Intraoperative Echocardiography

Indications and Techniques Used

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Intraoperative Echocardiography

- The use of TEE and Epicardial colorDoppler echo in the operating room provides information for assessing the outcome of heart surgery immediately after the surgical procedure.

Epicardial Echocardiography

- Normal transducer sterilized by a cold gas technique
- Non sterile transducer placed inside a steril plastic cover

Epicardial Echocardiography

- Acquisition of data is made by the surgeon in the steril field.
- A second person operates the instrument controls of the echo machine.

Epicardial Echocardiography

- Major Advantages: its ability to provide multiple tomographic planes and its easy availability.

- Limitations: poor visualization of the apex; interruption of the operation during the examinations; the pt can be studied only after thoracotomy.

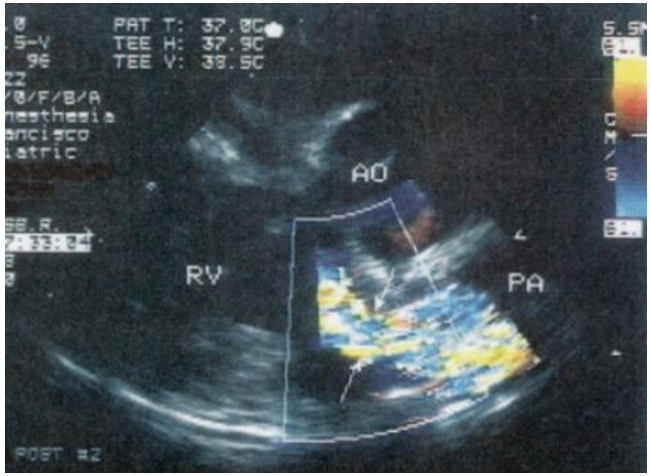
Intraoperative TEE

- Intra-operative TEE is an important monitoring and diagnostic tool used during surgery for repair of CHD.
- In several studies TEE has been shown to provide additional intra-cardiac anatomic information.
- Its ability to be used intra-operatively before and after cardiac repair makes it a unique tool.

Garg R, Ann Card Anaesth 2009

Introduction

- The first experience with pediatric intraoperative TEE was described by Cyran in 1989 in children 7.5 yr of age using an adult-sized probe.
- Before TEE was available for intra-operative use, significant residual abnormalities were frequently not detected.
- The result was often substantial post-operative morbidity and mortality and sometimes the need for re-operation.



Am J Cardiol 1989;63:594-8

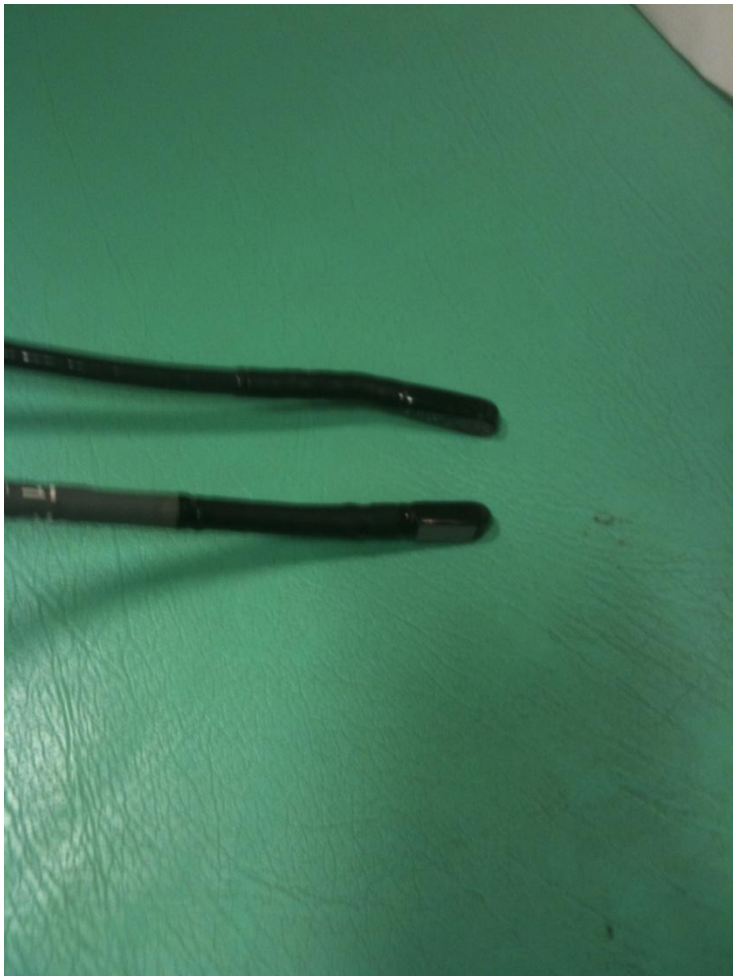
Surgical Risk and TEE

- **Low risk**: ASD, VSD, valve replacement, and extracardiac procedures.
- **Moderate risk:** AVSD, combined ASD and VSD or combined VSD and pulmonary stenosis, valve reconstruction, subaortic stenosis resection.
- **High risk**: Reoperation and neo-natal surgery, Fontan procedure, Fallot's tetralogy, Ebstein anomaly.

Gallivan S, Eur J Cardiothor Surg 2001

Multiplane TEE Pediatric Probe

Micro multiplane TEE (5 mm) with good resolution enable us perform TEEs in neonates ≈ 2.5kg.



Intraoperative TEE: How to perform

- A complete examination should be performed before surgical correction to confirm the diagnosis.
- Baseline images should be stored in the echocardiography machine for comparison after surgical correction.

Intraoperative TEE: How to perform

After surgical repair, TEE is done to see:

- Residual shunts,
- Valve regurgitation,
- Gradients across ventricu
- Gradients across ventricular o
- Proper placement of the patch,
- Assessment of ventricular function.

Intraoperative TEE in CHD Feasibility and Safety

- **Complications: 1.6%**
  - **Bleeding and arrhythmias**
- **No deaths or episodes of bacterial endocarditis attributable to this procedure have been reported in any pediatric series.**
- ***Bacteremia: 7-17% of patients***

Ann Card Anesth, 2009: 12-2: 173

Intraoperative TEE in CHD Controindications & Method

- **Absolute:**
  - significant and symptomatic esophageal pathology
  - vascular rings
- Inability to insert an appropriate-sized TEE probe: 1-5%
- *The probe must be sterilized in glutaraldehyde (20 minutes) and must be thoroughly washed in clean running water.*
- *Bite guard is placed (to protect the probe).*

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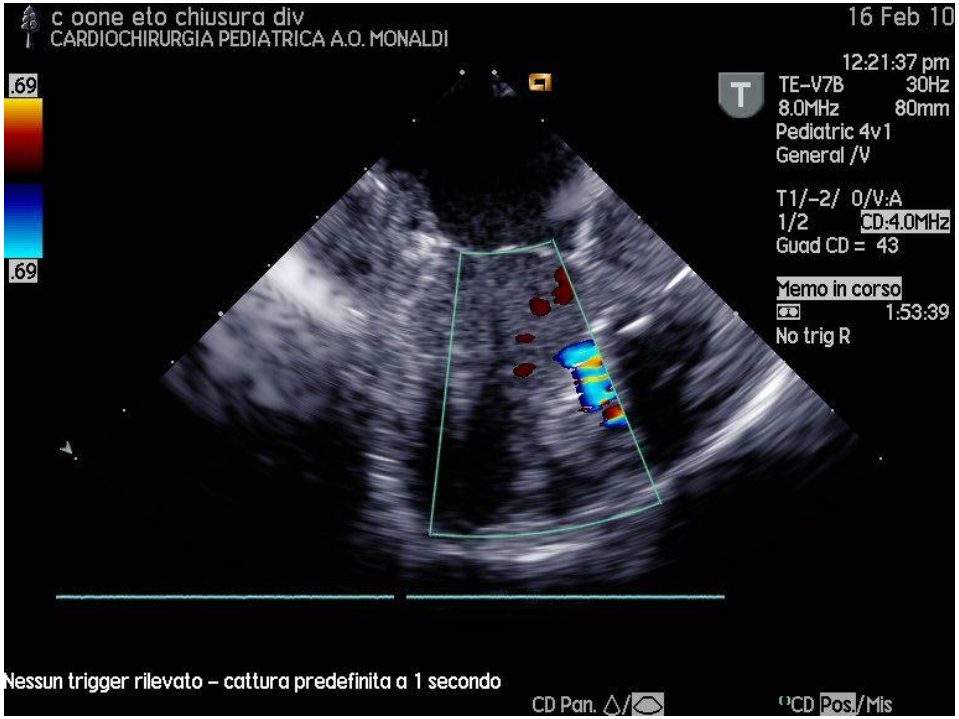
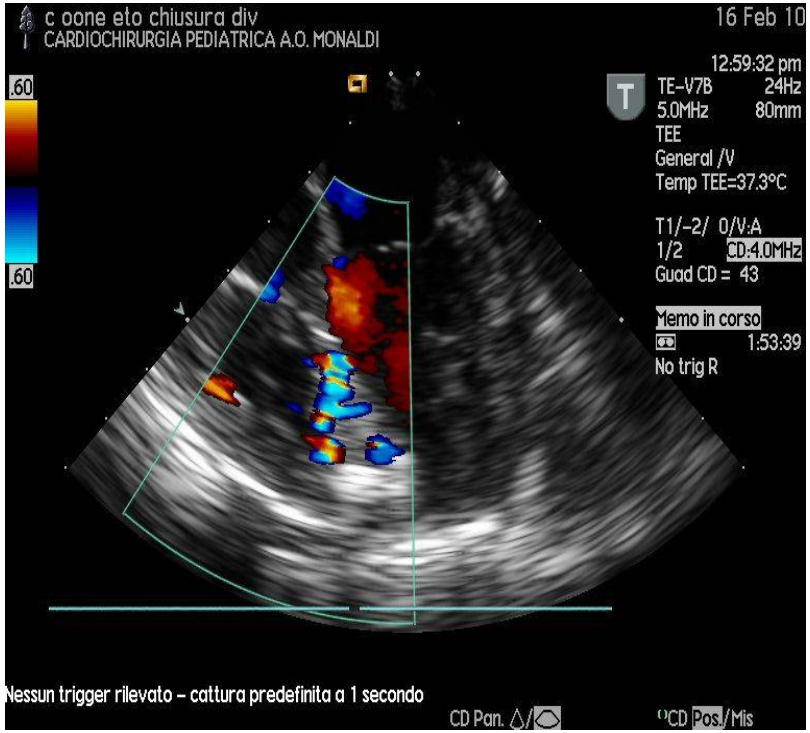
TEE: Role in Operatory Room

Tetralogy of Fallot

- Closure of the malalignment VSD
- Resection/patch repair of the infundibular obstruction.
- Residual VSD
- Assessment of residual RVOTO (desirable < 40 mmHg)
- Pulmonary regurgitation (not desirable!)
- Right ventricular size and contractility (related to hemodinamic conditions)
- Distal pulmonary arteries obstruction

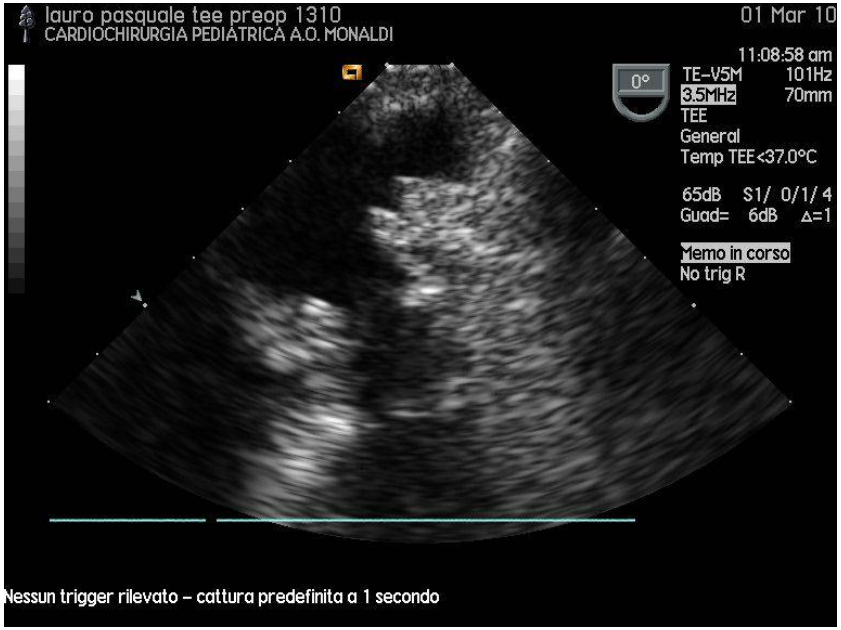
TOF: Hybrid Procedure



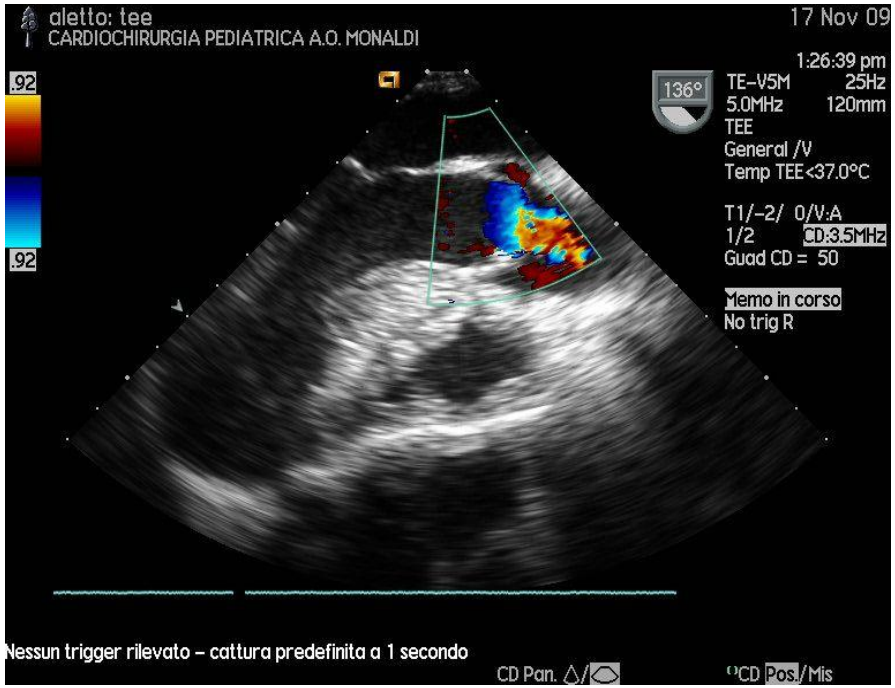


Ventriculopulmonary Conduits

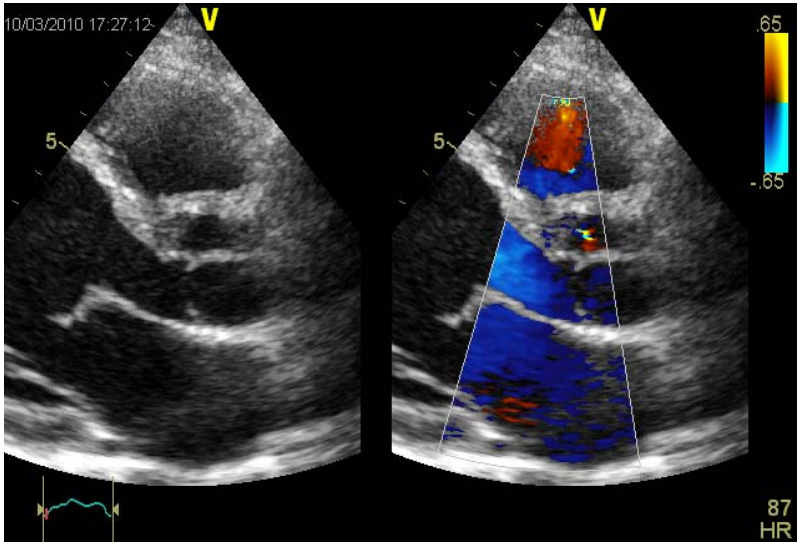
PW Doppler sampling to estimate the gradients. (velocity <2-2.5 m/sec is not significant)
Conduit regurgitation (relatively frequent)
Morphology and movement of the conduit valve

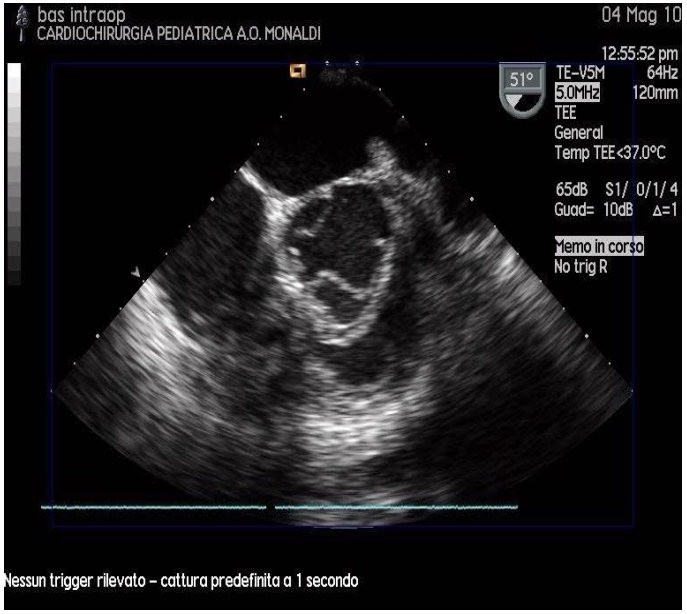


Bicuspid Aortic Valve Valvuloplasty

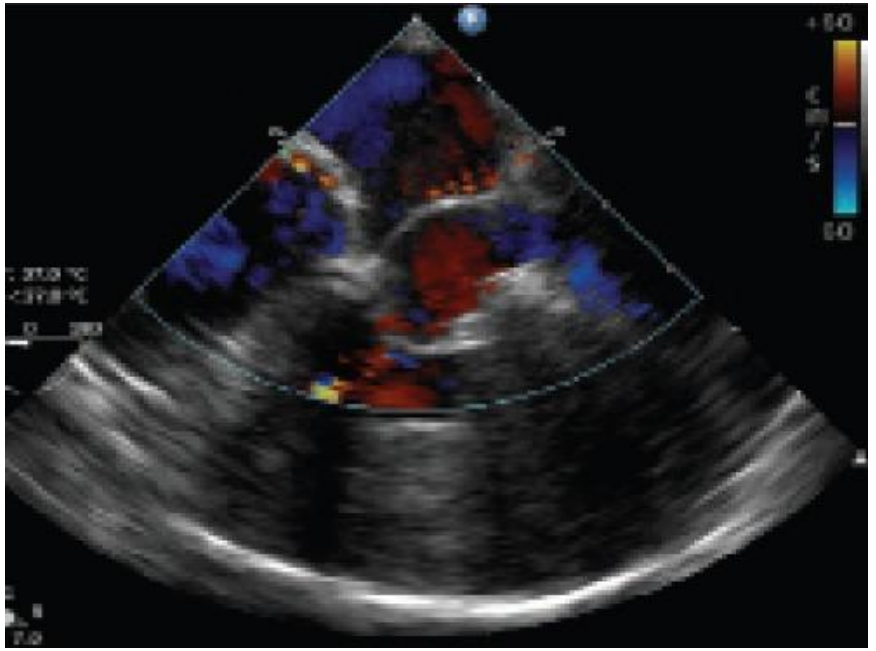


Aortic Valvuloplasty





Intraoperative TEE: Pratical Exemples



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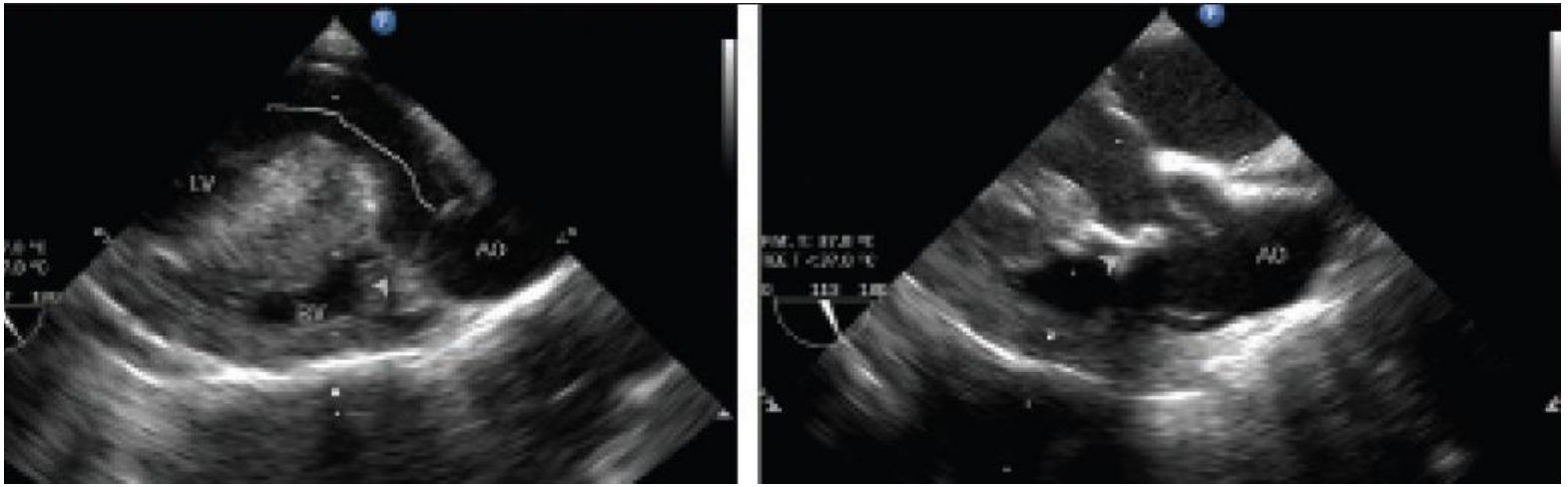
TEE: Role in Operatory Room



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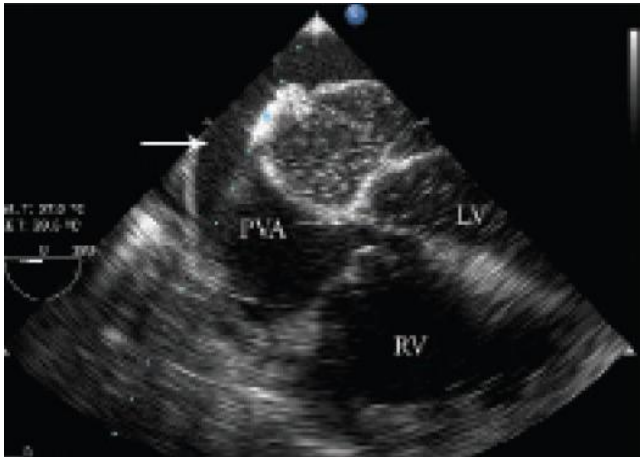
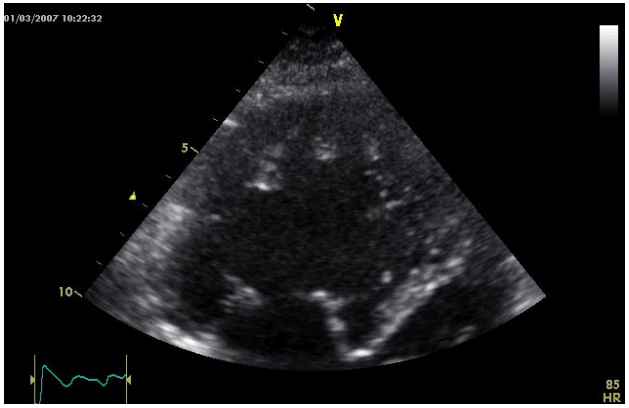
TEE: Role in Operatory Room

Atrial Repair of Transposition of the Great Arteries

- *Performed if either the LV has regressed or there is a coronary anomaly making it unsuitable for ASO*
- Pulmonary venous pathway (< 4-5 mmHg)
- Sistemic venous pathway (phasic gradient, < 6 mmHg)
- Small baffle leaks (sist-to-pulm shunt, desaturation)
- Midbaffle obstruction (redundant or too short)
- LVOTO
- Presence and severity of tricuspid regurgitation.



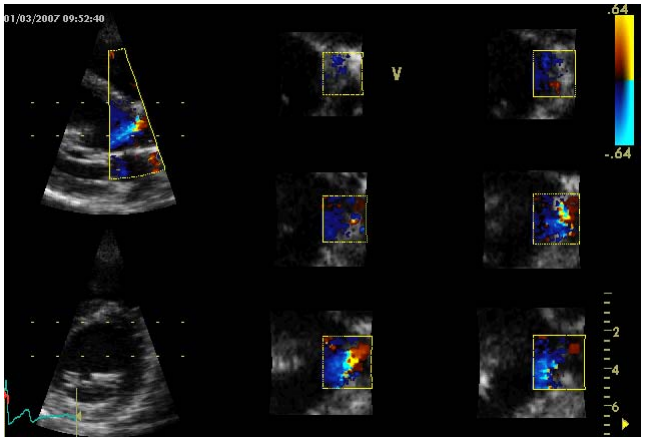


post-operative Senning showing contrast injection in the Sistemic Venous Atrium to check baffle leak

Intraoperative TEE: D-TGA

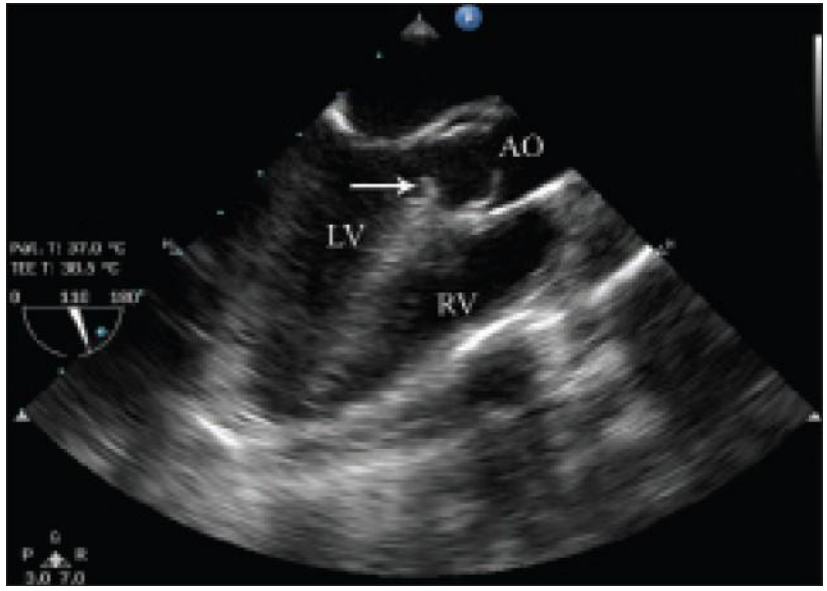
Anatomic Correction of Tratsposition of the Great Arteries

- Neoaortic valvular insufficiency (degree)
- Supravalvular or branch pulmonary stenosis
- Assessment of coronary flow is unsatisfactory
- Ventricular function



TEE: Role in Operatory Room

- **Sub-aortic membrane**
- Circumferential membrane in the LVOT just before the aortic valve causing a fixed sub-aortic obstruction.
- Relation of this membrane to the aortic cusps
- Aortic regurgitation.
- Gradient across LVOT
- Visualize the complete excision of the membrane



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3D TEE

- 3D TEE is gaining popularity in assessing the intra-cardiac anatomy.

- 3D TEE has great impact in valve repairs in adult cardiac surgical patients.

Take Home Messages

- Intraoperative echo reduces the need for re-operation and then post-operative morbidity and mortality.
- Hemodynamic conditions influence the evaluation!!!

Intraoperative TEE in CHD

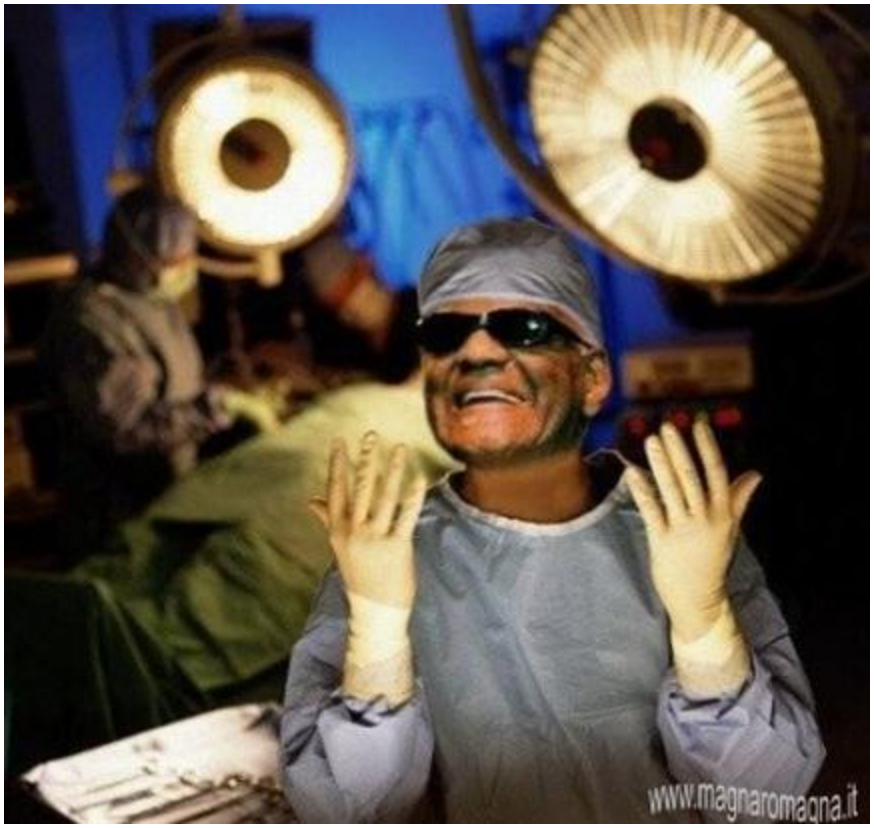
Conclusions

- Intra-operative TEE is a safe, reliable good diagnostictic modality, which provides a real-time assessment of surgical repair before removal of bypass cannulas and closure of the sternotomy.

- The introduction of a pediatric 3D TEE probe will help understand the complex intra-cardiac anatomy in a better way.

Cardiac Surgery and Intraoperative Echocardiogaphy

It is a team work



….Sometimes we are the eyes of our surgeons…