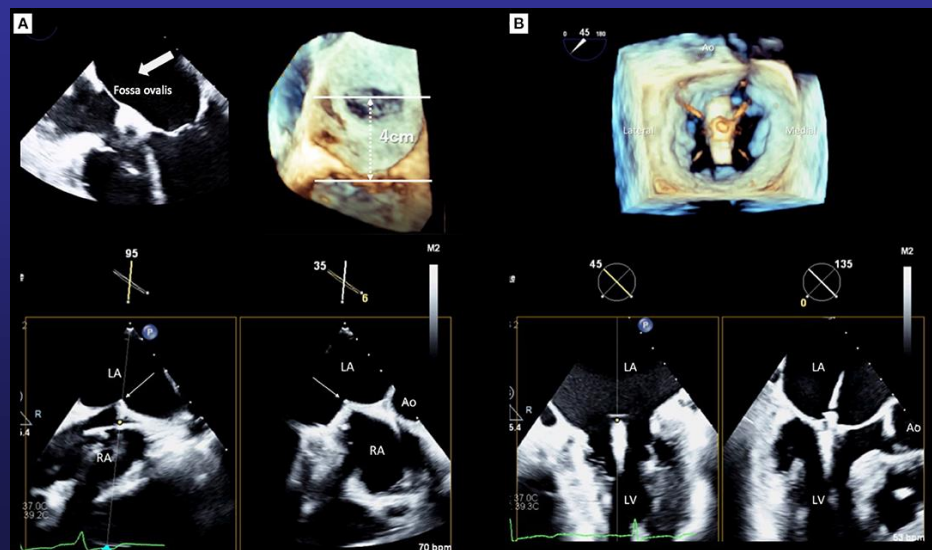
Table 4 Acquisition and presentation of cardiac valves

| | | | | | | | | | |
|------------------------|----------|---|---|--|--|---|---|---|---|
| Aortic Valve | 2DE ➔ |  | 3DE ➔ |  |  |  | | | |
| Mitral Valve | 2DE ➔ |  | 3DE ➔ |  |  |  |  |  | |
| Pulmonic Valve | 2DE ➔ |  | 3DE ➔ |  |  |  |  |  | |
| Tricuspid Valve | 2DE ➔ |  |  | 3DE ➔ |  |  |  |  |  |

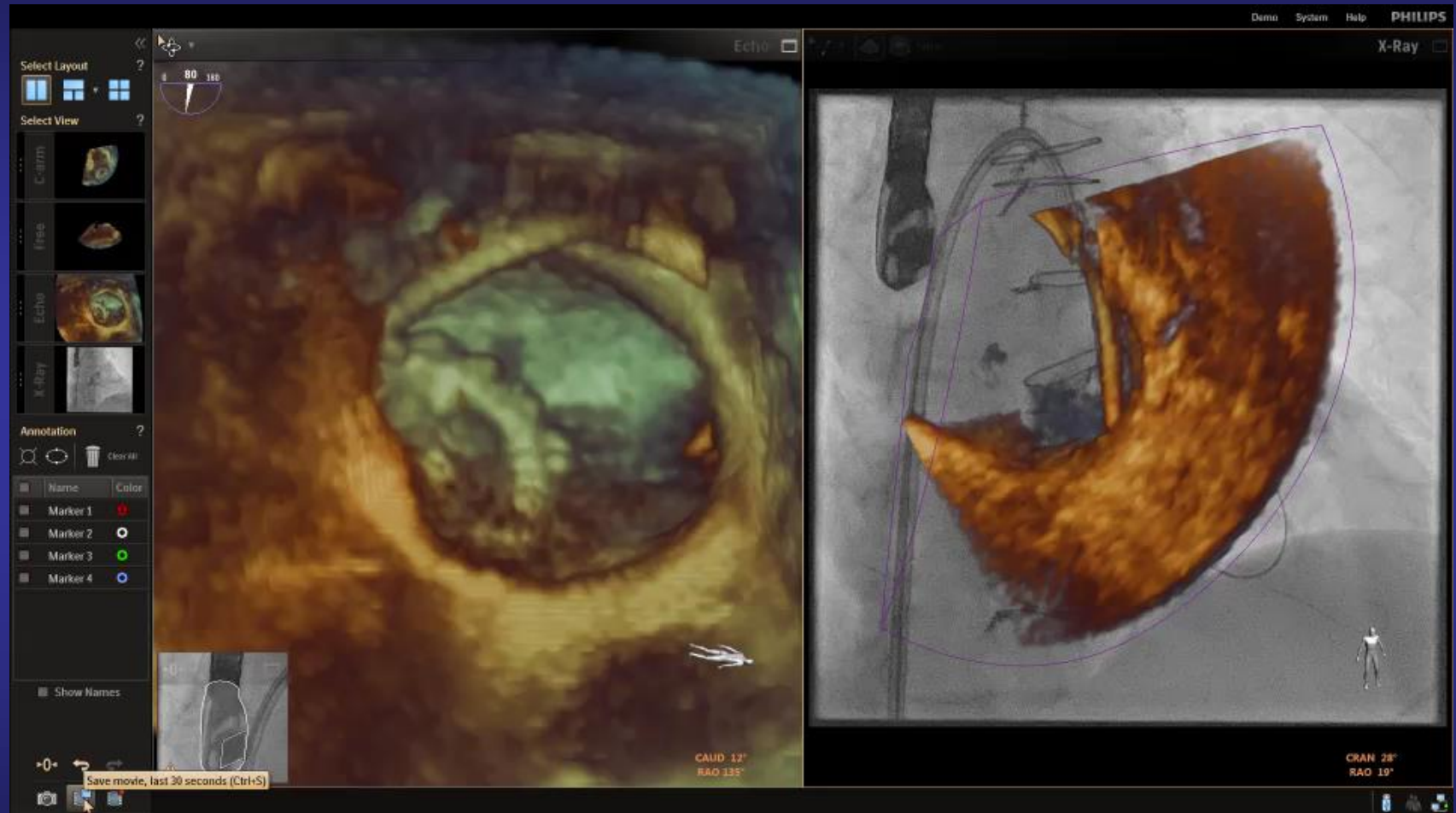
- **From full 2D exam followed by focused 3D exam to introduction in the clinical routine:**
 - Standardized acquisition protocol
 - Automated display of standard cut-plane 3D and 2D echo views
 - Simplified cropping tools
 - Automatic quantification software (chamber quantification..)

Special needs for the Cathlab

- Fast switch from one modality to another one (biplane vs 3D zoom)
- Specific views
- Visualization of catheters and devices
- Live MPRs
- Fusion imaging

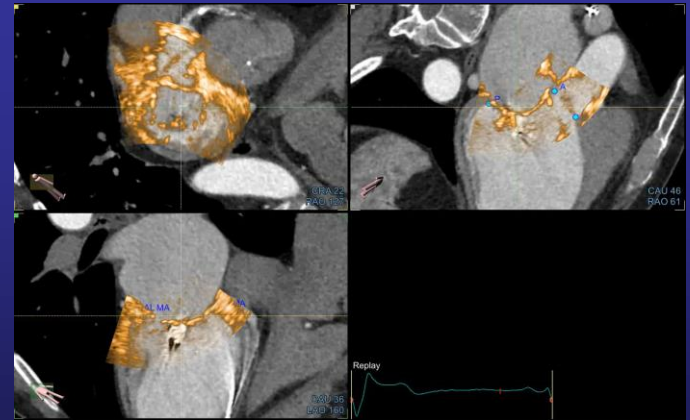
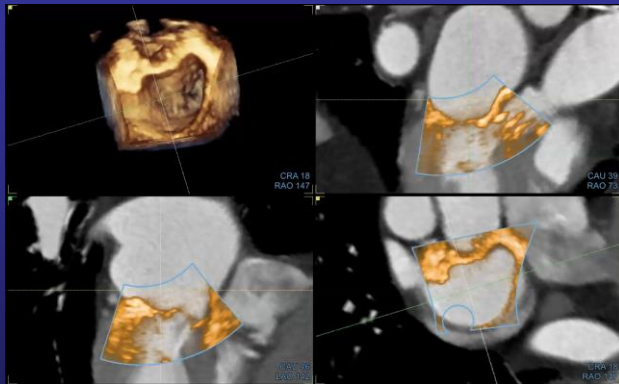
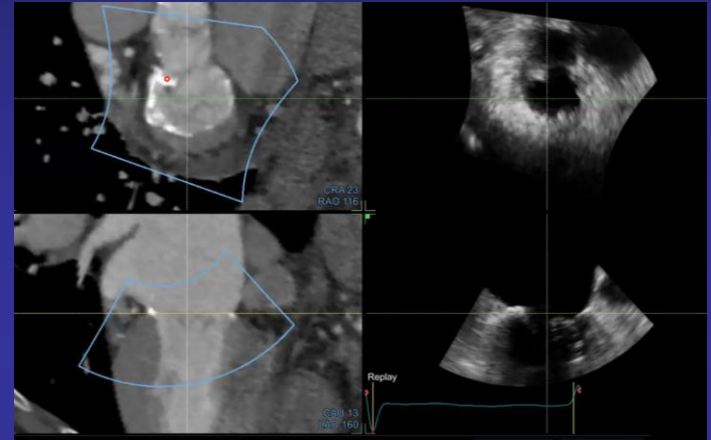
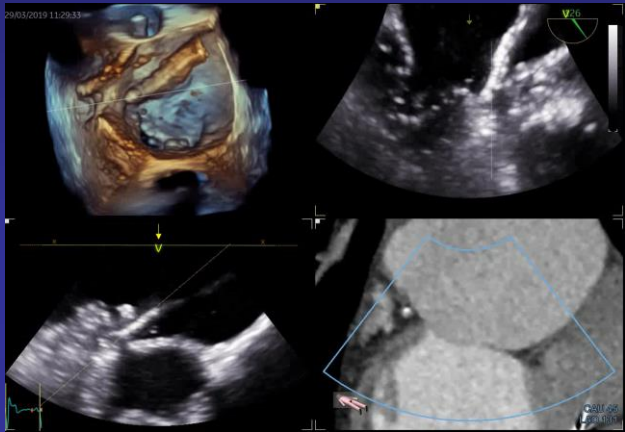


Fusion echo-fluoroscopy: PVL



Fusion imaging: Echo and CT

H

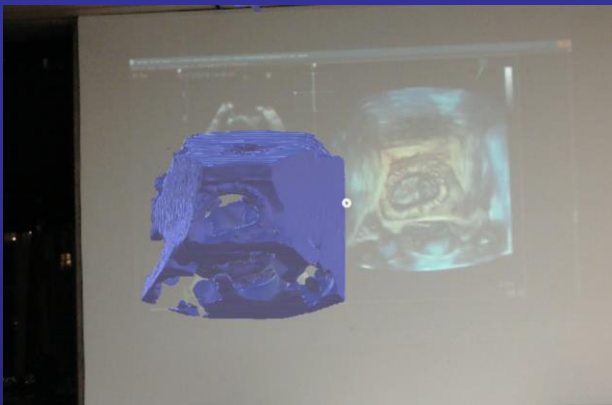
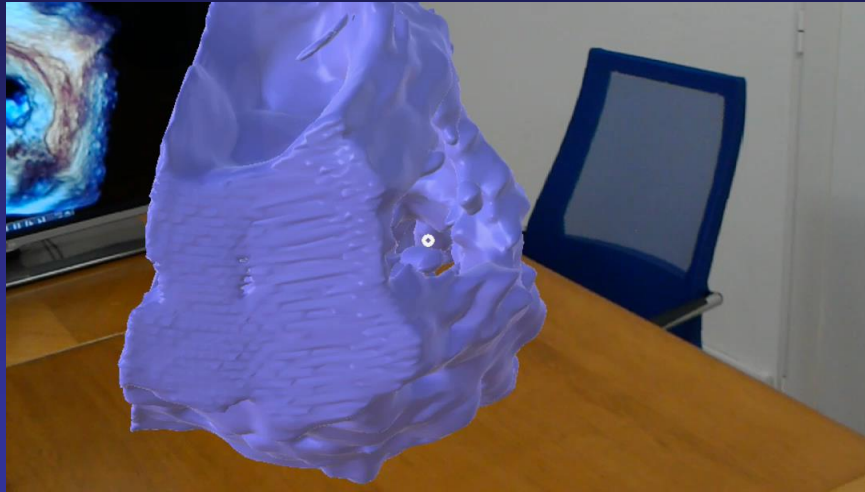


Heart-Team / Valve-Team

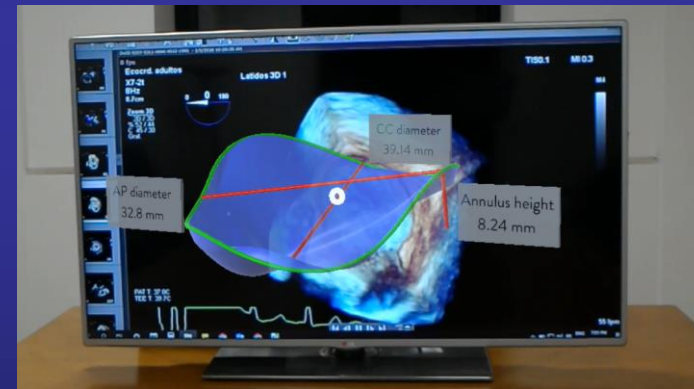
Individualized risk
assessment:
Clinical characteristics
Life-expectancy
Need for reintervention

Imaging
TEE

Surgical and
interventional
team skills



Courtesy of Artiness



Conclusions

- **RT3DE technology is now adequate for clinical use and is already recommended for certain indications**
- **Echo laboratories should implement this technology taking into account the minimal requirements including continue training and education to follow developments**
- **Further requirement for the cath lab and operating theater are needed and in continuos evolution**