



*Mesa Redonda*

*Análise da Valva Mitral para Fins de Tratamento Cirúrgico*

***Plastia ou Troca? Quais os dados mais relevantes que a imagem deve fornecer ao cirurgião para fins de planejamento cirúrgico?***

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# Declaração de Potencial Conflito de Interesse

Nome do Palestrante:

**Renato A. K. Kalil**

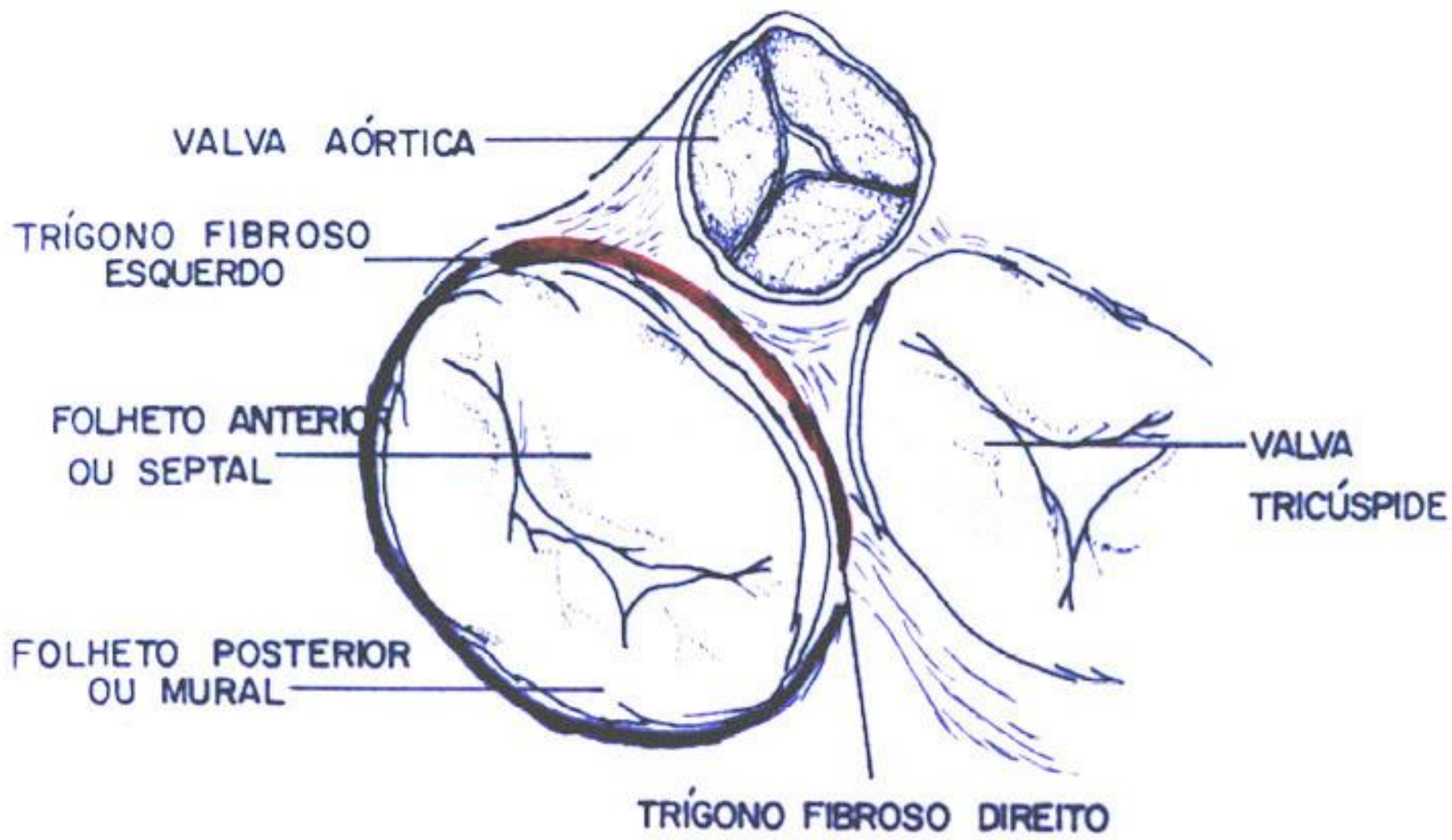
Título da Apresentação:

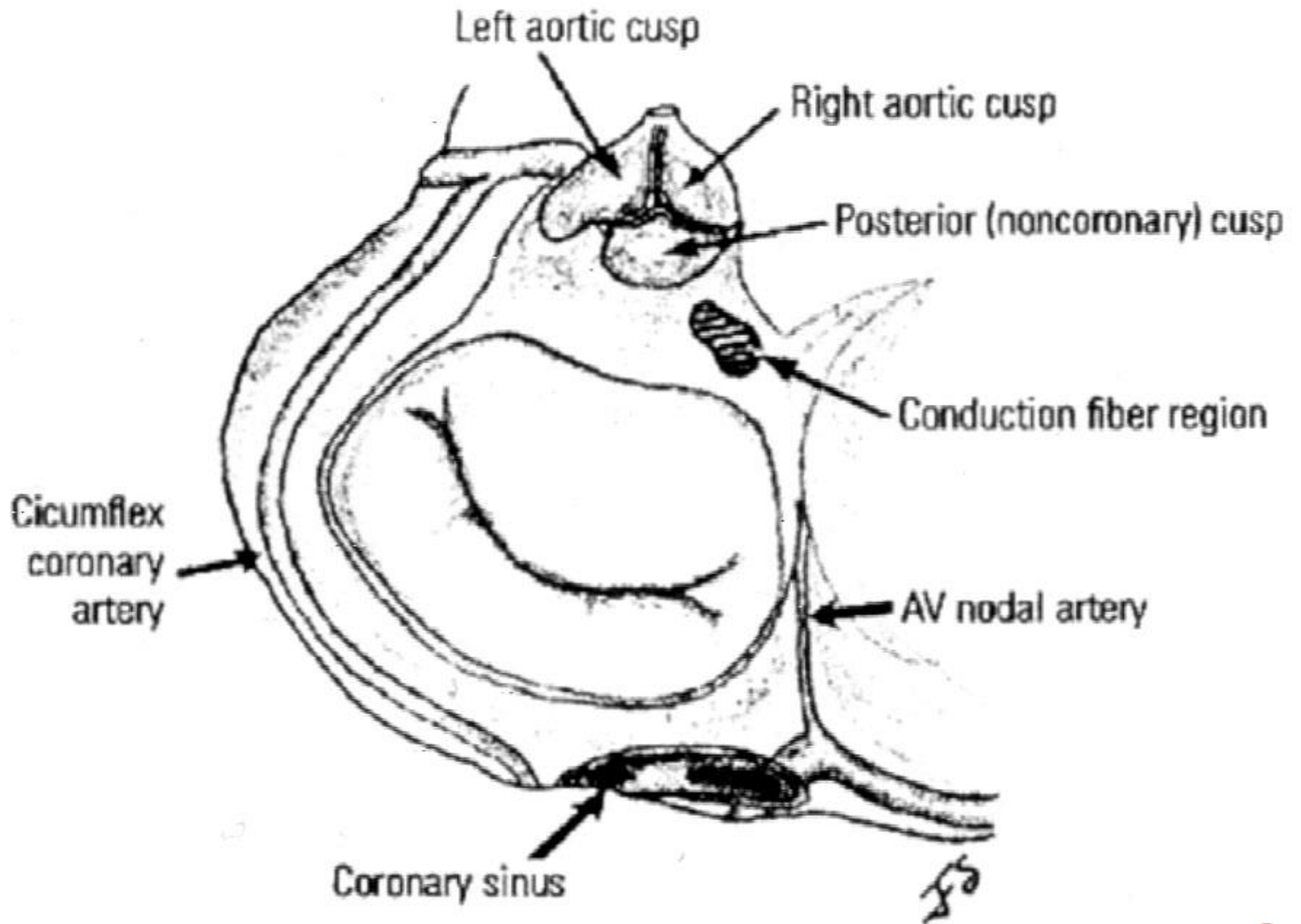
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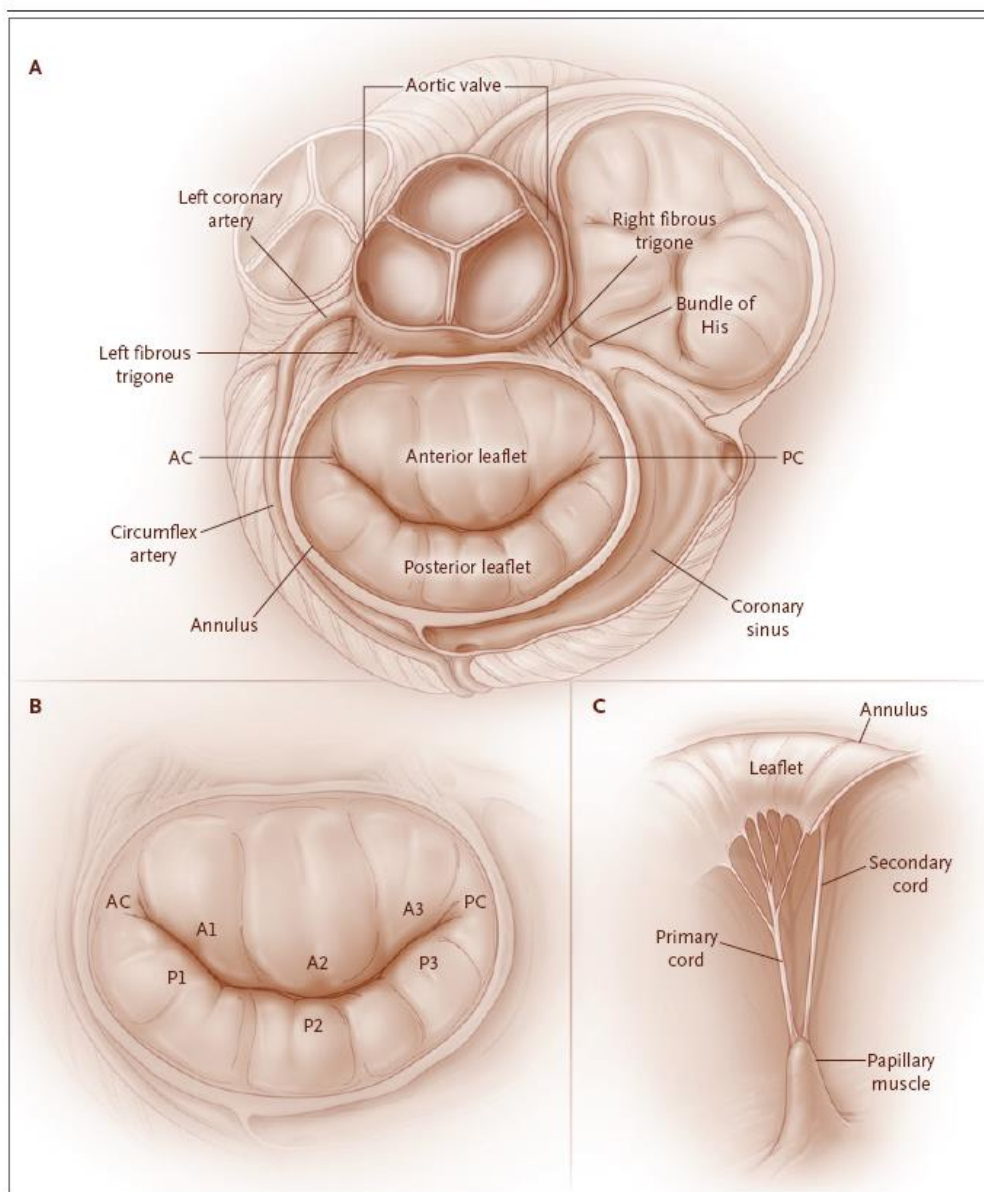
*Plastia ou Troca? Quais os dados mais relevantes que a imagem deve fornecer ao cirurgião para fins de planejamento cirúrgico?*

**Não possuo nenhum conflito de interesse relacionado a esta apresentação**



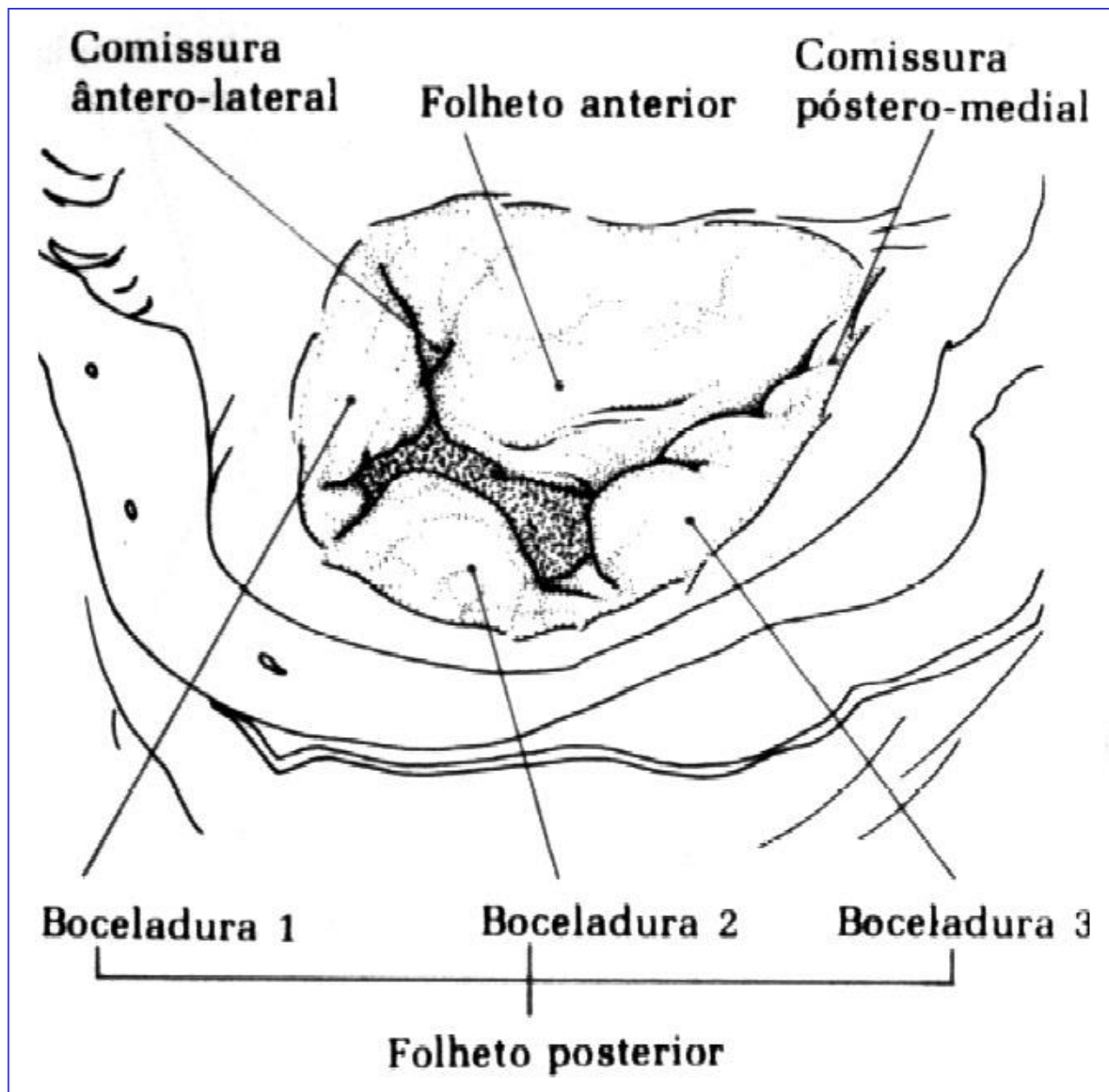


Mitral valve anatomy – important anatomic relationships.



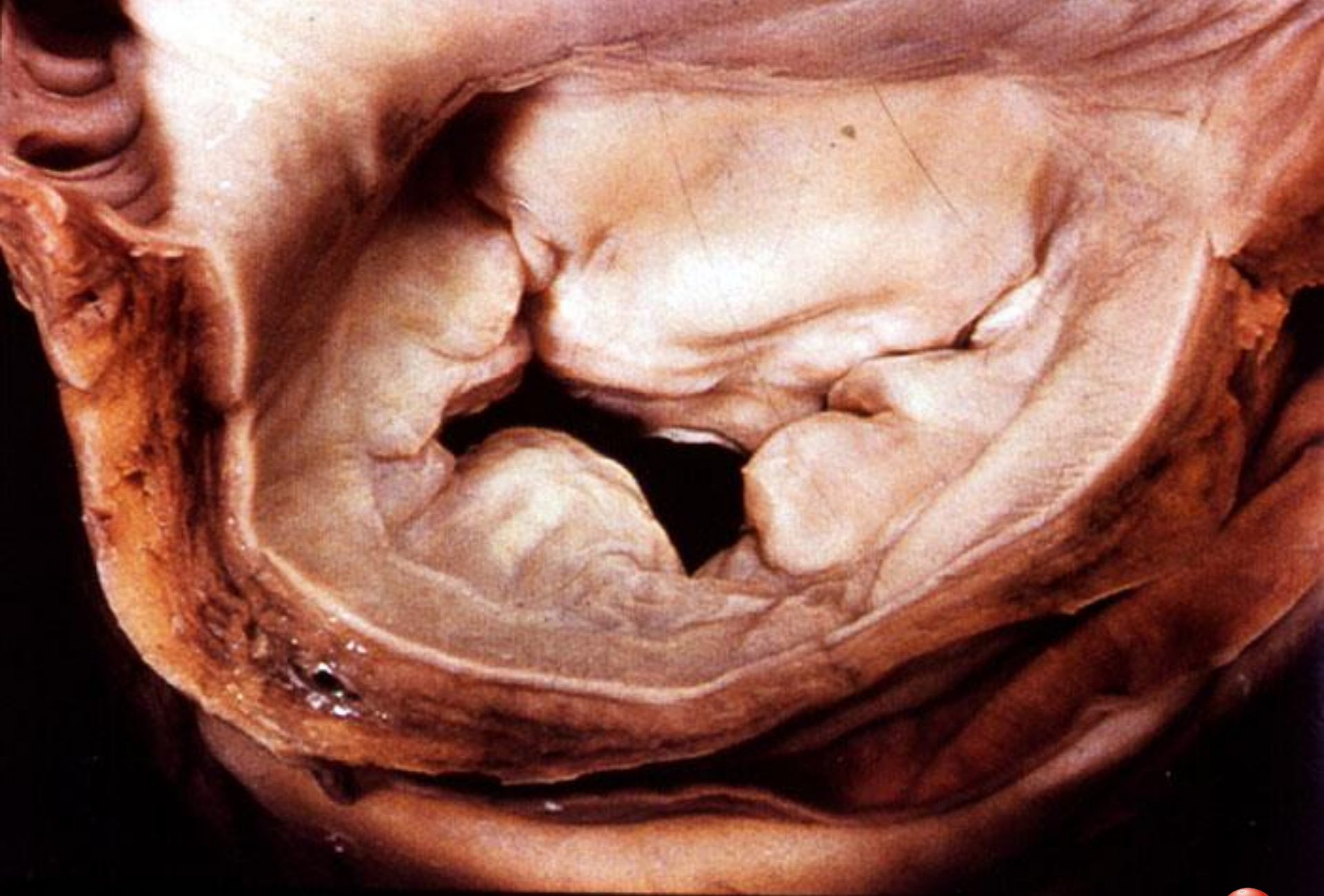
**Figure 1. The Mitral Valve.**

The mitral valve has anterior and posterior leaflets, which are separated by the anterior commissure (AC) and the posterior commissure (PC) (Panel A). The leaflets are inserted on the circumference of the mitral annulus, which is in continuity with the aortic annulus and the left and right fibrous trigones. The circumflex coronary artery, coronary sinus, aortic valve, and bundle of His are all close to the mitral valve. Panel B shows the mitral-valve leaflets, each of which usually consists of three discrete segments or scallops. These are designated A1, A2, and A3 for the anterior leaflet and P1, P2, and P3 for the posterior leaflet. The valve leaflets each receive chordae tendineae from the anterolateral and posteromedial papillary muscles (Panel C). Primary chordae are attached to the free edge of the valve leaflet, and secondary chordae are attached to the ventricular surface of the leaflet.



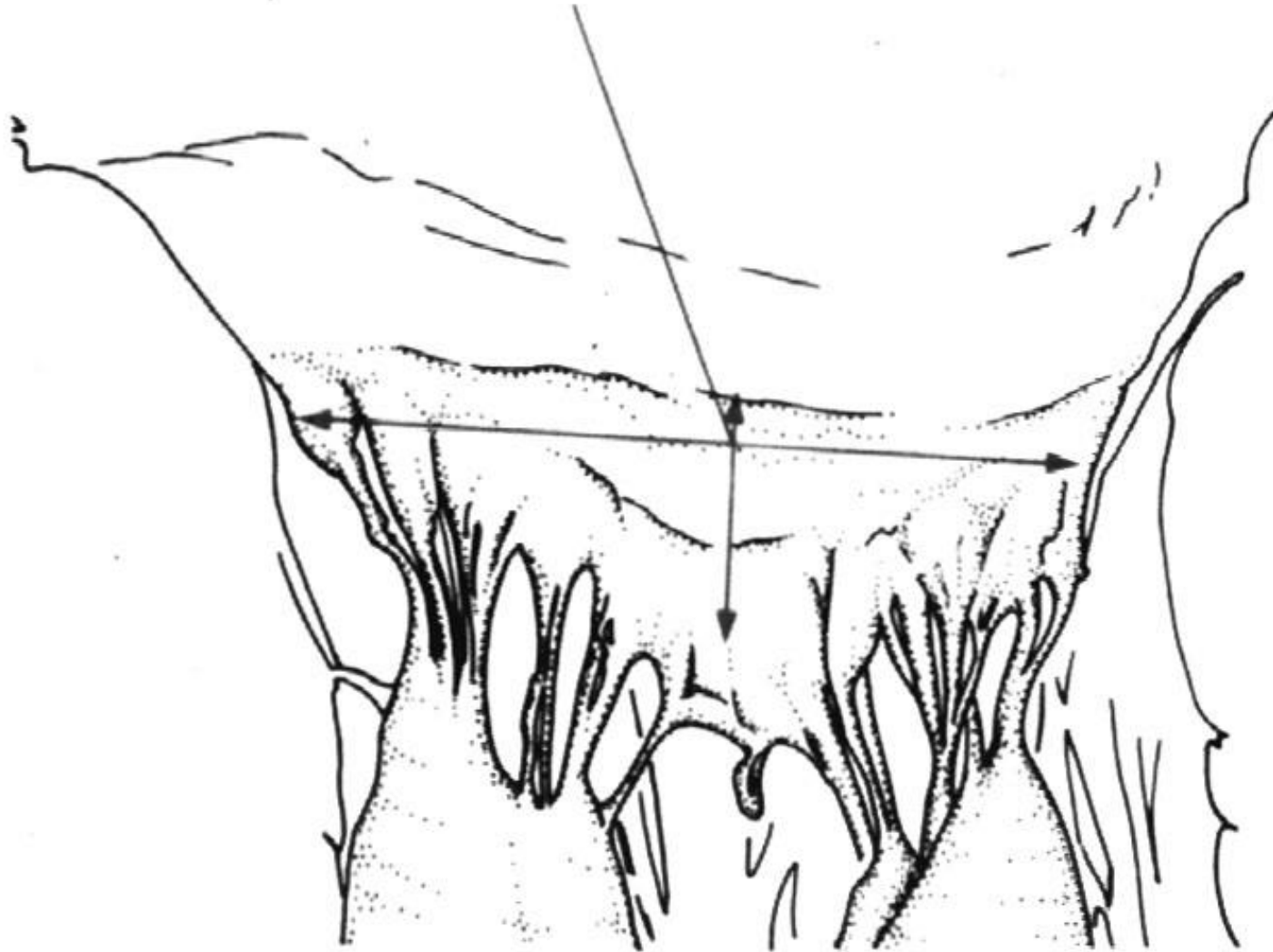
**Válvula mitral vista de cima mostrando o folheto anterior ou septal e o posterior ou mural com suas três boceladuras.**

Anderson RH & Becker A. Atlas de Anatomia Cardíaca. Livr Edit Santos, SP. 1983



Anderson RH & Becker A. Atlas de Anatomia Cardíaca. Livr Edit Santos, SP. 1983

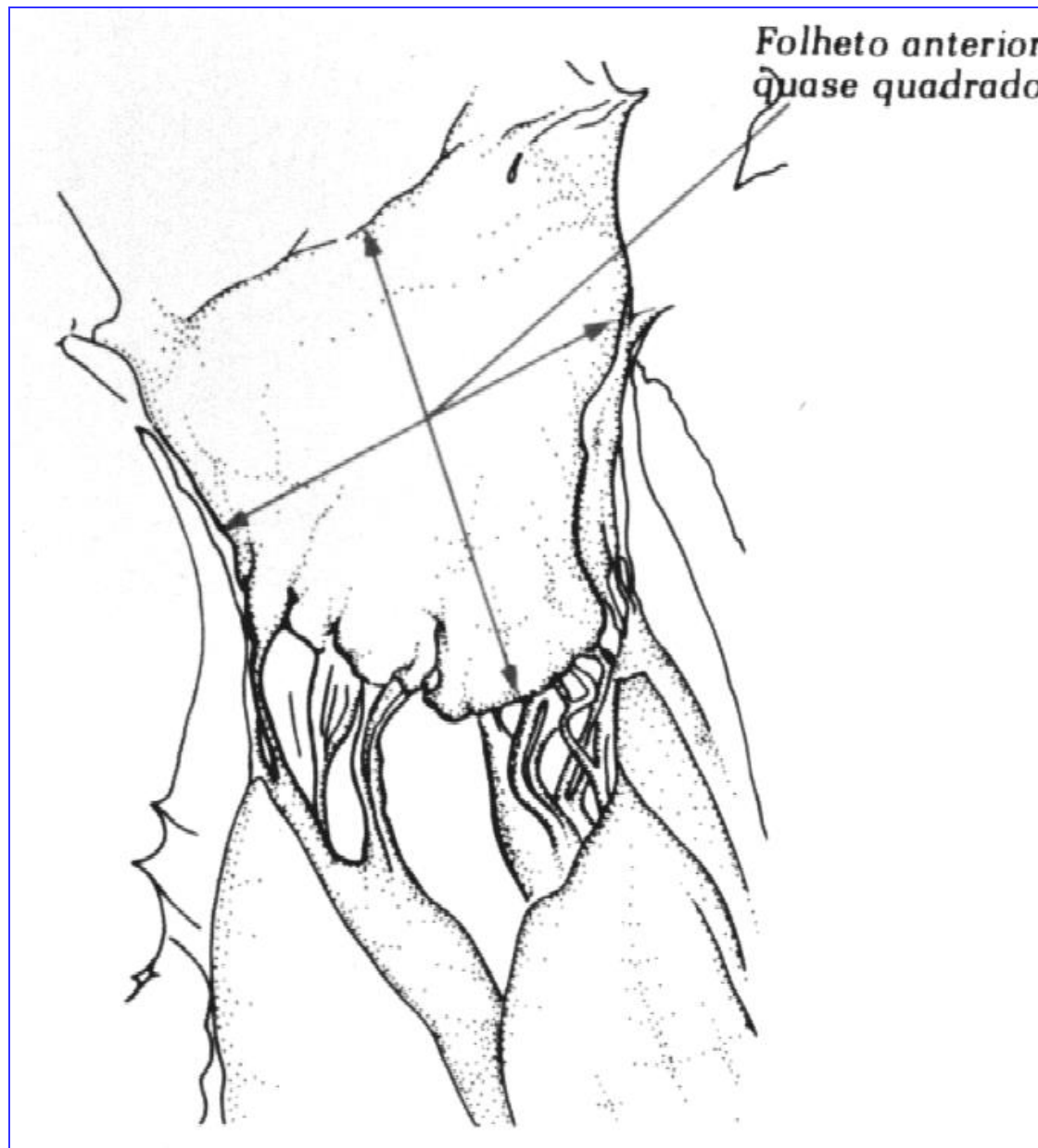
Folheto posterior  
longo e estreito



Anderson RH & Becker A. Atlas de Anatomia Cardíaca. Livr Edit Santos, SP. 1983

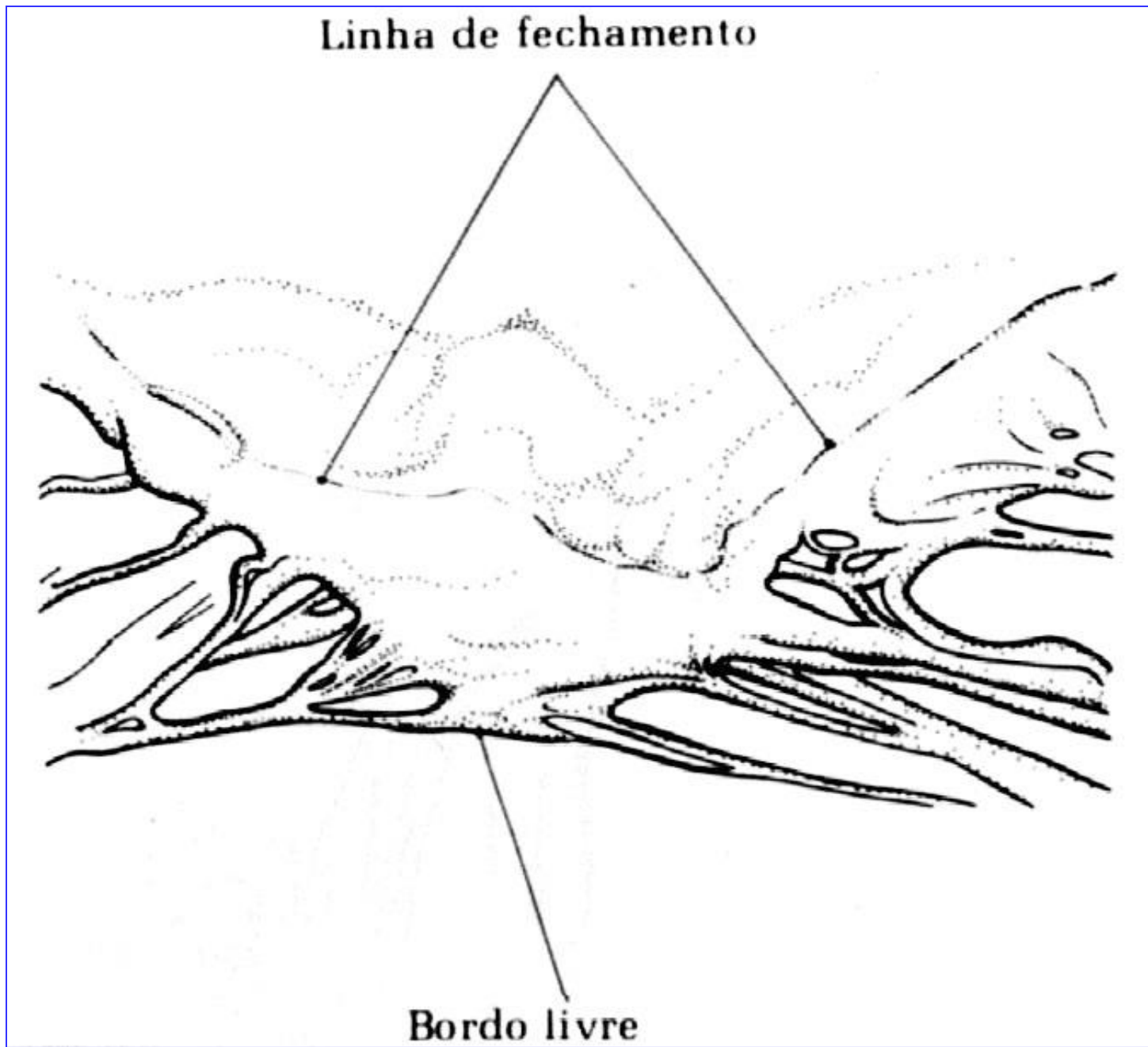








Anderson RH & Becker A. Atlas de Anatomia Cardíaca. Livr Edit Santos, SP. 1983



Anderson RH & Becker A. Atlas de Anatomia Cardíaca. Livr Edit Santos, SP. 1983



Zona lisa

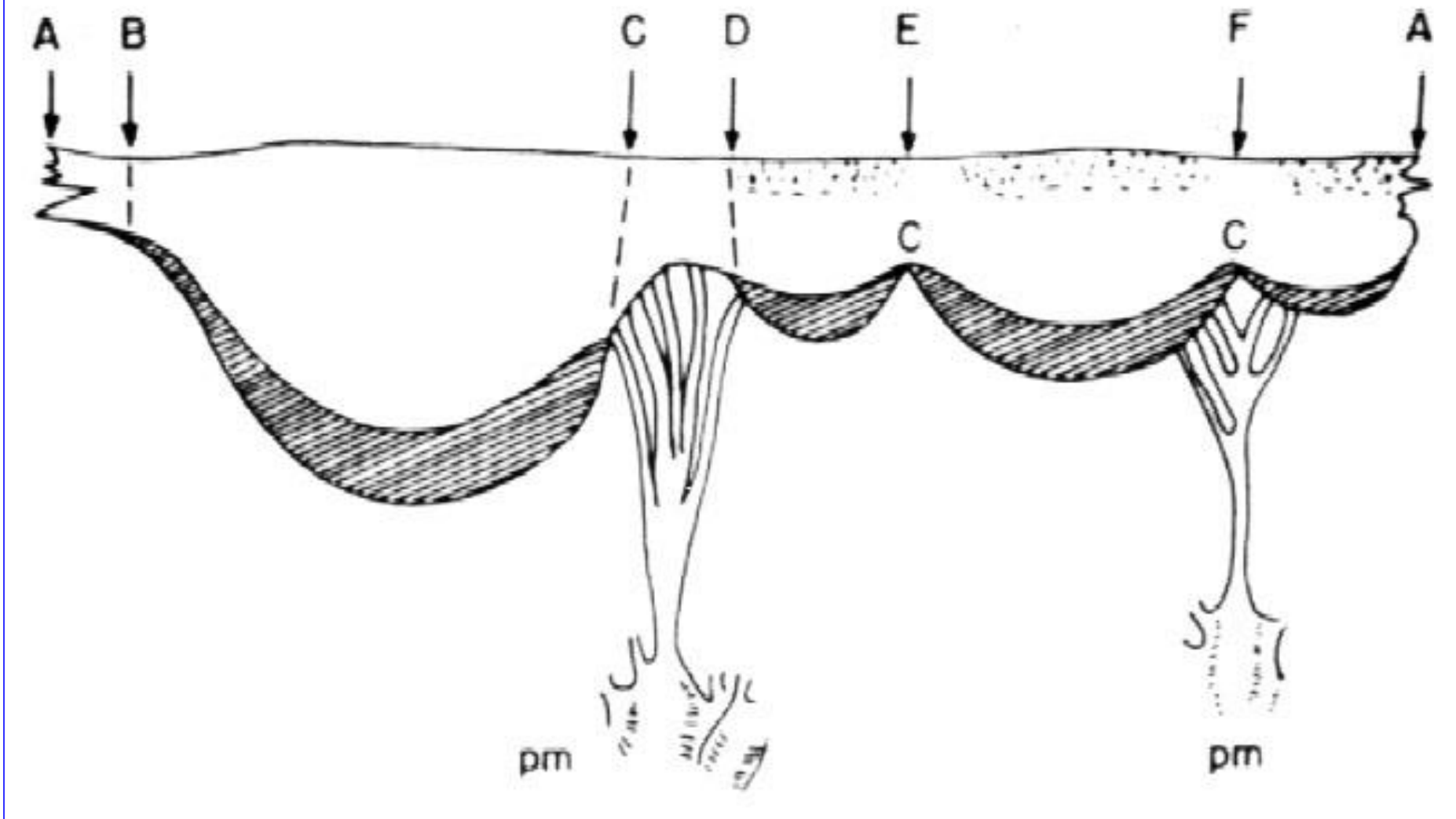
Ânulo



Zona áspera

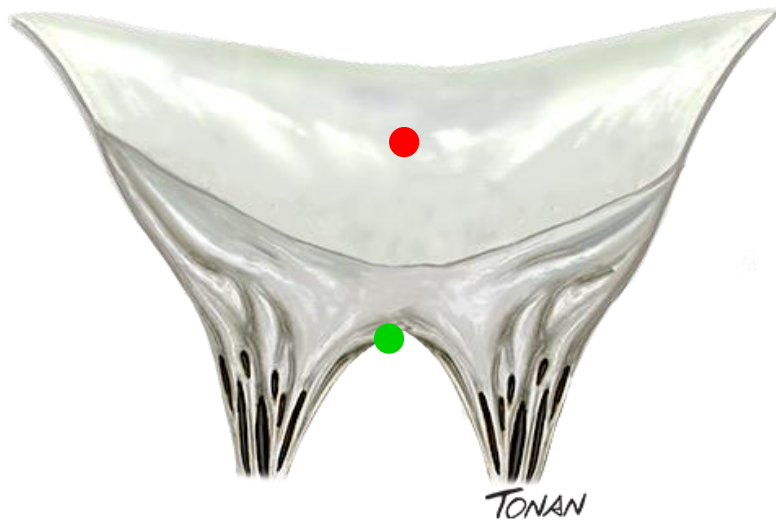
Bordo livre

Linha de fechamento  
(na face atrial)

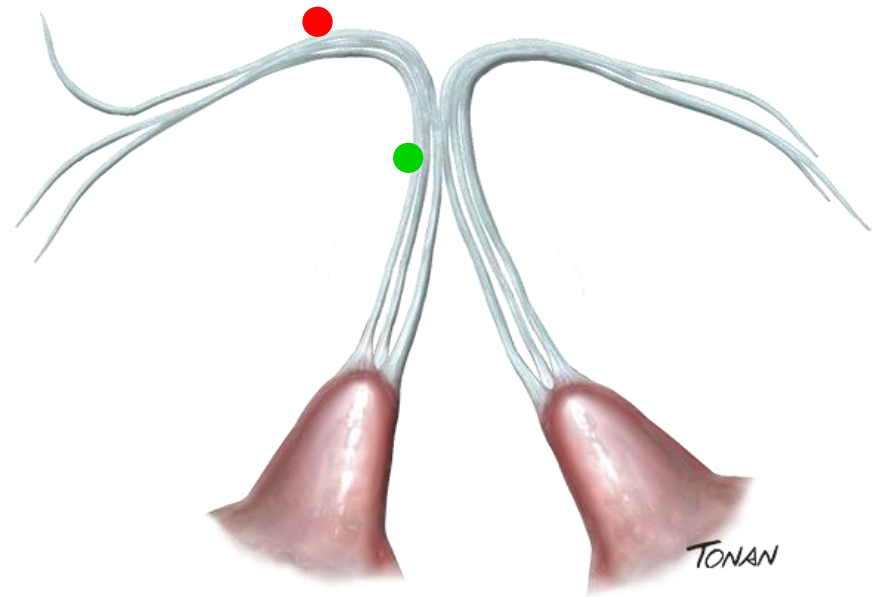


**Diagrama representando a valva mitral e sua cardoalha tendinosa <sup>2</sup>.  
 A-B=comissura antero-lateral; A-C=folheto anterior; E-F=porção central do folheto posterior; F-A=porção comissural antero-lateral;  
 C=fenda ou indentação; pm=músculo papilar. A área sombrada representa a zona áspera e a área pontilhada representa a zona basal.**

# Mitral valve morphology with its large rough zone of leaflet coaptation



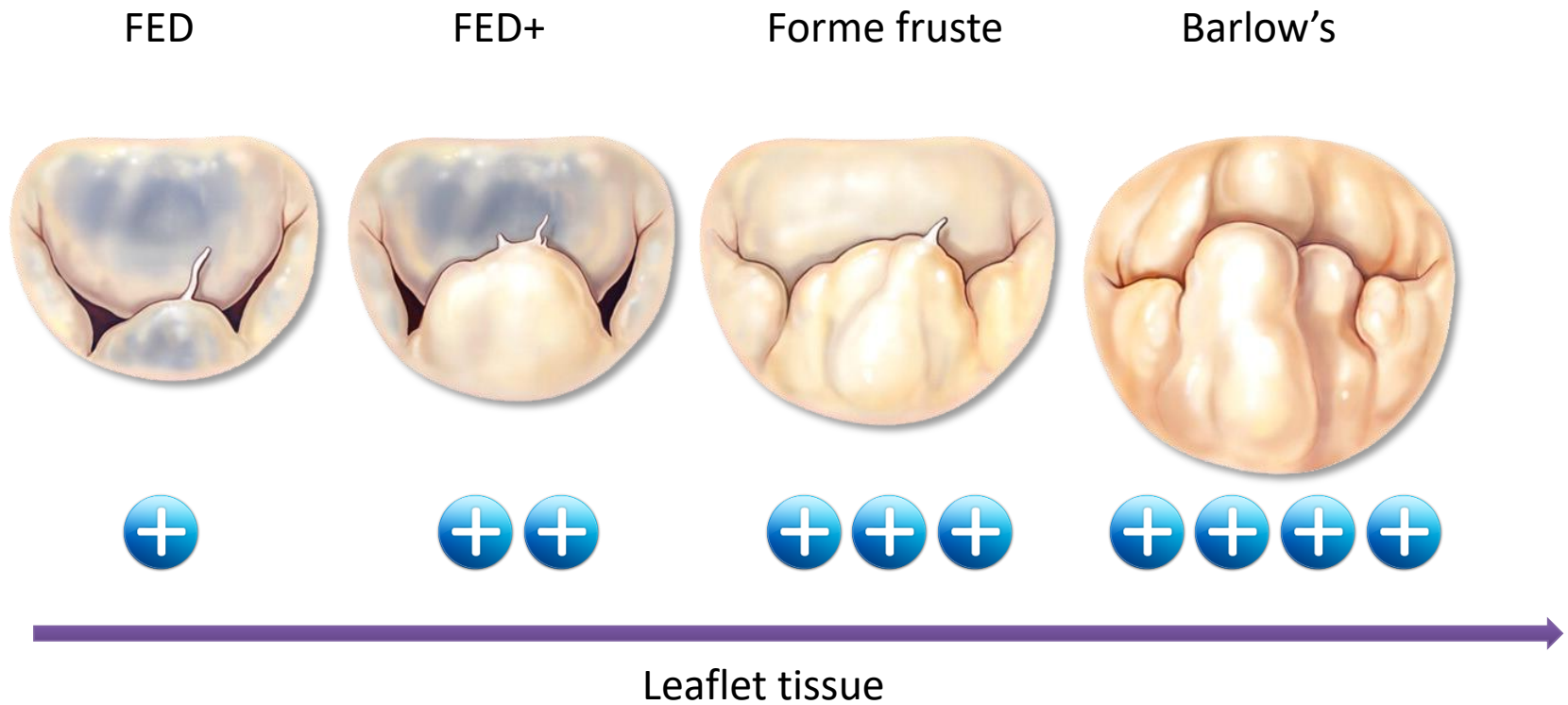
 Rough zone



 Clear zone



# Degenerative mitral valve regurgitation



# Fisiologia

O mecanismo de funcionamento da valva mitral inclui a participação de:

Folhetos

Cordoalha

Músculos papilares

Parede ventricular

Anel valvar

Átrio esquerdo

# Valvuloplasty Principles

Maintain an adequate minimal useful orifice

Maintain a large coaptation zone, > 5mm

Maintain leaflet support by chordae

Preserve flexibility

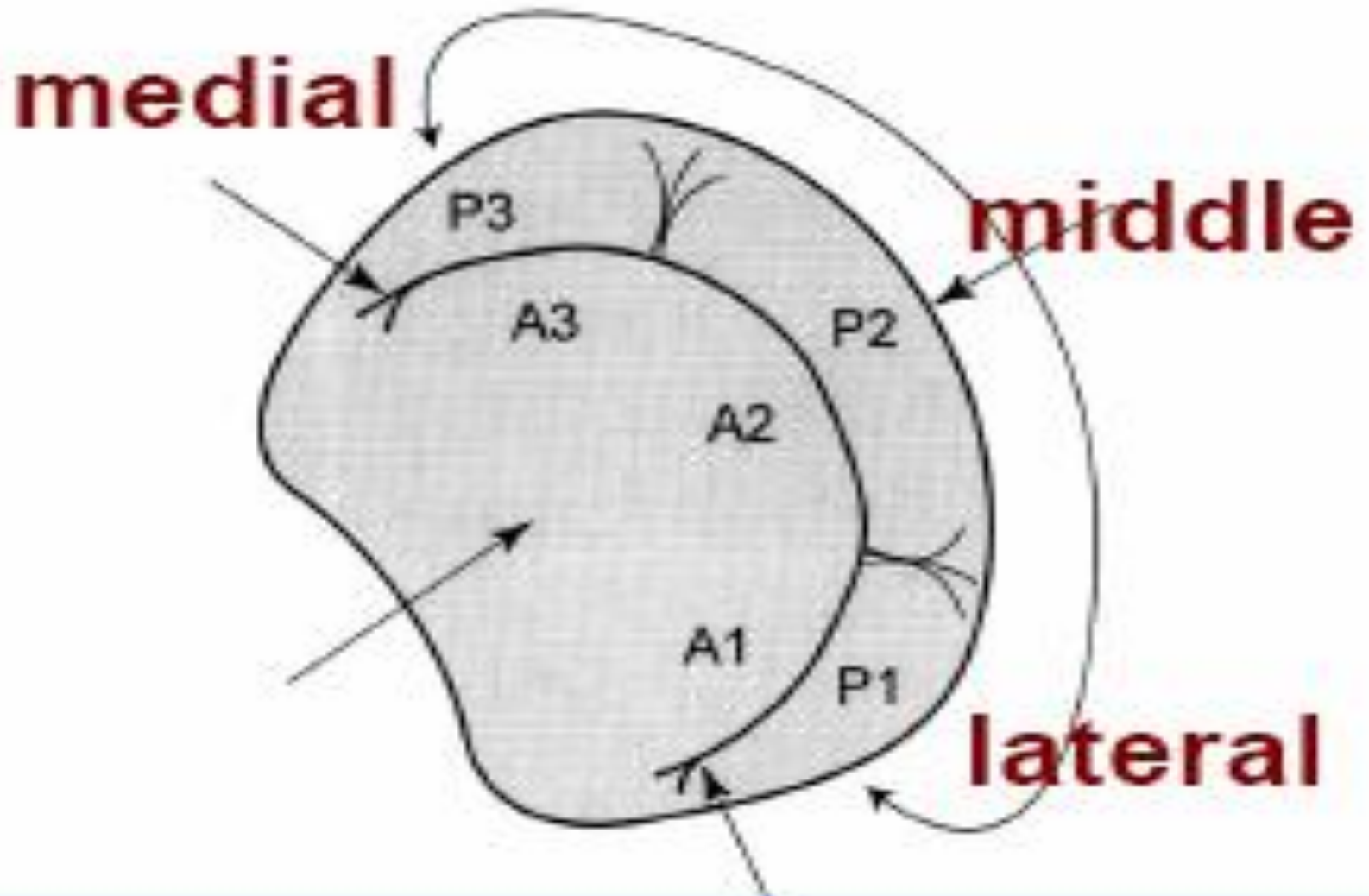
Preview fibrosis and calcification

Use compatible chordae or membranes

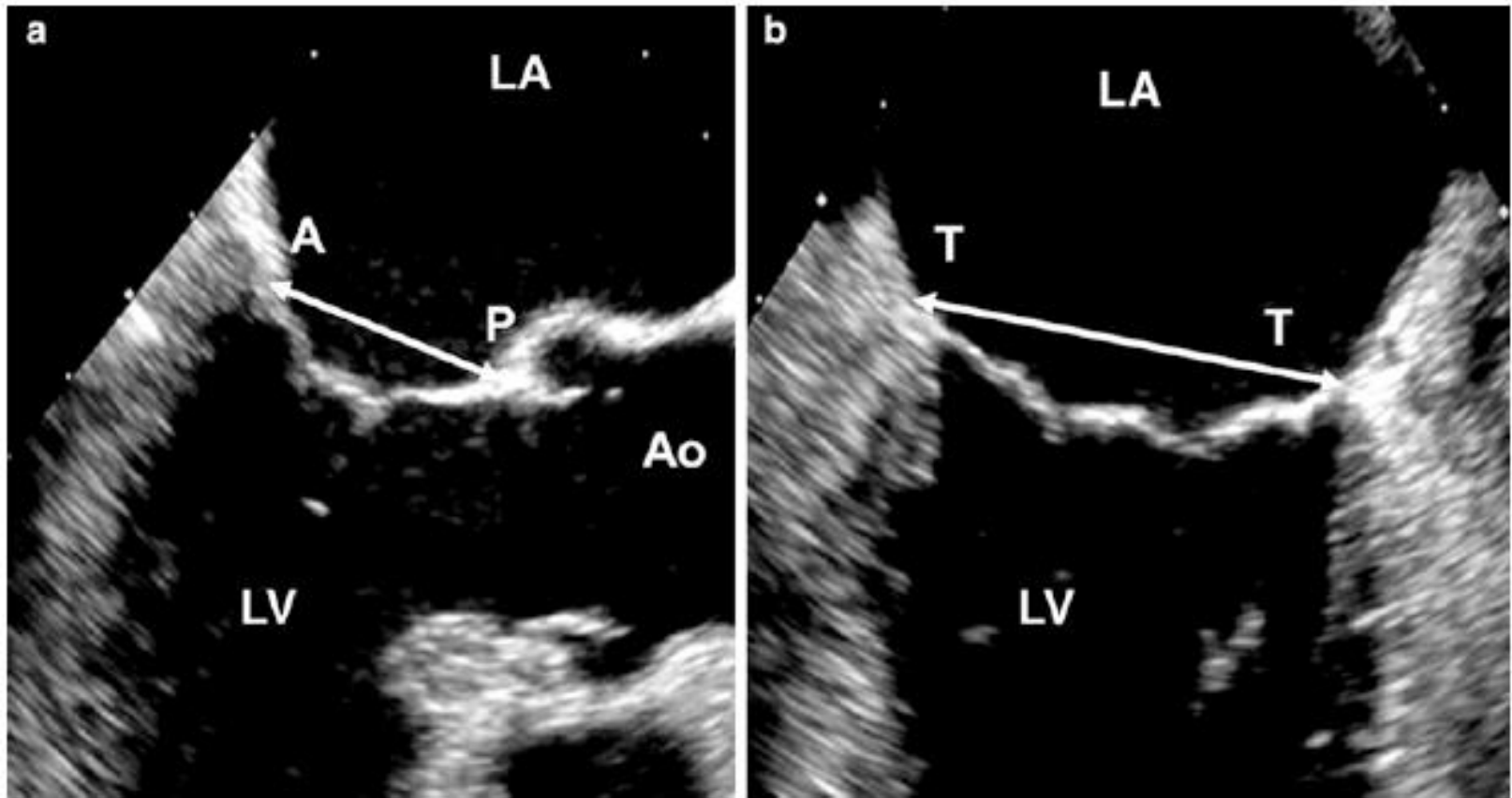
Maximum of autologous material “Respect rather than resect”

# Componentes Valva Mitral

conforme classificação de Carpentier

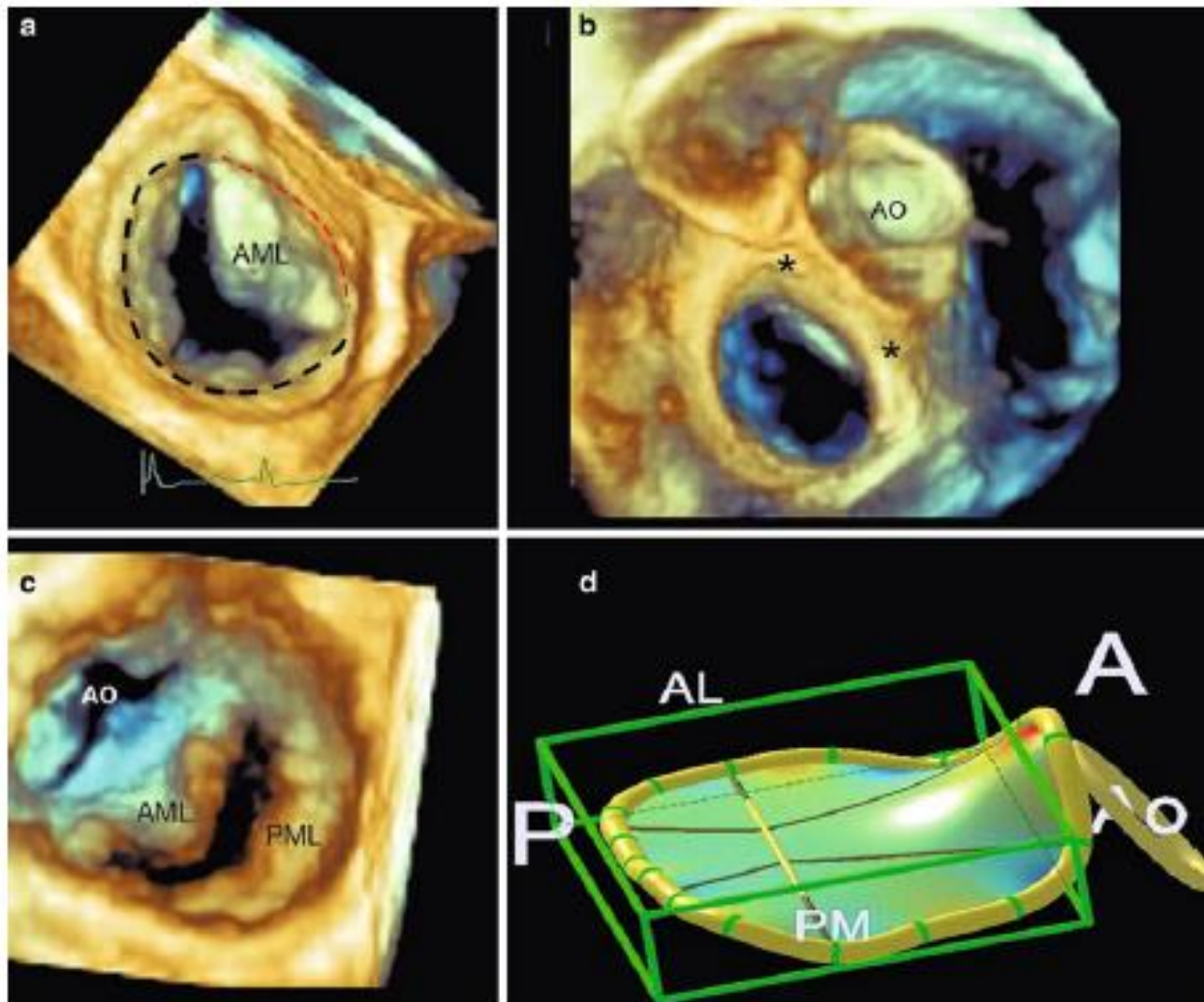


## *Annulus da valva mitral*



**Fig. 1.2** The anteroposterior (*AP*) and transversal (*TT*) diameters measured in (a) the long-axis and (b) two-chamber transesophageal approach. *LA* left atrium, *LV* left ventricle, *Ao* aorta

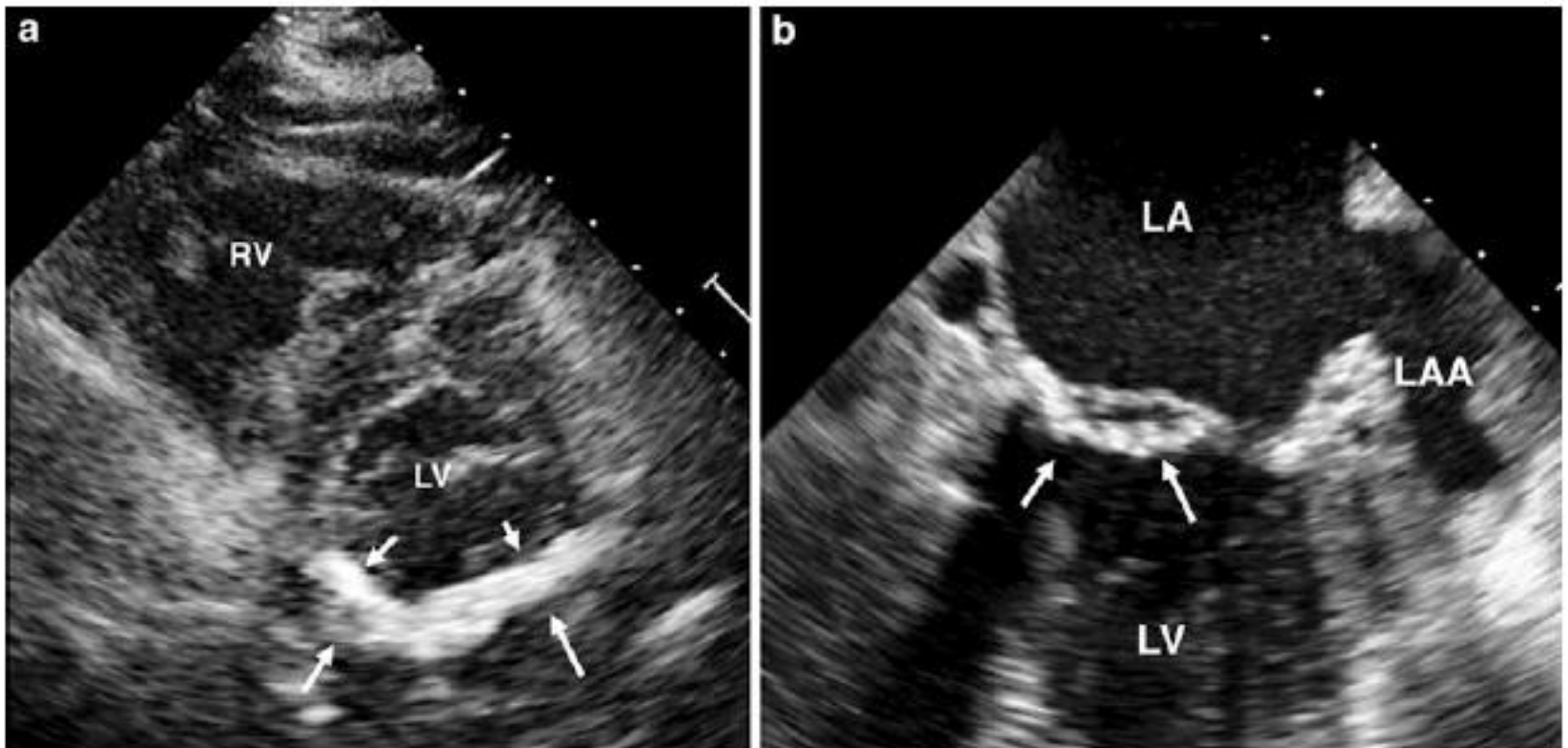
## Annulus da valva mitral



**Fig. 1.3** a Mitral valve and annulus seen from *above* (similar to the surgical view). The *dotted red line* indicates the anterior portion and the *dotted black line* the posterior portion; b same view from a different angle showing the tight connection between the mitral valve and aorta (*Ao*). The two asterisks indicate the locations of the two trigones; c same valve seen from the left

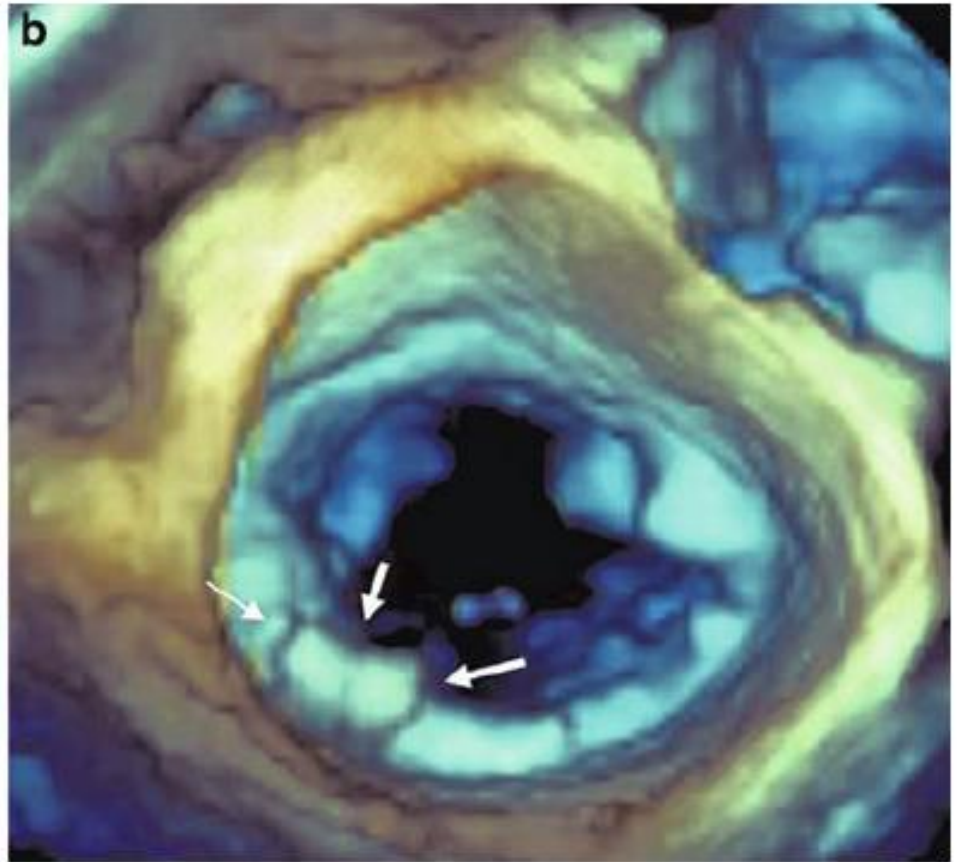
ventricle. The ventricular surface of the anterior mitral leaflet (*AML*) continues imperceptibly with the intercuspid triangle (see text). *PML* posterior mitral leaflet; d virtual reconstruction of the saddle-like shape of the annulus. *AL* anterolateral, *PM* posteromedial, *Ao* Aorta, *A* anterior, *P* posterior

## *Annulus da valva mitral*



**Fig. 2.1** a Transthoracic parasternal short-axis slice showing widespread calcification extending to the entire posterior annulus; b transesophageal two-chamber slice

of the same patient. *LA* left atrium, *LV* left ventricle, *RV* right ventricle, *LAA* left atrial appendage

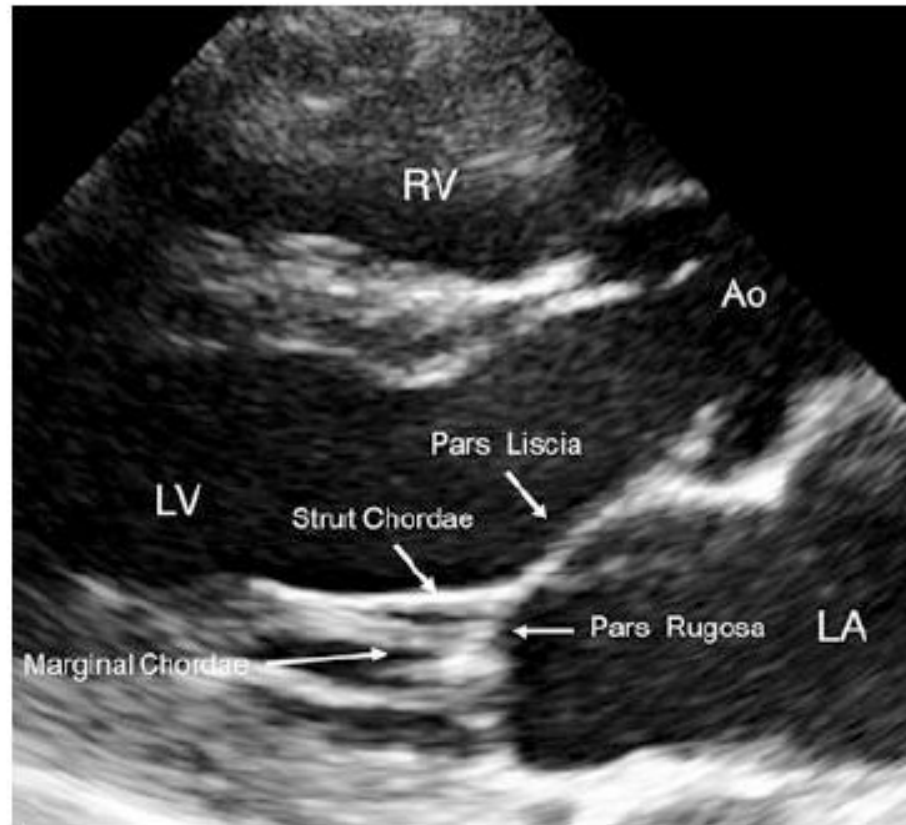


**Fig. 2.5 a** Three-dimensional echocardiographic images of the mitral valve seen from the atrium in a patient with extensive calcification of the posterior portion of the annulus. It is noted how the calcification, being at the same depth as the leaflets, has the same beige tone. However, it can be distinguished due to its irregular

shape (*arrows*) and the fact that it is slightly higher than the posterior leaflet; **b** nodular calcification inserted in the center of the posterior portion of the annulus. Once again, it is not the color tone (similar *blue* to the surrounding structures) but rather the fact that it is slightly higher that enables diagnosis (*arrows*)

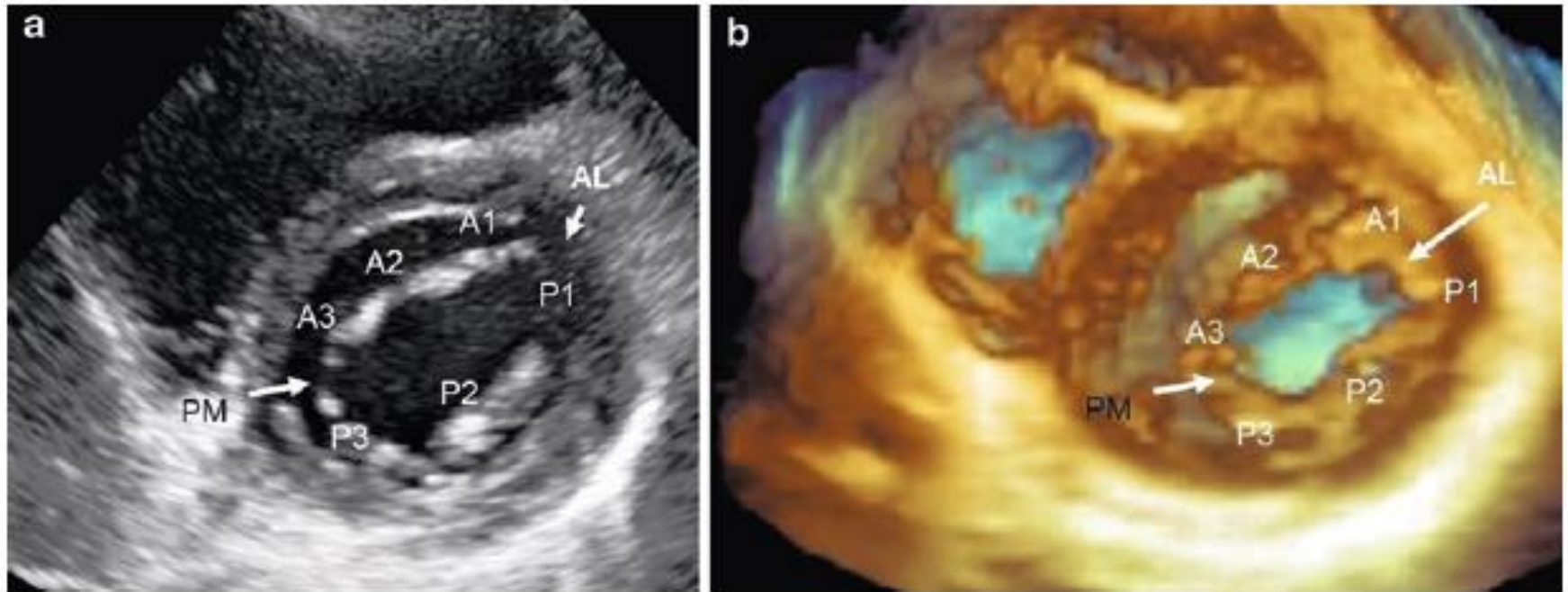


## *Folhetos*



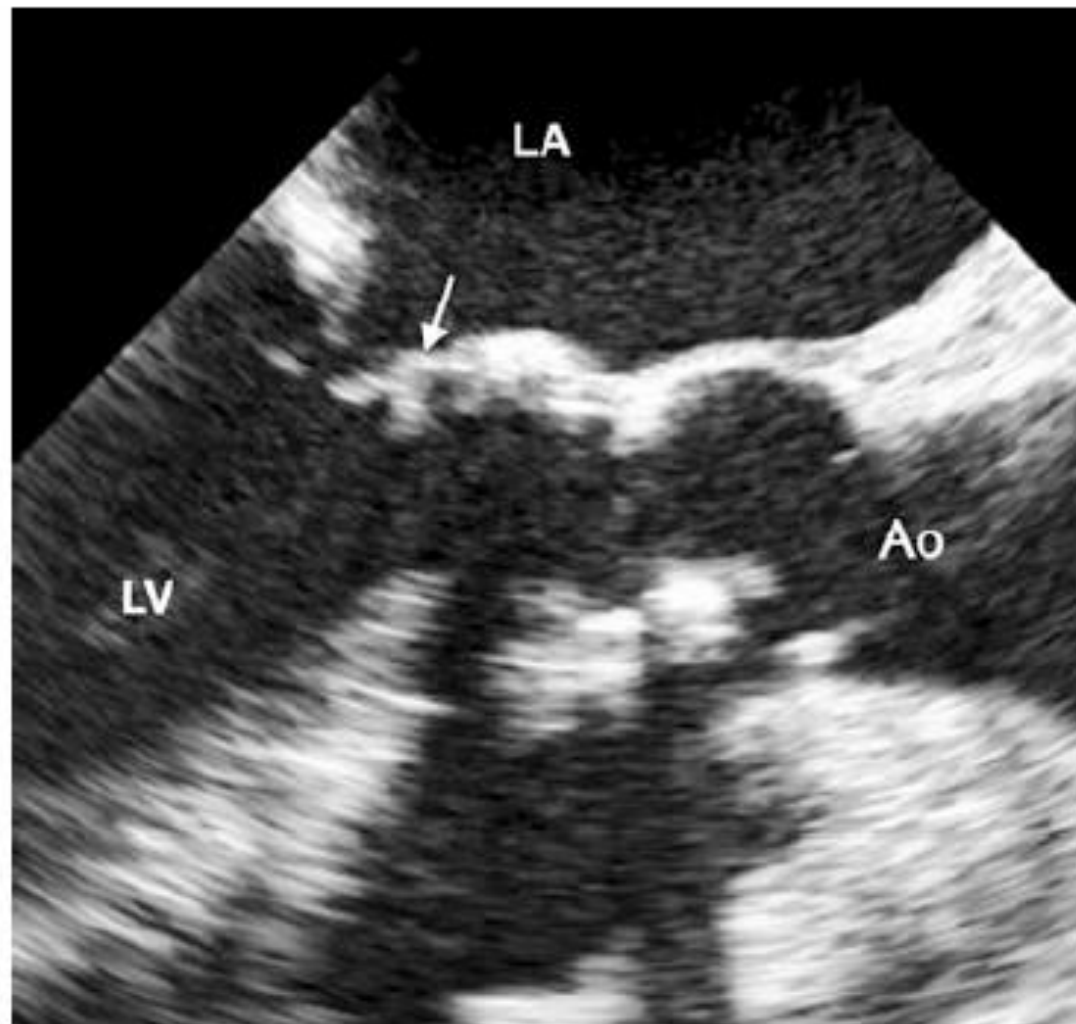
**Fig. 1.4** Transthoracic parasternal long-axis echocardiographic images titled medially to visualize the chordae tendineae of the posteromedial papillary muscles. The Pars Liscia and Pars Rugosa, Strut Chordae and Marginal Chordae can be seen. *LA* left atrium, *LV* left ventricle, *RV* right ventricle, *Ao* aorta

## Folhetos

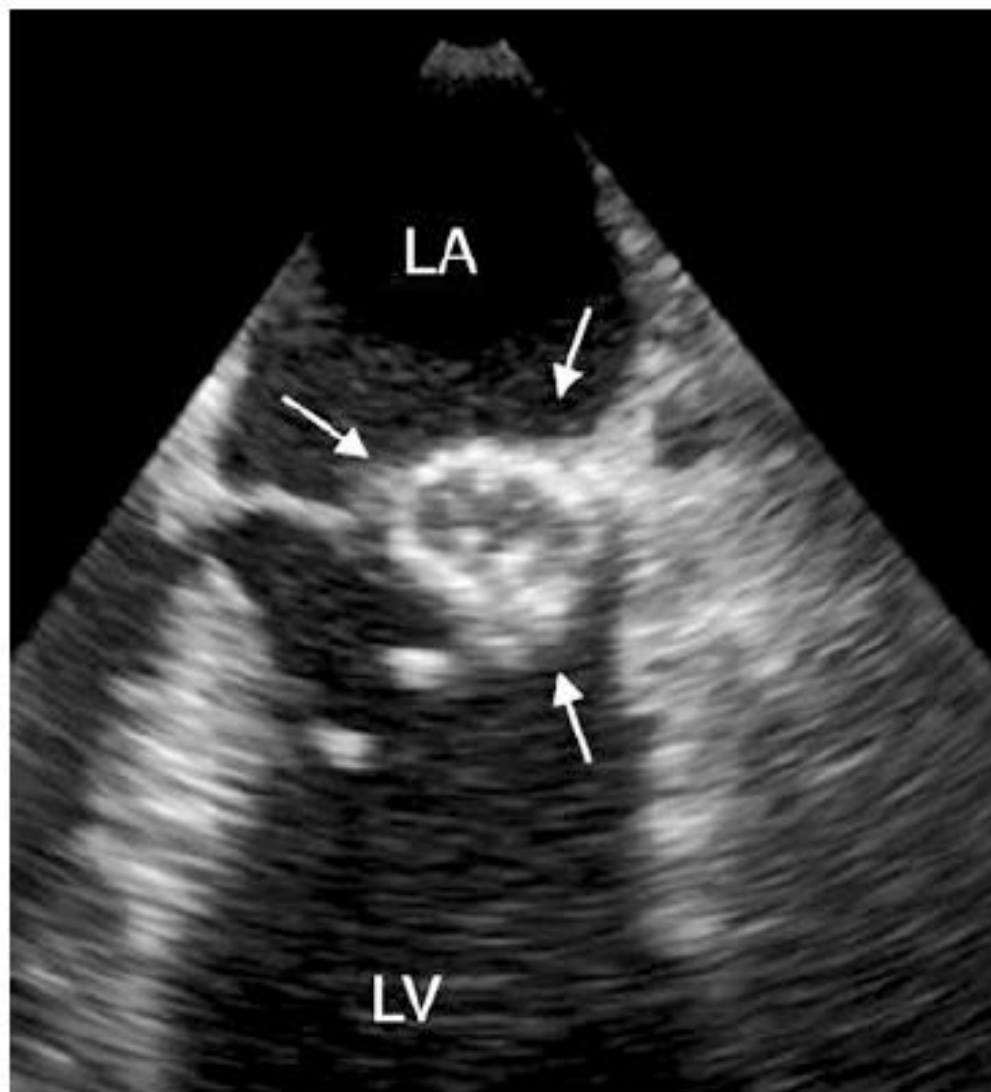


**Fig. 1.5** **a** Two-dimensional short-axis images of the mitral leaflets. All parts of the leaflets can be identified, including the anterolateral (*AL*) and posteromedial (*PM*)

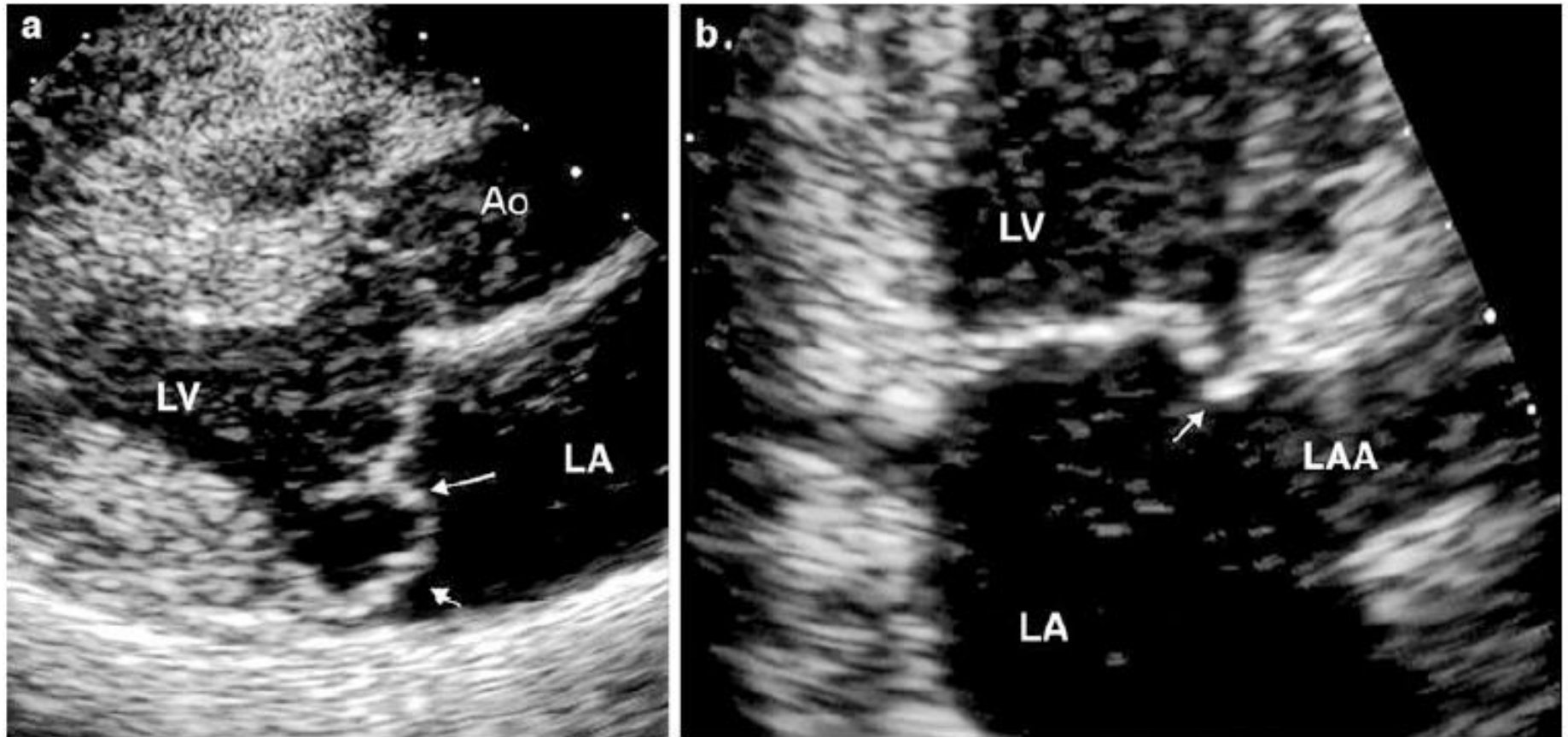
commissures. **b** Observation from the left ventricle, which can easily be deduced from transthoracic three-dimensional image



**Fig. 2.2** Widespread calcification of the posterior and anterior leaflets. The connection point is located toward the margin of the anterior leaflet (*arrow*). *LA* left atrium, *LV* left ventricle, *Ao* aorta

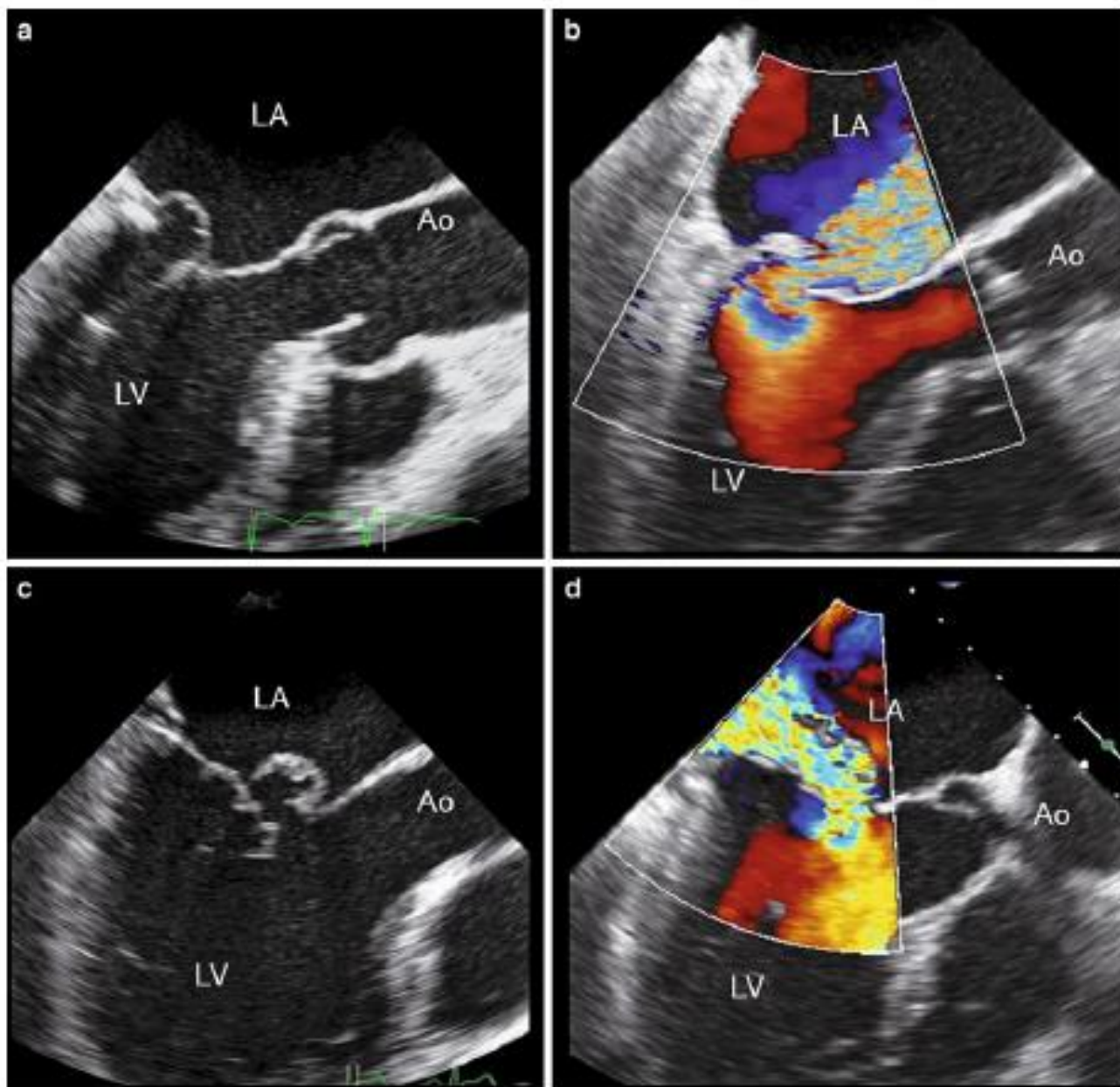


**Fig. 2.3** Widespread caseous calcification of the posterior leaflet of the mitral valve with a hyperechogenic case (*arrows*) and an irregular echolucent internal part (see text). *LA* left atrium, *LV* left ventricle



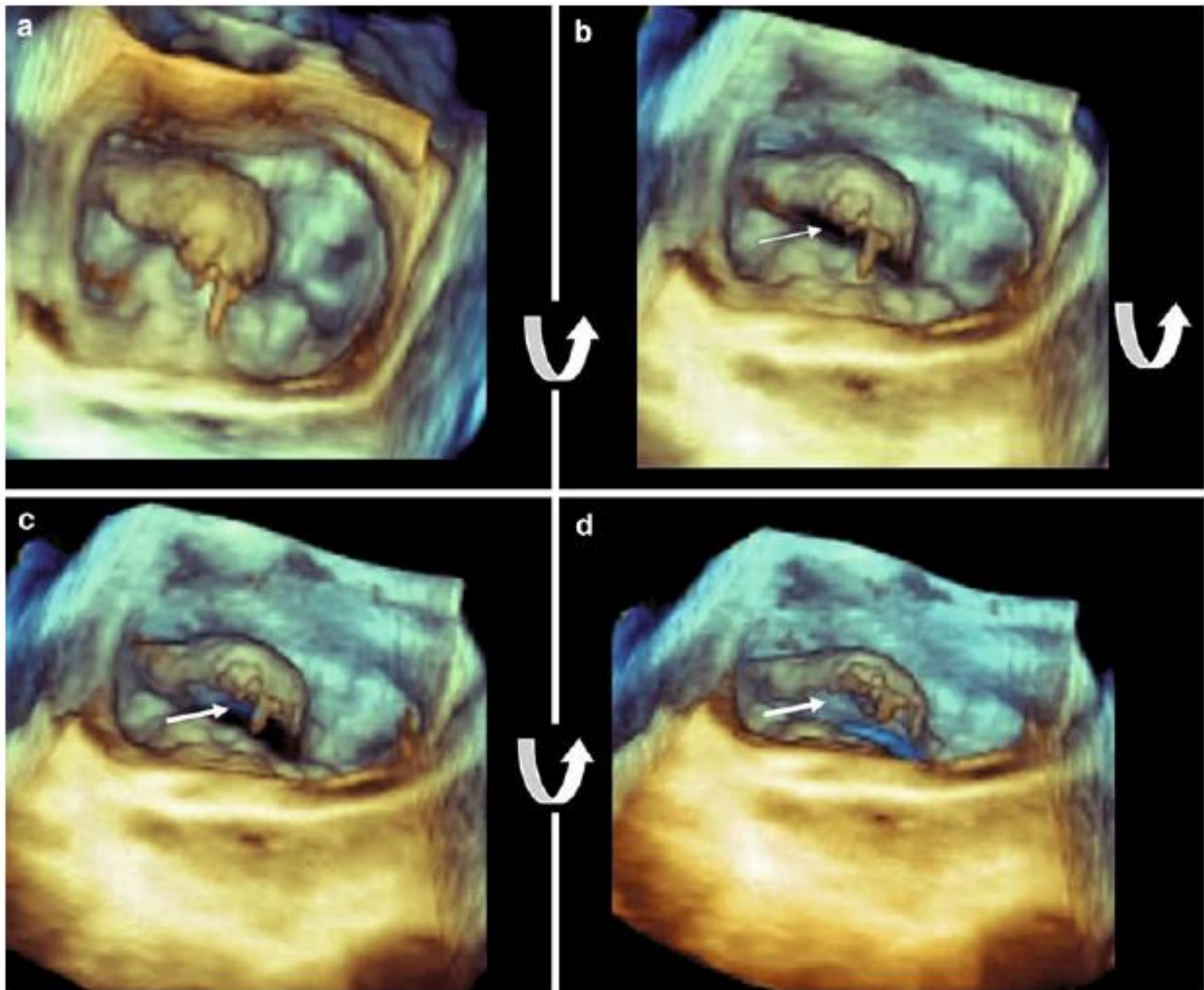
**Fig. 2.7** a Parasternal long-axis view showing evident prolapse of the central part (*P2*) of the posterior leaflet (arrows); b apical two-chamber view showing a small

prolapse of the lateral part (*P1*) of the posterior leaflet (arrow). *LV* left ventricle, *LA* left atrium, *Ao* aorta, *LAA* left atrial appendage

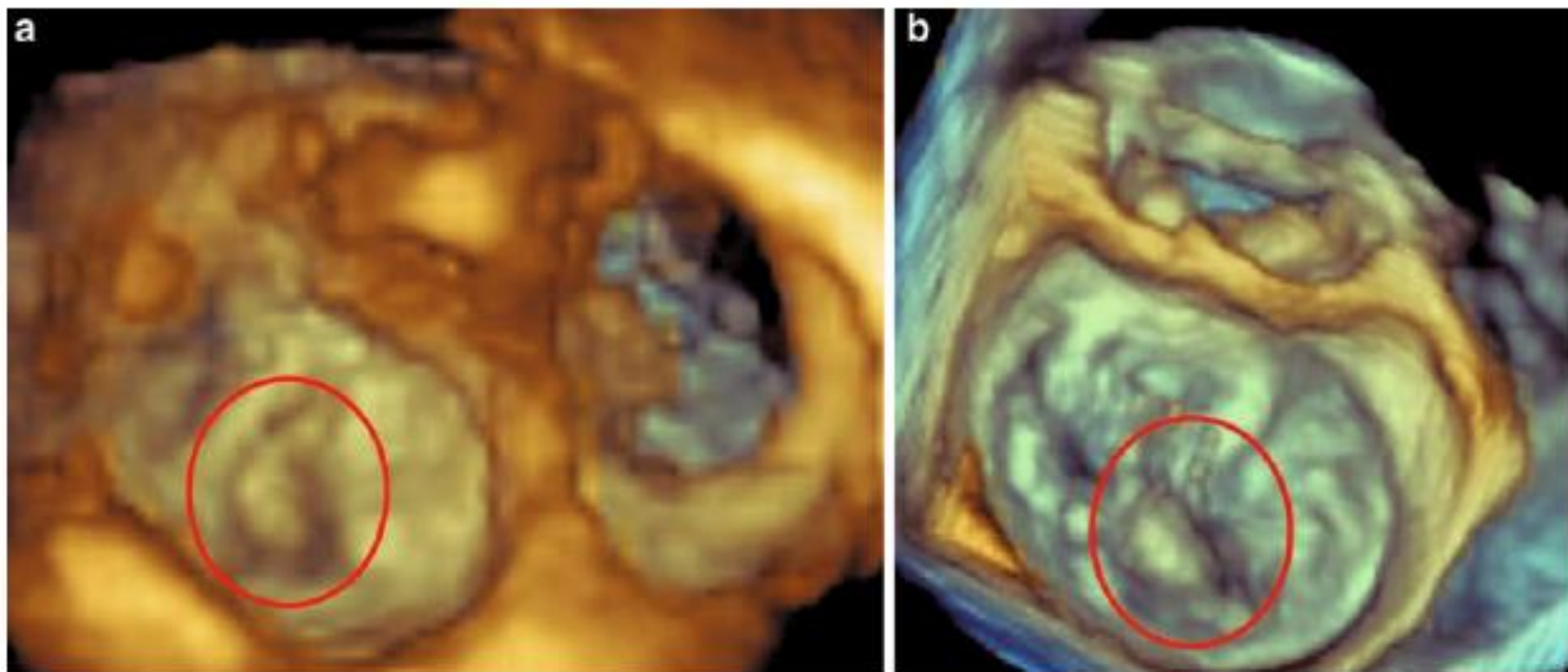


**Fig. 2.9** a, b Same patient as in Fig. 2.5. It can be seen how the regurgitation flow is directed toward the posterior wall of the aorta; c, d wide flail of the anterior

leaflet. In this case regurgitation flow is directed toward the opposite part. *LV* left ventricle, *LA* left atrium, *Ao* aorta

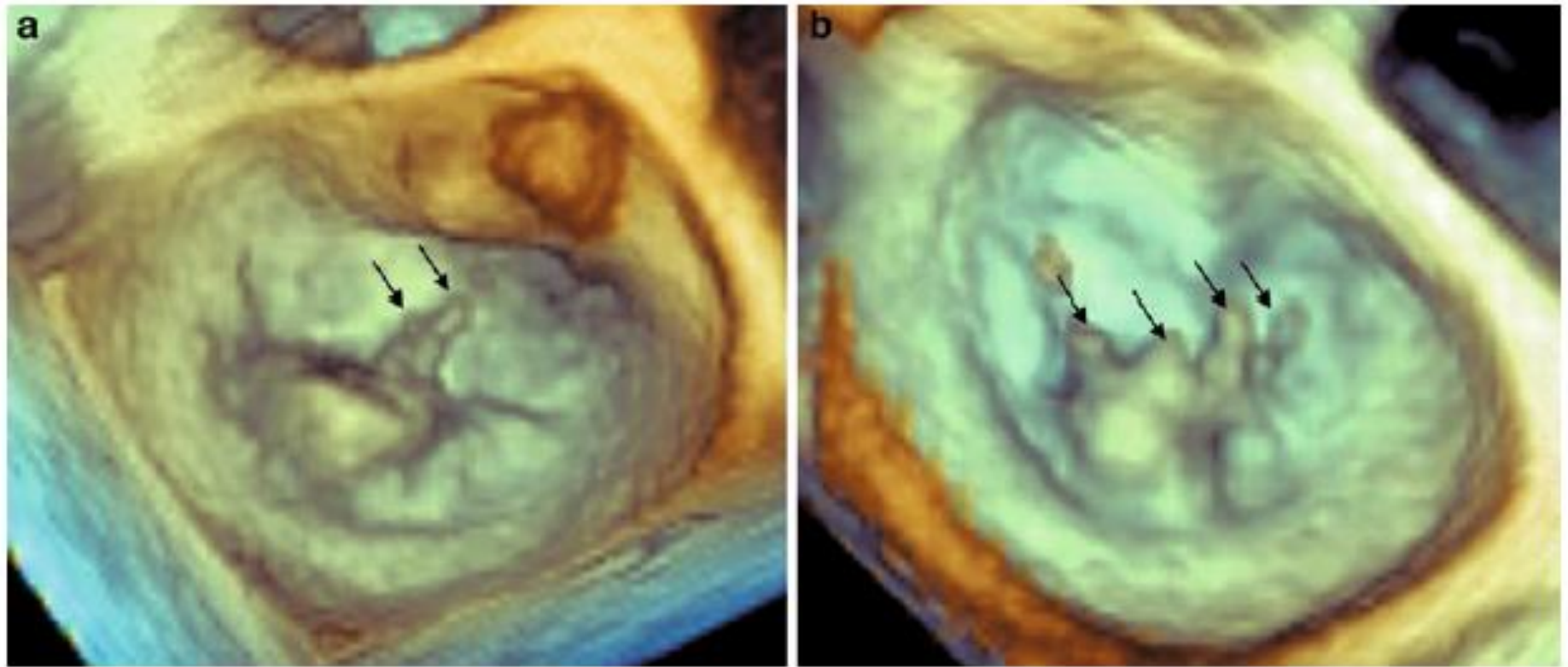


**Fig. 2.18** a-d Multiple ruptured chordae tendineae of the anterior leaflet. Gradual rotation of the image in direction of the arrows shows the regurgitation orifice (little white arrow)

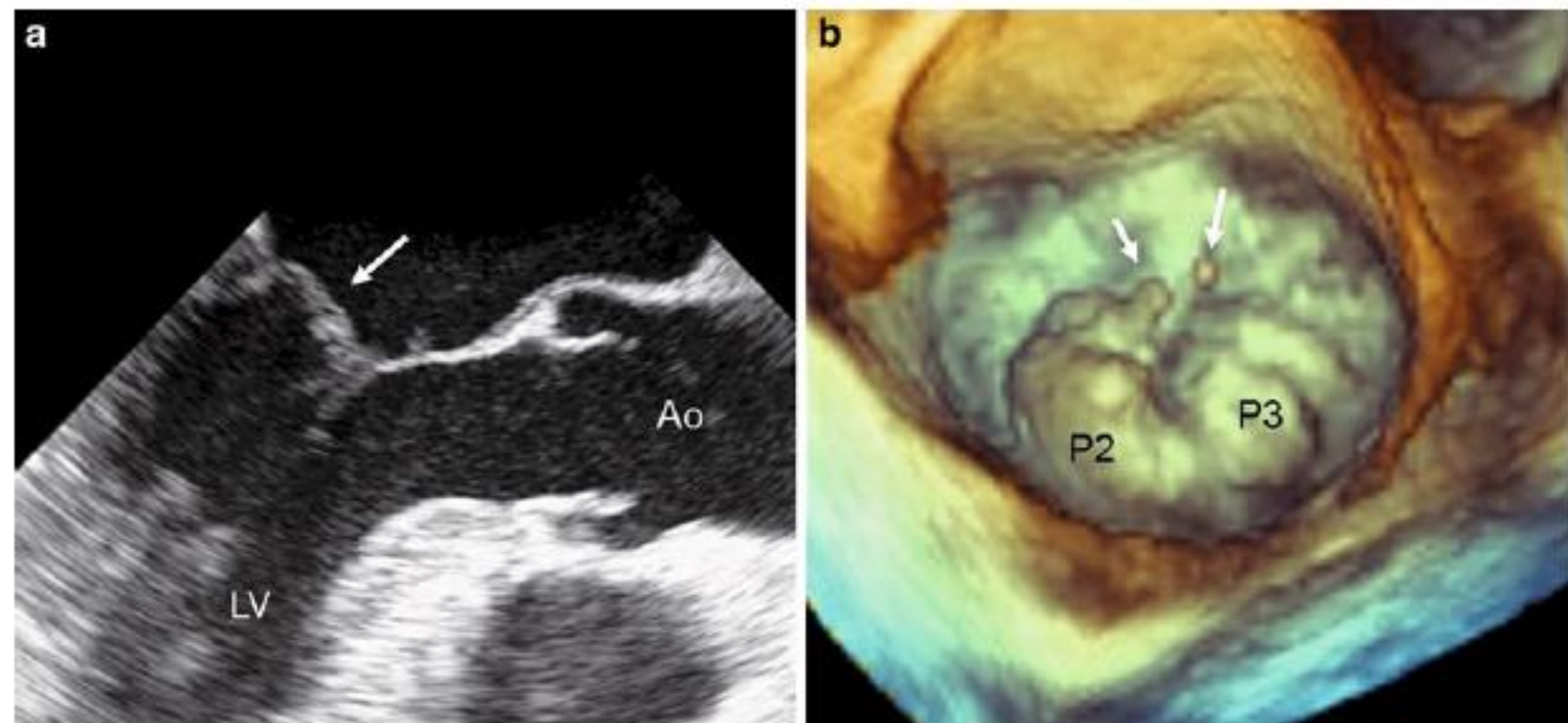


**Fig. 2.15** (a) Transthoracic and (b) transesophageal three-dimensional echocardiography. The difference in resolution between the two approaches is evident. *Red circle* ruptured chordae



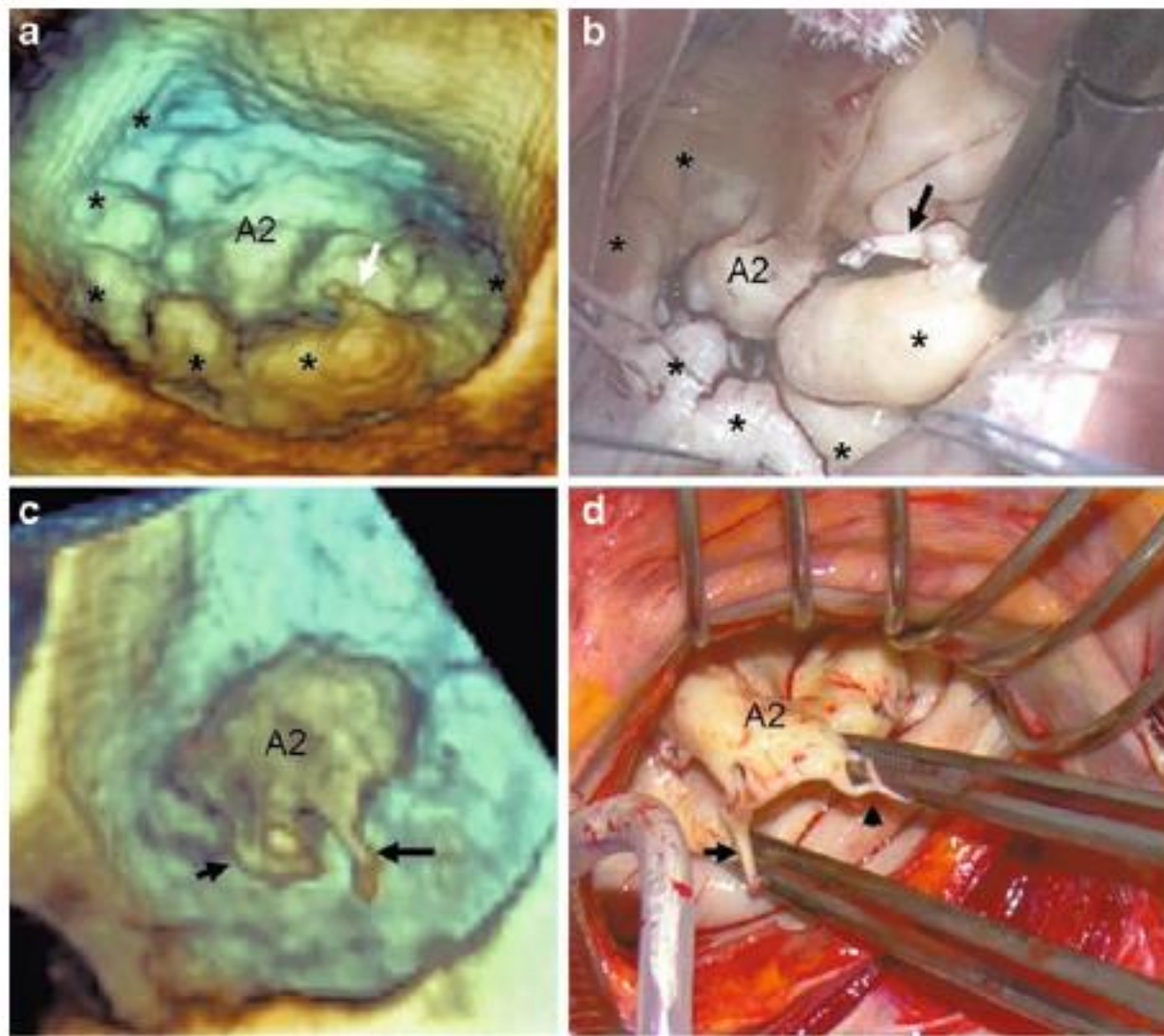


**Fig. 2.17** Two examples of (a) two and (b) four ruptured chordae tendineae (*arrows*)

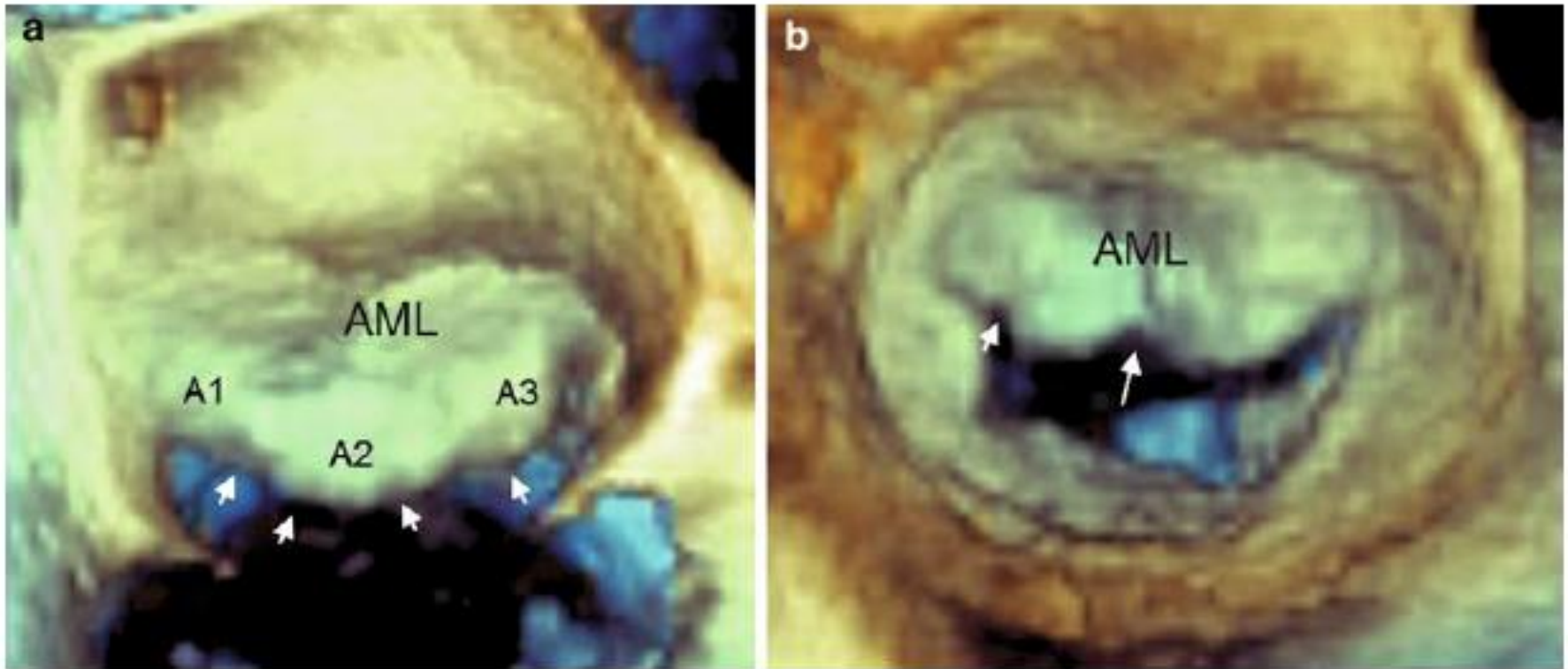


**Fig. 2.20** **a** Two-dimensional image showing a large prolapse of *P2* (*arrow*); **b** three-dimensional image showing that the prolapse is much more extensive, involving *P3*, and that two chordae tendineae are ruptured (*arrows*)

**Fig. 2.21** **a** Image of a myxomatous mitral valve with multiple prolapses (*asterisks*) and a ruptured chorda tendinea of the medial part of *P2* (*arrow*); **b** corresponding anatomical view photographed in the operating theater; **c** image of multiple ruptured chordae tendineae (*arrows*) of the central part of the anterior leaflet (*A2*); **d** corresponding surgical anatomical photograph; **e** prolapse of *P2* with rupture of a chorda tendinea (*arrow*); **f** corresponding surgical anatomical photograph



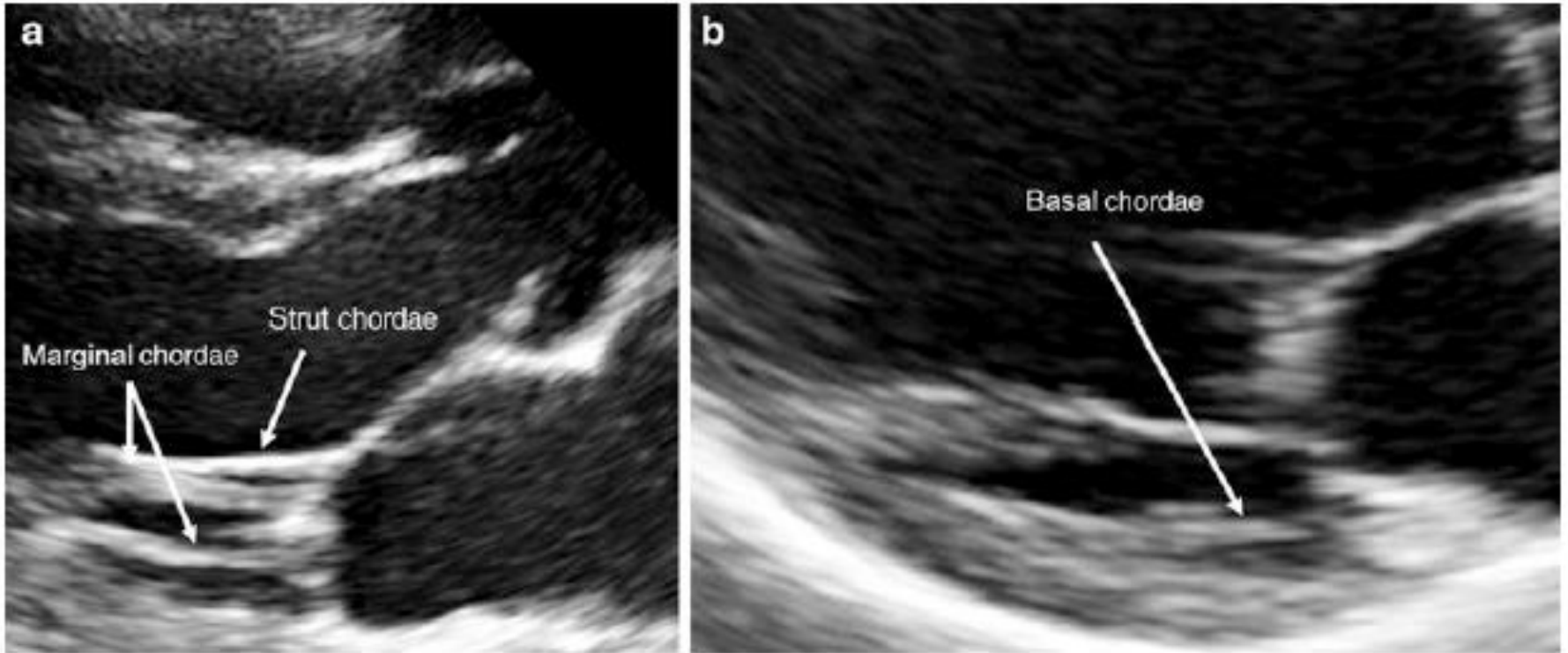
## *Bordas dos folhetos - incisões*



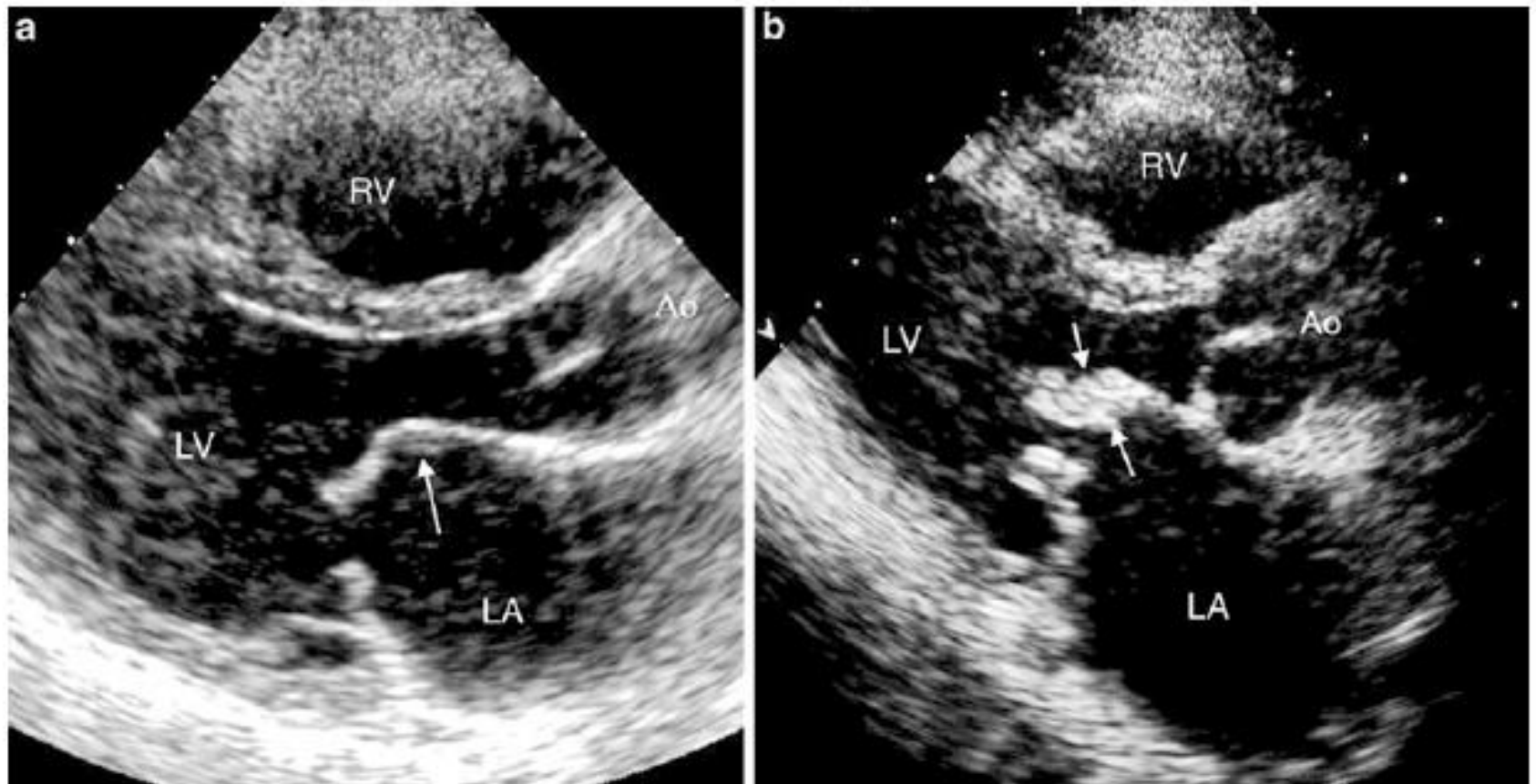
**Fig. 1.15** **a** Three-dimensional image in which the annulus and posterior leaflet have been excluded with an appropriate slice to better visualize the margin of the anterior leaflet. It is clear that the free margin of the leaflet has a certain irregularity (*arrows*) but incisões

cannot be seen; **b** three-dimensional images from the surgical view. The free margin shows small incisões but do not make it possible to divide the leaflet into scallops (sub-cleft). *AML* anterior mitral leaflet

## *Cordoalha tendínea*



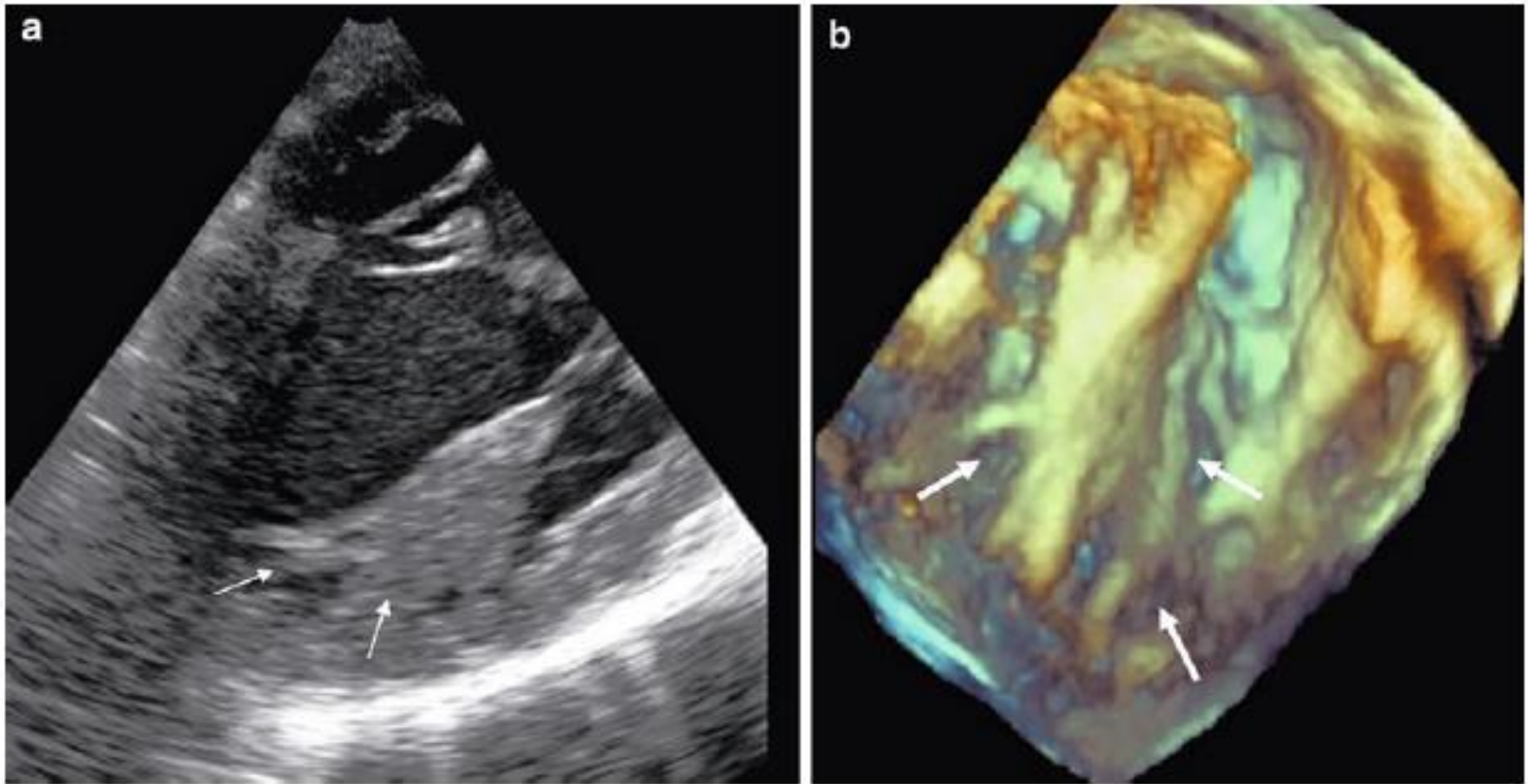
**Fig. 1.19** Two-dimensional parasternal long-axis views where all three types of chordae (*strut* and *marginal* in panel a, *basal* in panel b) can be distinguished



**Fig. 5.7 a** Two-dimensional image in the parasternal long-axis view of a young patient with mitral stenosis. In this case the body of the anterior leaflet is flexible and elastic and this leads to the diastolic doming characteristic (*arrow*).

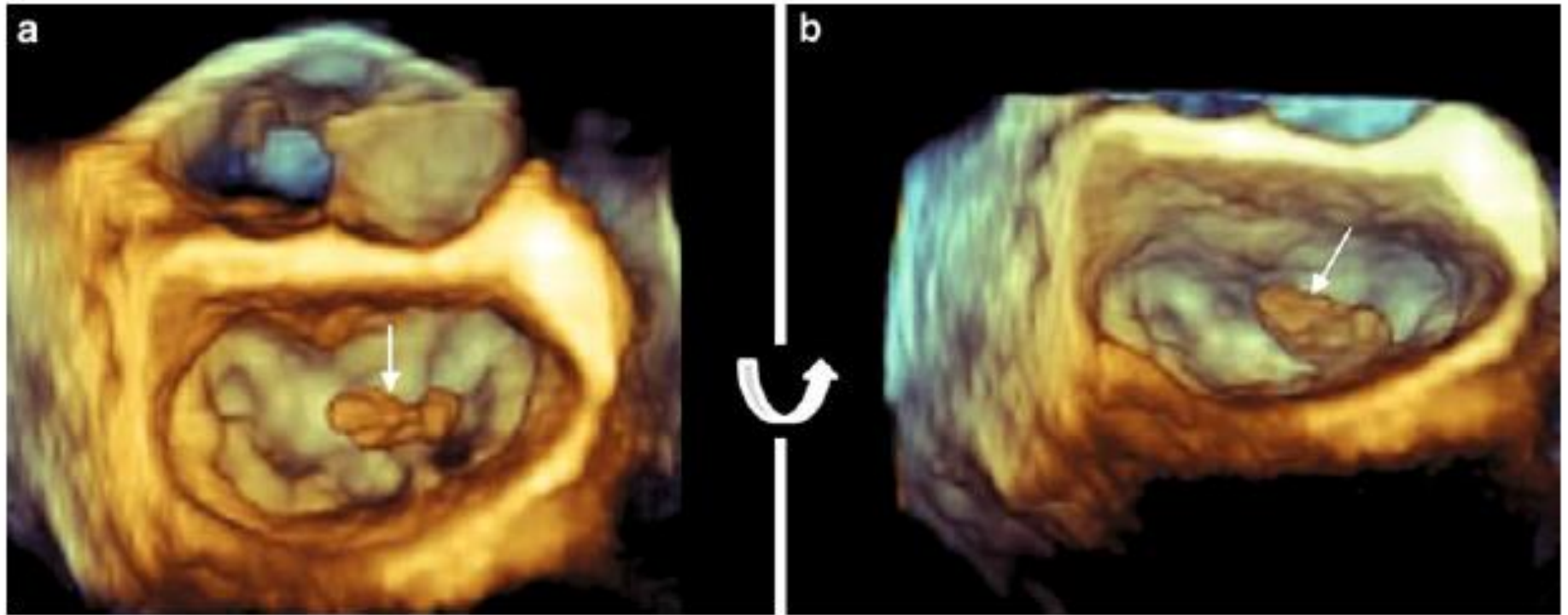
**b** Two-dimensional image in the parasternal long-axis view of a 74-year-old patient with mitral stenosis. In this example the body of the anterior leaflet is thickened and rigid (*arrows*). *LA*, left atrium; *LV*, left ventricle; *Ao*, aorta; *RV*, right ventricle

## *Músculos papilares e cavidade ventricular esquerda*



**Fig. 1.24** a Transesophageal and transgastric two-dimensional image and (b) three-dimensional echocardiographic view of the same patient in a similar

projection. The specific connections between the papillary muscles and ventricular walls can clearly be seen

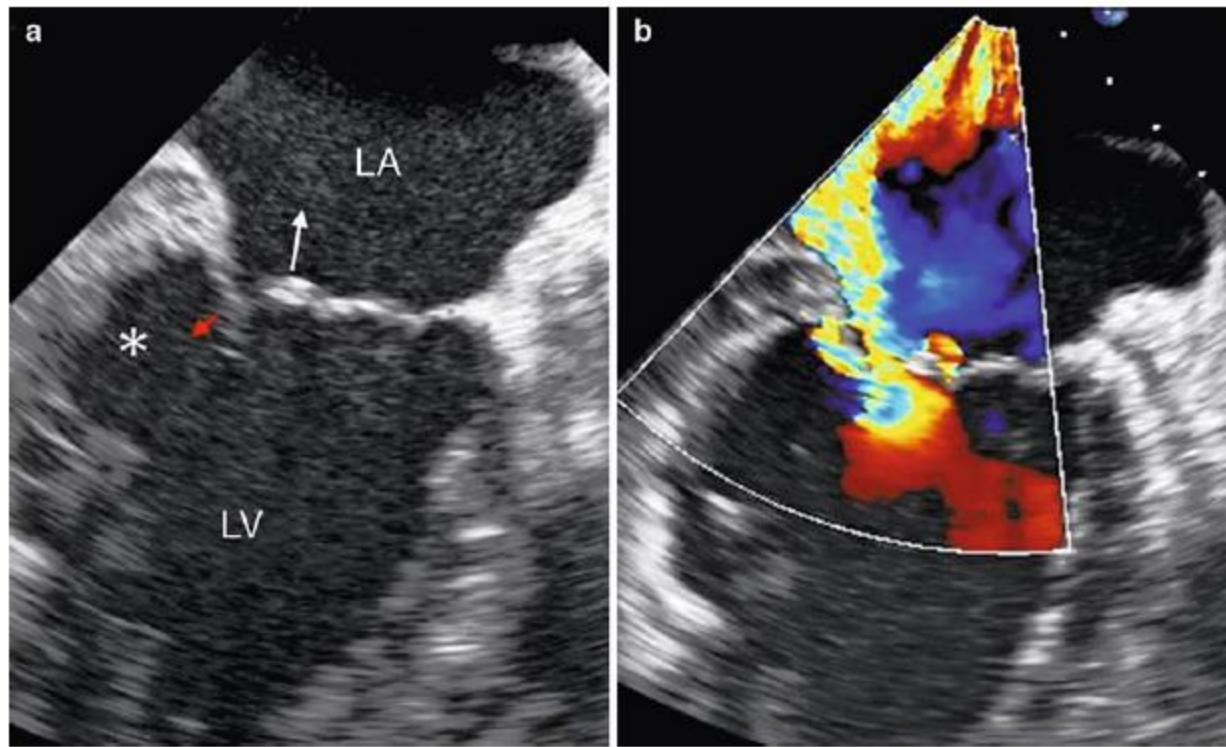


**Fig. 2.28** Same case as in Fig. 2.27. (a) Three-dimensional image seen from above and (b) with a slight downward rotation (*curved arrow*). Vegetation is

indicated by the *arrow*. The vegetation appears attached to the central and medial parts of the anterior leaflet (A2, A3)

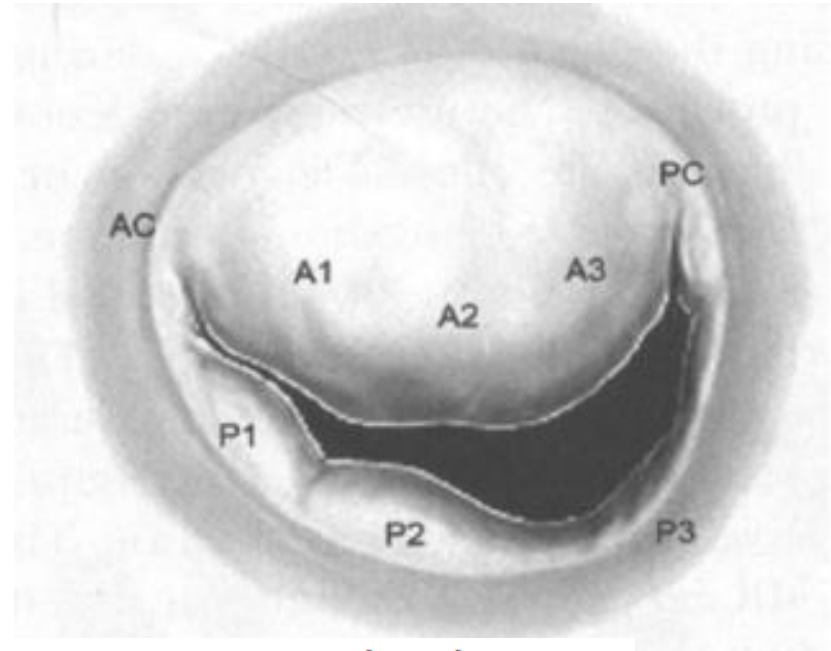
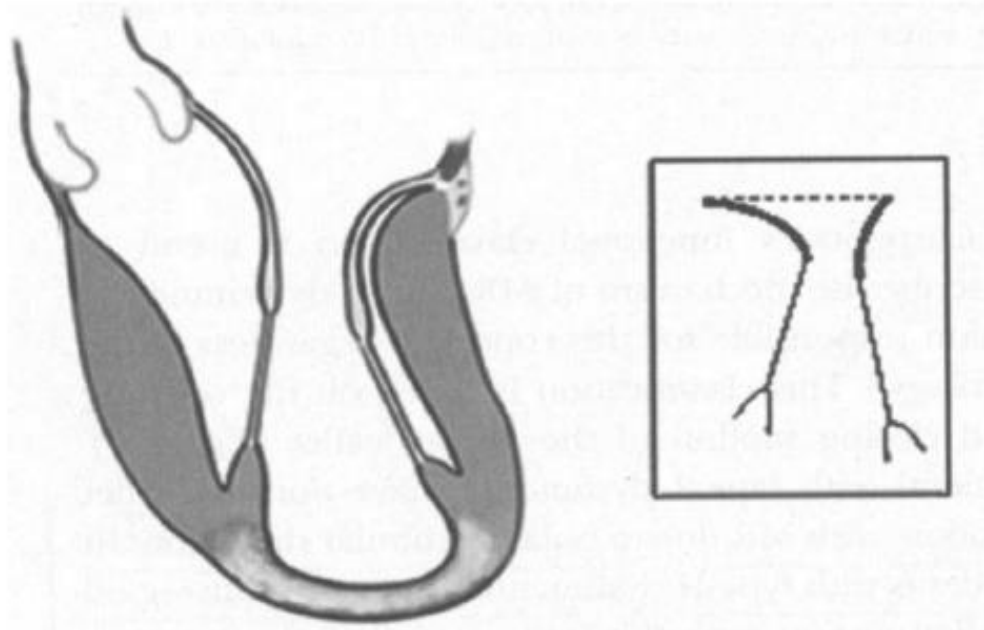


## *Insuficiência mitral funcional*



**Fig. 3.1** **a** Two-dimensional transesophageal images in a patient with inferoposterior infarction, showing kinetic changes in the basal segment of the inferior wall (*asterisk*) and traction mainly on the posterior leaflet (*red arrow*). It can be seen how the anterior leaflet slides under the posterior leaflet (*white arrow* in the direction of

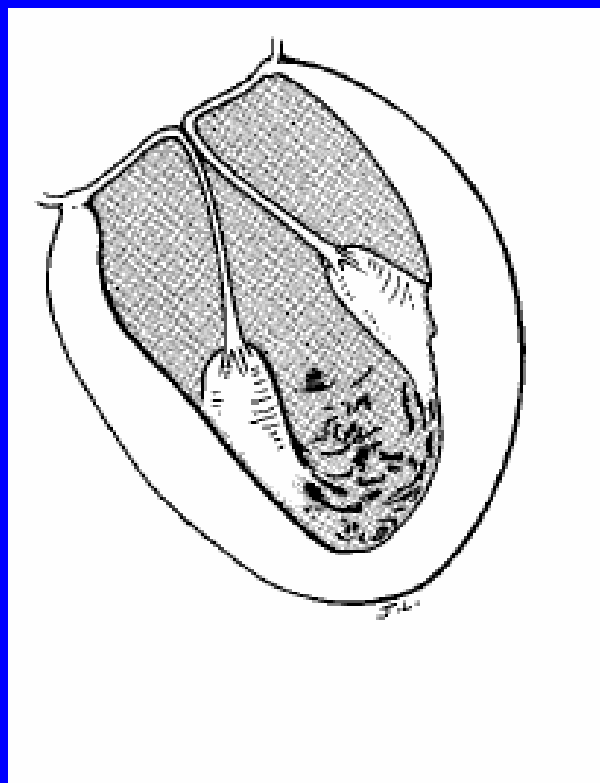
the sliding), creating the false impression of a prolapse. However, it is clear how the leaflet does not pass beyond the level of the annulus. **b** The same image with color Doppler. The regurgitation flow is in the opposite direction from the pseudo-prolapse. *LV* left ventricle, *LA* left atrium



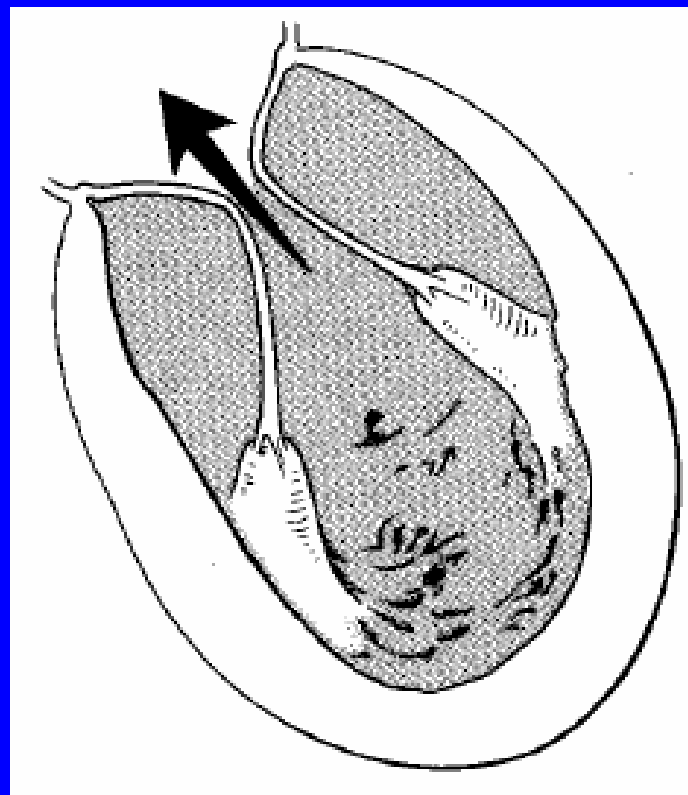
**FIGURE 2.** Restricted leaflet motion. It is noticed in the cross sectional view of the mitral valve that segments P3/P2 do not coapt due to restricted motion of the leaflet. Type IIIb dysfunction of Carpentier's classification. Reprinted with permission from *Am Heart Hosp J.* 2006;4:261–268.<sup>6</sup>

- **Cardiomiopatas isquêmica e dilatada**

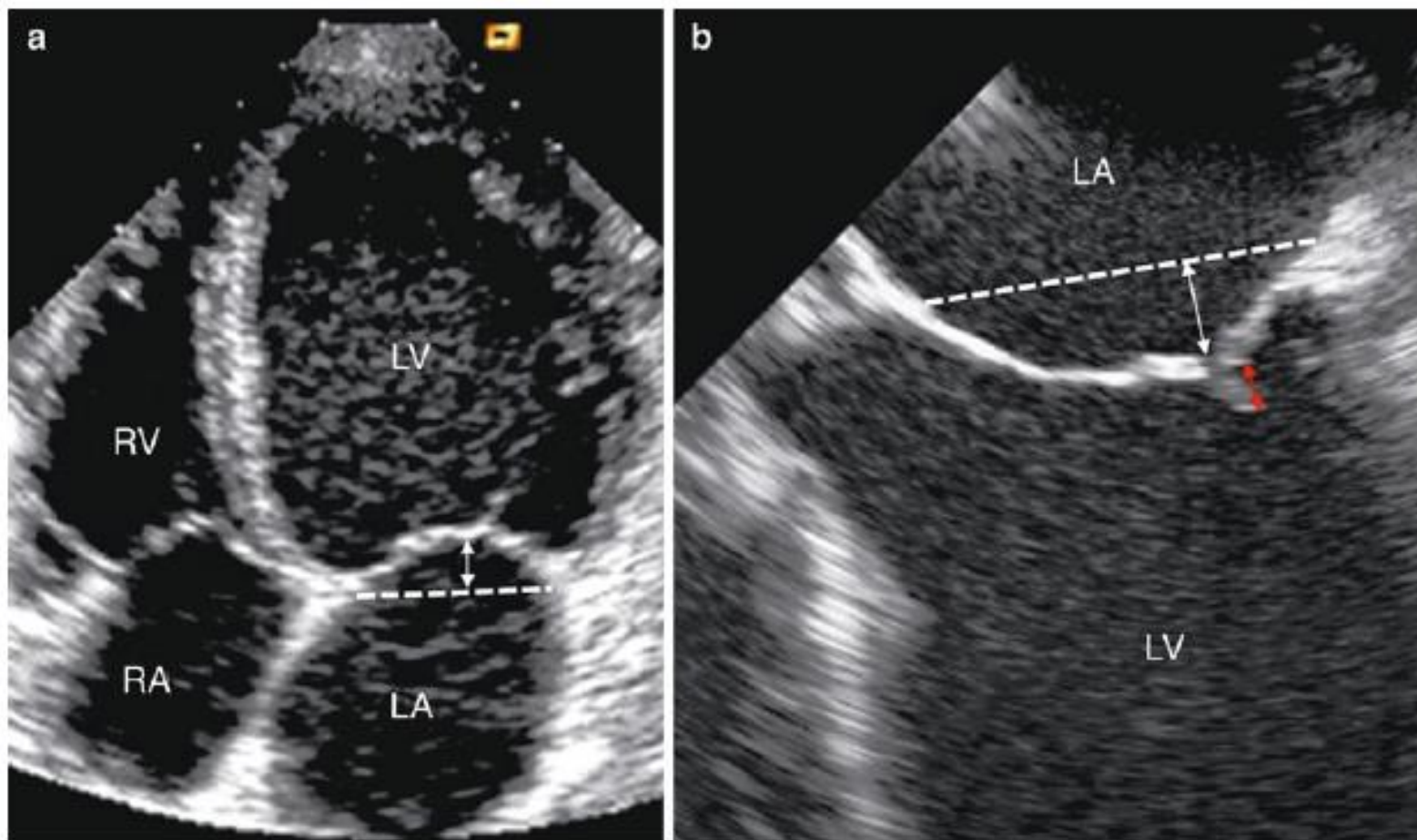
## **MR from Apical Tethering of Normal leaflets**



**Normal leaflet position  
(for comparison)**



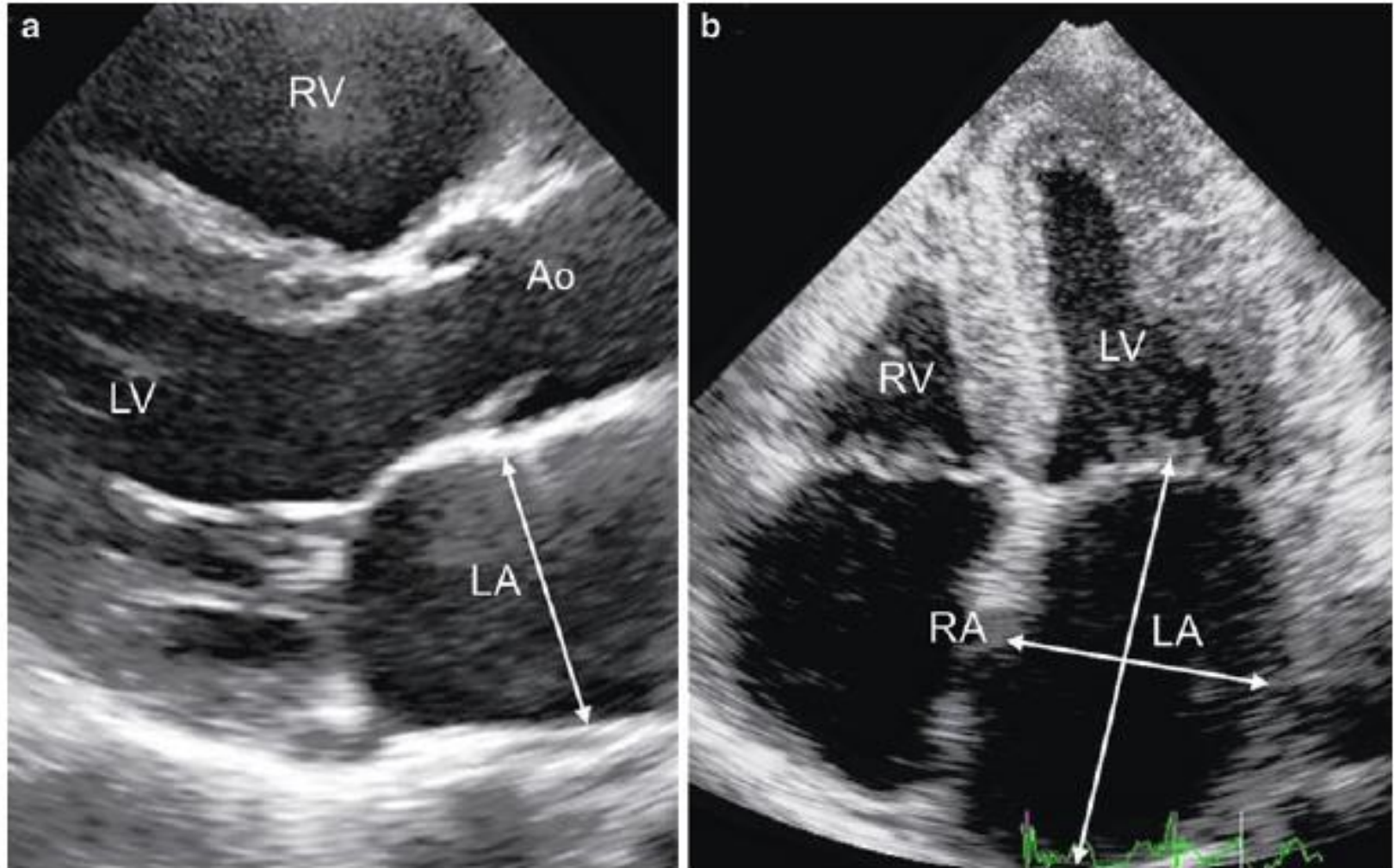
**Coaptation line  
displaced Apically**



**Fig. 3.10** **a** Four-chamber transthoracic apical view in a patient with non-ischemic dilated cardiomyopathy. Classical conformation with a “symmetrical tent” due to dislocation of both papillary muscles. Measurement of the tenting height. The height of tenting is measured (double-headed arrow). **b** Magnified transesophageal

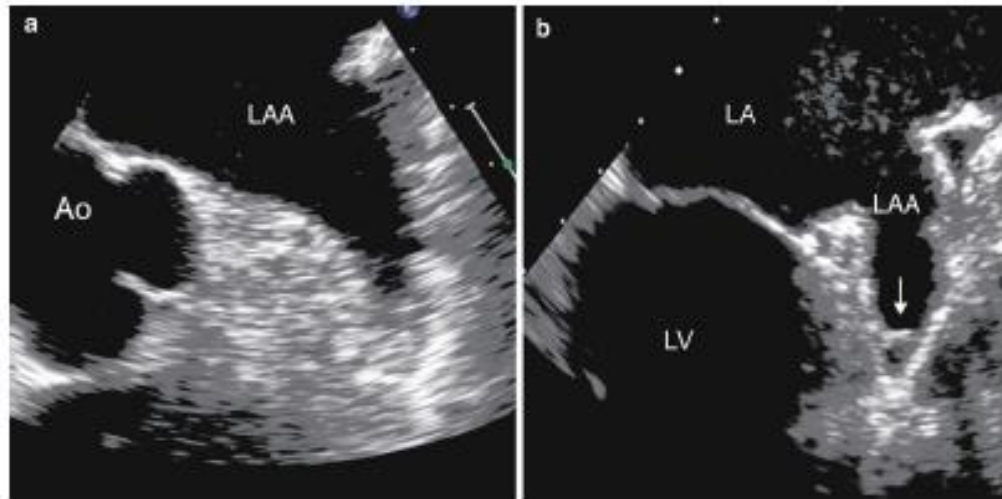
image of the mitral valve in a second patient with non-ischemic dilated cardiomyopathy. Measurement of the tenting height (white double-headed arrow) and the residual coaptation area (red double-headed arrow). LV left ventricle, LA left atrium, Ao aorta, RV right ventricle, RA right atrium

## Átrio Esquerdo

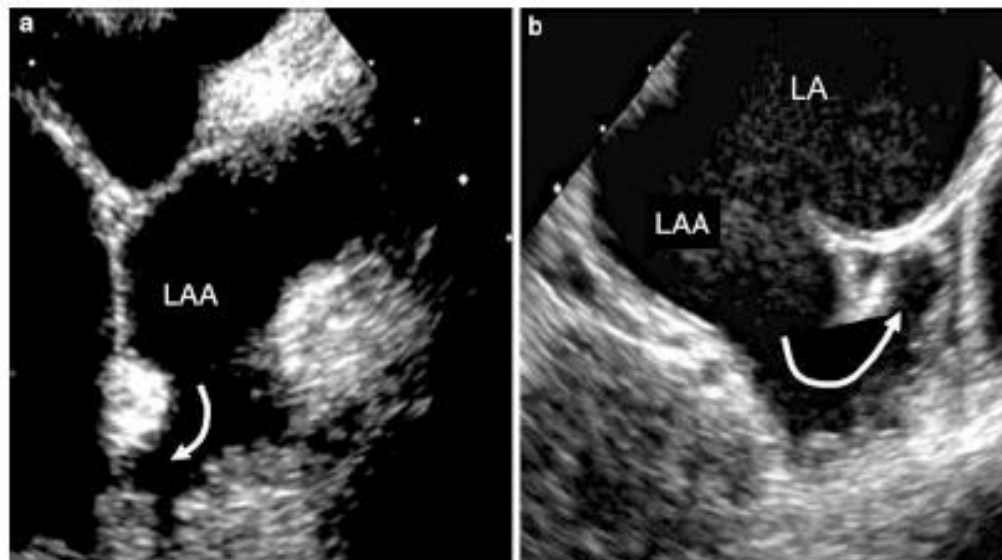


**Fig. 6.2** a Parasternal long-axis view and (b) apical four-chamber view with linear measurements of the left atrium. LA left atrium, LV left ventricle, RA right atrium, RV right ventricle, Ao aorta

## Apêndice atrial esquerdo

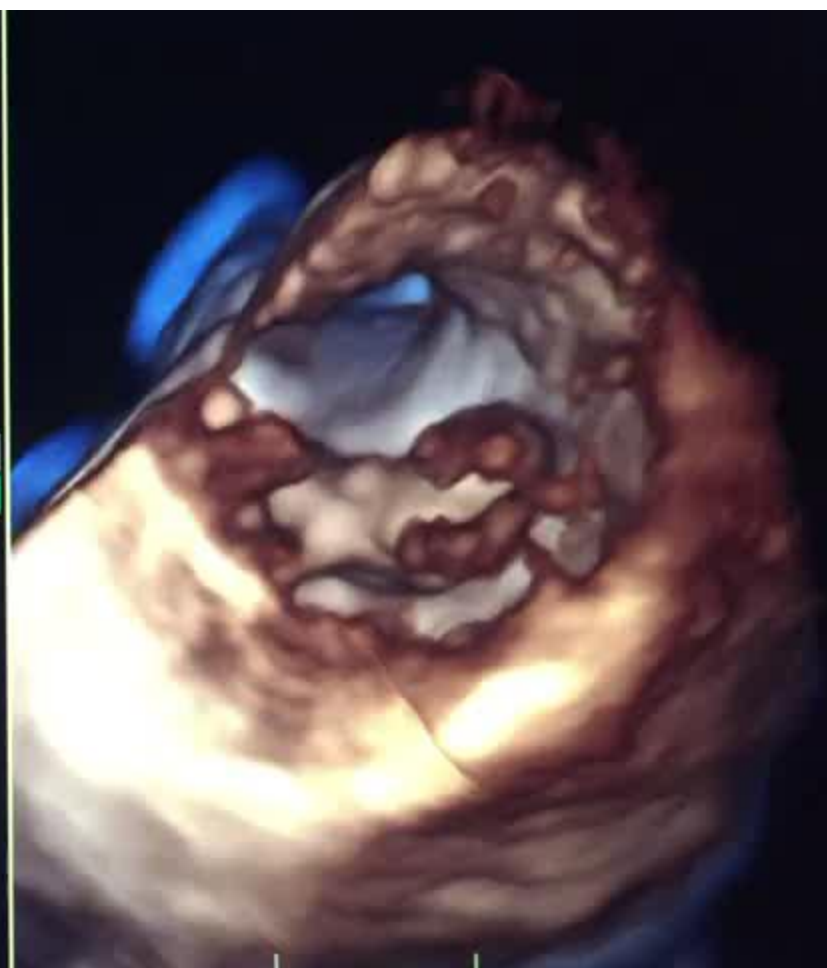
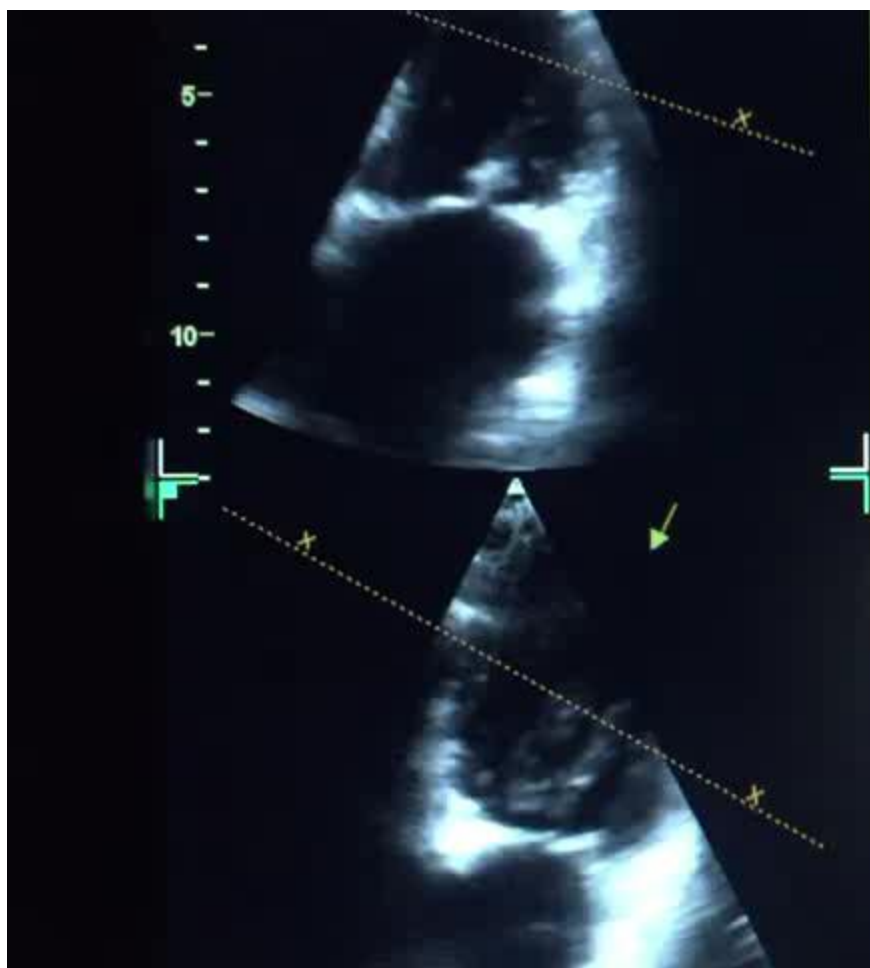


**Fig. 6.3** Two-dimensional transesophageal images (mid-esophagus) of two sectional planes at (a) 20–30° and (b) 80–90°. Both sections show an LAA with a triangular form. The *arrow* indicates a musculus pectinatus



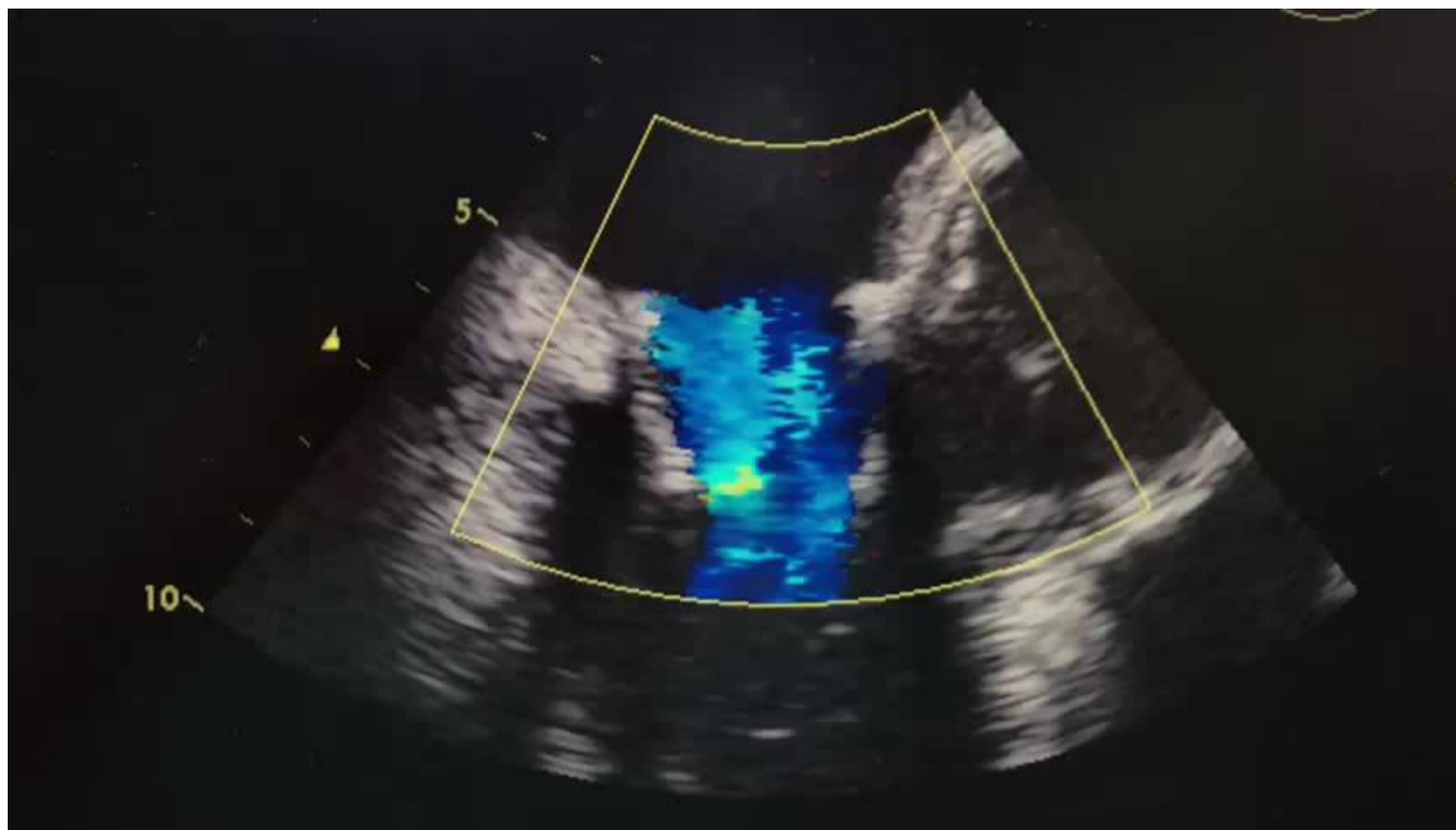
**Fig. 6.4 a,b** Two two-dimensional transesophageal images (at the mid-esophageal level) with an angle of 120–130° and anticlockwise rotation until the ultrasound beam does not cross a tangential plane of the LAA. The

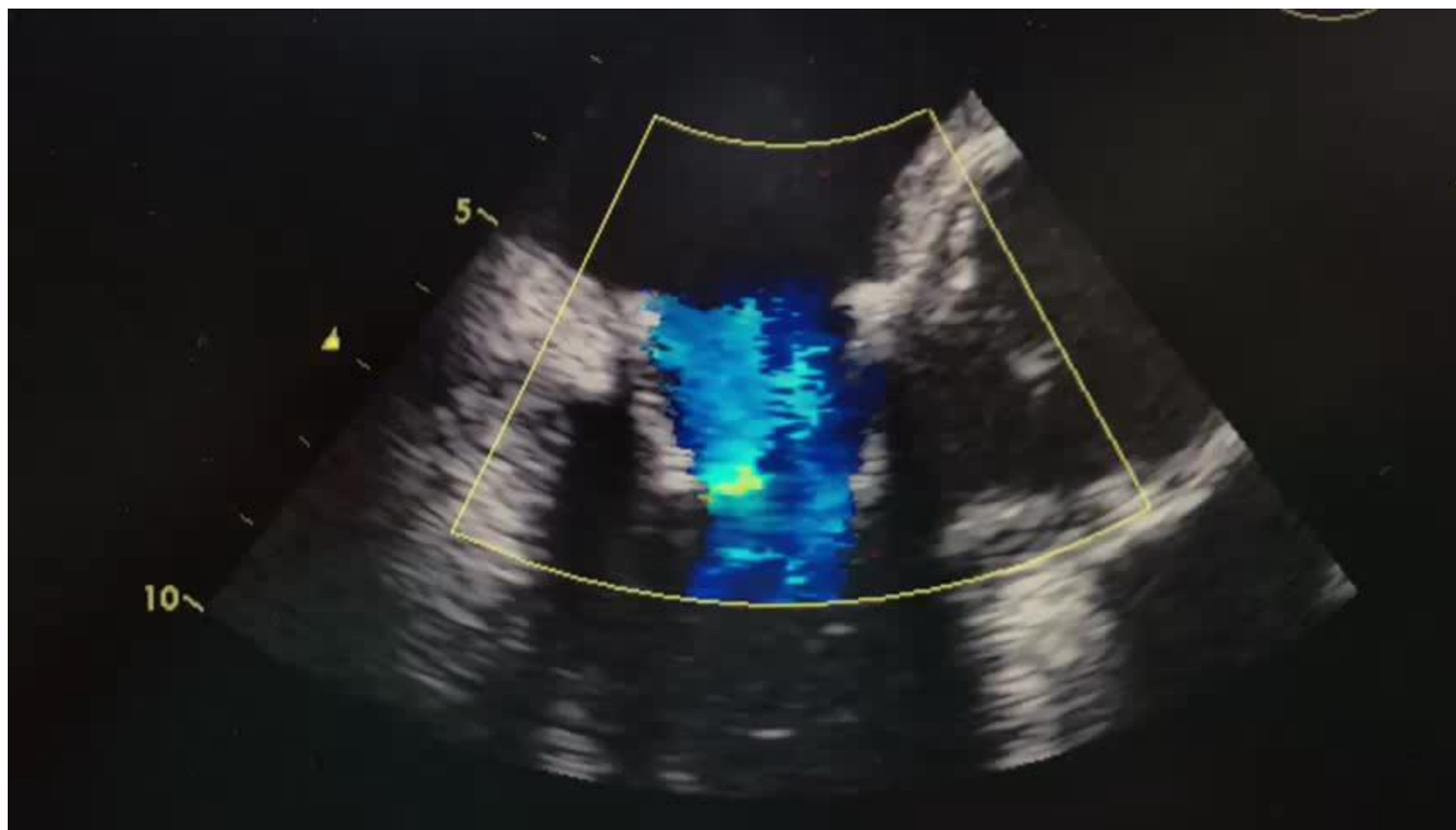
absolutely irregular form is observed with the musculi pectinati and small lobes. *LA* left atrium, *LAA* left atrial appendage

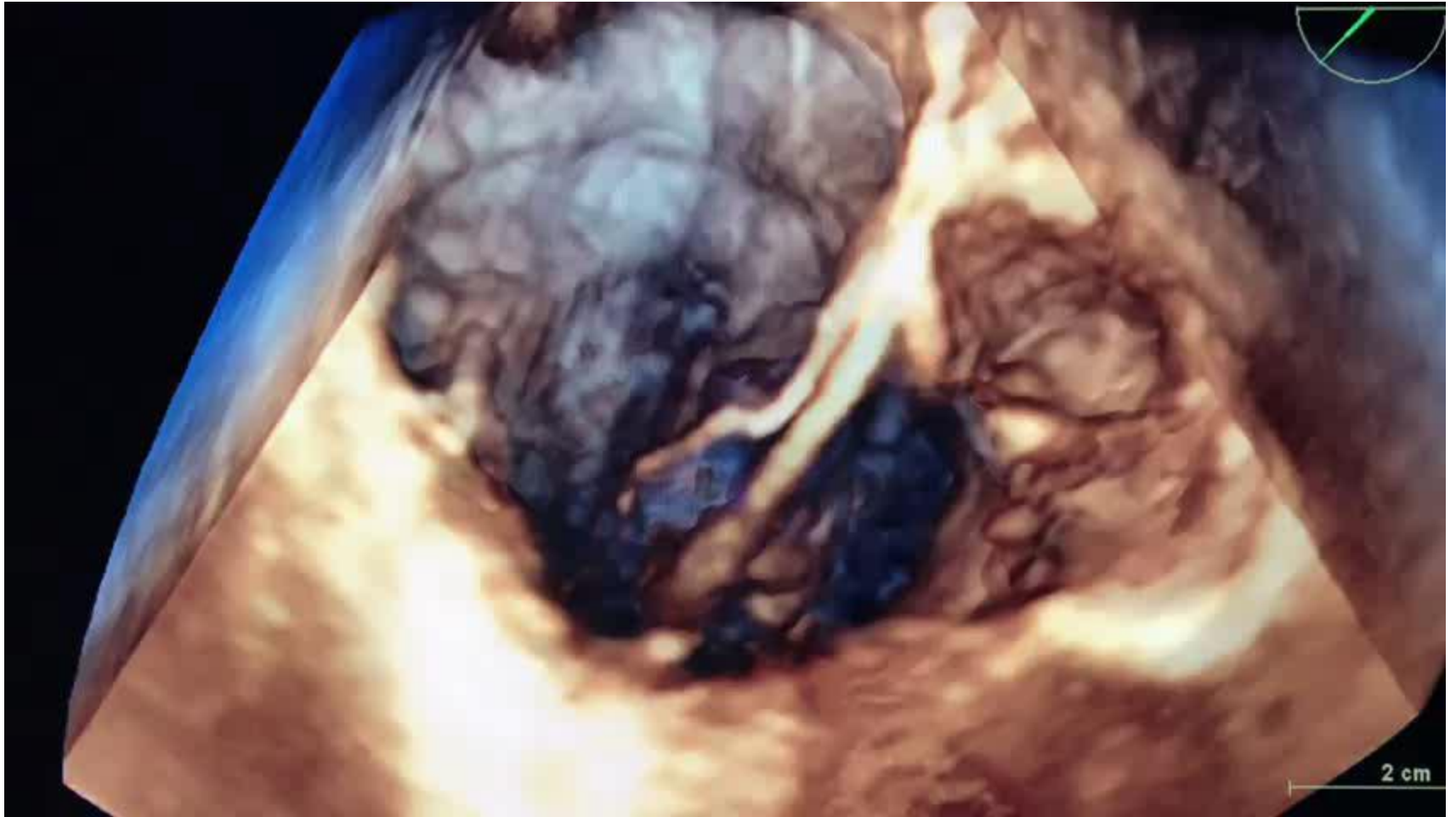


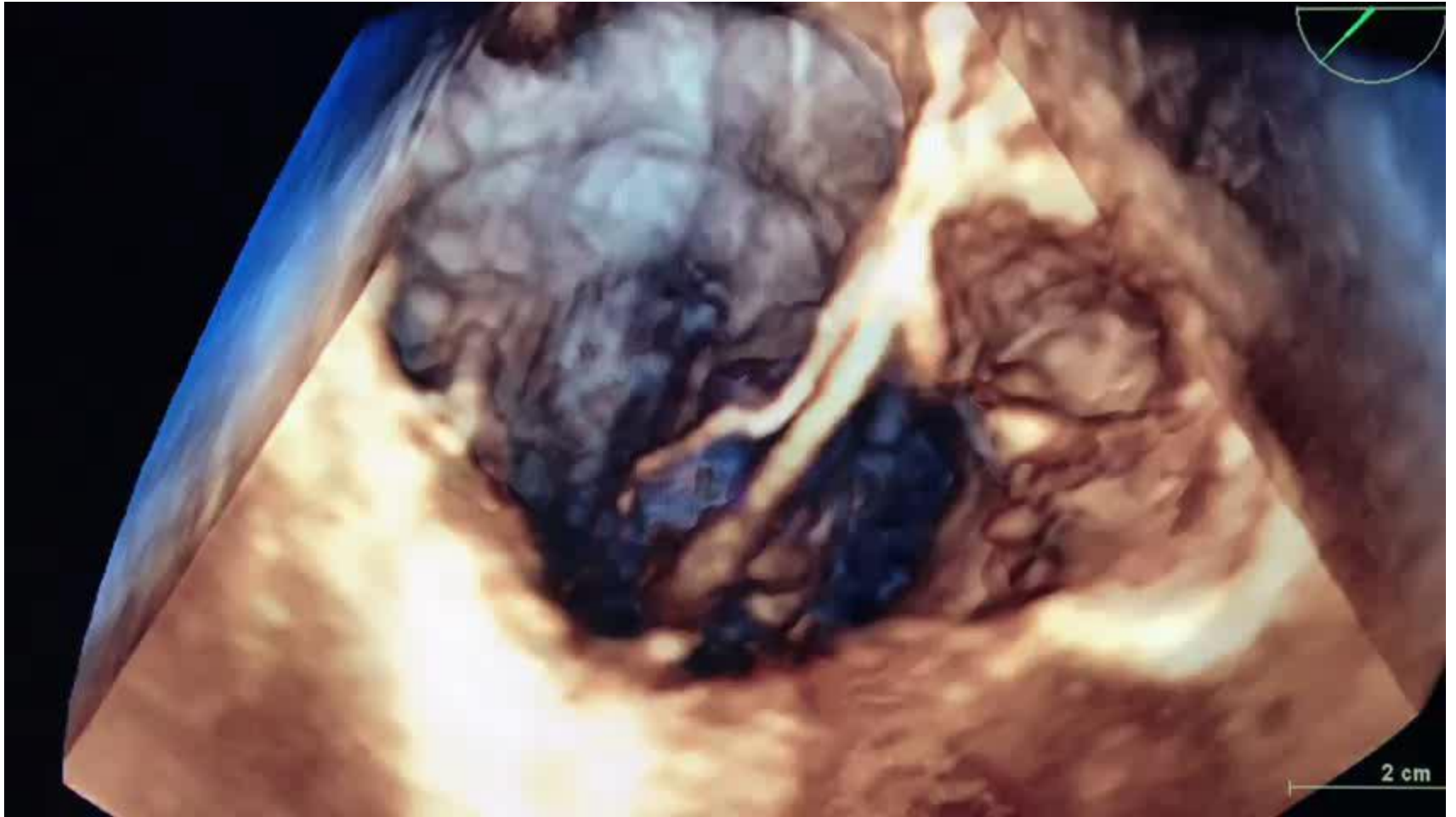




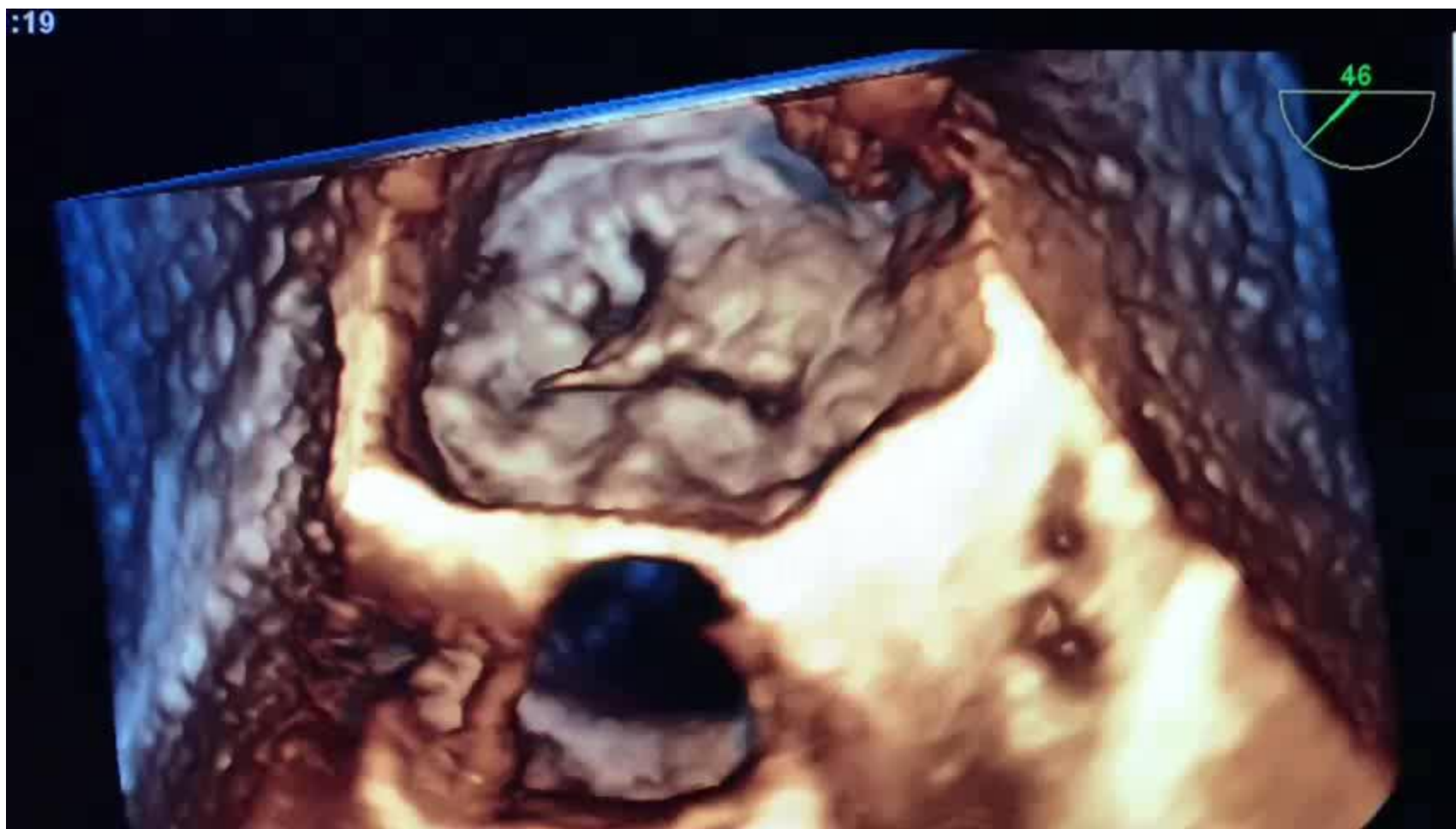




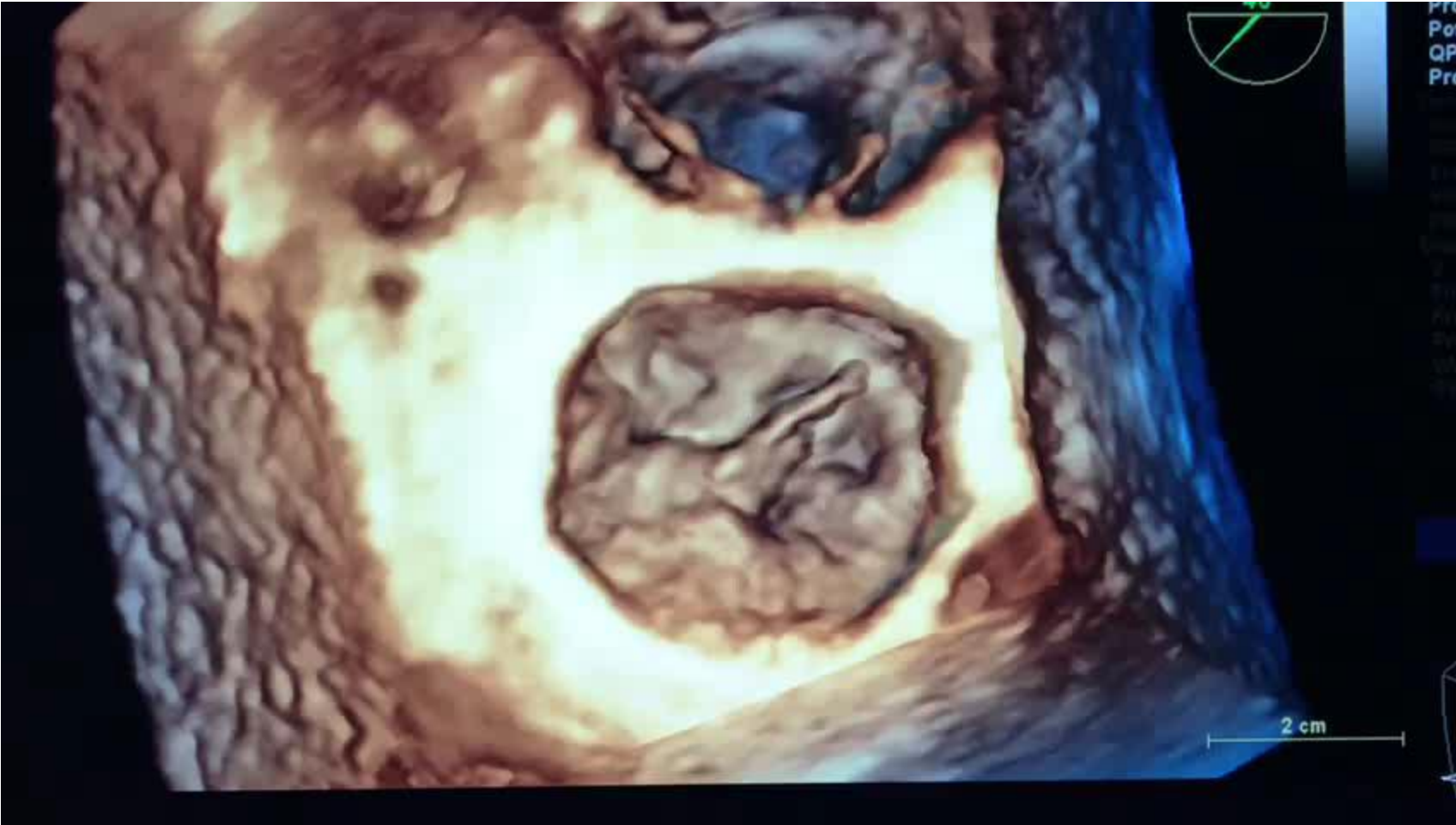


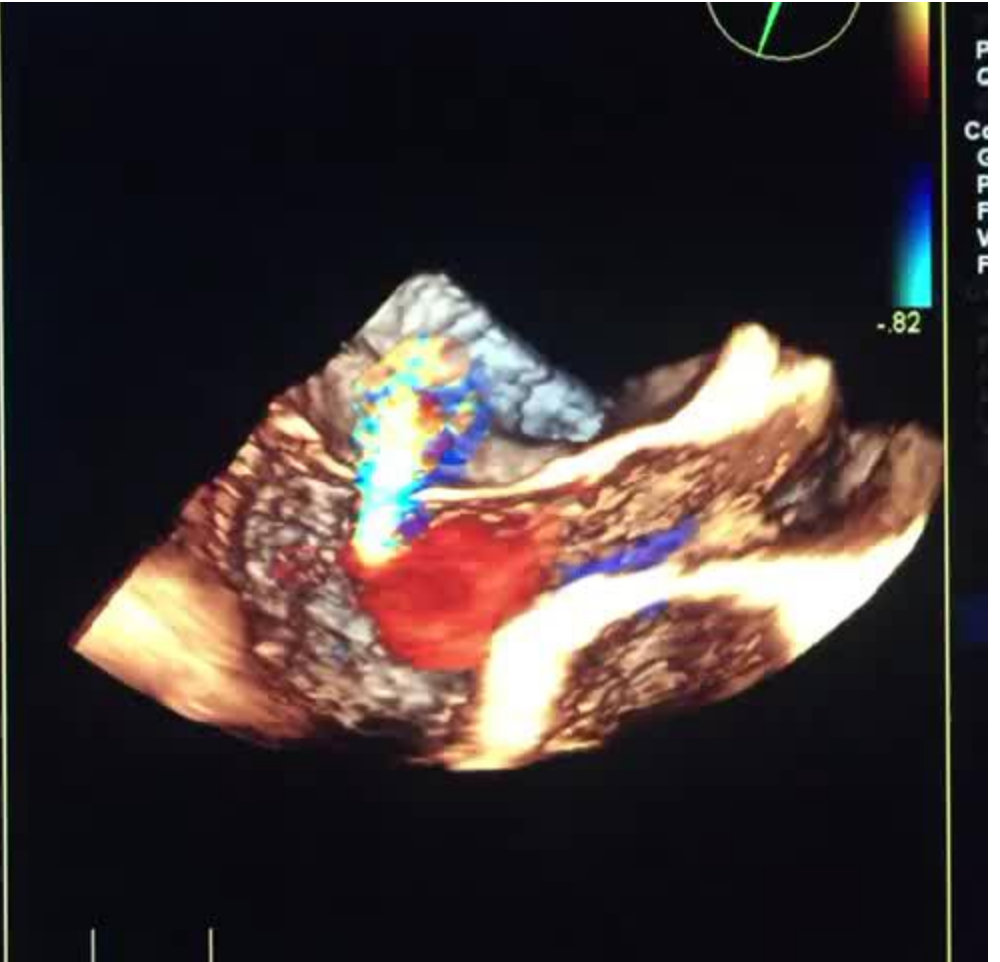
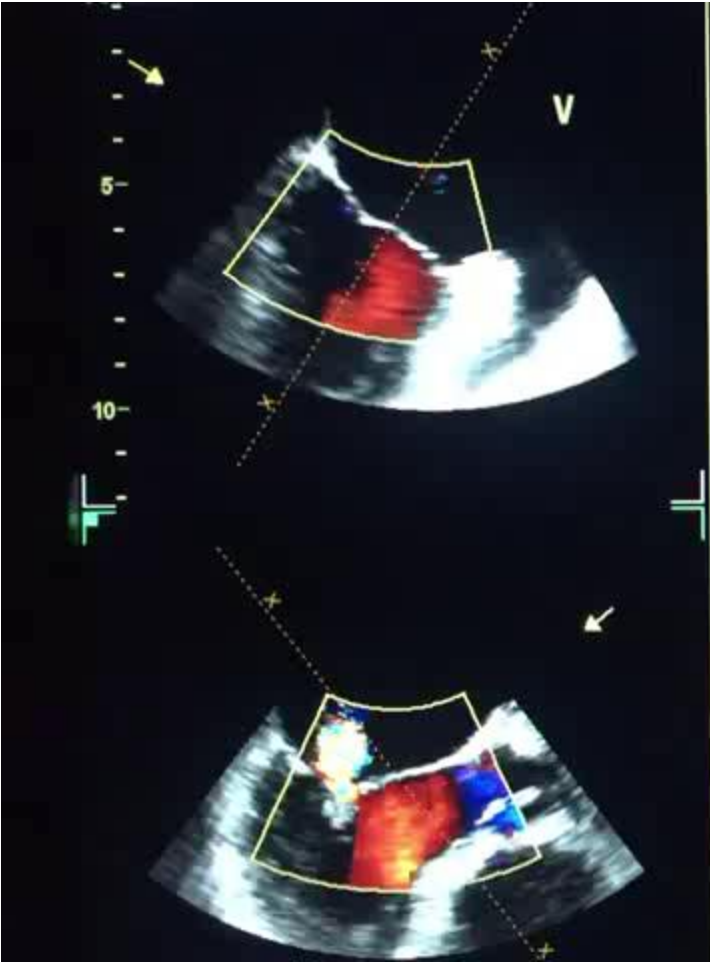


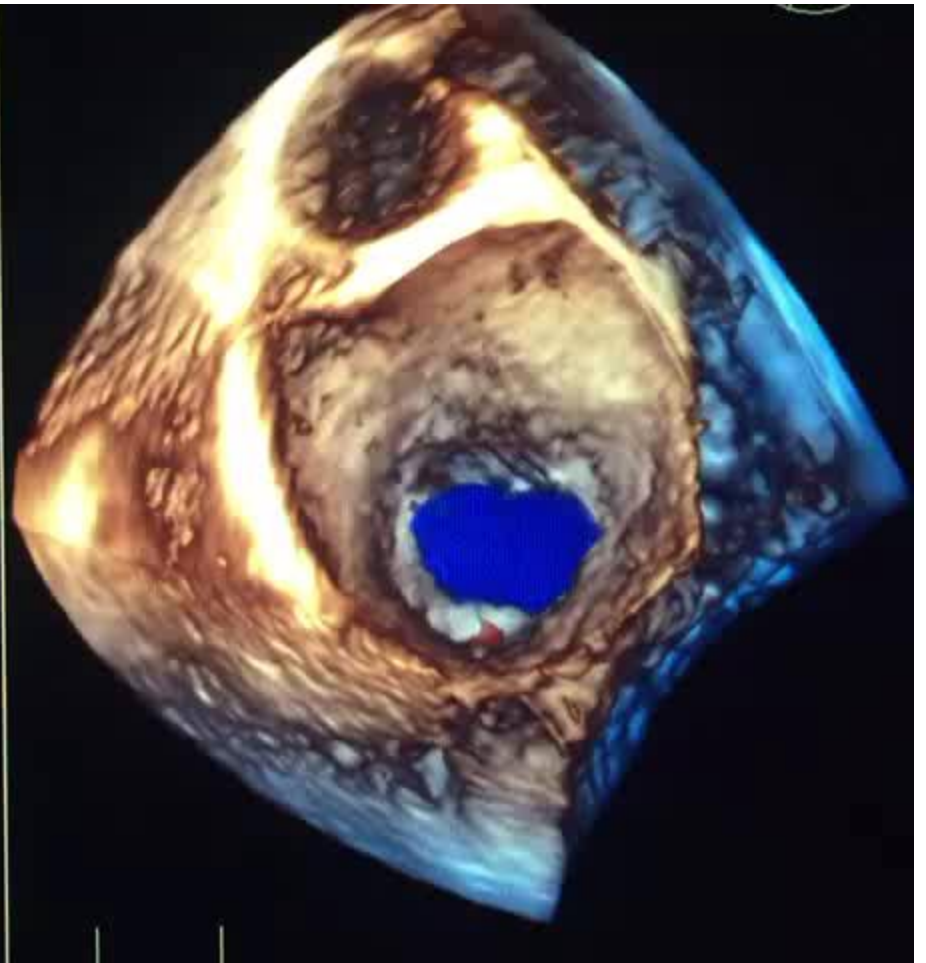
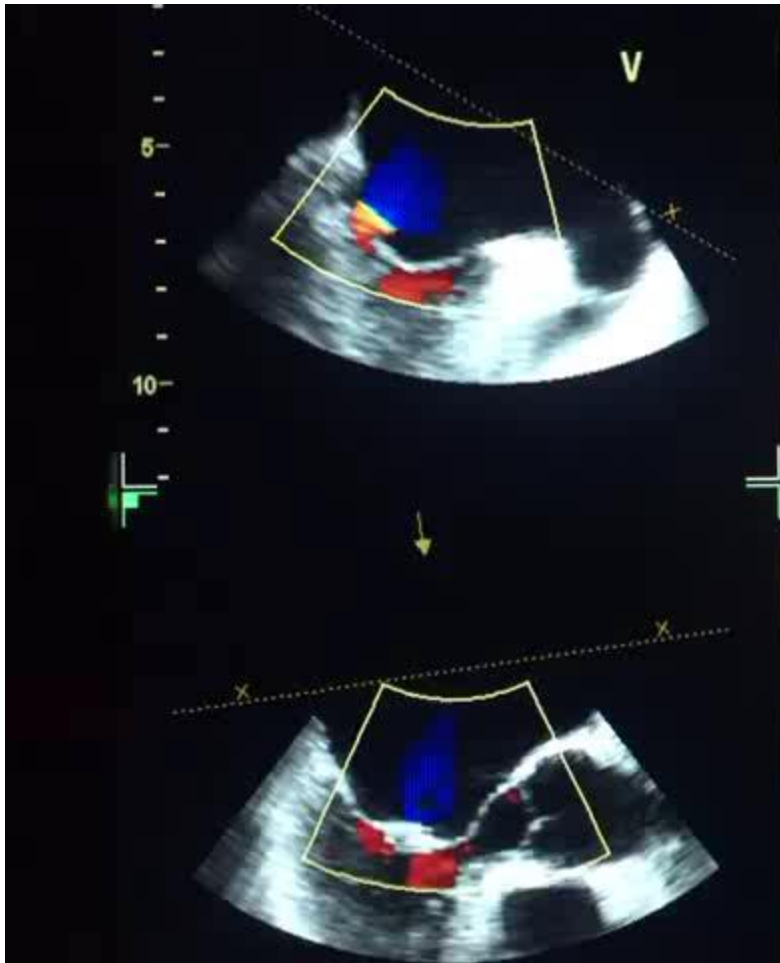
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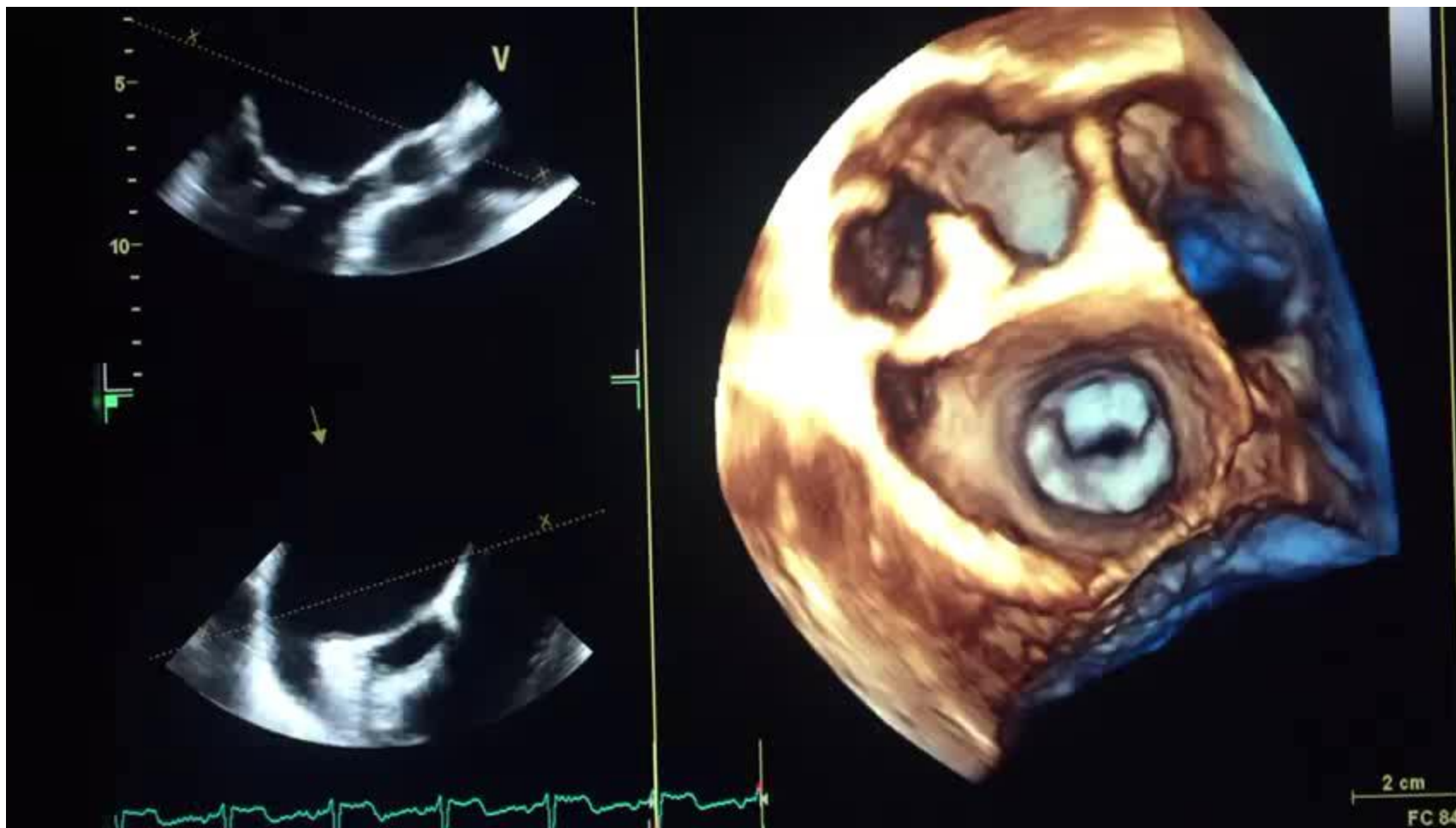
46







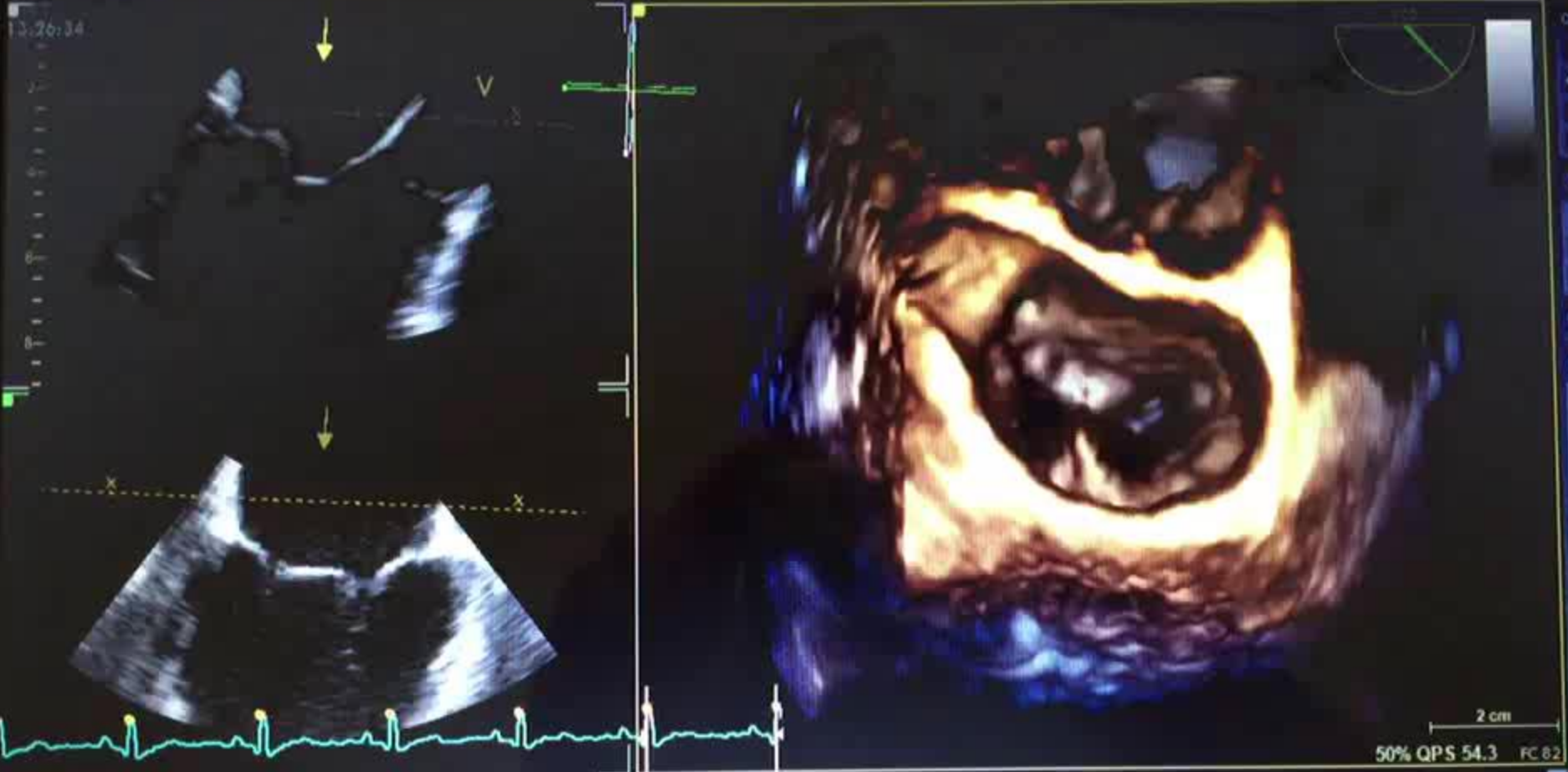




Análise

Arquiv. Arm: Alt 1 Arm: Alt 2

13:26:34

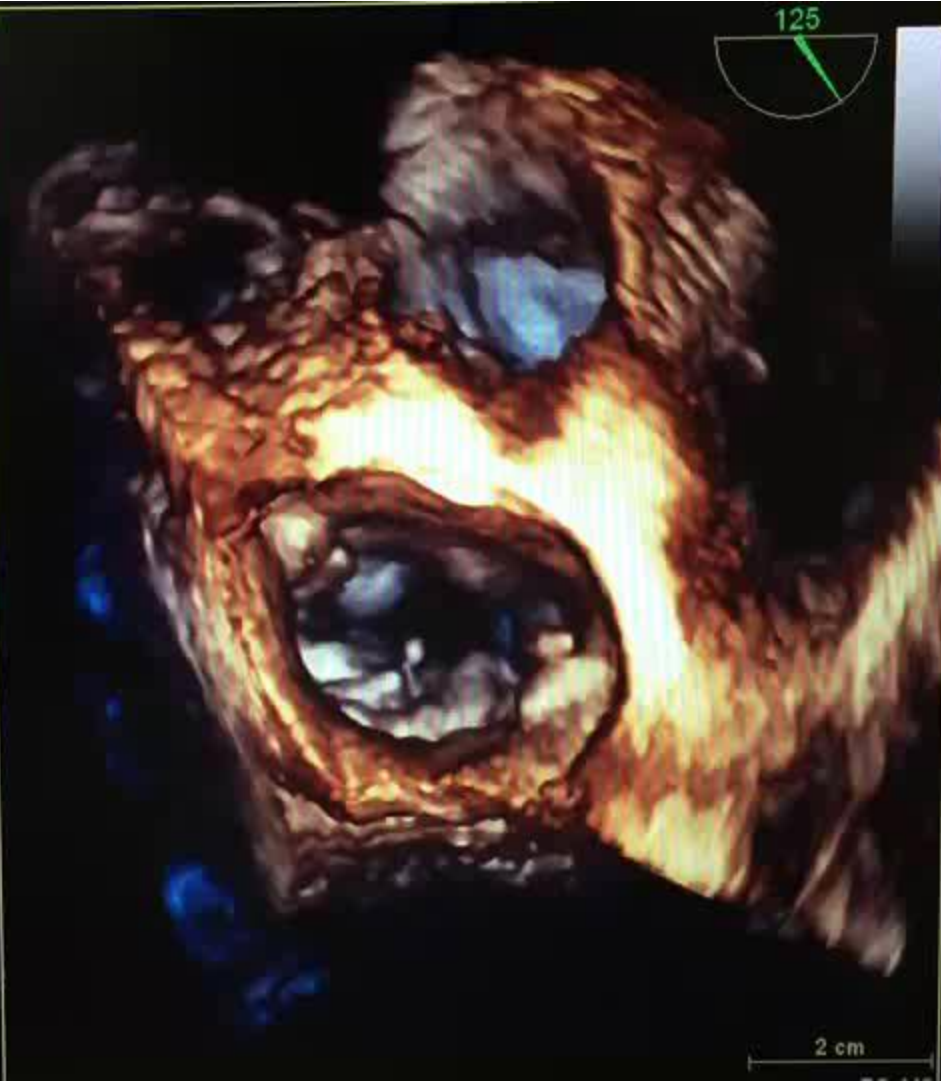


50% QPS 54.3 FC 82



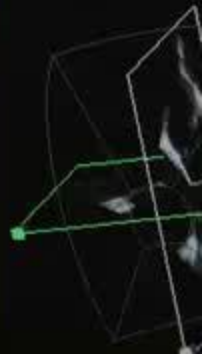


12:46:19



2D  
Freq.  
Proc.  
Potência  
QPS  
Prof.

144:146





*Mesa Redonda*

*Análise da Valva Mitral para Fins de Tratamento Cirúrgico*

***Plastia ou Troca? Quais os dados mais relevantes que a imagem deve fornecer ao cirurgião para fins de planejamento cirúrgico?***

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