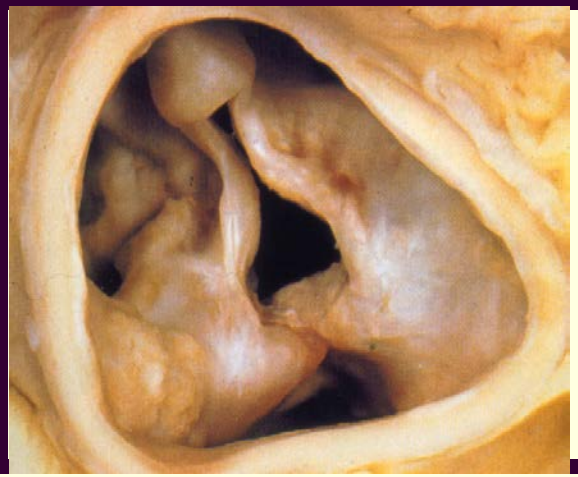
Ο ρόλος του Περιεγχειρητικού Echo κατά τη χειρουργική αντιμετώπιση των παθήσεων της αορτικής βαλβίδας



Effie Rouska, MD
Cardiologist
University Hospital of Larissa

All the cases presented in this lecture are patients cases from Glenfield Hospital, Leicester,UK

Acknowledgements

Effie ROUSKA, MD

I am indebted
to ***Dr Justiaan Swanevelder*** *and to* ***Dr Derek Chin***
for their constant support throughout my training
at Glenfield Hospital
and during the whole accreditation procedure

The revolution !

Past …….. Present

Transoesophageal stethoscope

Transoesophageal Echo probe

Which is the role of ITEE ?

- All pts with heart valve disease are accepted for surgery on the basis of TTE and/or TEE
- ITEE
  - *Diagnostic function*
    - Refine the diagnosis
    - Change the operative plan
    - Complications
  - *Monitoring function*
  - *Assess the result*

Definition

- Before cardiac surgery
- During cardiac surgery
- After cardiac surgery
- In intensive care unit

"When expertly used……."

"Performing a complete examination"

Cahalan MK, et al. American Society of Echocardiography and Society of Cardiovascular Anesthesiologists task force guidelines for training in perioperative echocardiography. Anesth Analg 2002;94:1384-8
Shanewise JS. Performing a complete transesophageal echocardiographic examination. Anesthesiol Clin North America 2001;19(4):727-67

Objectives

- Assists the surgeon with the planning of the operation
- Allows intraoperative monitoring
- Guides surgical manipulations
- Confirms the results of the operation

Y. Katsnelson, J. Roman, et al. Current state of intraoperative echocardiography. Echocardiography 2003; Vol. 20, NY. o 8.

Pre-op application

- Confirmation of the already existing diagnosis
- New findings – impact on surgery!
- Precise measurements upon the type of the operation

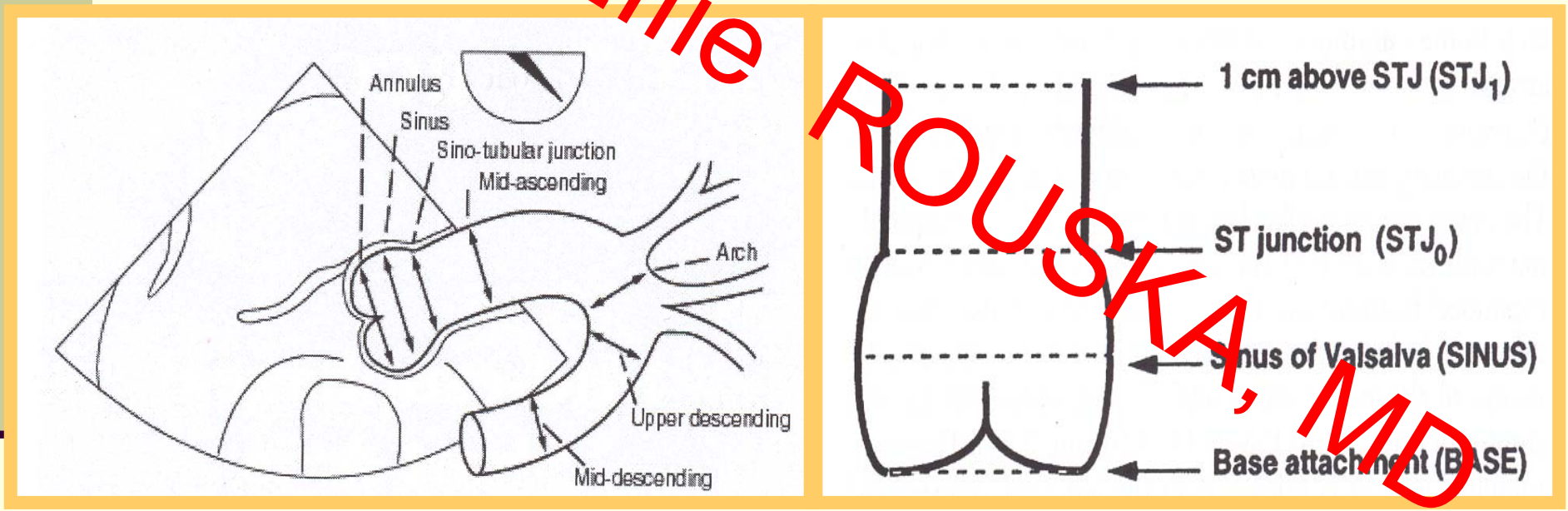
Principles of Assessment

- Severity of lesion
- Symptoms
- Left ventricular function
- Associated lesions
- Individual risk-benefit ratio

Most frequent pre-bypass TOE findings likely to affect the surgical plan

- ASD, patent foramen ovale
- Valvular disease: new or absent or of different severity, annulus sizing
- Global and regional LV and RV function not corresponding to preoperative findings
- Intracardiac thrombi
- Tumors
- Left superior vena cava
- Aortic atheromatosis

Use of TEE in Aortic Valve Surgery



- Precise measurements
- Decision upon the type of prostheses

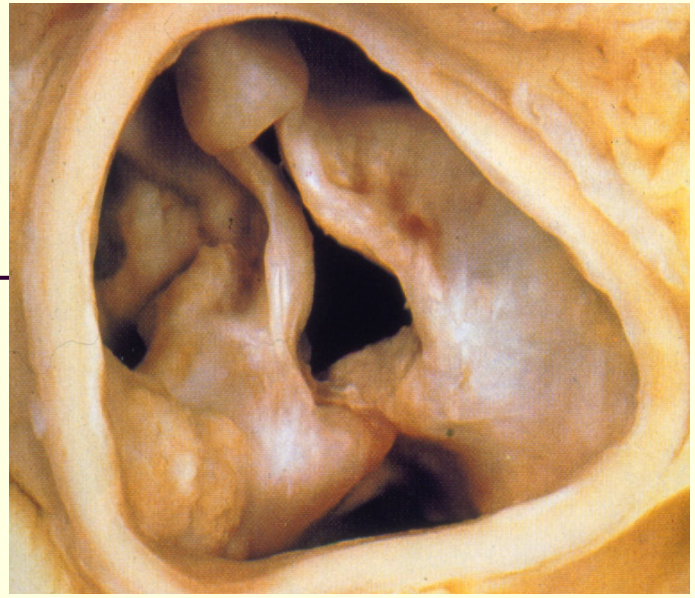
Intra-op application

- Intraoparative monitoring
  - TEE vs PAC or LVEDD vs PCWP/CVP
- Guide to positioning of cannulae / surgical manipulations
- Inadequate venous drainage
- Distribution of cardioplegia (*contrast echo*)
- Minimization of the risk of air embolization
- Assistance in weaning from CPB

Post-op application

- Direct assessment of the surgical result
- New findings/complications
- Post op monitoring
- Guide to post op management

Aortic Valve diseases



- Pathology
  - Aortic regurgitation (AR)
  - Aortic stenosis (AS)
- Surgery
  - Repair
  - Replacement
    - *Mechanical prostheses*
    - *Stented Bioprostheses*
    - *Stentless Xenograft*
    - *Homograft*
    - *Ross procedure*

Mechanical prostheses

Bileaflet Valve

Disk Valve

Valvular Bioprostheses

- Stented

- Stentless

Preoperative Predictors of Surgical Outcome in AV Disease

Severity of preoperative symptoms of reduced exercise tolerance
Severity of depression of left ventricular ejection fraction
Duration of preoperative left ventricular systolic dysfunction

ACC/AHA Practice Guidelines
Circulation 2006; 114:84-231

Surgical Risks

Immediate Outcome of AVR

- **Parsonnet score ≥ 20 ⇨ 31%mortality**

  Age70-74=7
  Aortic valve surgery=5
  AS gradient >120mmHg=7
  CABG at valve surgery=2
  LVEF 30-49%=2

- **Euroscore ≥ 6 ⇨ 11% mortality**

  Age70-74=3
  Other than isolated CABG=2
  Active Endocarditis=3
  Thoracic Aorta Surgery=3
  LVEF 30-50%=1

In Conclusion before Surgery

- Predict individual patient risk
- Avoid irreversible cardiomyopathy
- Consider concomitant dx
- Assess local surgical outcomes

Indications for AV Replacement or Repair? Timing for Surgery …

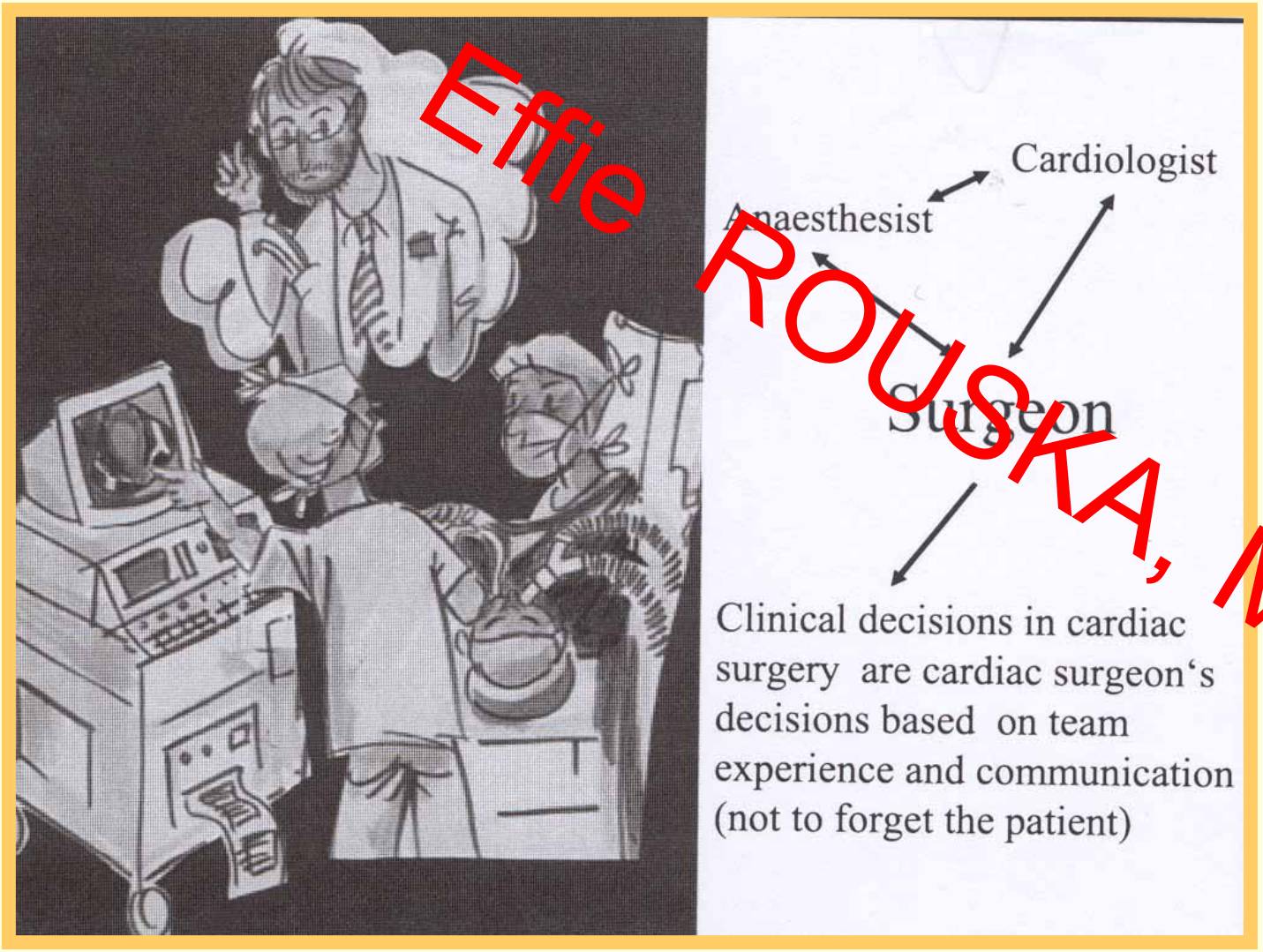
ACC/AHA Practice Guidelines
Circulation 2006;114:84-231

Planning the operation

Discussion between a Cardiac Surgeon and a Cardiologist

Defined roles

Team's communication



Pre-op ITEE evaluation of AR

- Define the AV structure
- Number of leaflets
- Movements of cusps (normal – restricted - excessive)
- Aortic root morphology
- Origin and direction of regurgitant jet
- Mechanism of AR

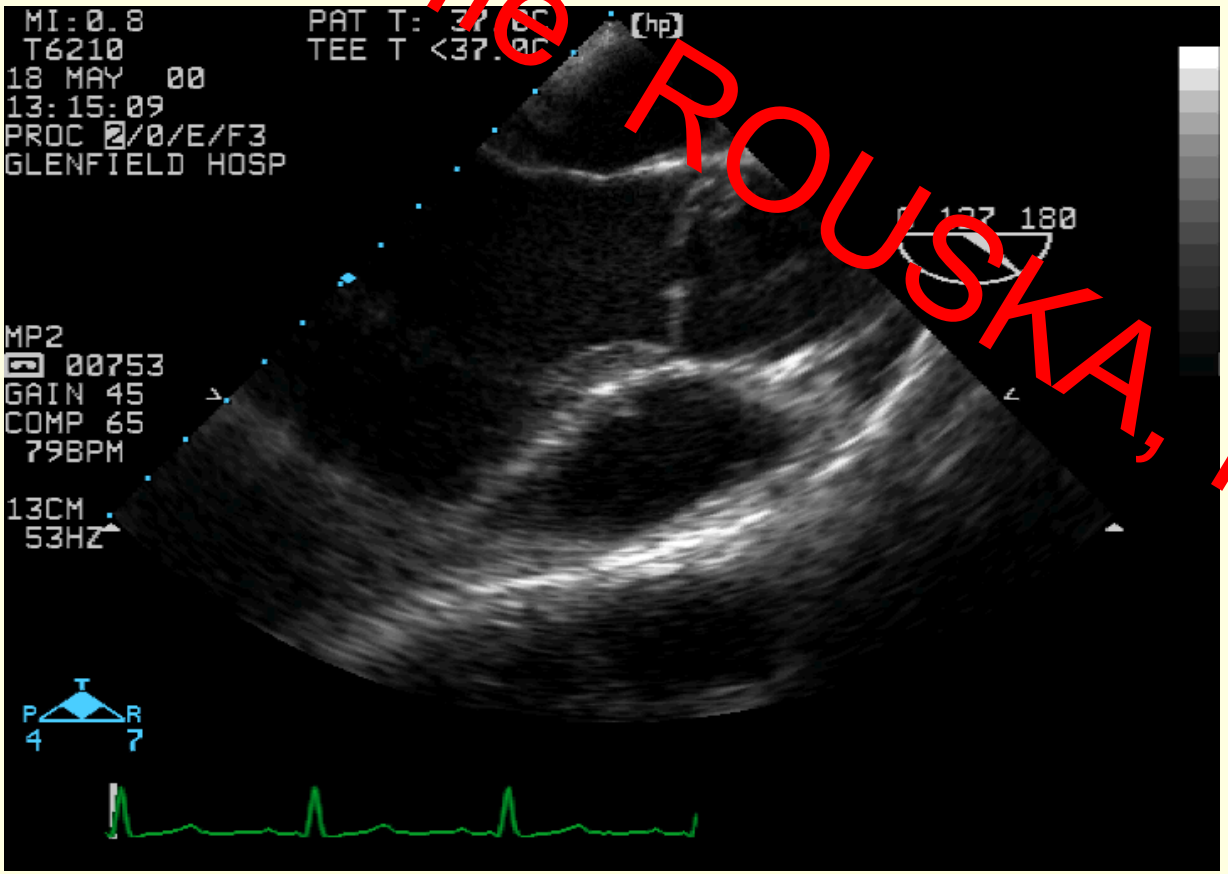
Coen GI, et al. J. Am. Soc Echo 1996;9:508

Aortic regurgitation - 2D

chamber enlargement/remodelling

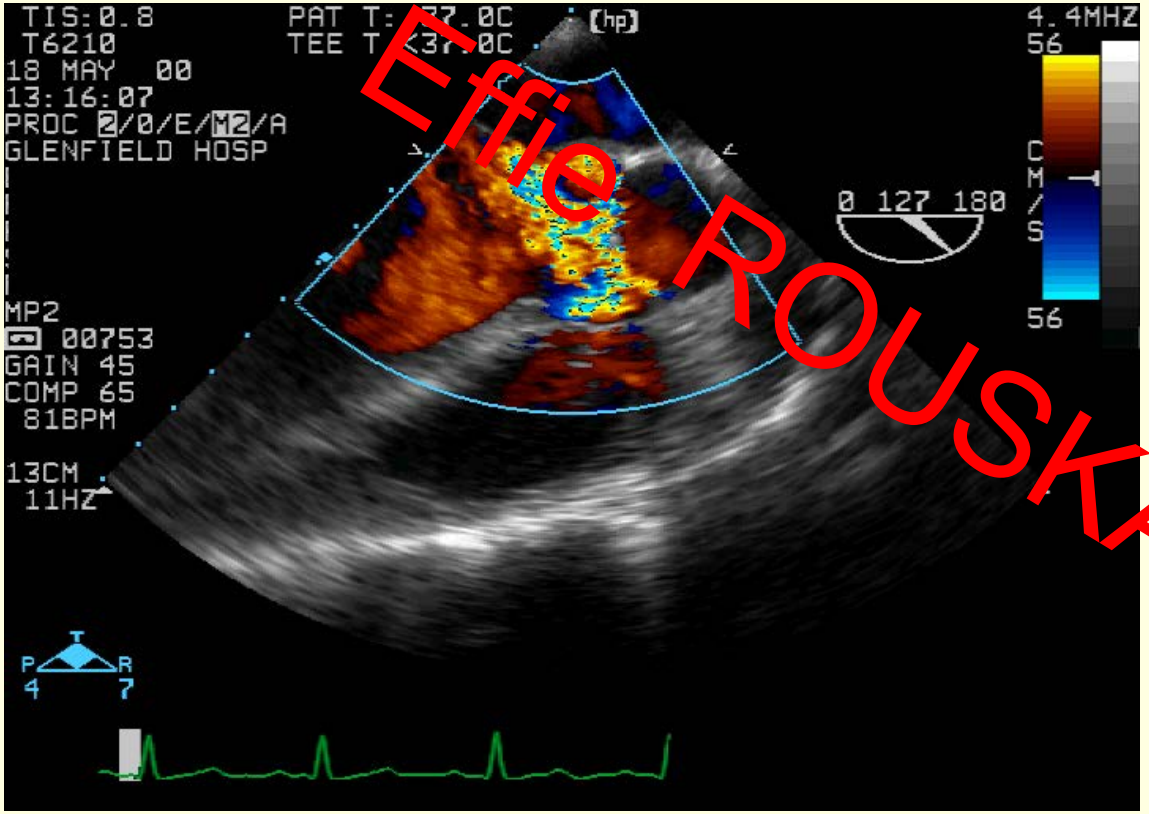
interpret within clinical context at time of examination

?intra-op, BP, medication?



Aortic regurgitation - 2D + CFD

- Flow convergence
- Vena contracta
- Jet direction and size



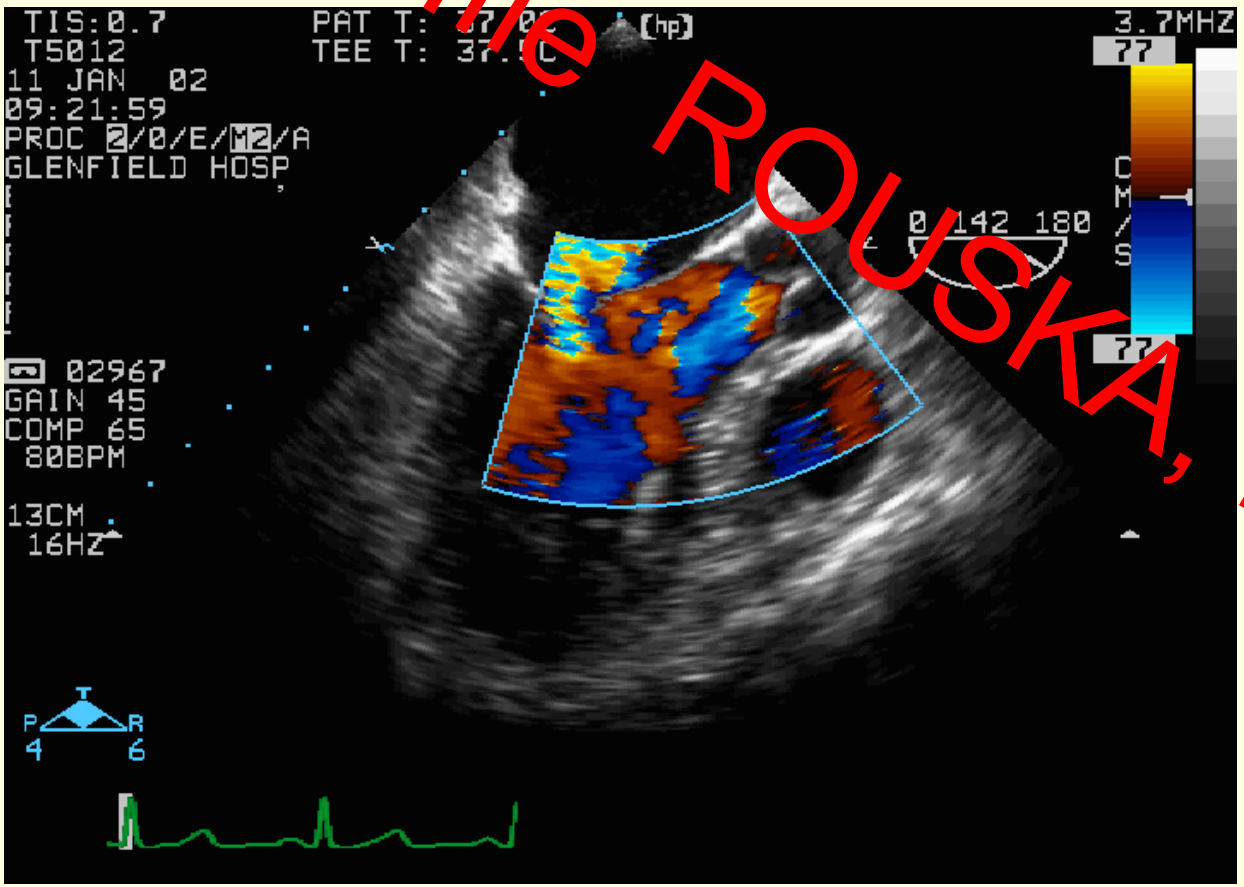
Use with caution!

Zoghbi WA, et al. Recommendations for evaluation of the severity of native valvular regurgitation with two-dimensional and Doppler echocardiography: a report from the ASE nomenclature and standards committee and task force on valvular regurgitation. J Am Soc Echocardiogr 2003;16:777-802

Aortic regurgitation - Perry Index

Perry GJ, et al. Evaluation of aortic insufficiency by Doppler color flow mapping. J Am Coll Cardiol 1987:952-959

Jet height / LVOT height ratio	Grade I	< 25%
	Grade II	25 - 46%
	Grade III	46 - 65%
	Grade IV	> 65%

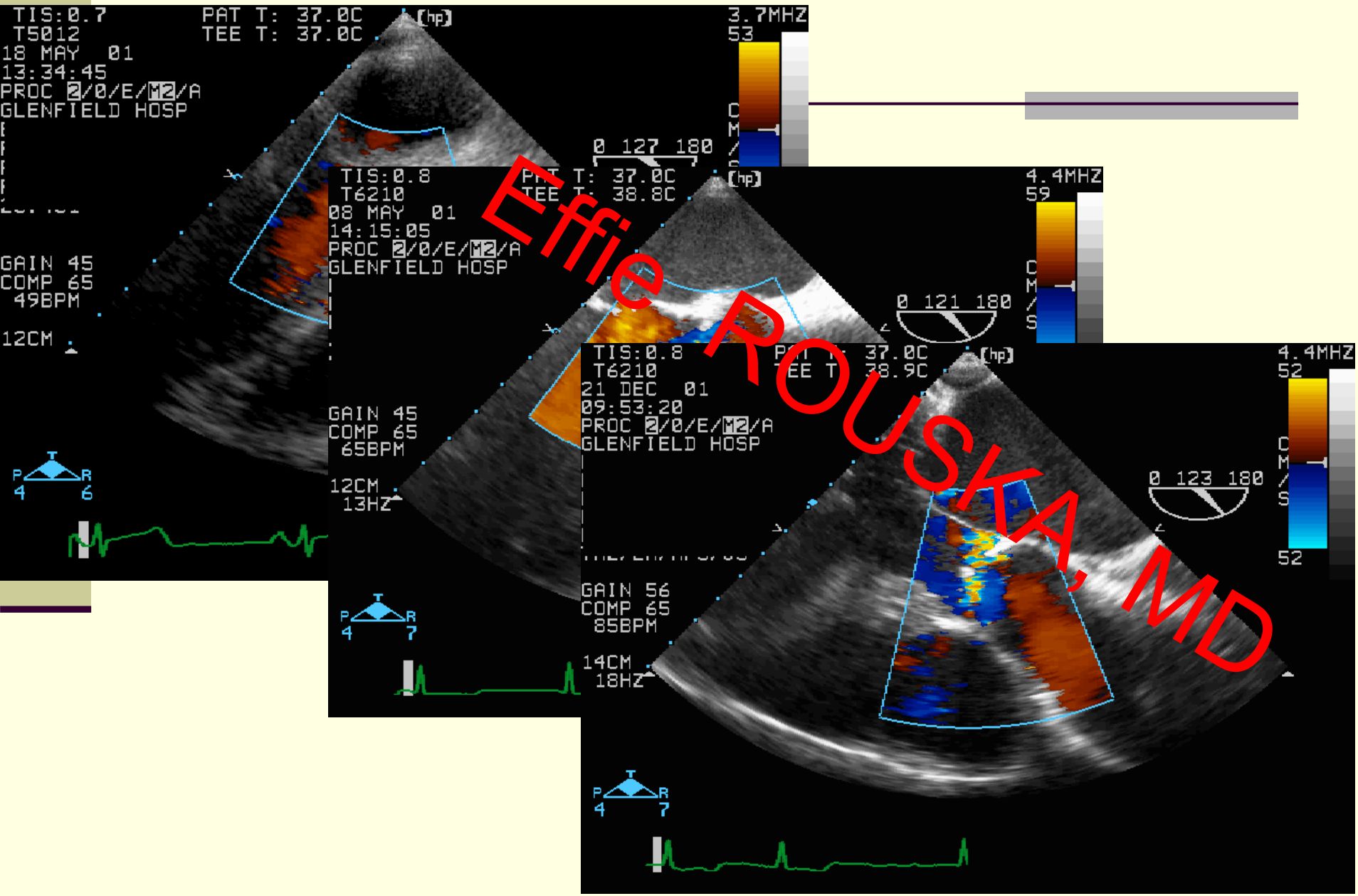


Grading Aortic Regurgitation

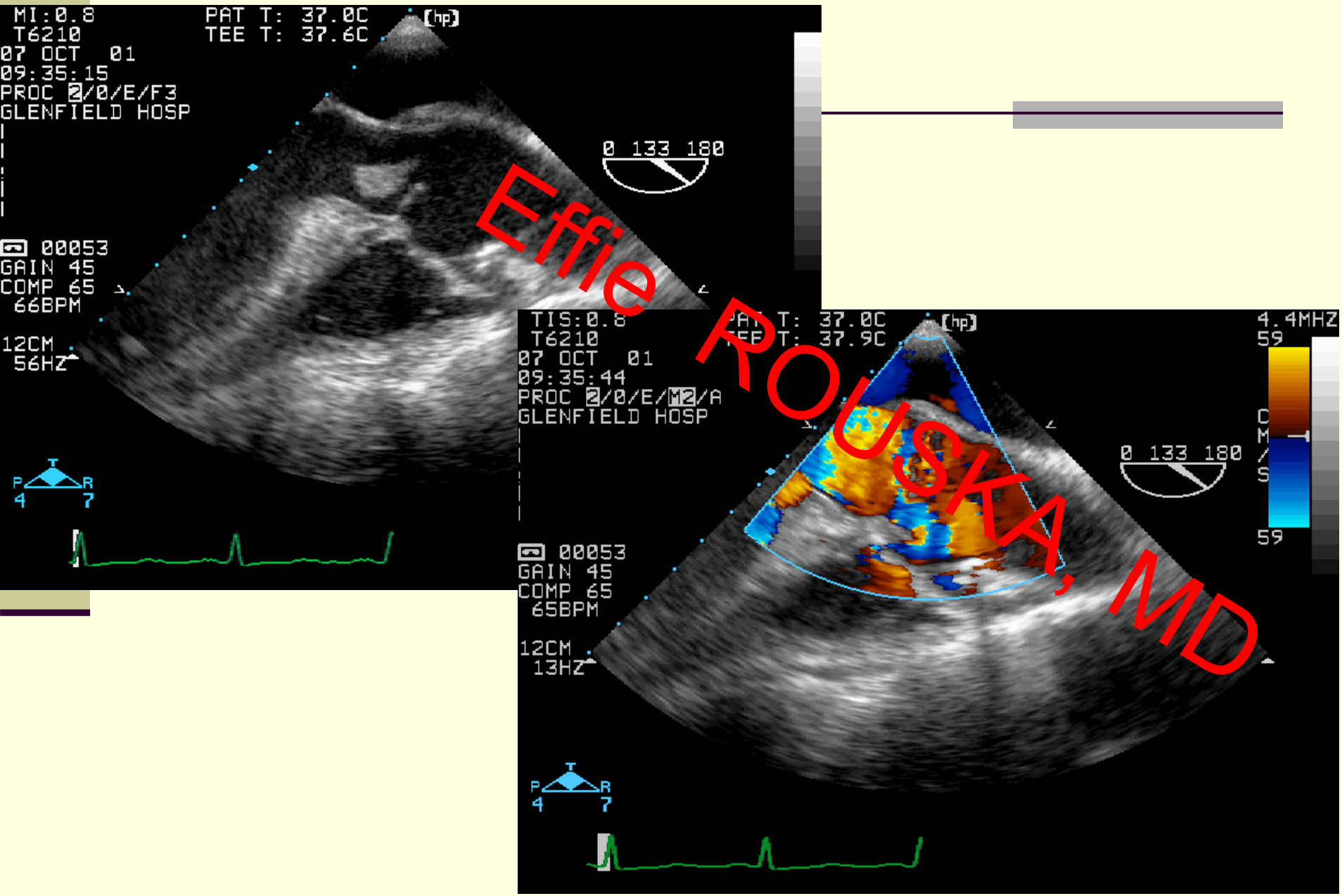
Grading Aortic Insufficiency

Severity of Aortic Insufficiency	Jet Width/LVOT Width Ratio (15)	Average Regurgitant Fraction (24)
1+	< 0.25	28%
2+	0.25 to 0.46	33%
3+	0.47 to 0.64	53%
4+	> 0.64	62%

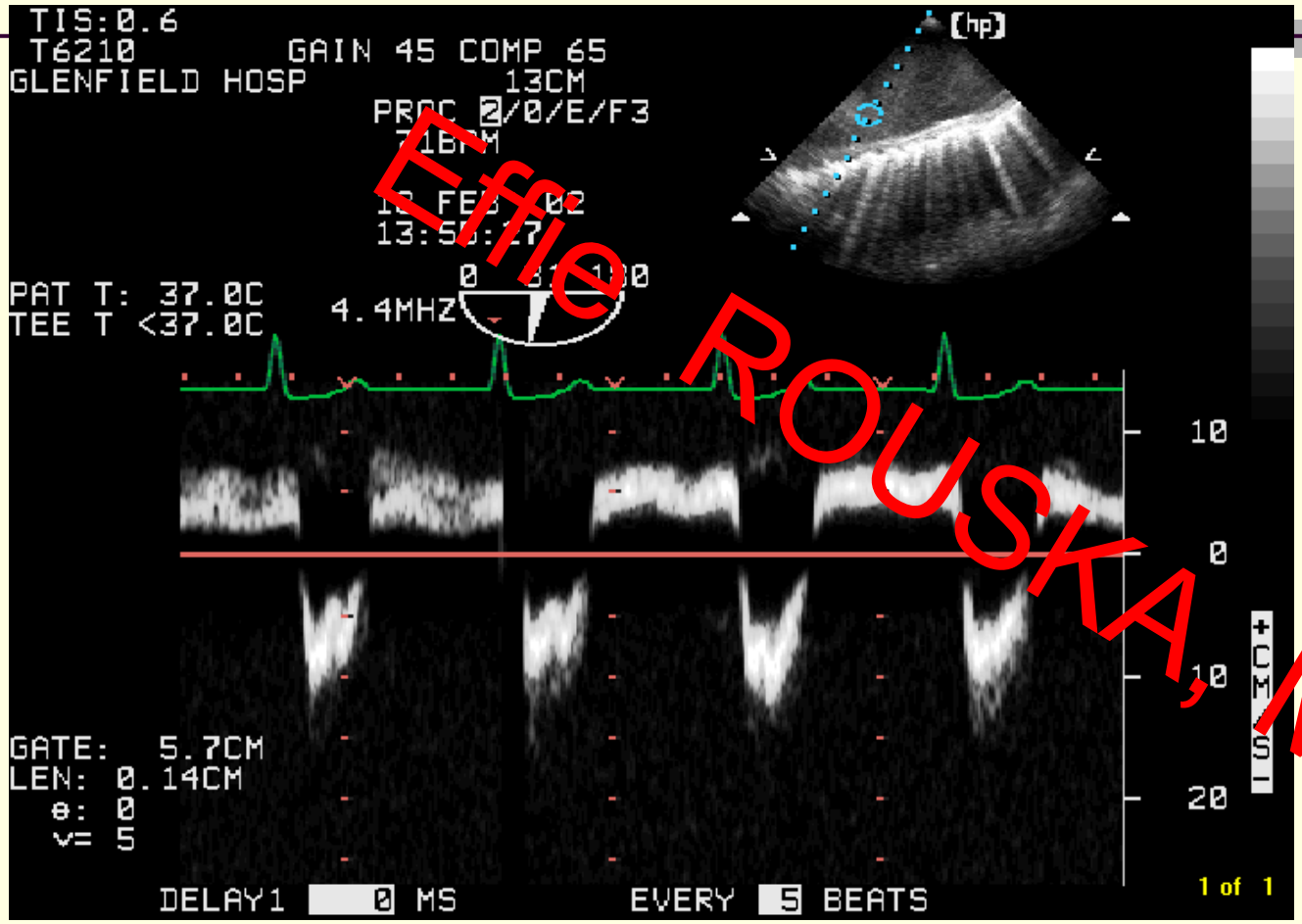
Vena Contracta - direction



Vena Contracta – leaflet prolapse



AR - holodiastolic flow reversal in descending aorta



Takenaka K, et al. Pulsed Doppler echocardiographic detection of regurgitant blood flow in the ascending, descending and abdominal aorta of patients with aortic regurgitation. J Cardiol 1987;17:301-309

Main objectives in theatres

- Clarification of the mechanism
  Plan of the operation

- Discussion with the surgeon

Functional classification for AR

El Khoury, Rubay, Noirhomme, d'Udekem, et al
University Hospital of Louvain, Brussels, Belgium

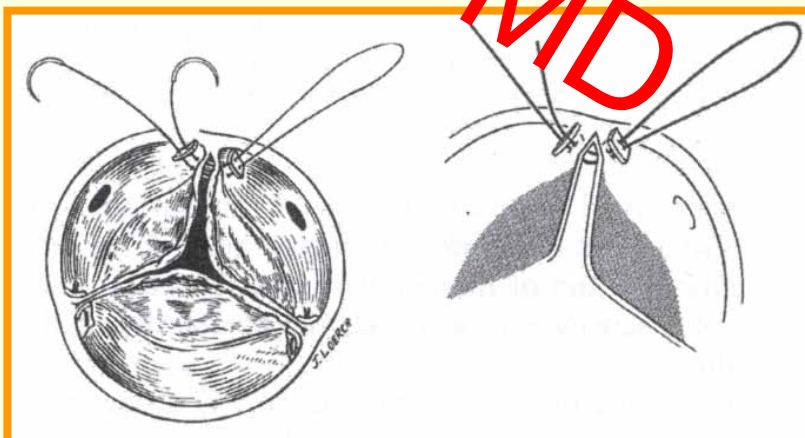
- **Type I** — normal cusp motion (central jet)
  - Type I a — STJ dilatation
  - Type I b — STJ + sinuses of Valsalva dilatation
    ?aneurysm, ?Marfan
  - Type I c — annular dilatation
    poor coaptation and apposition, ?aortic dissection
  - Type I d — leaflet defect / perforation
    ?endocarditis

- **Type II** — cusp prolapse (eccentric jet)
  excessive cusp tissue, commissural disruption + malpositioning, poor coaptation and apposition
  ?endocarditis

- **Type III** — restricted cusp motion (central jet)
  ?quadricuspid valve , ?unicuspid valve
  ?bicuspid valve, ?calcification

1. Normal leaflet structure and motion

- Echo findings
  - **Normal leaflets (motion and structure)**
  - **Severe AR**
  - **Central regurgitant jet**
- Pathology
  - Dilation of Ao Root
  - Dilation of sinotubular junction (STJ)
- Surgery
  - commisuroplasty

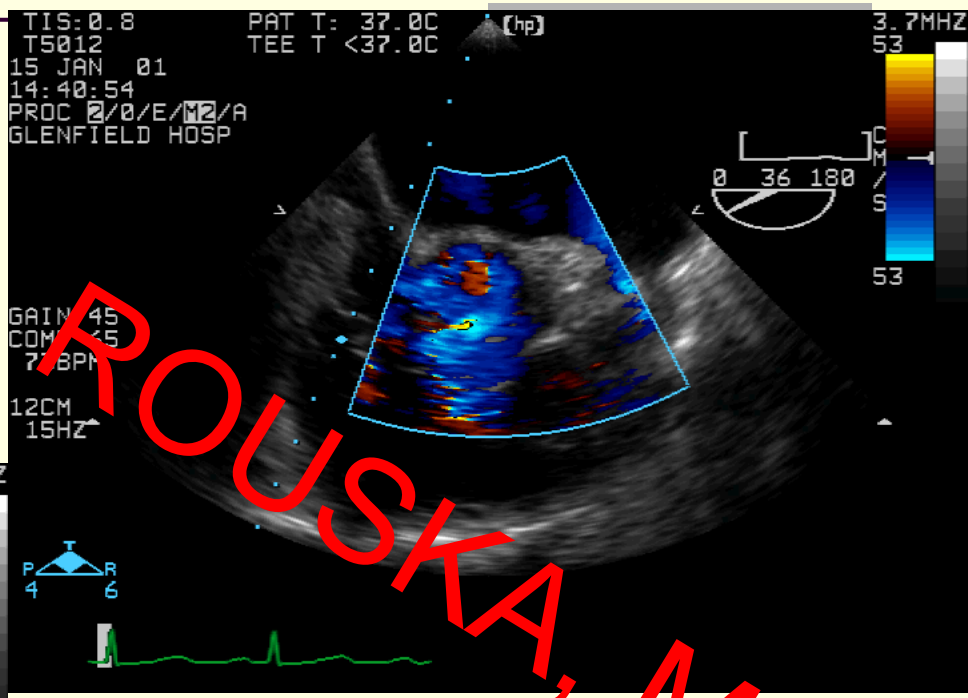


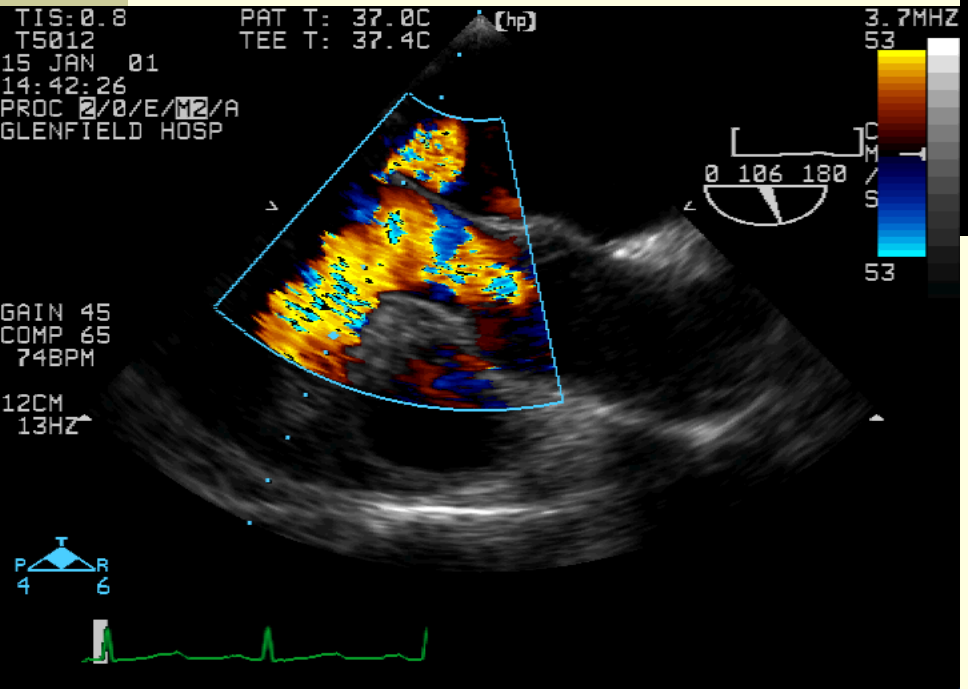
- Echo findings
  - **Normal AV**
  - **Severe AR**
  - AoR should be checked
- Pathology
  - Ao dissection should be considered
- Surgery
  - Resuspension of aortic valve
  - Valve sparing Aortic root replacement

Normal AoR

1. Symmetric sinuses
2. Valvular annulus 19-23 mm
3. STJ diametre 2-3 mm > valvular annulus

AR - Type I : normal cusp motion





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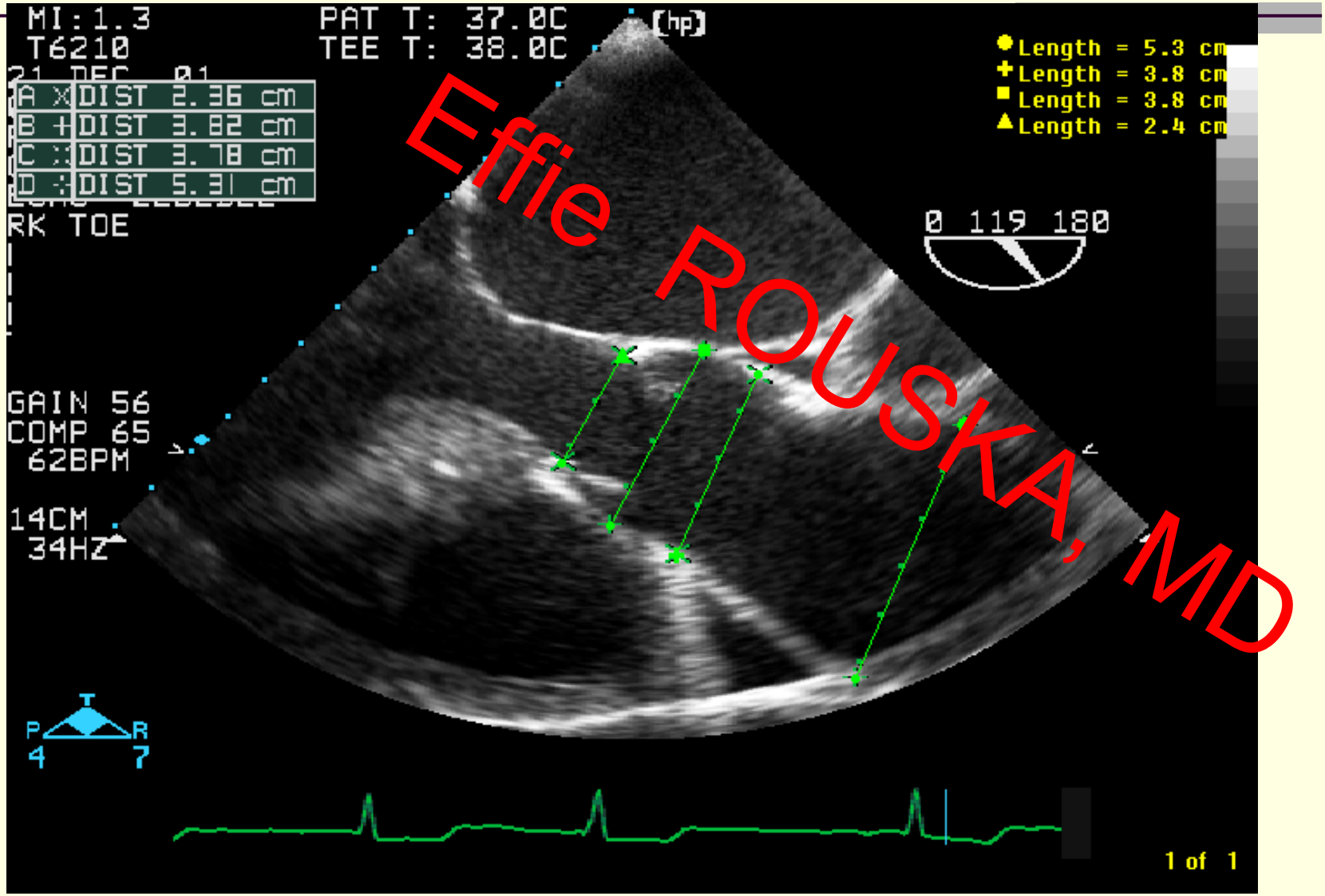
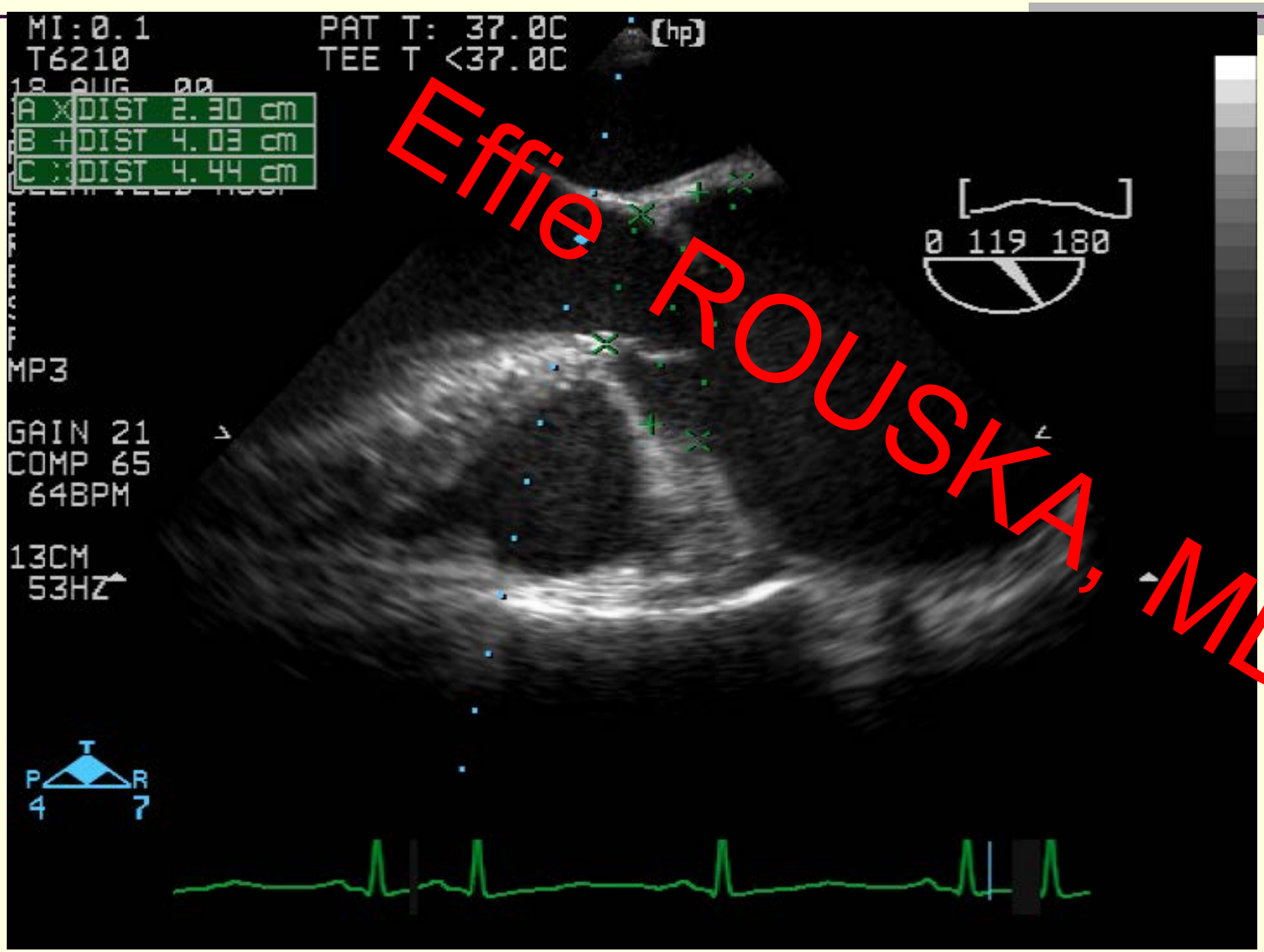
AR - Type I : normal cusp motion

I a : STJ dilated



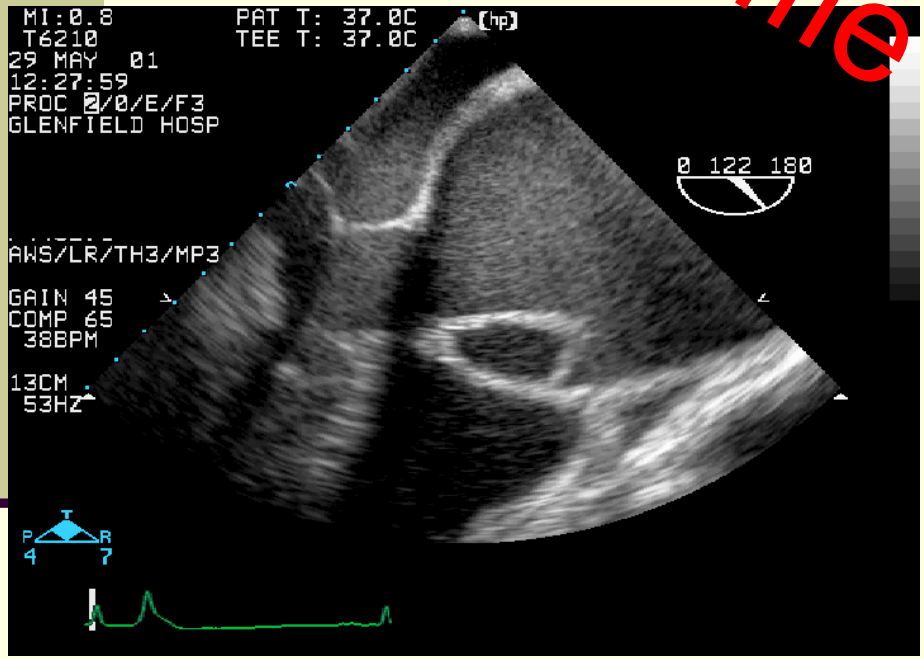
AR - Type I : normal cusp motion

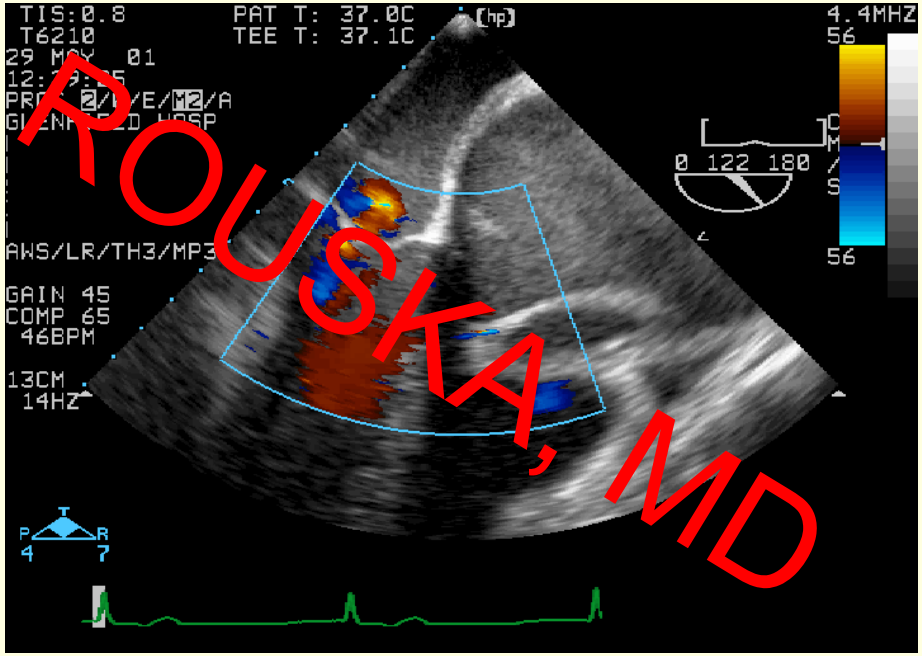
I b : STJ and sinuses of Valsalva dilated

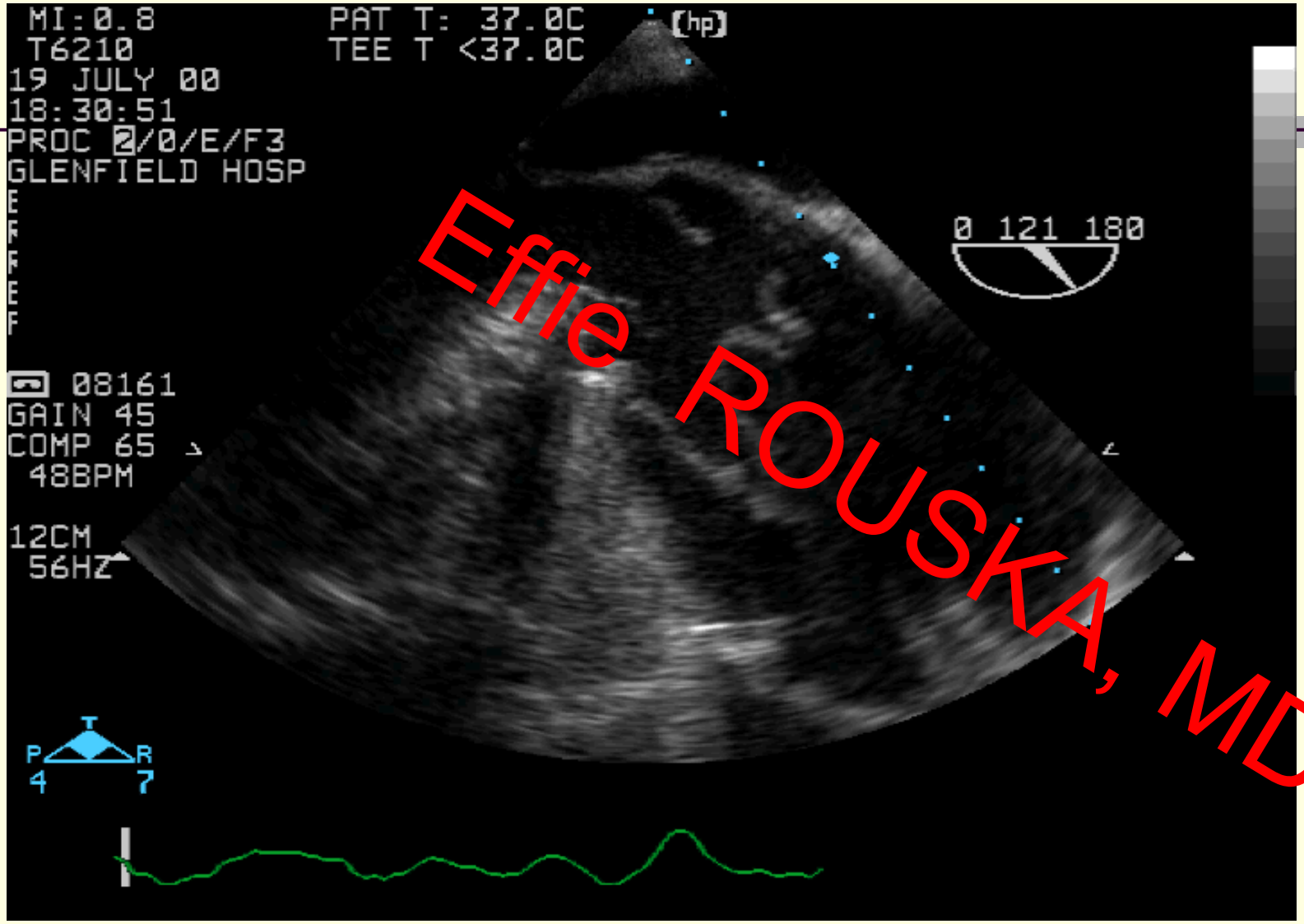


AR - ? Type I : normal cusp motion

I c : annular dilatation - dissection



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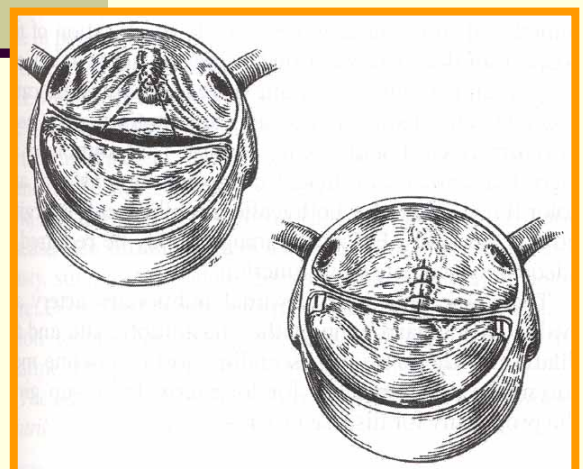
48BPM
12CM
56HZ
PAT T: 37.0C
TEE T <37.0C
(hp)
0 121 180
Effie ROUSKA, MD

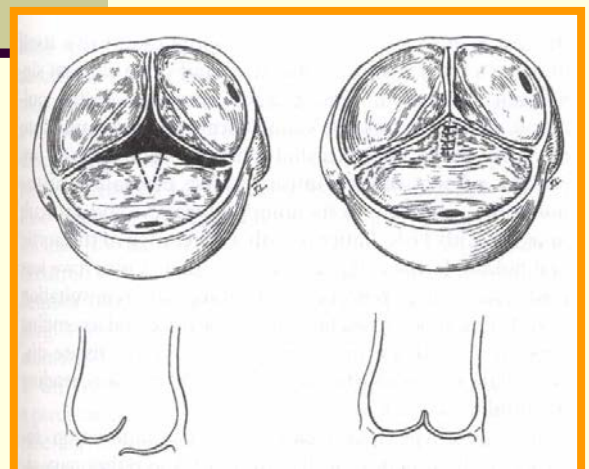
2. Excessive leaflet motion

- Echo findings
  - Excessive leaflet motion
- Pathology
  - Bicuspid AoV with redundancy & prolapse of fused cusp
- Surgery
  - Triangular resection & commisuroplasty



Fraser C, et al. Ann Thorac Surg 1994;58:386

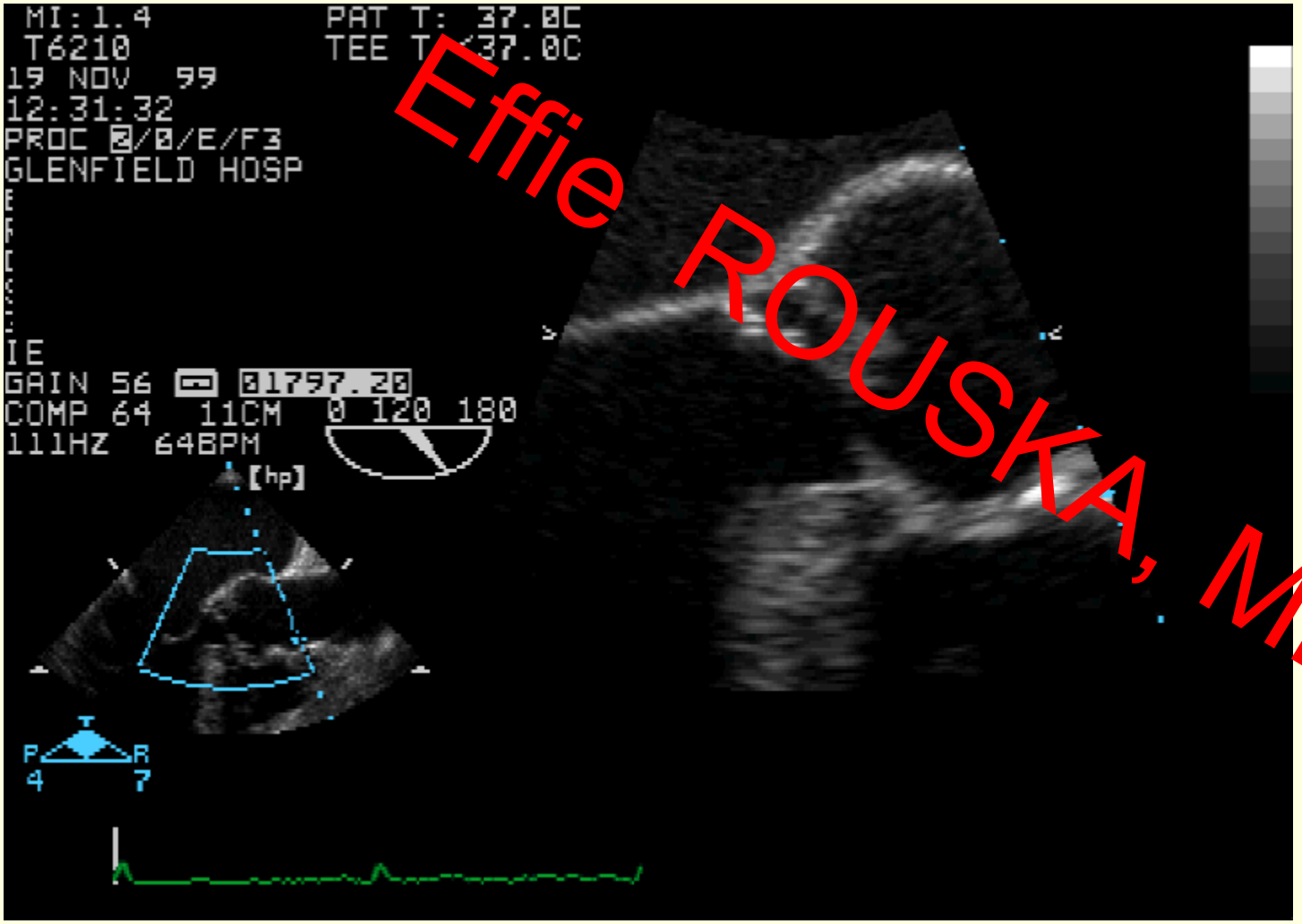
- Echo findings
  - Excessive leaflet motion
- Pathology
  - Tricuspid AoV with prolapse (commonly to RCC) due to leaflet fenestration
- Surgery
  - Triangular resection & commisuroplasty



Tatsuno K, et al. Circulation 1973;48:1028

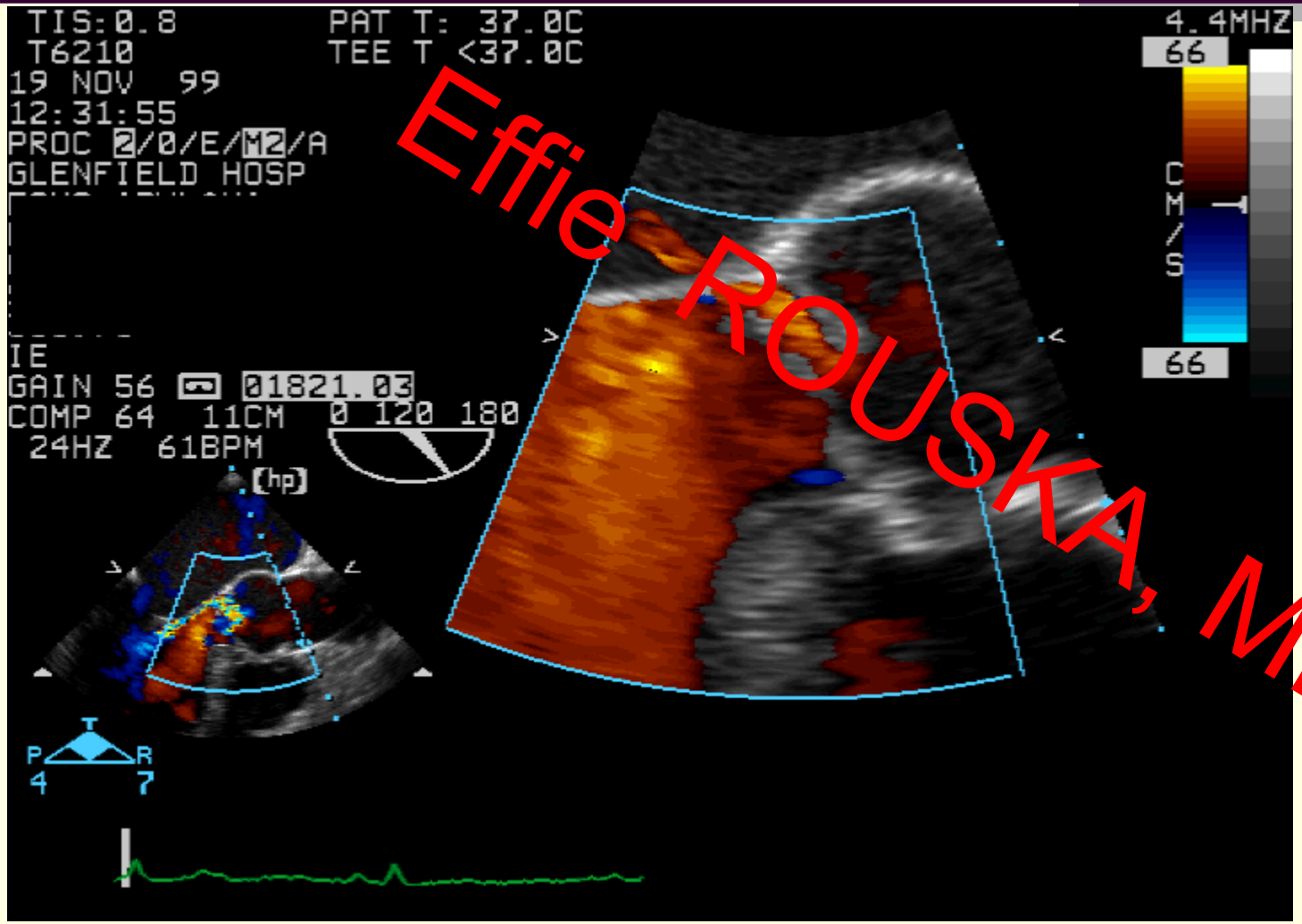
AR - Type II : cusp prolapse

? endocarditis



AR - Type II : cusp prolapse

? endocarditis

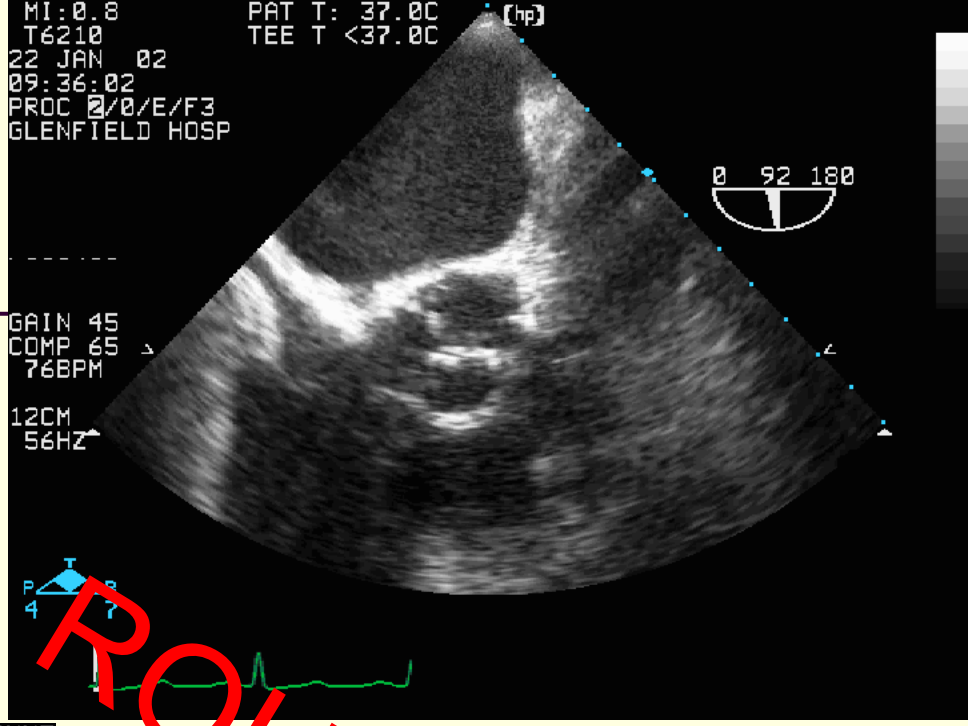


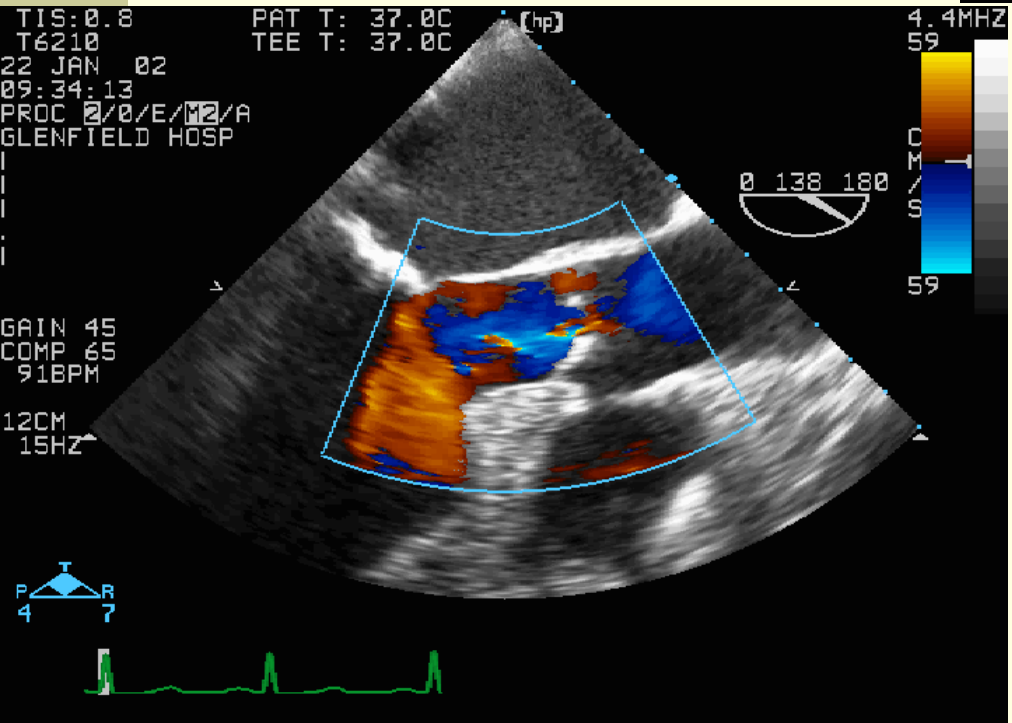
3. Restricted leaflet motion

- Echo findings
  - Restricted leaflet motion
  - Normal size AoR
  - Central regurgitation
  - Leaflet coaptation distal to the plane of the annulus
- Pathology
  - Degenerative – rheumatic – fibrocalcific AoV
  - Unicuspid/Bicuspid/Quadricuspid Aov
- Surgery
  - AVR, very rare AV repair

Duran CM, et al. J Cardiovasc Surg 1994;9:204

AR - Type III : restricted cusp motion





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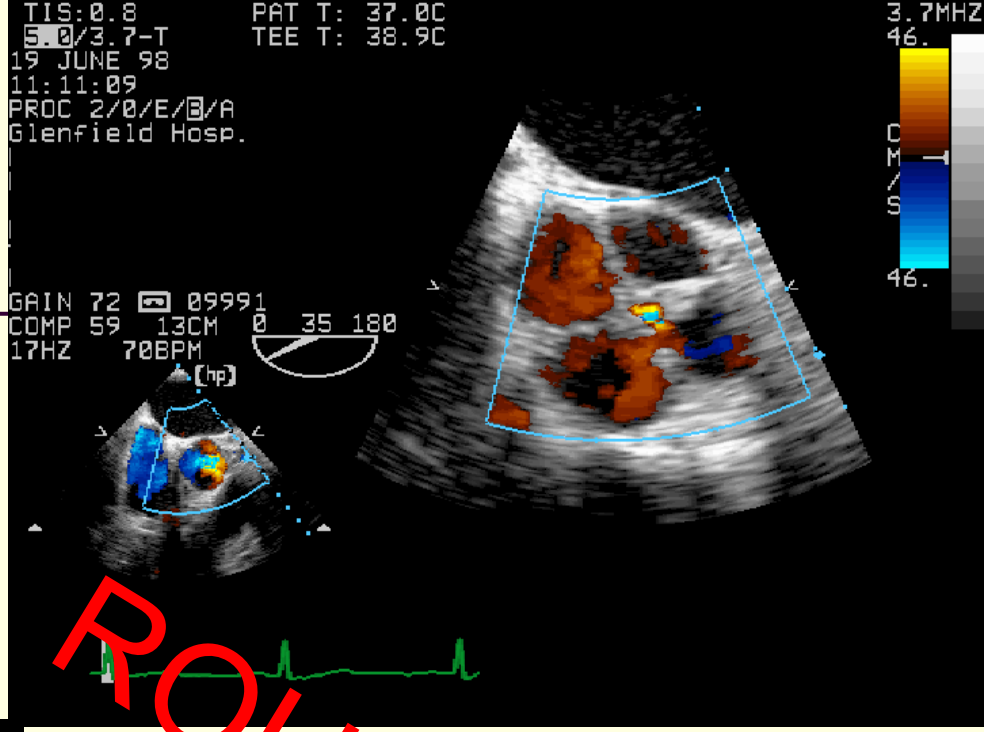
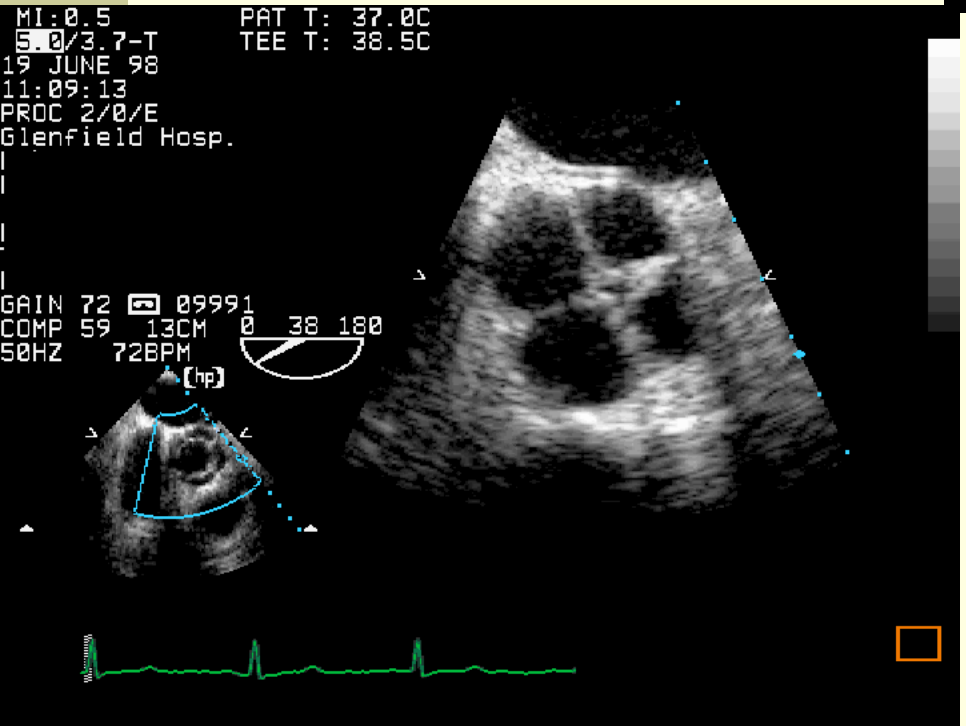
AR - Type III : restricted cusp motion

quadricuspid





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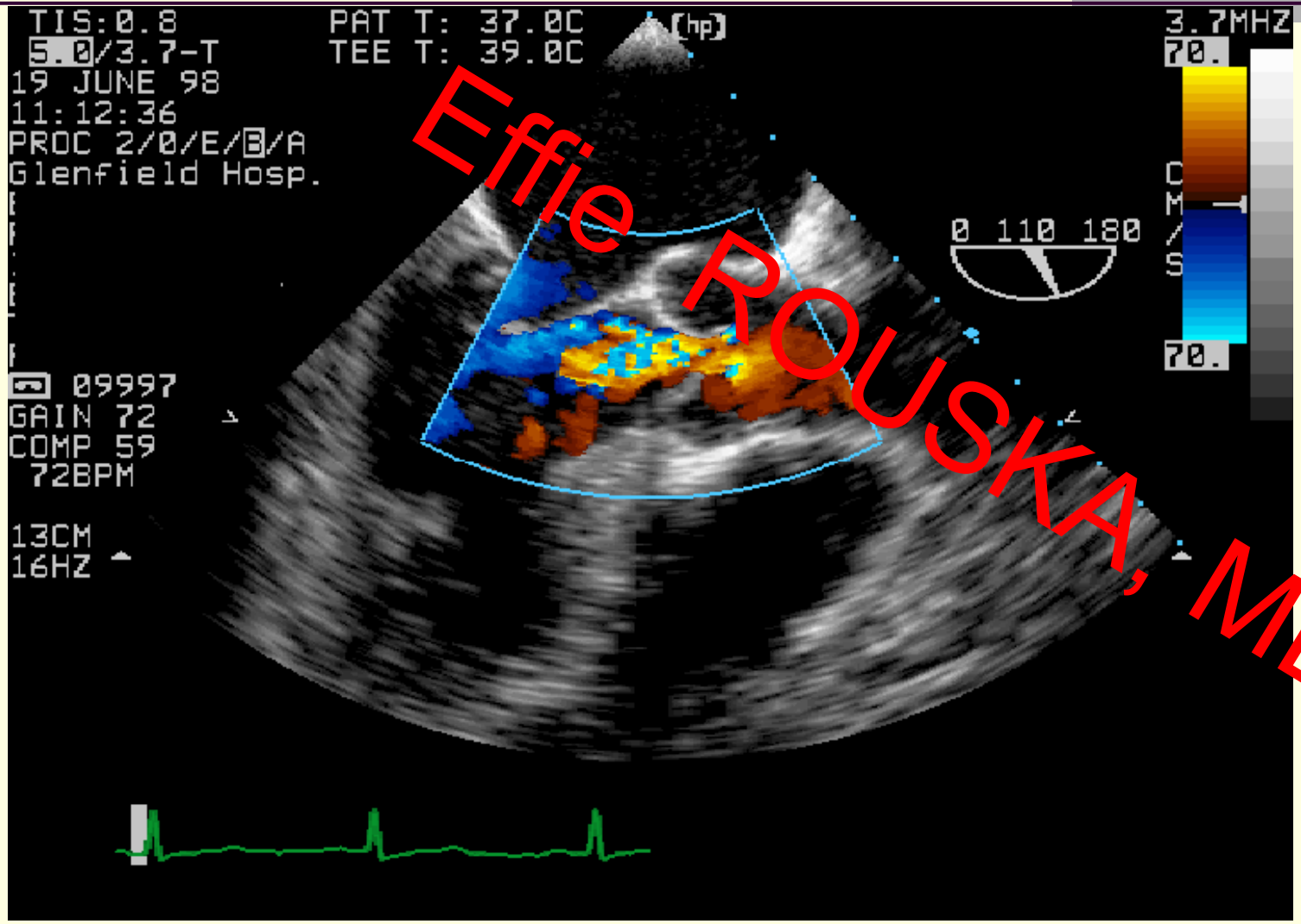
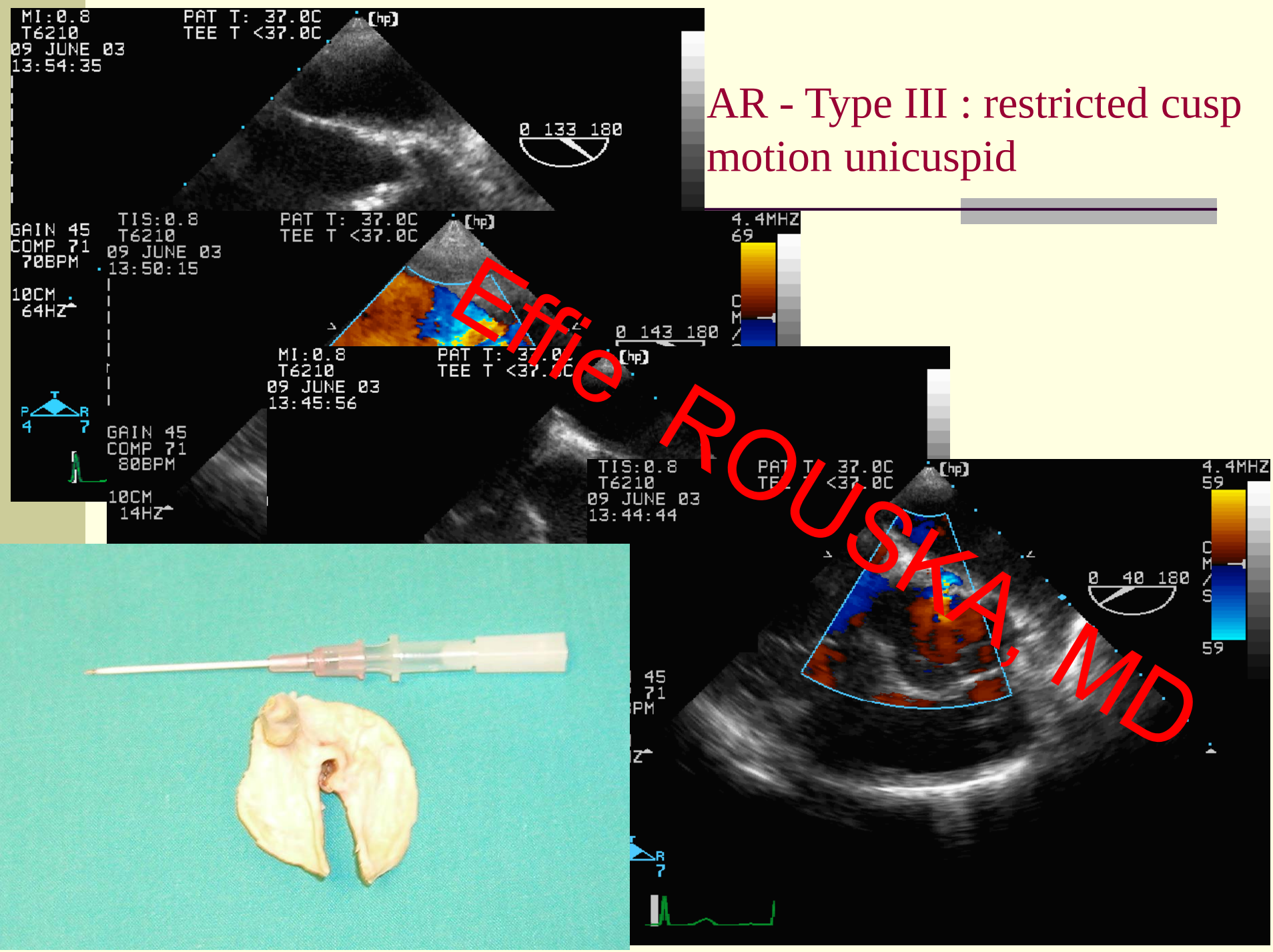
Rare – 0.008%

Cusp malcoaptation

AR - Type III : restricted cusp motion quadricuspid



AR - Type III : restricted cusp motion unicuspid

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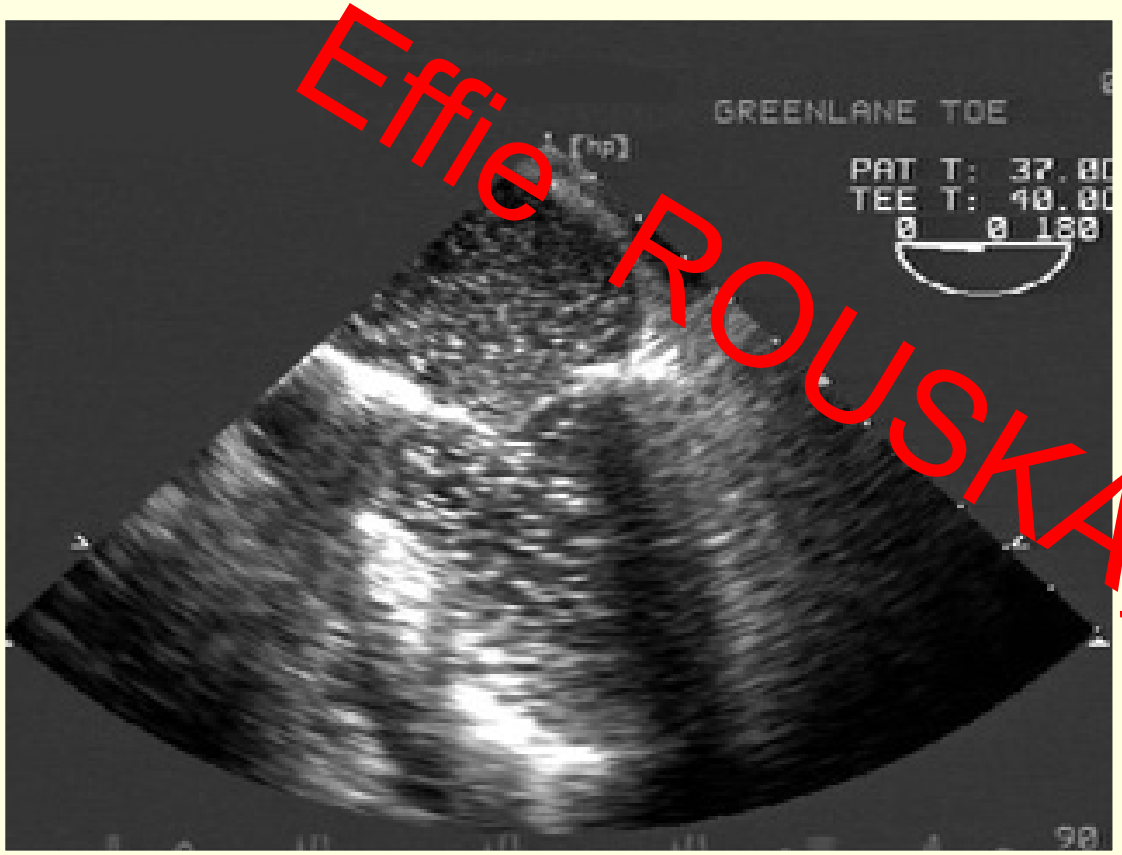
Air in the heart



TOE and evaluation of AV prosthesis

Post CPB

- Leaflet motion
- Prosthesis specific regurgitation
- Paravalvular leak?
- Transvalvular pressure gradient (CW-Doppler)
- LV outflow tract obstruction?
- LV wall motion

Post-op ITEE evaluation of

AV repair

- Valve morphology
  - Appears abnormal
    - Thickened leaflets
    - Bicuspid
    - Mildly stenotic
- Residual Aortic Regurgitation
  - Degree & Mechanism

If AR > grade 1 found is not accepted

Fraser C, et al. Ann Thorac Surg 1994;58:386

Post-op ITEE evaluation of AVR with
Stentless xenograft

- Residual Aortic regurgitation
  - Should not be if prosthesis is placed in subcoronary position
    - Degree
    - Leak (valvular or paravalvular)

Valvular : *minor AR is acceptable ,*
due to distortion/compression during insertion
>mild AR is unacceptable

Paravalvular : *technical fault*
should be corrected

Post-op ITEE evaluation of AVR with

Stentless xenograft

- Residual Regurgitant Jet (central or essentric)

Central : - *small bioprosthesis*

- *disproportion STJ / annulus* *

Eccentric : - *commissural pillars not aligned correctly*

* *Should be corrected*

- *Plication of AAo wall*
- *Wedge excision of non coronary sinus*

Post-op ITEE evaluation of AVR with *Stentless xenograft*

- Transvalvular residual gradient
  - Should not exceed 20 m Hg
  - After 6 months is getting lower
  - Pledgeted sutures can lead to obstruction
  - Differentiated from LVOT obstruction

Post-op ITEE evaluation of AVR with

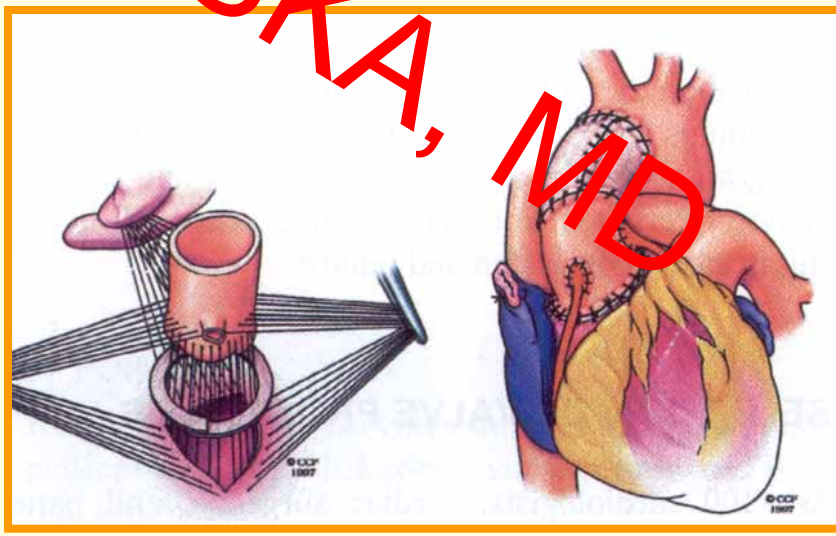
Aortic *Homograft – subcoronary implantation*

- Less easily inserted
  - Lack of stiffness
  - Commissures' orientation depends on surgeon
- Residual Aortic Regurgitation
  - Mild AR is seen in up to 20%
  - More than mild not accepted
- Residual Gradient
  - > 20% is uncommon
    - small aortic root → enlargement

Post-op ITEE evaluation of AVR with

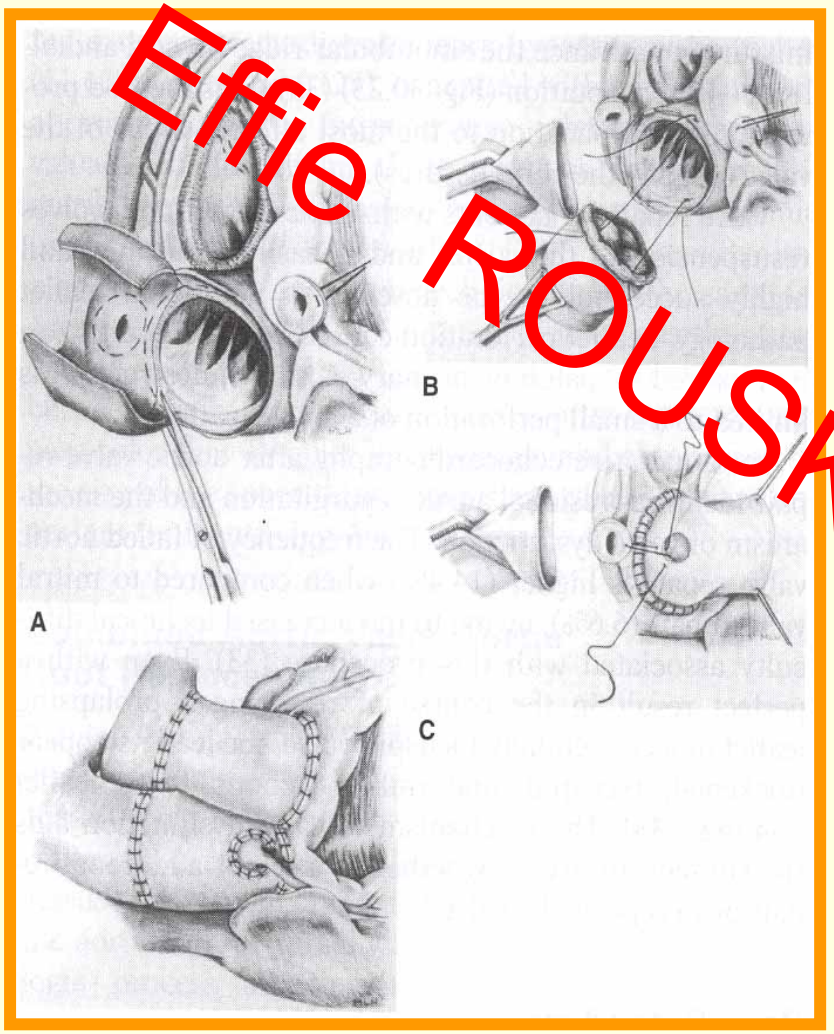
Aortic *Homograft – Root replacement*

- Residual Aortic Regurgitation
  - Only trivial is accepted
- Coronary implantation
  - Special care not to be distorted or kinked



Post-op ITEE evaluation of AVR with

Ross procedure



Post-op ITEE evaluation of AVR with *Ross procedure*

- Aortic annulus dilatation
  - Reduction aortic annuloplasty
  - Echo finding: thicken Aorta root
- Coronary implantation
  - Pulmonary wall elastic
    - Coronary ostia displaced cephalad
    - Prone to distortion
- Residual Gradient
  - Lower that any other prosthesis
  - 5-10mmHg at the surgery, 2-3mmHg after six months
- Assessment of pulmonic homograft
  - Pulmonary insufficiency
  - Pulmonary leaflets very thin

Post-op ITEE evaluation of AVR with

Homograft - Stentless xenograft – Ross procedure

- Complications
  - Loose suture line

    flow in the echo free space between graft and native aorta
  - Suture dehiscence / haematoma

    bulging of the graft

Petrou M, et al. Circulation 1994;90:II-198

Van Roosmalen R, et al. Int J Cardiac Imaging 1999;15:209

Post-op ITEE evaluation of LV function

- New LV wall motion abnormalities

  Coronary artery malperfusion

  1. Obstruction of coronary ostia by prostheses
     (AVR with mechanical or stented prostheses)
  2. Technical failure of button anastomosis
     (Bentall procedure)
  3. Kinking of coronary after implantation on graft
     (Bentall procedure)

- Pitfalls
  - Assessment of proximal flow of RCA & LCA

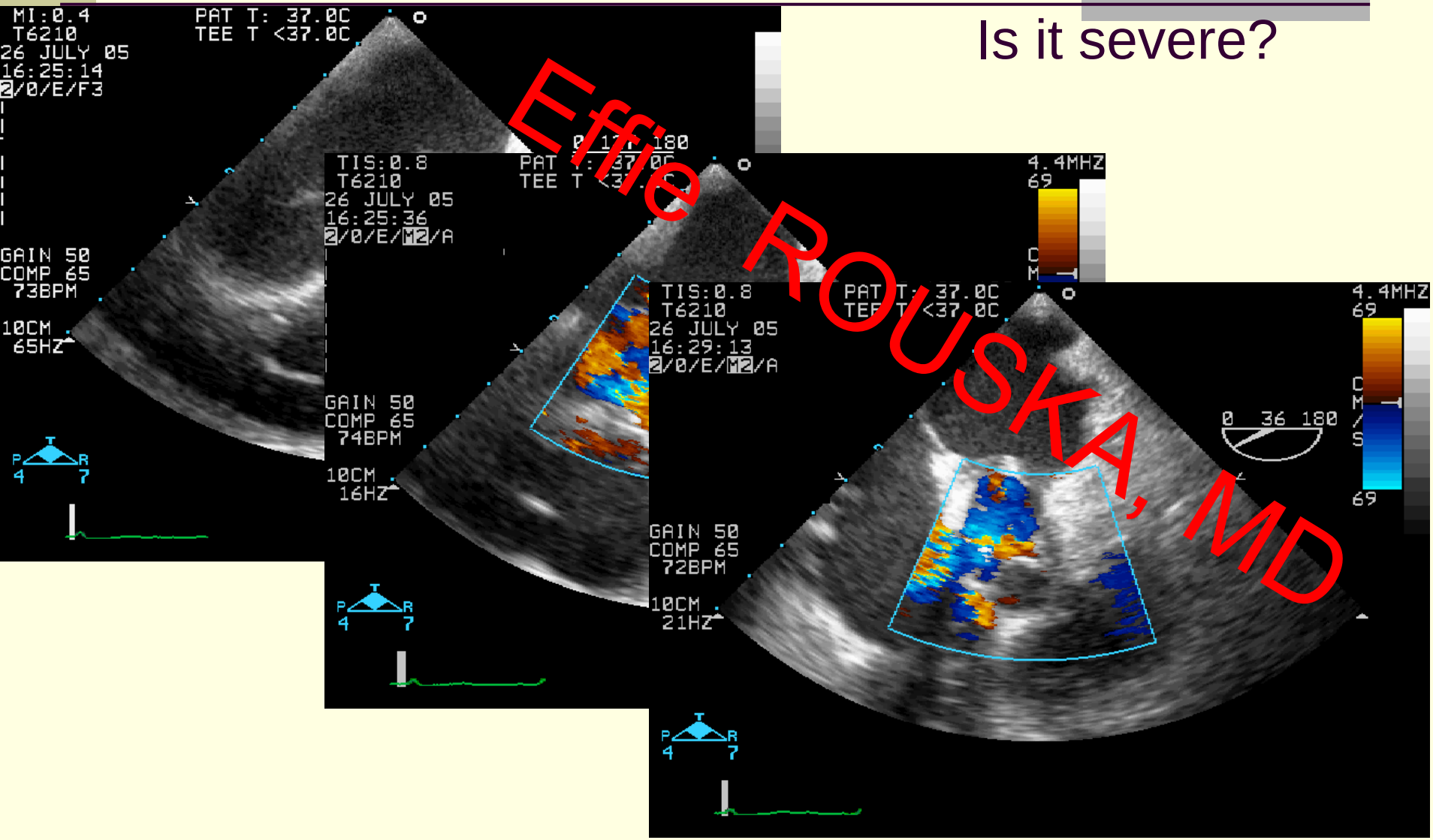
Let’s go in theatres now…

1

60 yr old female

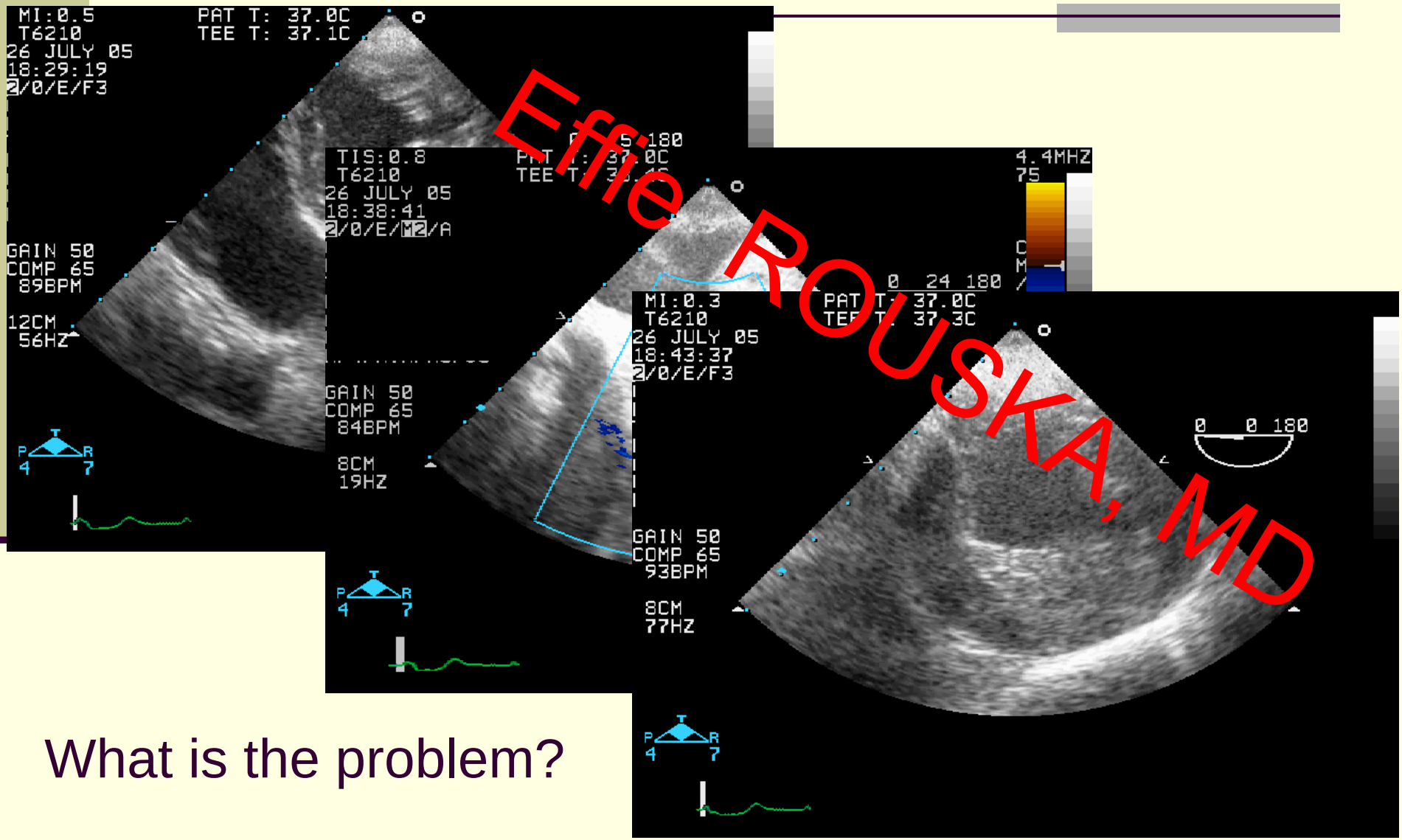
AVR - why?

Is it severe?



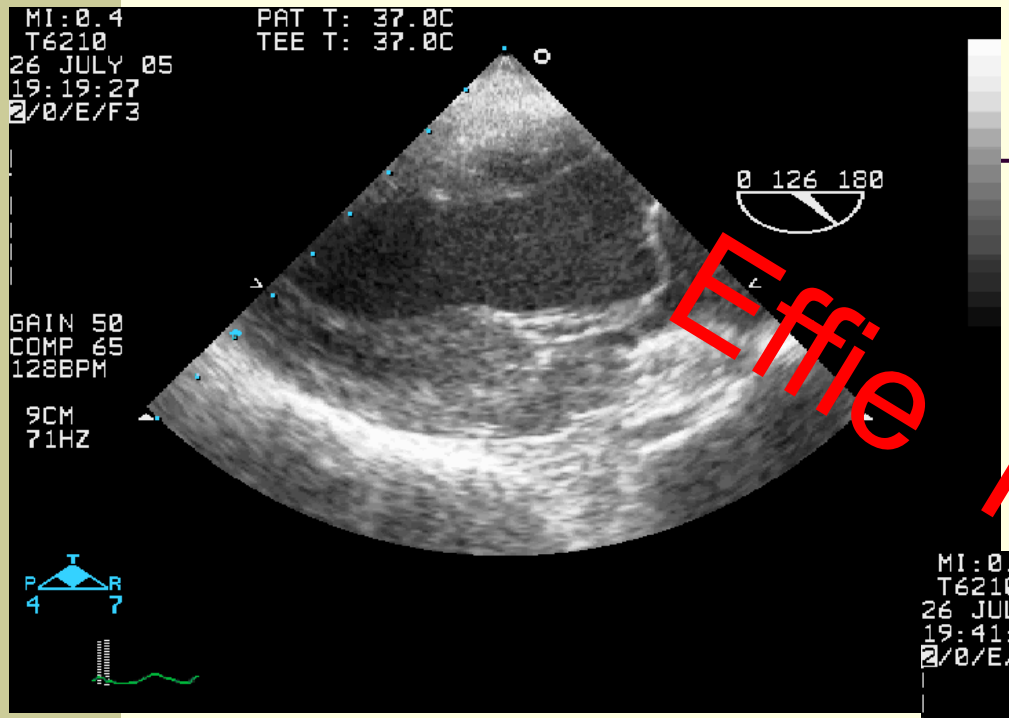
Stentless tissue valve

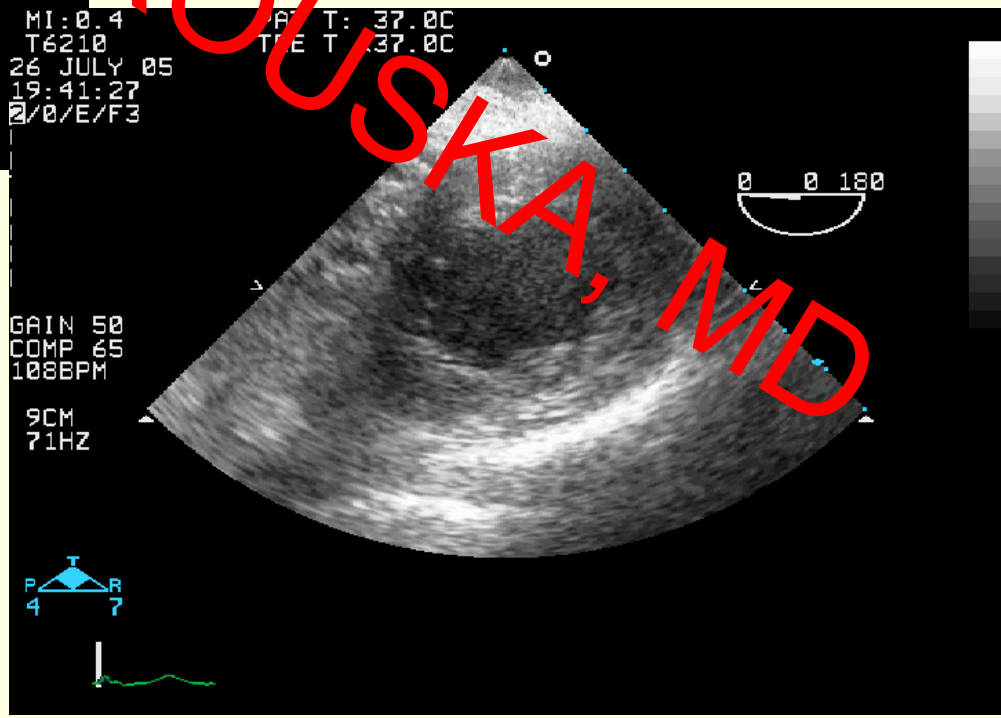
On separation from CPB



What is the problem?

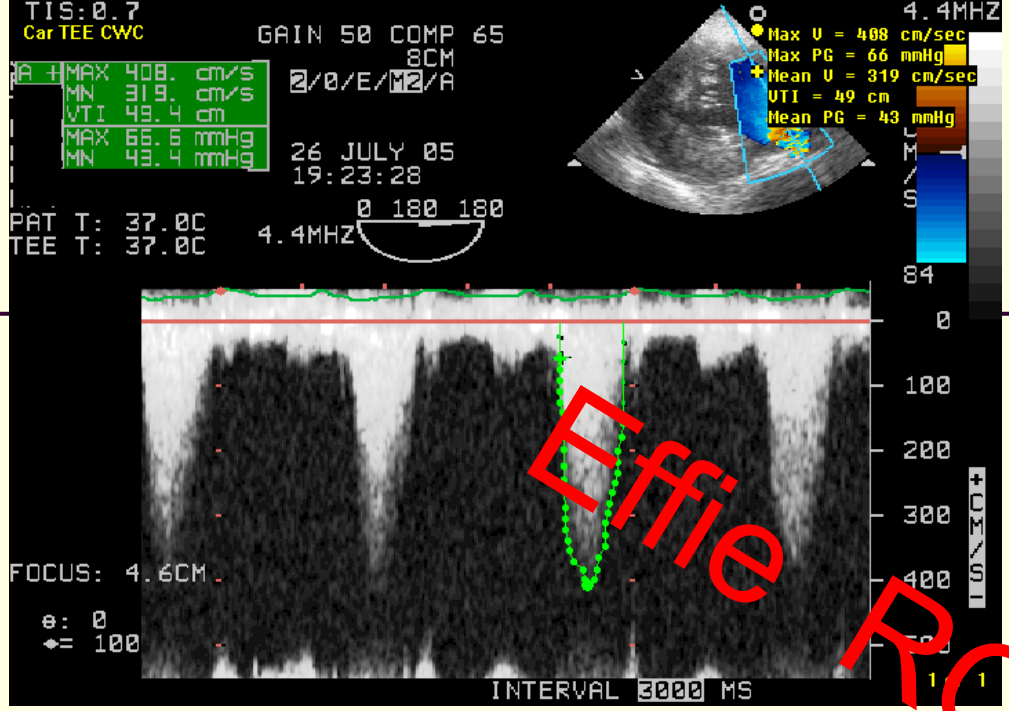
What can we do? What have we done?

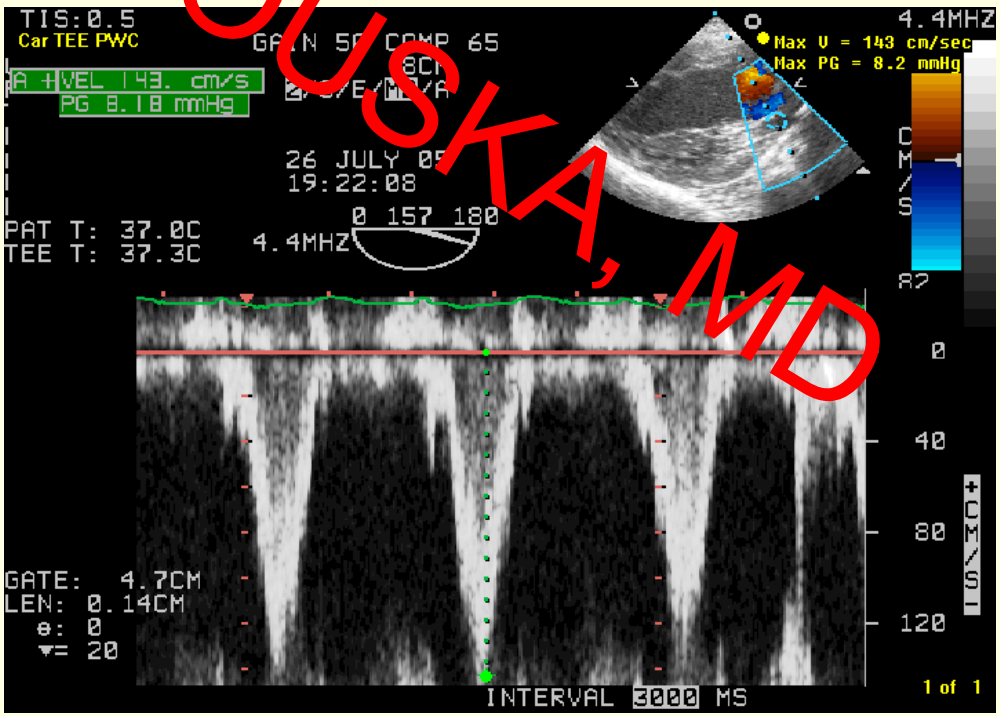




Effie ROUSKA, MD

Vein graft to RCA!

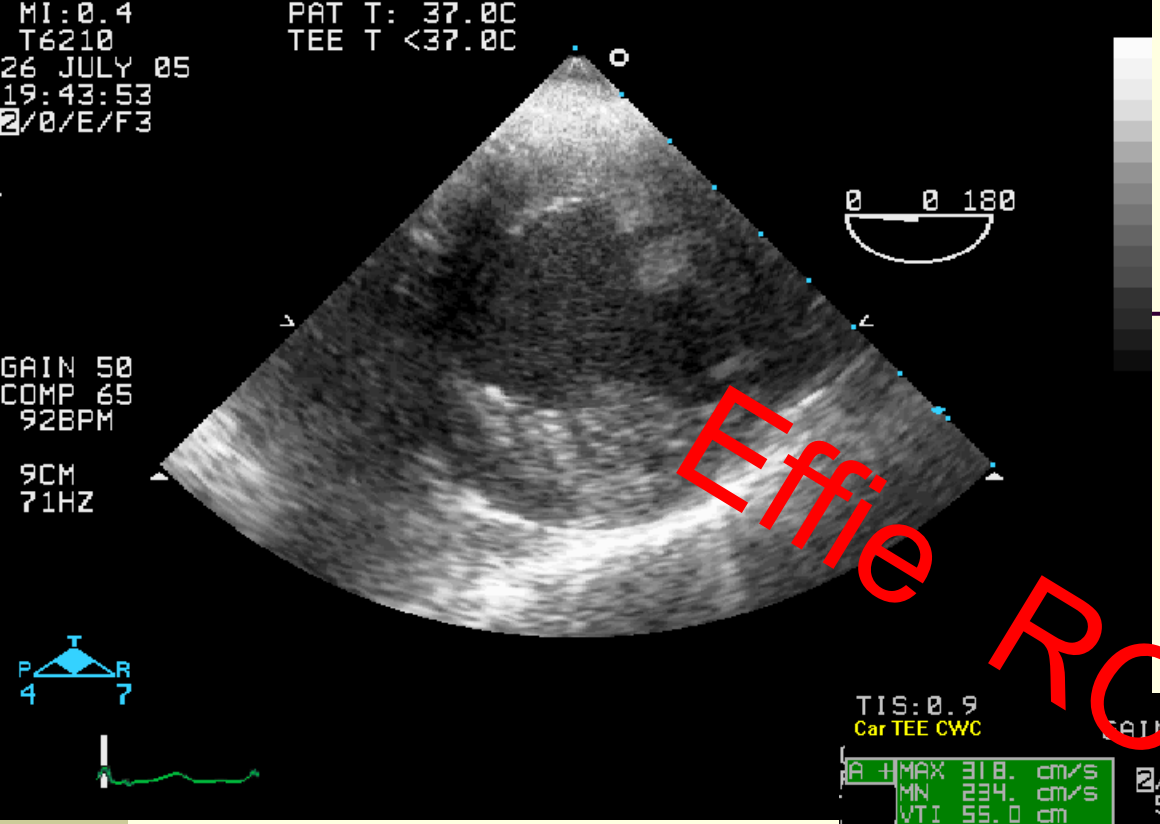


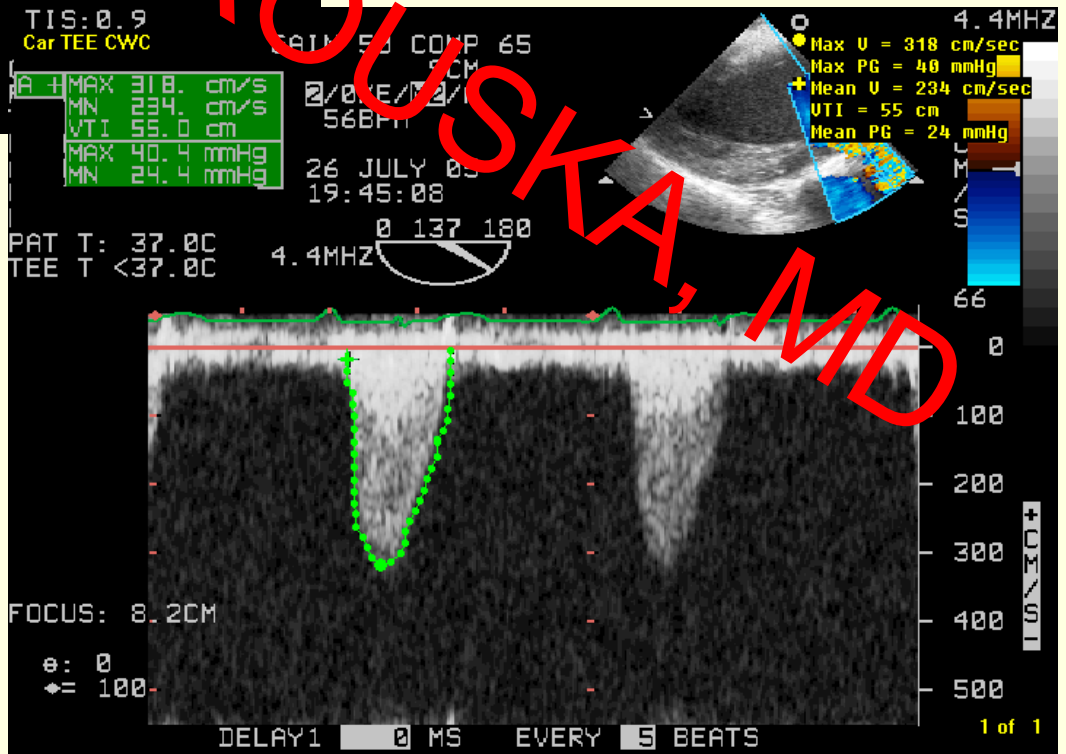


What about the gradient?

Pressure recovery?

Less inotropes
Better filling





Effie ROUSKA, MD

Decreasing!

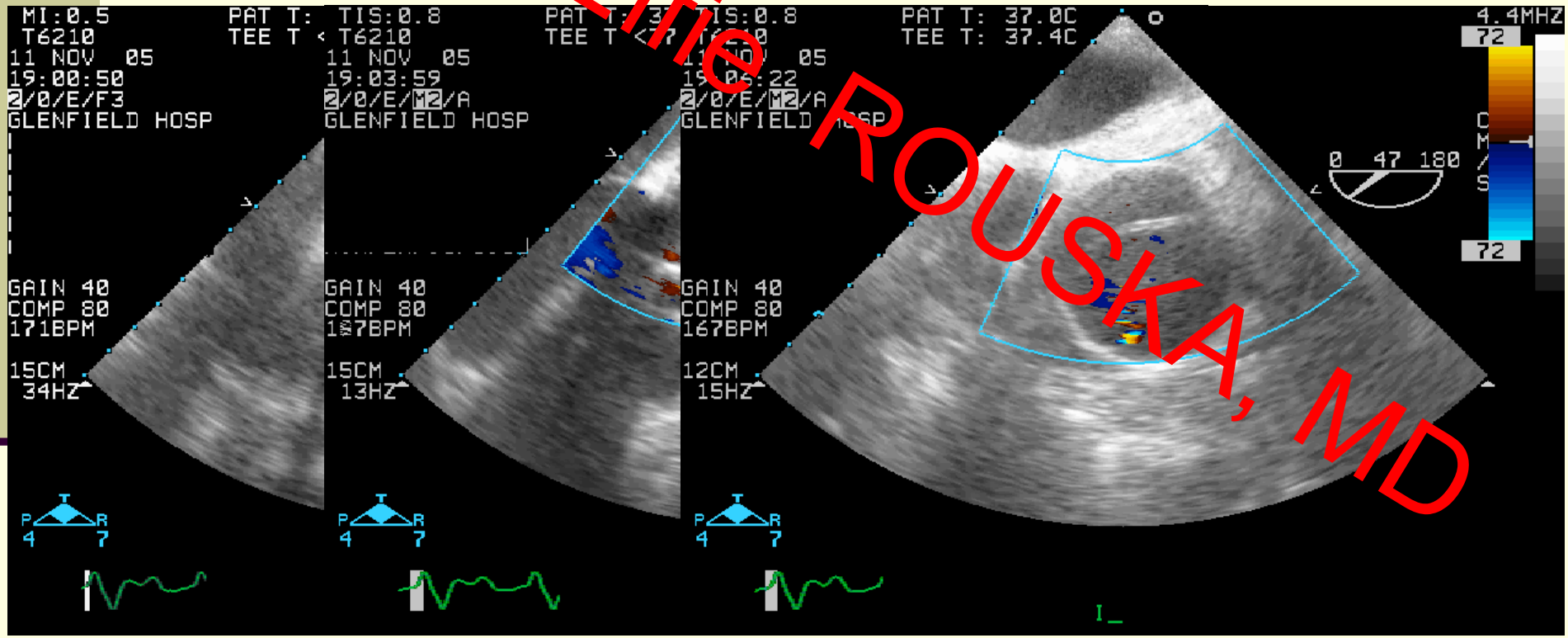
2 60 yrs old male with severe AR, asc aorta 36 mm

Stented bioprosthetic valve

Immediate postop TOE – insignificant

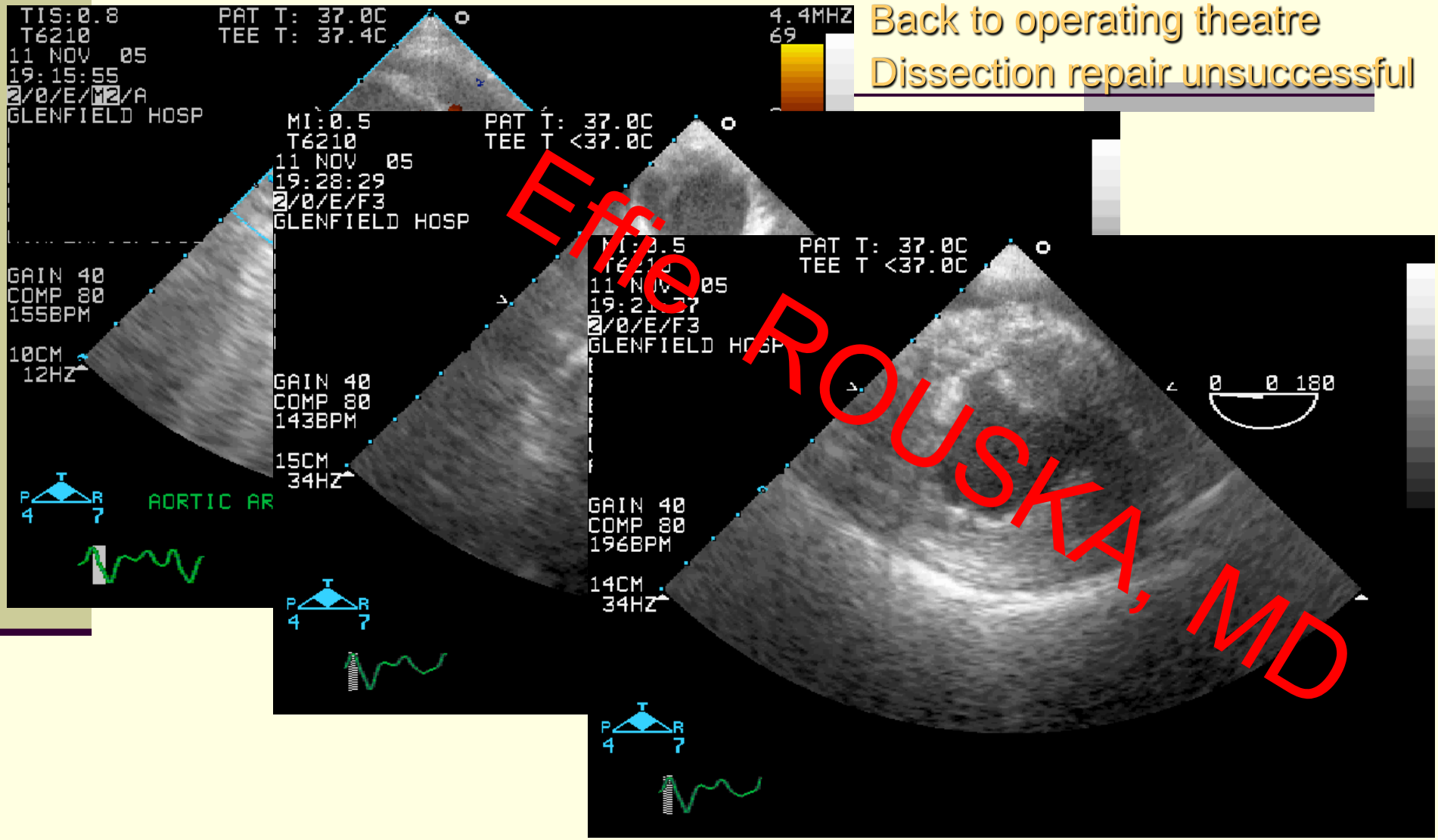
Concerns about left radial arterial line

2hrs post surgery – anuric on CICU, hemodynamically stable



Intra-operative TOE not strongly indicated(Class II indication-ACC/AHA/ASE guidelines)

Stented bioprosthetic AVR – TOE in CICU

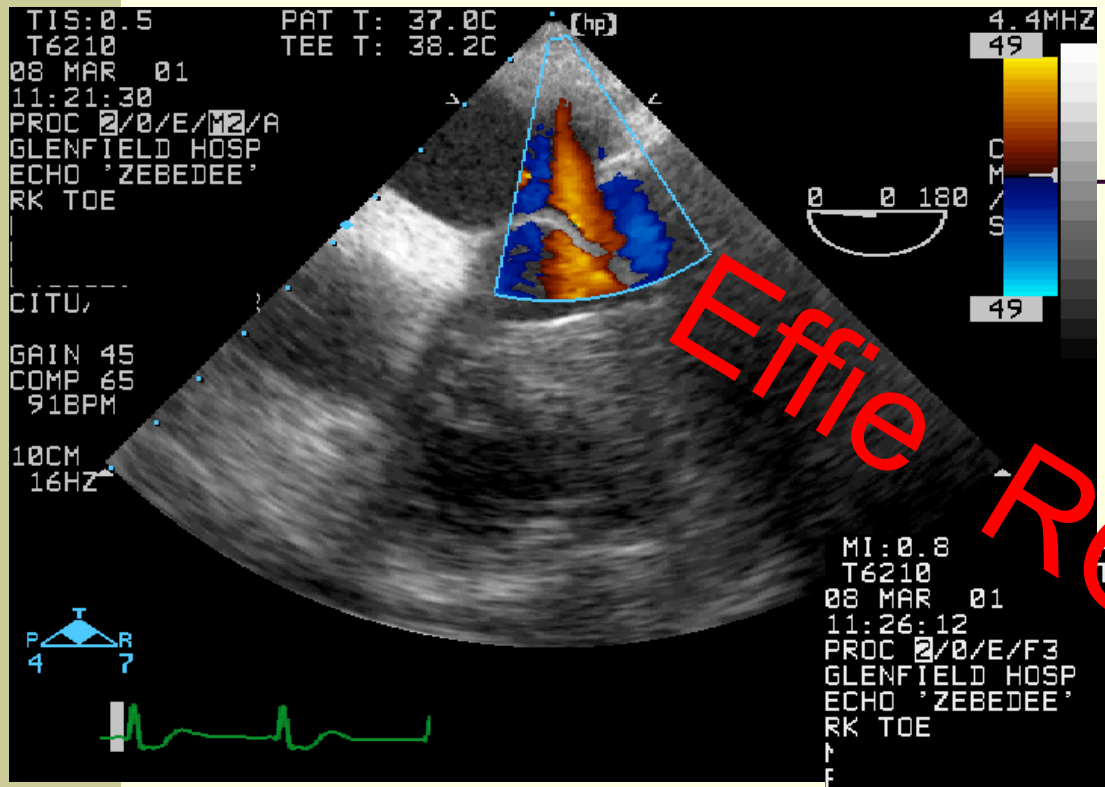


Back to operating theatre

Dissection repair unsuccessful

TEE in ICU

63 yrs old male – post MV repair

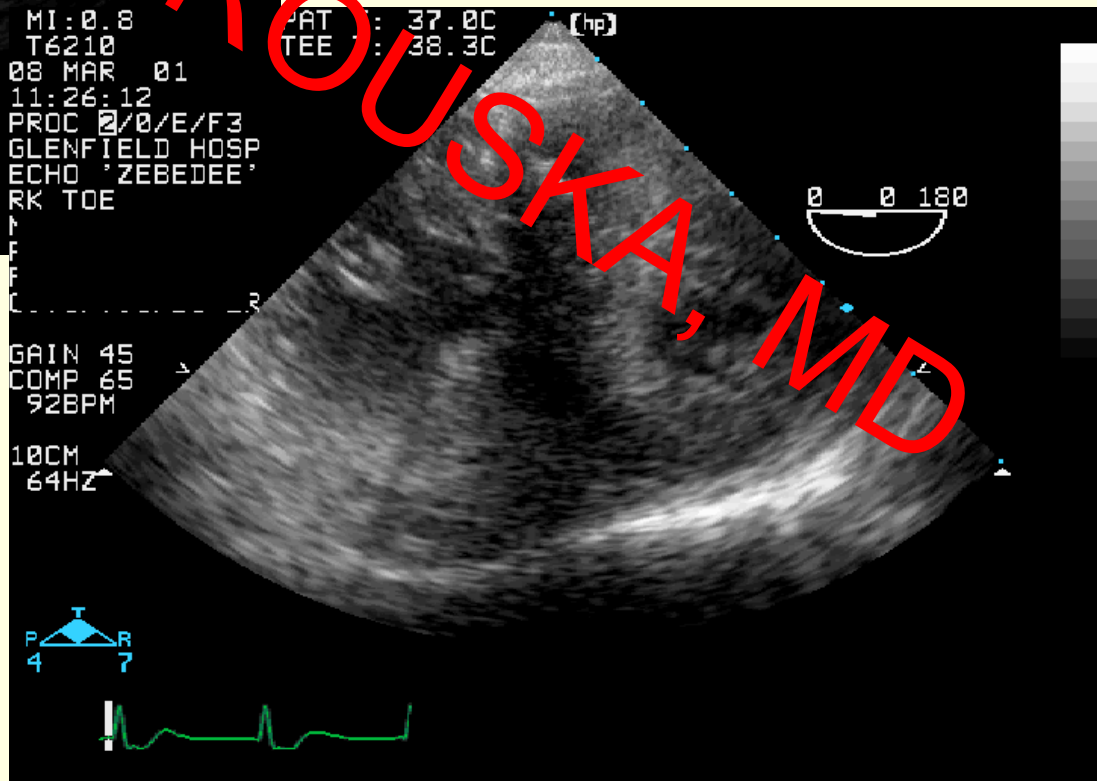


poor LV following surgery

high dose inotropes

hypotensive on CICU

increase in inotropes



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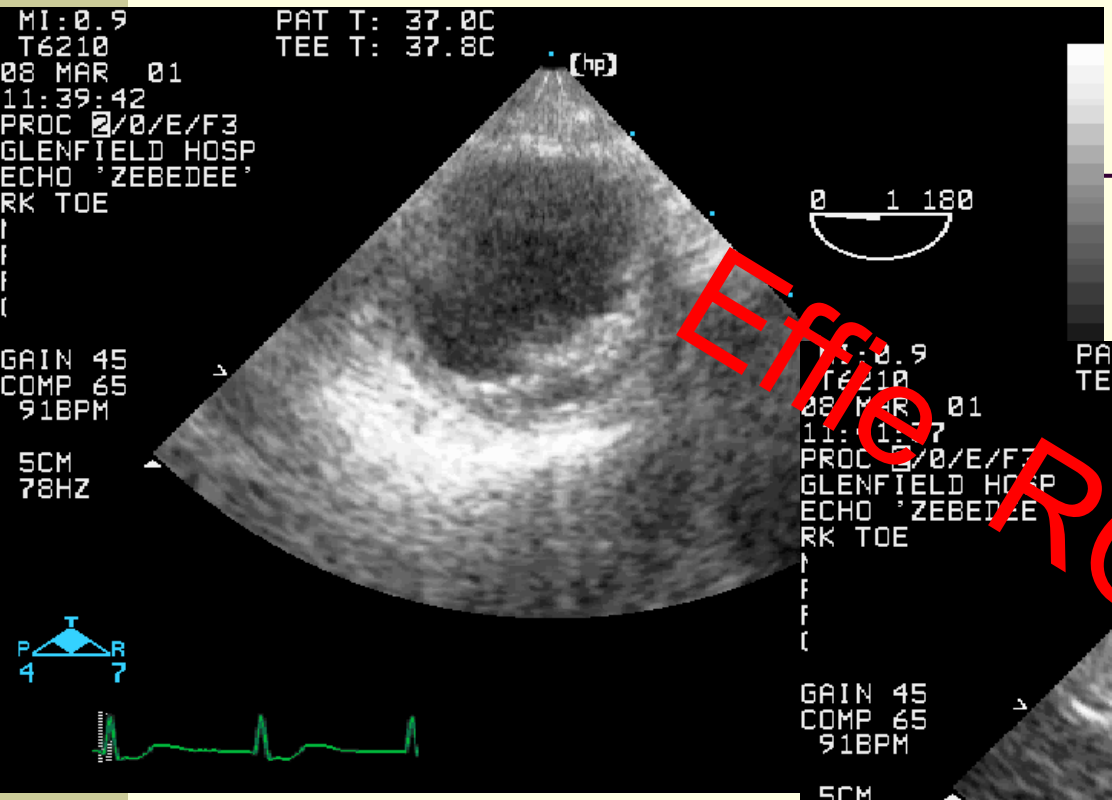
Why hypotensive?

Treatment options?

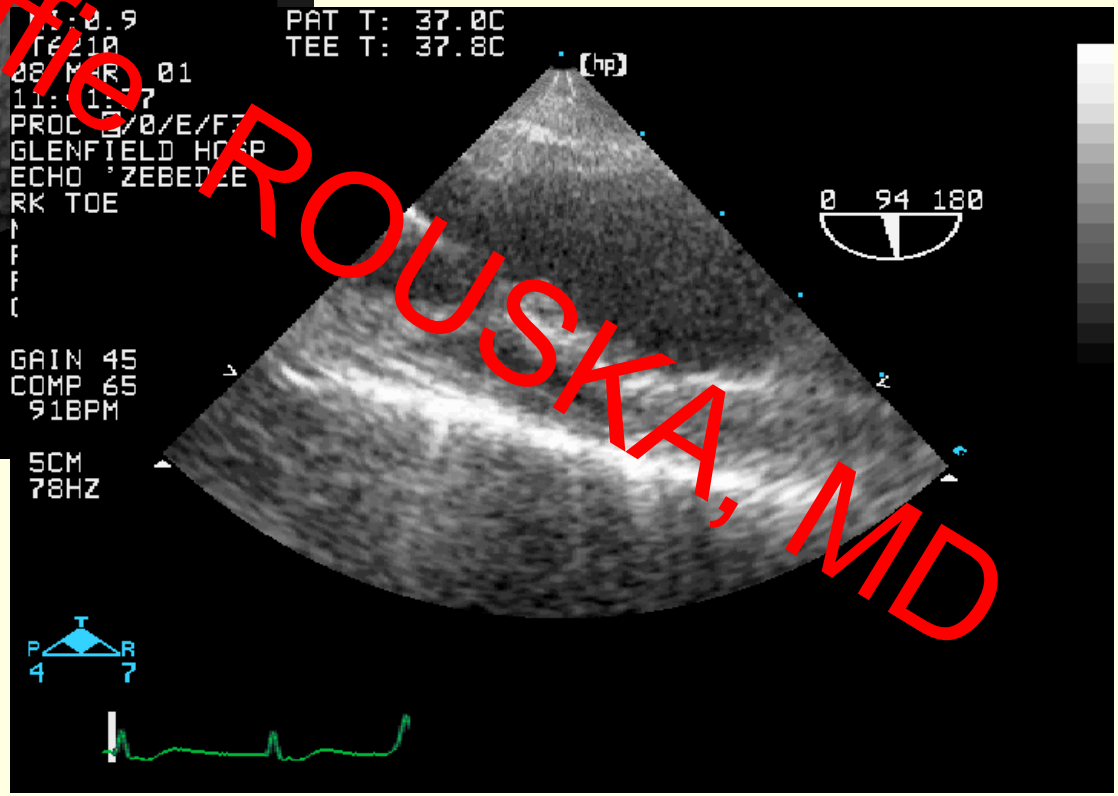
63 yrs old male – post MV repair



Volume

Decrease inotropes

IABP!



CXR – tip of IABP low

Difficult to advance

Should it be advanced any further?

Perioperative TOE

FOR ALL cardiac surgical patients ?

Shernan SK, Gelman S. Perioperative transesophageal echocardiography for cardiac surgery. A fleeting trend or standard of care? Anaesthetist 2002;51(2):79-80


Effie ROUSKA, MD
MR. A.W. SOSNOWSKI
CARDIOTHORACIC
SURGEON

Make things simple….

but not simpler than that…

Einstein

Thank you