Hospital General de Niños
Pedro de Elizalde

Cuidando a los niños desde 1779

From the registry to the cath lab: strategy and execution in SVS ASD closure

Dr. Jesús Damsky Barbosa
Jefe Unidad Cardiología
Hospital de Niños "Pedro de Elizalde"
jdamskyb@gmail.com
Cel:+5491158038203

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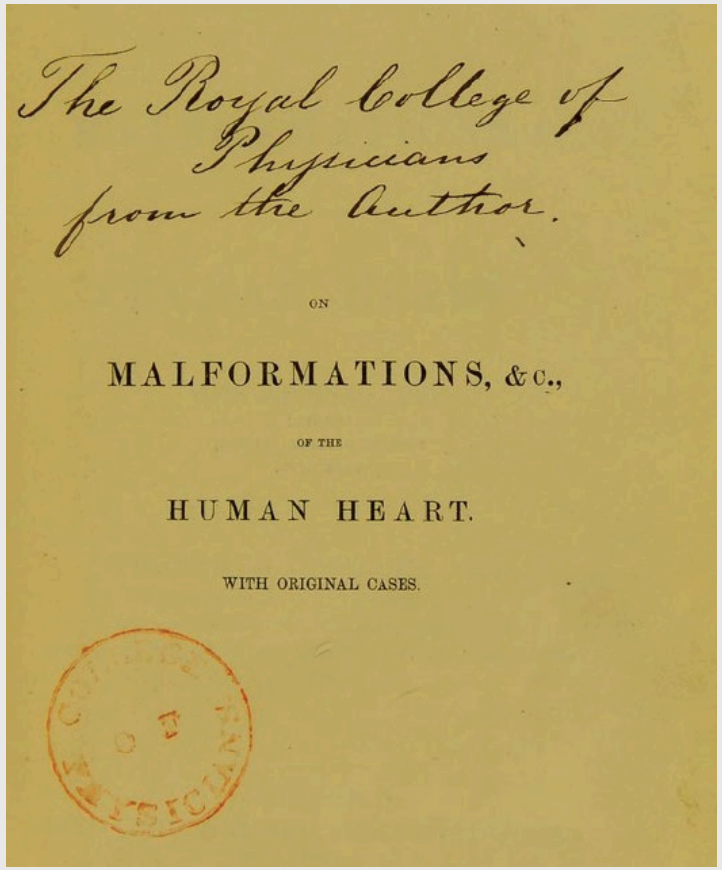
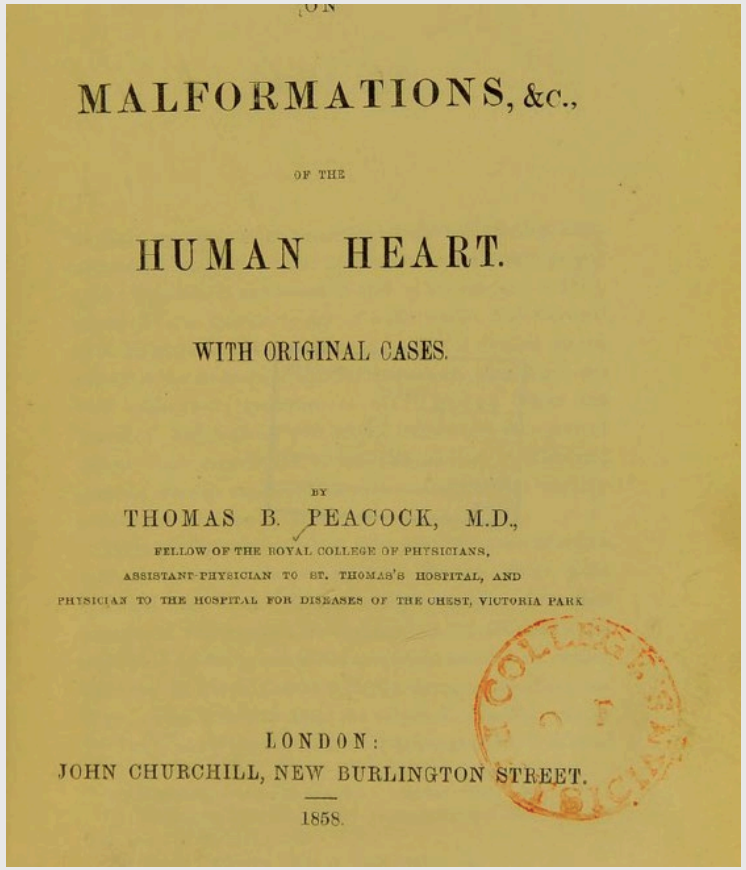
DECLARO NO TENER CONFLICTOS DE INTERES

- Descripta en 1858 por Peacock TB





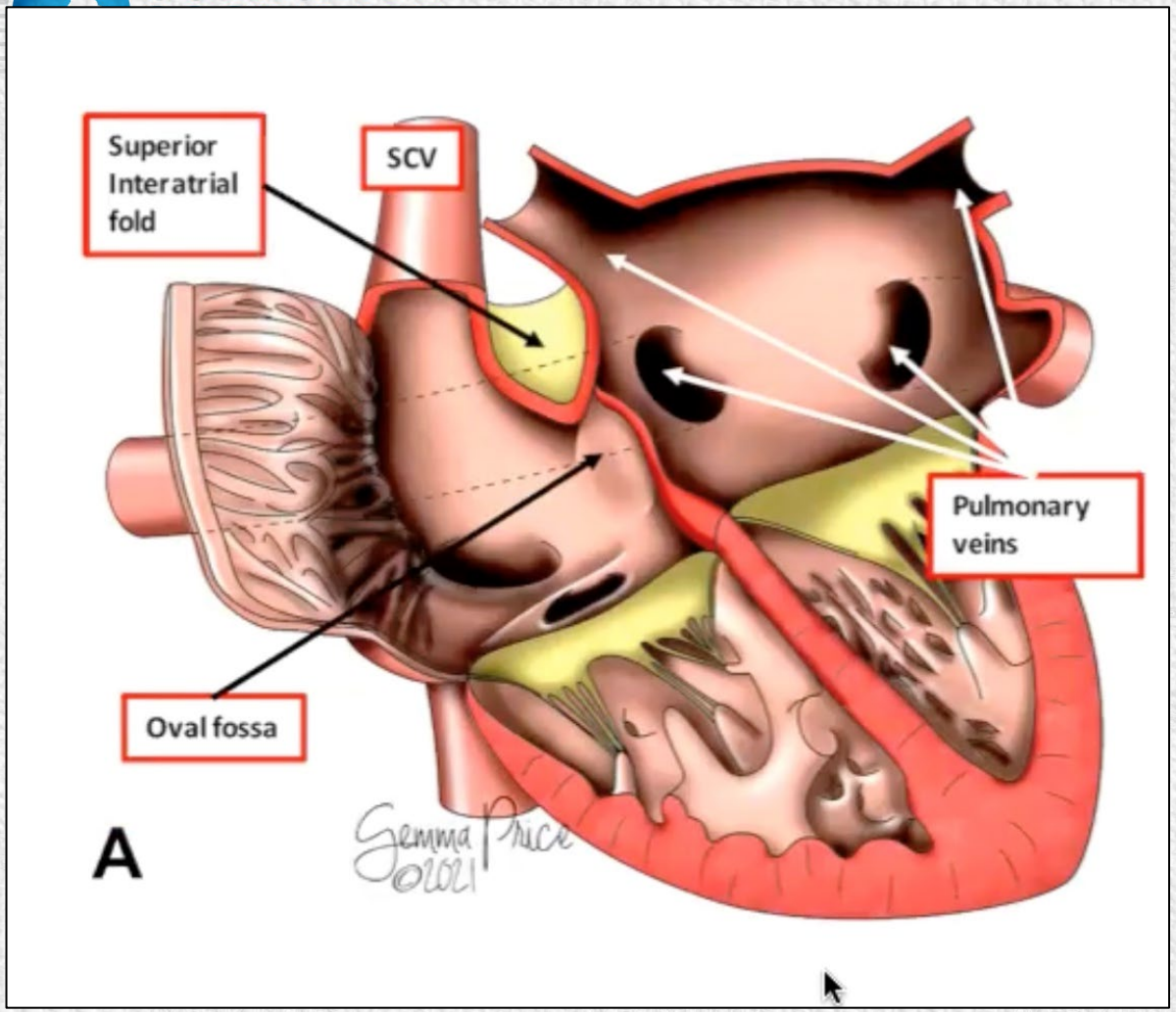
- Atrial septal defect caused by a deficiency of the common wall between the superior vena cava (SVC) and the right superior pulmonary vein, resulting in the SVC overriding the atrial septum

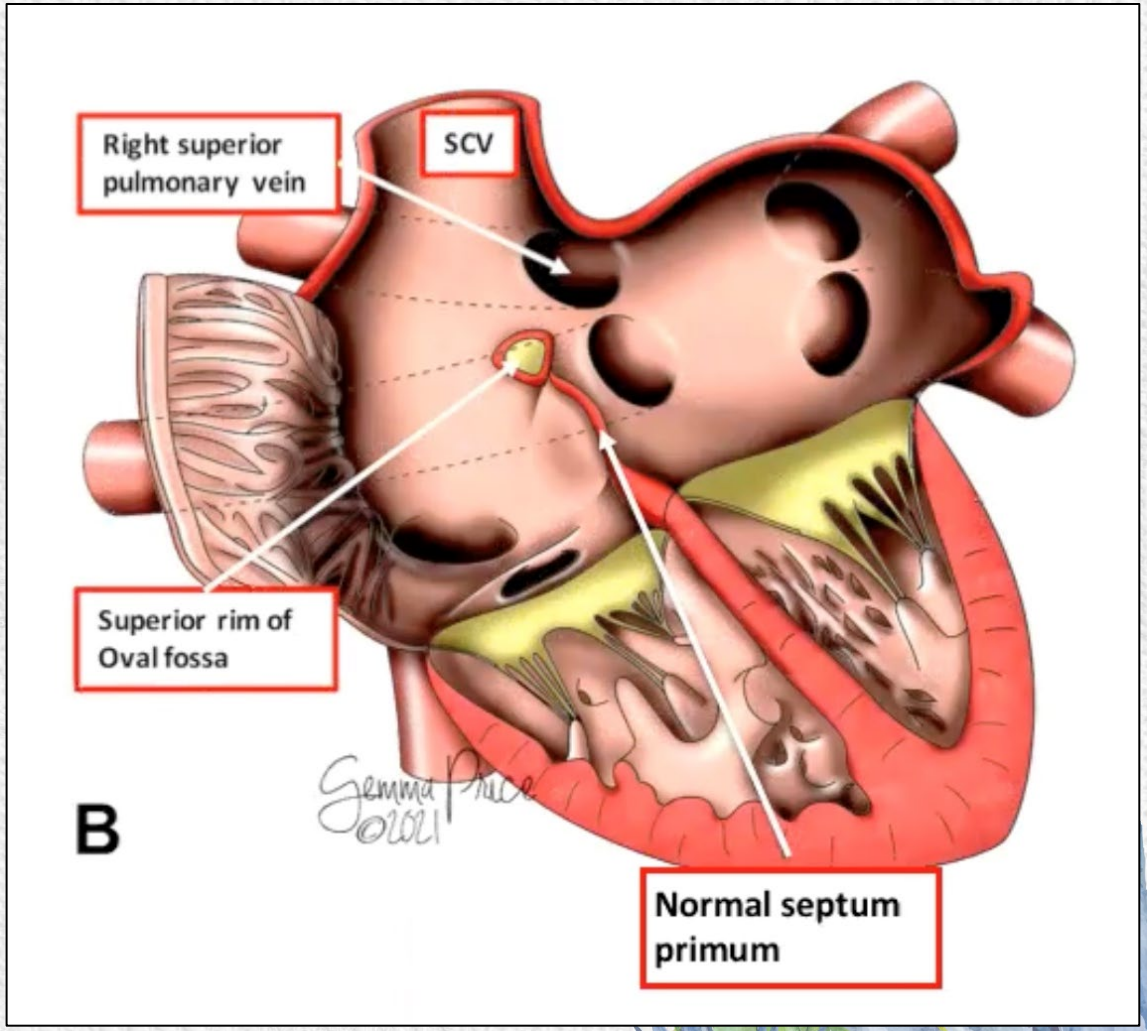
- Most common defect outside the fossa ovalis: 4–11% of all ASDs.
- 2 types:

  - SV SCV ASD: 87-90 %

  - SV ICV ASD: 10-13 %

- Although its treatment is surgical, endovascular therapy has been introduced over the past 10 years

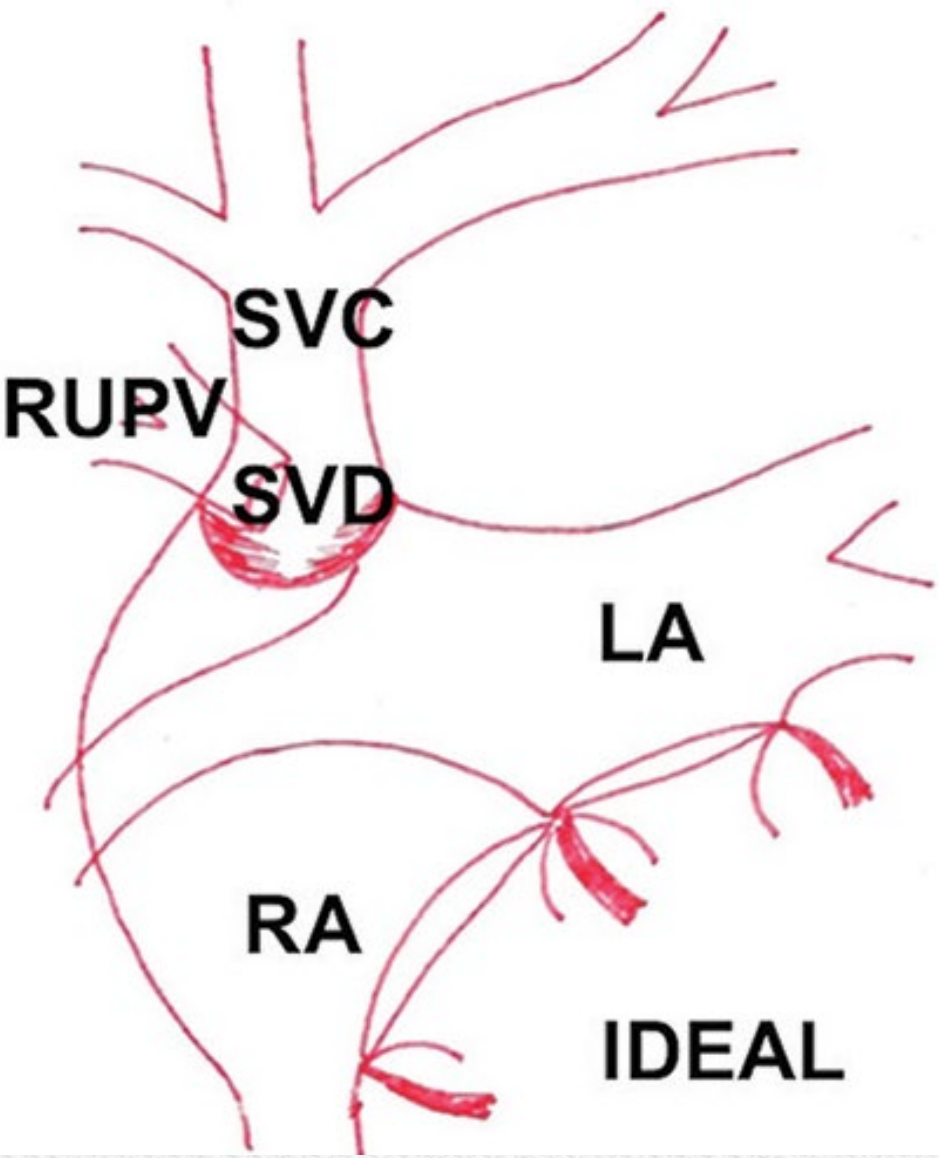




Relan J, et al. Heart. 2021 Aug 20; DOI: 10.1136/heartjnl-2021-319334.

- **First case presented:** CSI Frankfurt 2013 by Hussein Abdullah et al.

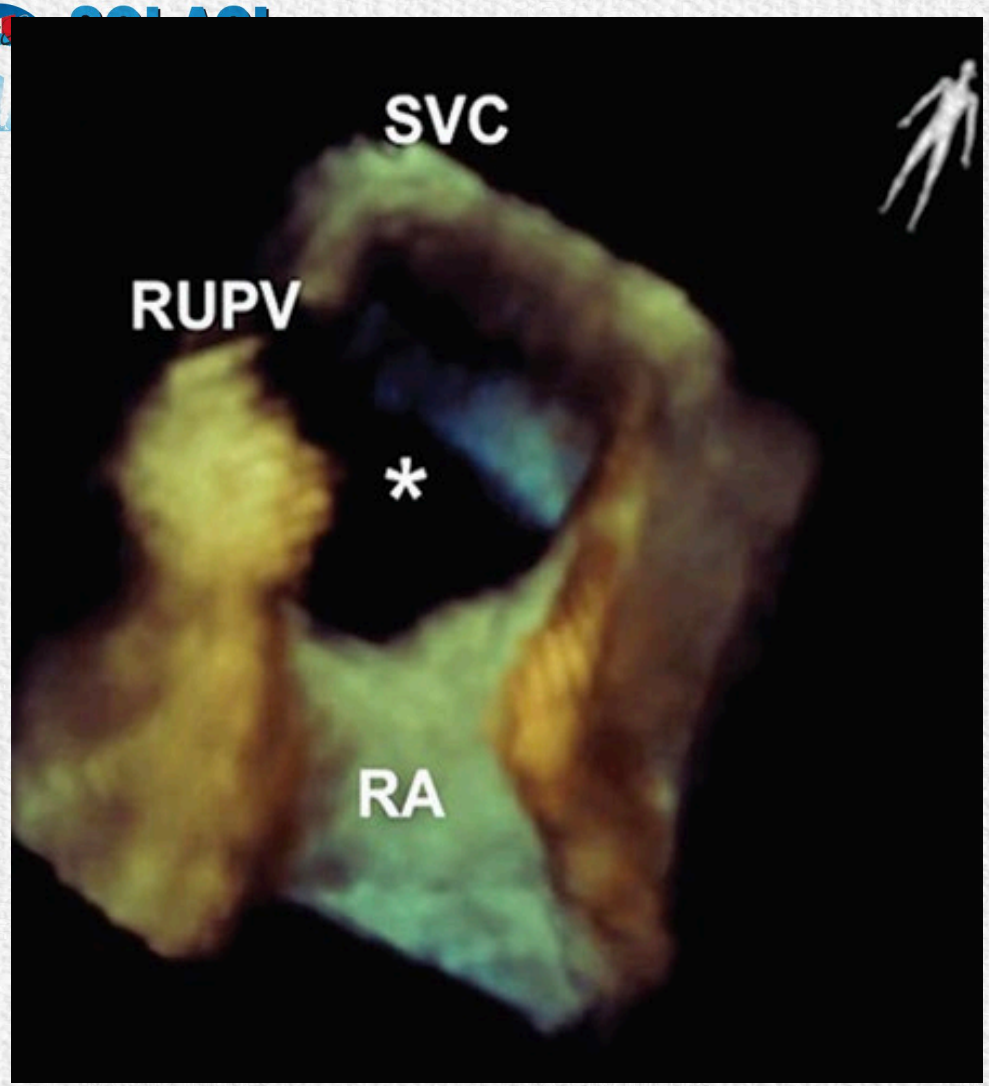
- **First published case:** Transcatheter closure of sinus venosus atrial septal defect with anomalous drainage of the right upper pulmonary vein into the superior vena cava — an innovative technique. Garg G, Tyagi H, Radha AS. *Catheter Cardiovasc Interv*. 2014;84:473–7.



An ideal echocardiographic anatomy:

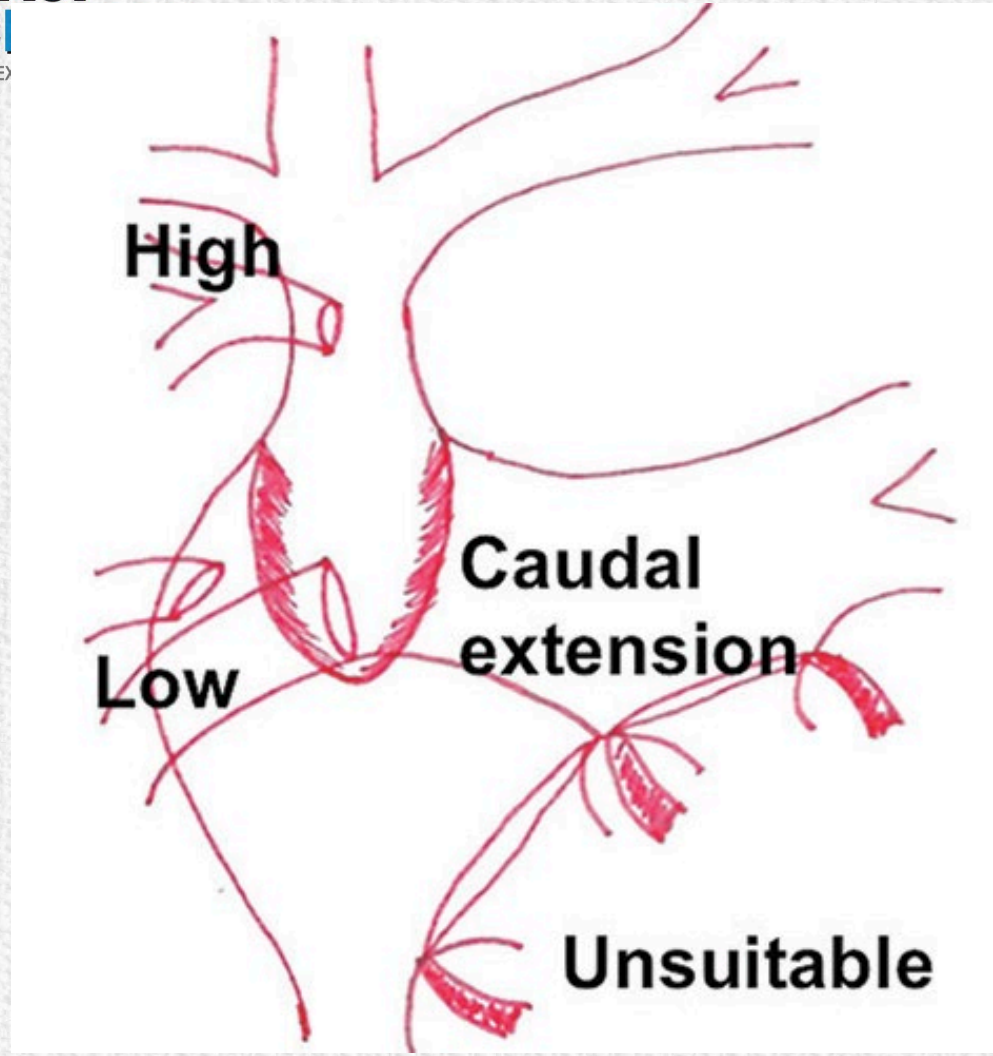
a) sinus venosus defect at the junction of the superior vena cava and the right atrium, with anomalous drainage of the right upper pulmonary vein precisely at the cavoatrial junction.

Kothandam Sivakumar. **How to do it? Transcatheter correction of superior sinus venosus defects.** Annals of Pediatric Cardiology. Volume 15. Issue 2. March-April 2022



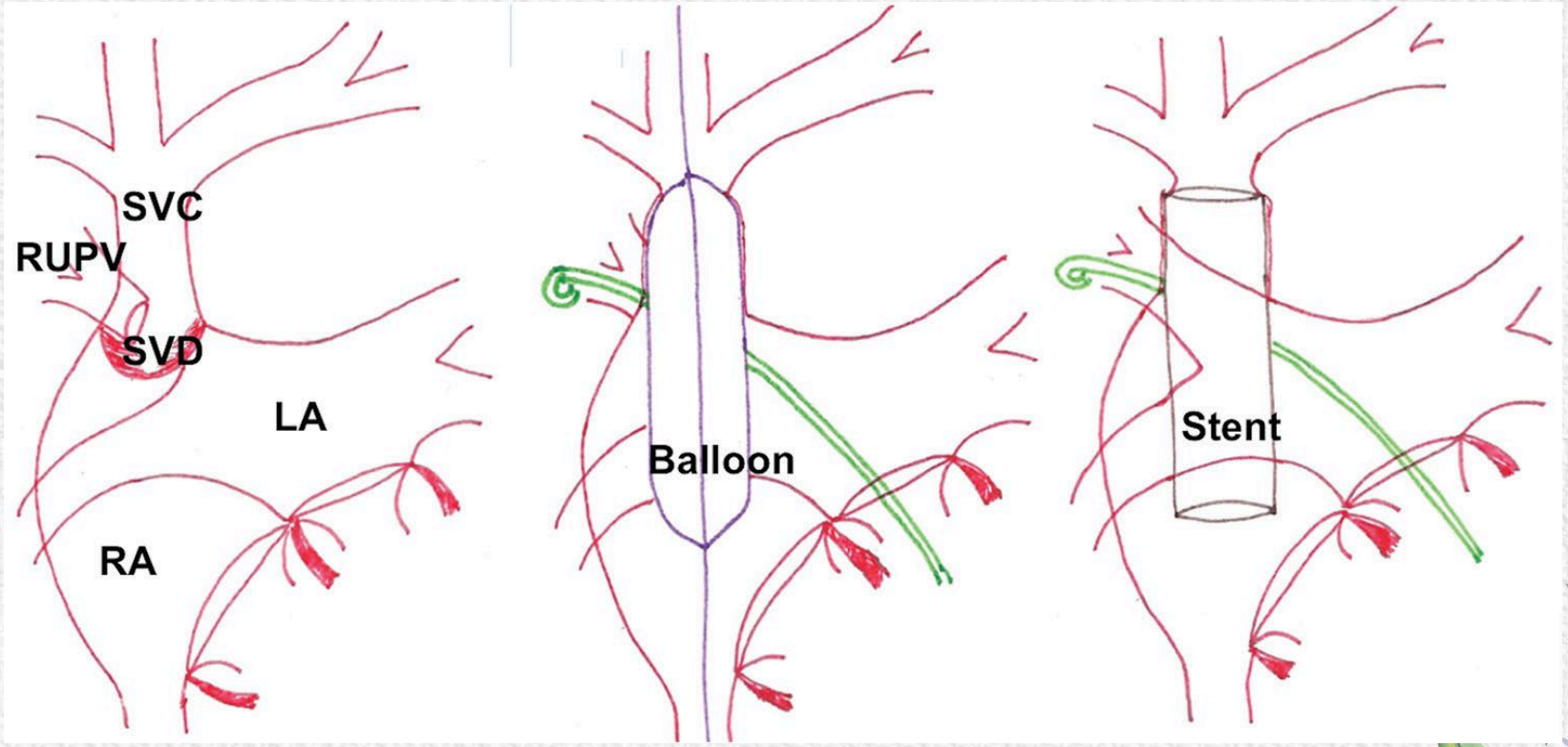
b) When there is a caudal extension of the sinus venosus defect toward the fossa ovalis, or when the right upper pulmonary vein drains too high or too low.

Kothandam Sivakumar. **How to do it? Transcatheter correction of superior sinus venosus defects.** Annals of Pediatric Cardiology. Volume 15. Issue 2. March-April 2022

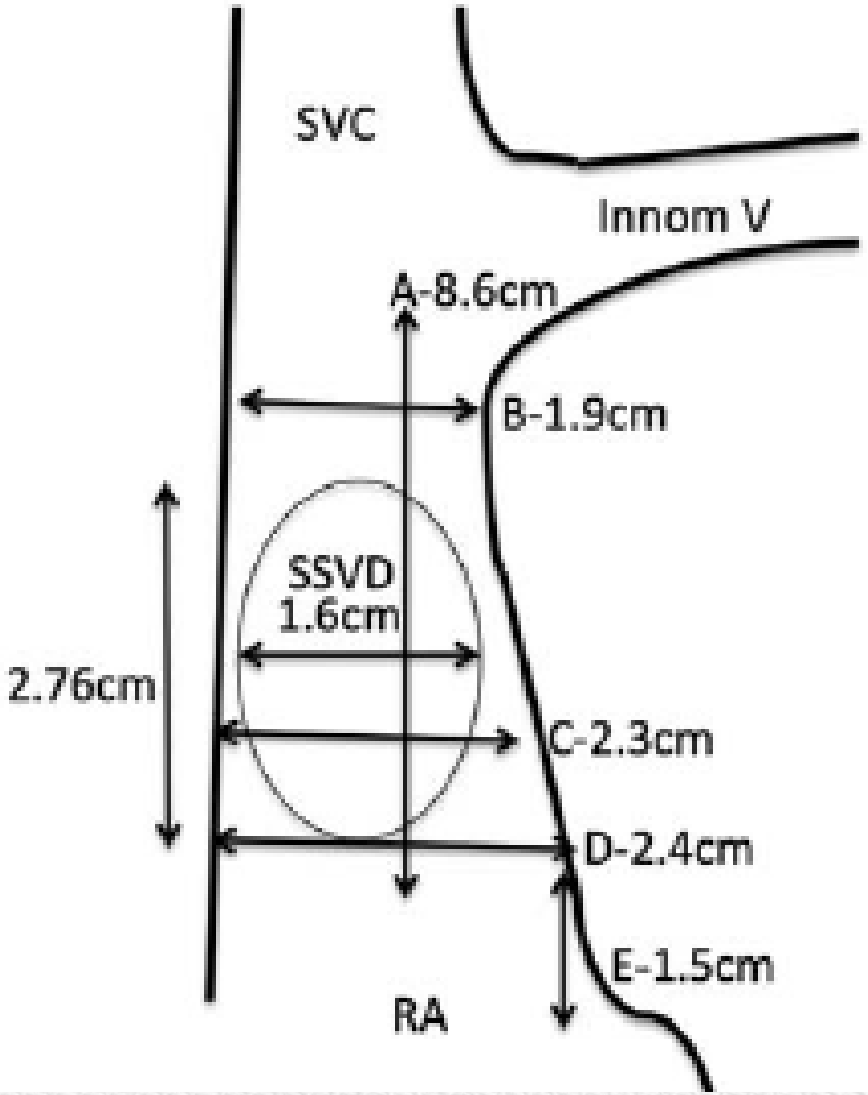


c) Surgical

Kothandam Sivakumar. **How to do it? Transcatheter correction of superior sinus venosus defects.** Annals of Pediatric Cardiology. Volume 15. Issue 2. March-April 2022



Kothandam Sivakumar. **How to do it? Transcatheter correction of superior sinus venosus defects.** Annals of Pediatric Cardiology. Volume 15. Issue 2. March-April 2022



Drawing showing the CT-based measurements used to select the appropriate stent.

Objetivo

- To exclude the SVC from the left atrium
- Directing the VPDS towards AI
- All this is achieved by covering the ASD with a stent.
- Avoid obstruction of neighboring venous structures

Catheter Cardiovasc Interv. 2018;92:353-357.

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ORIGINAL RESEARCH ARTICLE

Covered Stent Correction for Sinus Venosus Atrial Septal Defects, an Emerging Alternative to Surgical Repair: Results of an International Registry

Eric Rosenthal, MD; Shakeel A. Qureshi, MBChB; Kothandam Sivakumar, MD; Matthew Jones, MBBS; San-Fui Yong, MBBS; Saleha Kabir, PhD; Pramod Sagar, MD; Puthiyedath Thejaswi, MD; Sebastien Hascoet, MD; Clement Batteux, MD; Younes Boudjemline, MD, PhD; Ziyad M. Hijazi, MD, MPH; Jamil A. Aboulhosn, MD; Daniel S. Levi, MD; Morris M. Salem, MD; Edwin Francis, MD; Aleksander Kempny, MD; Alain Fraisse, MD; Carles Bautista-Rodriguez, MD; Kevin Walsh, MD; Damien Kenny, MD; Brian Traynor, MD; Salim N. Al Maskari, MD; James R. Bentham, MD, PhD; László Környei, MD, PhD; Muthukumaran C. Sivaprakasam, MRCPCH; Ata Firouzi, MD; Zahra Khajali, MD; Lee Benson, MD; Mark Osten, MD; Alban-Elouen Baruteau, MD; Matthew A. Crystal, MD; Thomas J. Forbes, MD; Stanimir Georgiev, MD; Horst Sievert, MD; Do Nguyen Tin, MD; Daniel Springmuller, MD; Anand Subramanian, MD; Hussein A.M. Abdullah, MD; Radwa Bedair, MD; Francisco Chamié, MD; Ahmet Celebi, MD; Jesus Damsky Barbosa, MD; Pieter De Meester, MD, PhD; Luca Giugno, MD; Zakaria Jalal, MD, PhD; Clement Karsenty, MD, PhD; Anastasia Schleiger, MD; Gregory Fleming, MD; Andre Jakob, MD; Tevfik Karagoaz, MD; Gur Mainzer, MD; Gareth J. Morgan, MD; Nazmi Narin, MD; Shabana Shahanavaz, MD; Zachary L. Steinberg, MD; Osamah Aldoss, MD; Elnur Alizade, MD; Oliver Aregullin, MD; Hélène Bouvaist, MD; Thilo Fleck, MD; Francois Godart, MD; Sophie Malekzadeh-Milani, MD; Paulo Motta, MD; Angel Sanchez-Recalde, MD; Juan Pablo Sandoval, MD; Weiyi Tan, MD, MPH; John Thomson, MD; Pablo Tomé Teixeirense, MD; Evan M. Zahn, MD

BACKGROUND: Covered stent correction for a sinus venosus atrial septal defect (SVASD) was first performed in 2009. This innovative approach was initially viewed as experimental and was reserved for highly selected patients with unusual anatomic variants. In 2016, increasing numbers of procedures began to be performed, and in several centers, it is now offered as a standard of care option alongside surgical repair. However, covered stent correction for SVASD is not recognized by regulatory authorities, and in the minds of many pediatric and adult congenital cardiologists and surgeons, the condition is viewed as treatable only by cardiac surgery with cardiopulmonary bypass.

METHODS: In April 2023, all centers identified from international conferences, publications, and colleague networks to be undertaking covered stent correction for SVASD were invited to participate in a retrospective audit of their procedures.

RESULTS: Data were received on 381 patients from 54 units over a 12-year period with 90% of procedures being performed over the past 5 years. Balloon-expandable stents (8 types) were used in the majority; self-expanding stents (4 types) were used in 4.5%. The commonest stent was the 10-zig covered Cheatham Platinum stent in 62% of cases. In 10 procedures, the stent embolized requiring surgical retrieval and repair of the defect, resulting in technically successful implantation in 371 of 381 (97.4%). Major complications (surgical drainage of tamponade, pacemaker implantation, surgery for pulmonary vein occlusion, and late stent removal) occurred in 5 patients (1.3%). Repeat catheterization to correct residual leaks was required in 7 patients (1.8%). Thus, 359 of 381 patients (94.2%) had successful correction without major complications or additional catheter interventions.

Circulation. 2025;151:744–756.
DOI: 10.1161/CIRCULATIONAHA.124.070271

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- India 85
- Near East 40
- Europe 138
- Americas 43

- India (85)
  - Chennai (Sivakumar)
- Qatar (18)
  - Sidra (Boudjemline, Hijazi)
- Oman (8)
  - Muscat (Almaskary)
- Iraq (4)
  - Baghdad (Abdul Wahab)
- Israel (2)
  - Jerusalem (Mainzer)
- Turkey (8)
  - Istanbul (Celebi, Berkan)
  - Izmir (Narin)
  - Ankara (Karagaoz)

- UK (71)
  - London (Rosenthal, Qureshi, Jones, Yong, Kempny, Fraisse)
  - Leeds (Bentham)
  - Bristol (Bedair, Turner)
- France (28)
  - Paris (Hascoet, Batteux, Milani)
  - Nantes (Baruteau)
  - Tolouse (Karsenty)
  - Grenoble (Bouvaist)
  - Bordeaux (Jalal)
- Germany (13)
  - Berlin (Schleiger, Berger)
  - Munich (Georgiev, Ewert, Haas, Jakob)
  - Freiburg (Fleck)
  - Frankfurt (Sievert)
- Ireland (10)
  - Dublin (Walsh)
- Hungary (9)
  - Budapest (Kornyei)
- Belgium (3)
  - Leuven (Gewillig)
- Italy (3)
  - Milan (Butera, Carminati)
- Spain (1)
  - Madrid (Sánchez-Recalde)

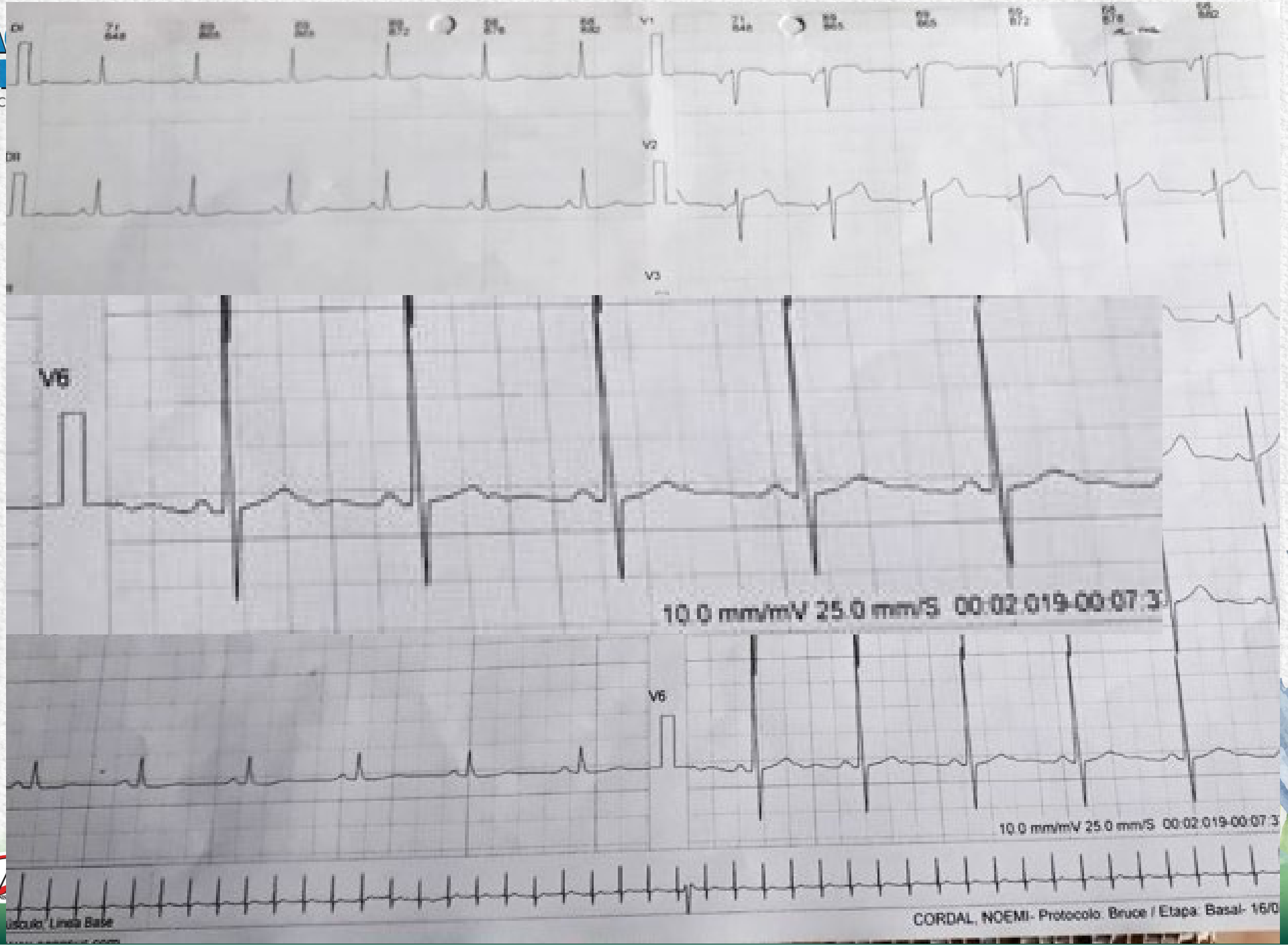
- Canada (5)
  - Toronto (Benson)
- Mexico (1)
  - Mexico City (Sandoval)
- Brazil (4)
  - Rio de Janeiro (Chamie)
  - Sao Paulo (Tome)
- Argentina (3)
  - Buenos Aires (Damsky)
- Chile (3)
  - Santiago (Springmuller)
- USA (27)
  - Los Angeles (Morris, Aboulhosn, Levi)
  - San Francisco (Zahn)
  - Ohio (Armstrong)
  - Denver (Morgan)
  - Houston (Tan)
  - Cincinnati (Shahanavaz)
  - Michigan (Vettukattil)
  - Duke (Fleming)
  - Baltimore (Thomson)
  - Florida (Forbes)

CASE 1

- **EDAD:** 61 AÑOS
- **SEXO:** FEMENINO
- **ANTEC LABORALES:** SERVICIO PENITENCIARIO Y MARATONISTA
- **ANTEC:** ACCIDENTE ISQUÉMICO TRANSITORIO el 30/08/2021
- CLASE FUNCIONAL 2 ? (SE CANSABA A LOS 10 KM)
- DERIVADO POR FORAMEN OVAL PERMEABLE

- **EX FÍSICO =**

  1 R NORMAL,
  SS EYECTIVO EN FP +
  2 R?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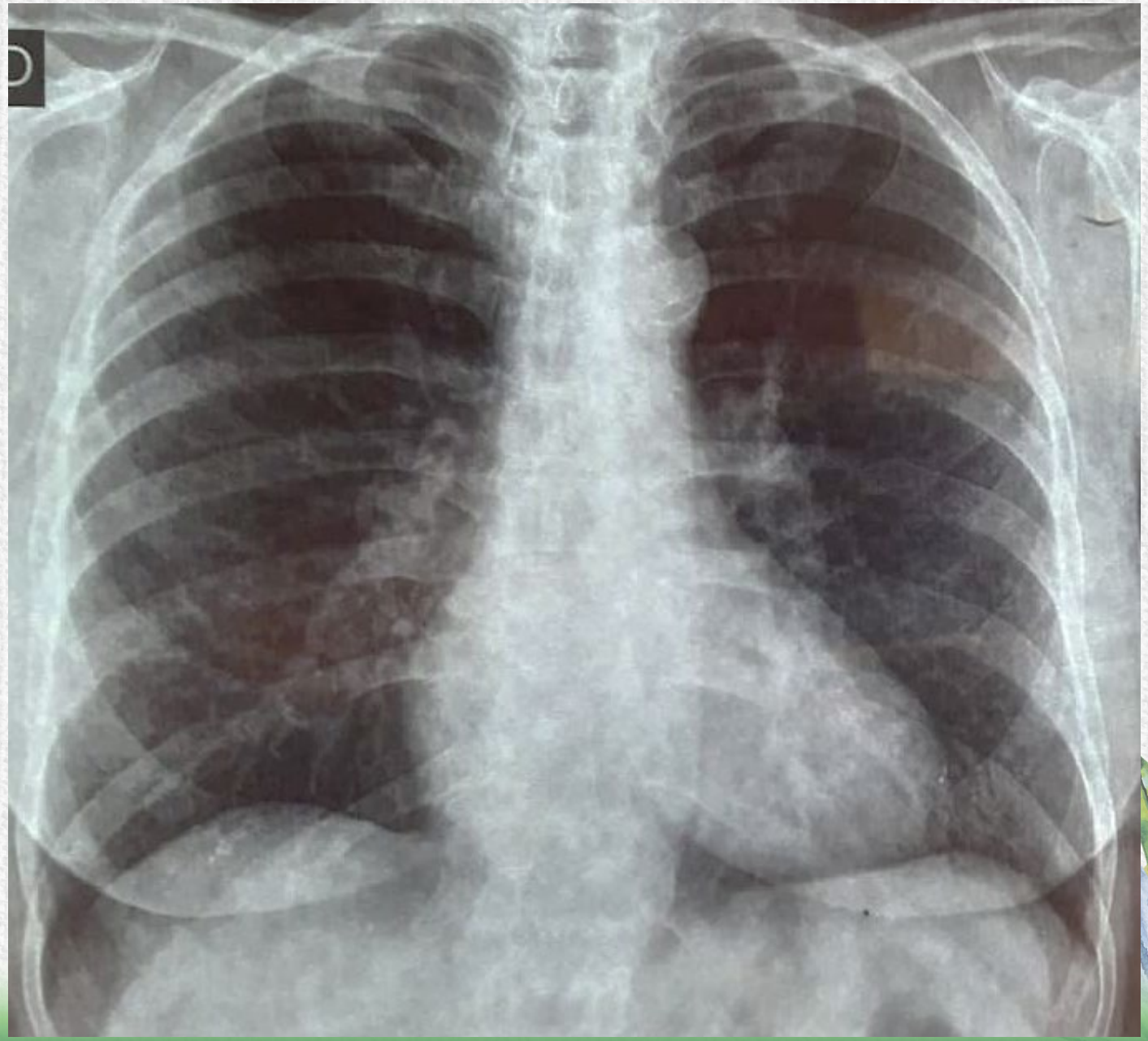
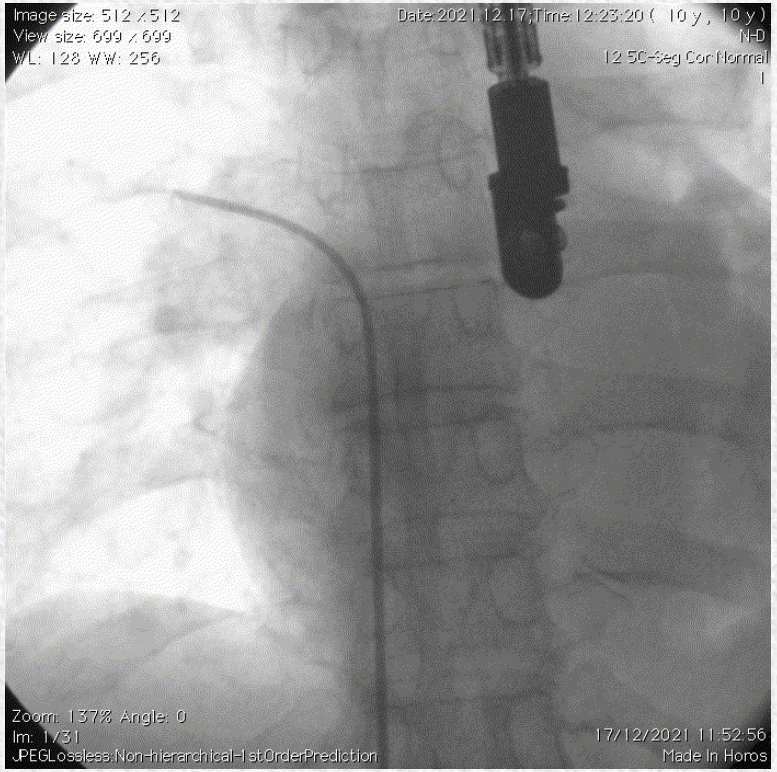
V2
V3
V6
10.0 mm/mV 25.0 mm/S 00:02:019-00:07:3
V6
10.0 mm/mV 25.0 mm/S 00:02:019-00:07:3
Ruido: Linea Base
CORDAL, NOEMI- Protocolo: Bruce / Etapa: Basal- 16/0

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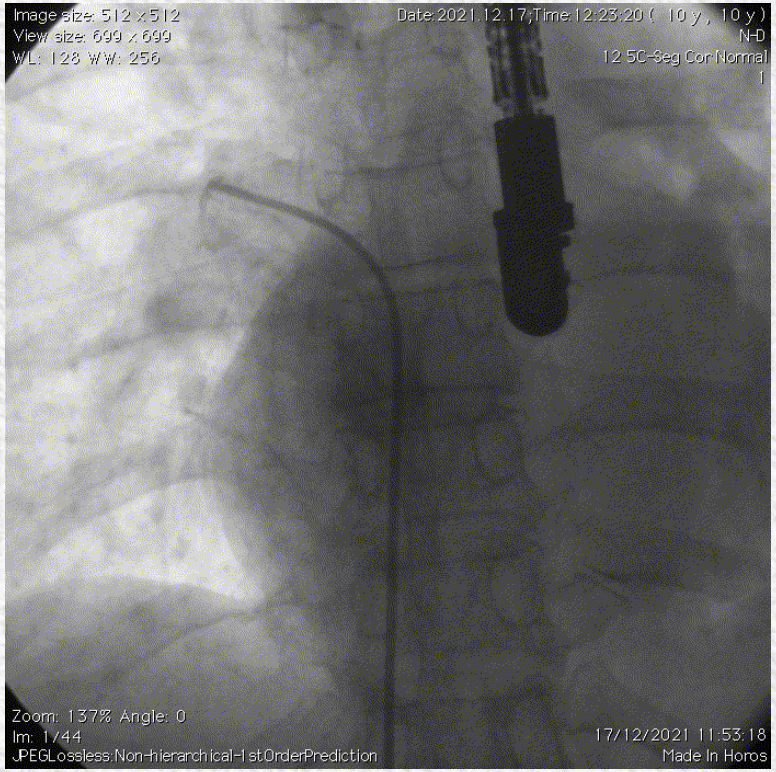
N-D
12 SC-Seg Cor Normal
1
Zoom: 137% Angle: 0
Im: 1/31
17/12/2021 11:52:56
JPEGLossless:Non-hierarchical-1stOrderPrediction
Made In Horos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12 SC-Seg Cor Normal
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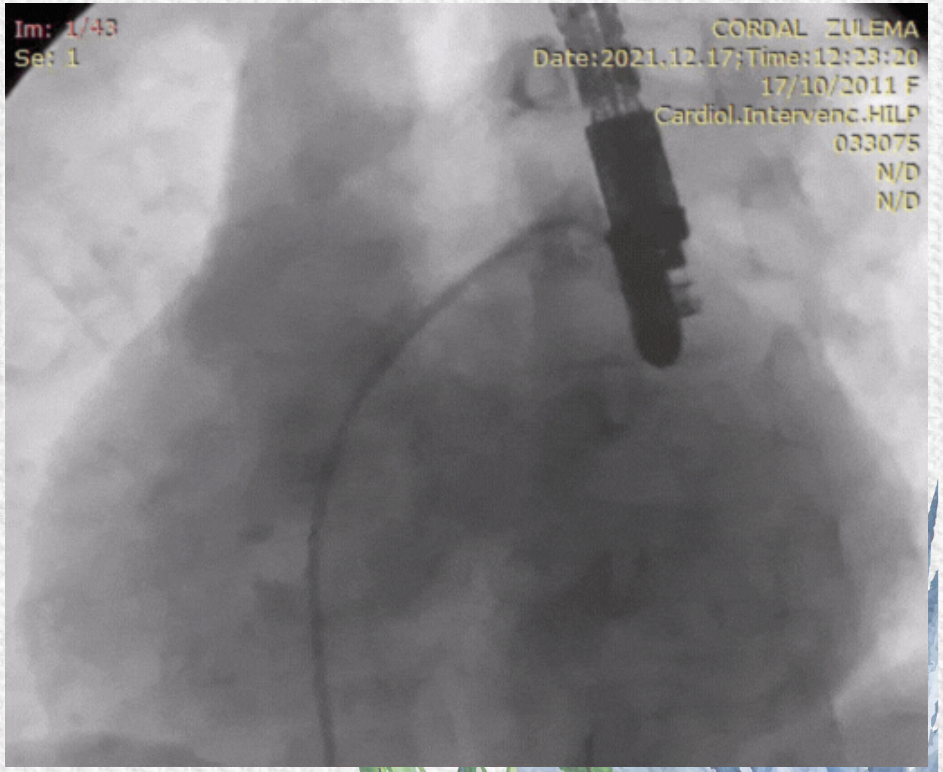
JPEGLossless:Non-hierarchical-1stOrderPrediction
Made In Horos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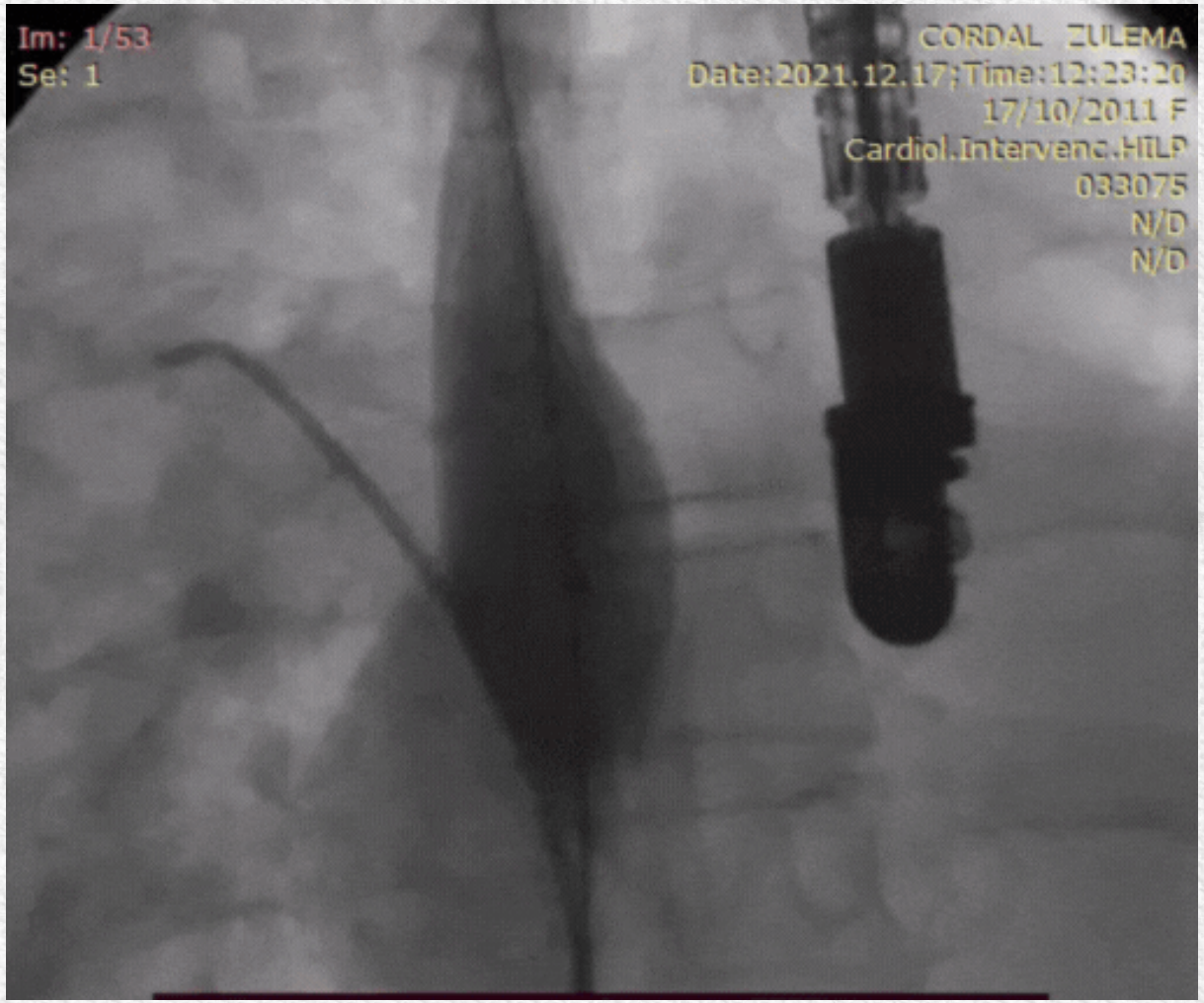
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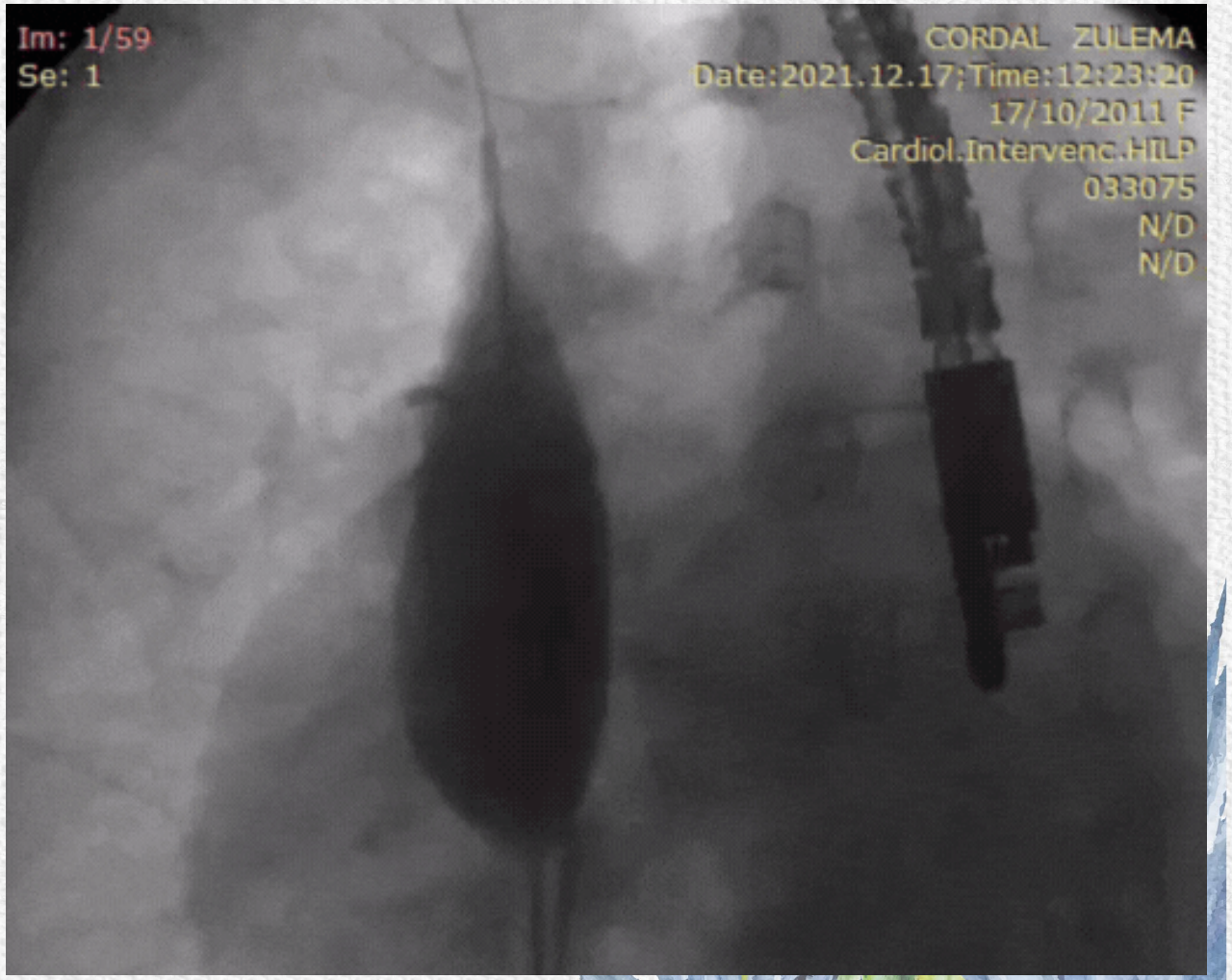
N/D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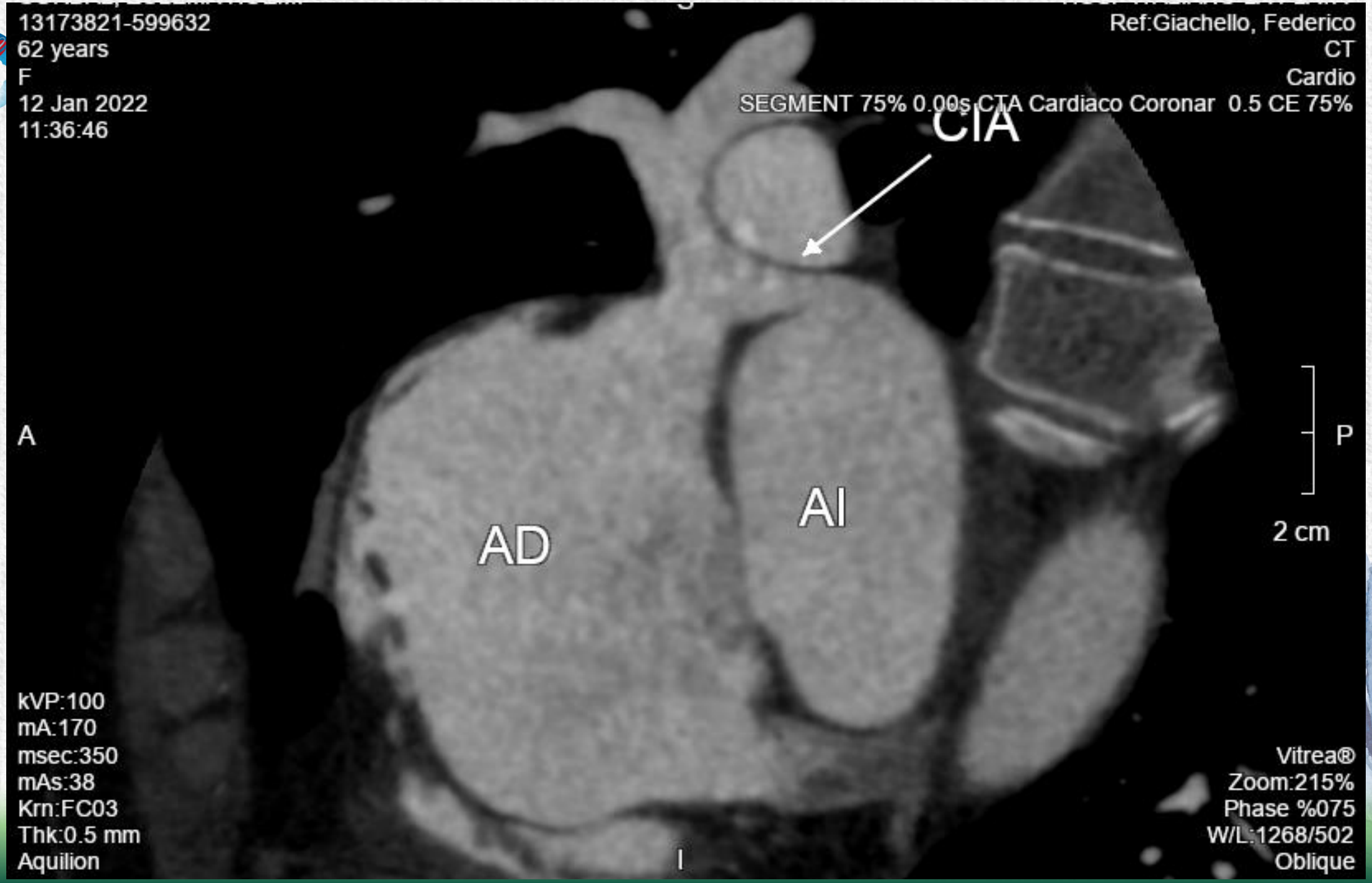
TAC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12 Jan 2022
11:36:46
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2 cm
kVP:100
mA:170
msec:350
mAs:38
Krn:FC03
Thk:0.5 mm
Aquilion
I
Vitrea®
Zoom:215%
Phase %075
W/L:1268/502
Oblique


13173821-599632
62 years
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12 Jan 2022
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Ref:Giachello, Federico
CT
Cardio
SEGMENT 75% 0.00s CTA Cardiaco Coronar 0.5 CE 75%
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CIA
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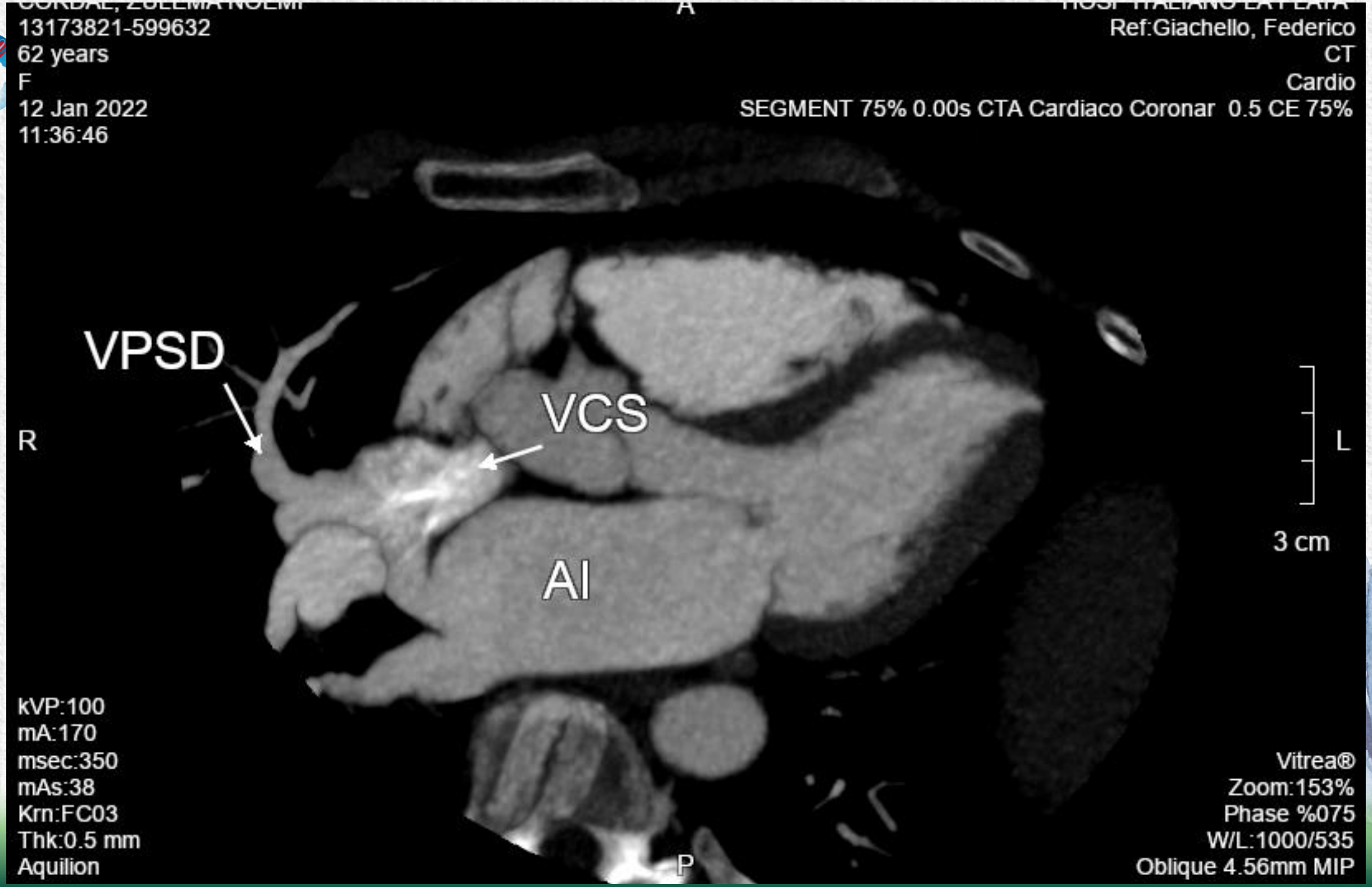
3 cm
kVP:100
mA:170
msec:350
mAs:38
Krn:FC03
Thk:0.5 mm
Aquilion
P
Vitrea®
Zoom:153%
Phase %075
W/L:997/317
Oblique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62 years
F
12 Jan 2022
11:36:46
A
Ref:Giachello, Federico
CT
Cardio
SEGMENT 75% 0.00s CTA Cardiaco Coronar 0.5 CE 75%
VPSD
VCS
AI
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3 cm
kVP:100
mA:170
msec:350
mAs:38
Krn:FC03
Thk:0.5 mm
Aquilion
P
Vitrea®
Zoom:153%
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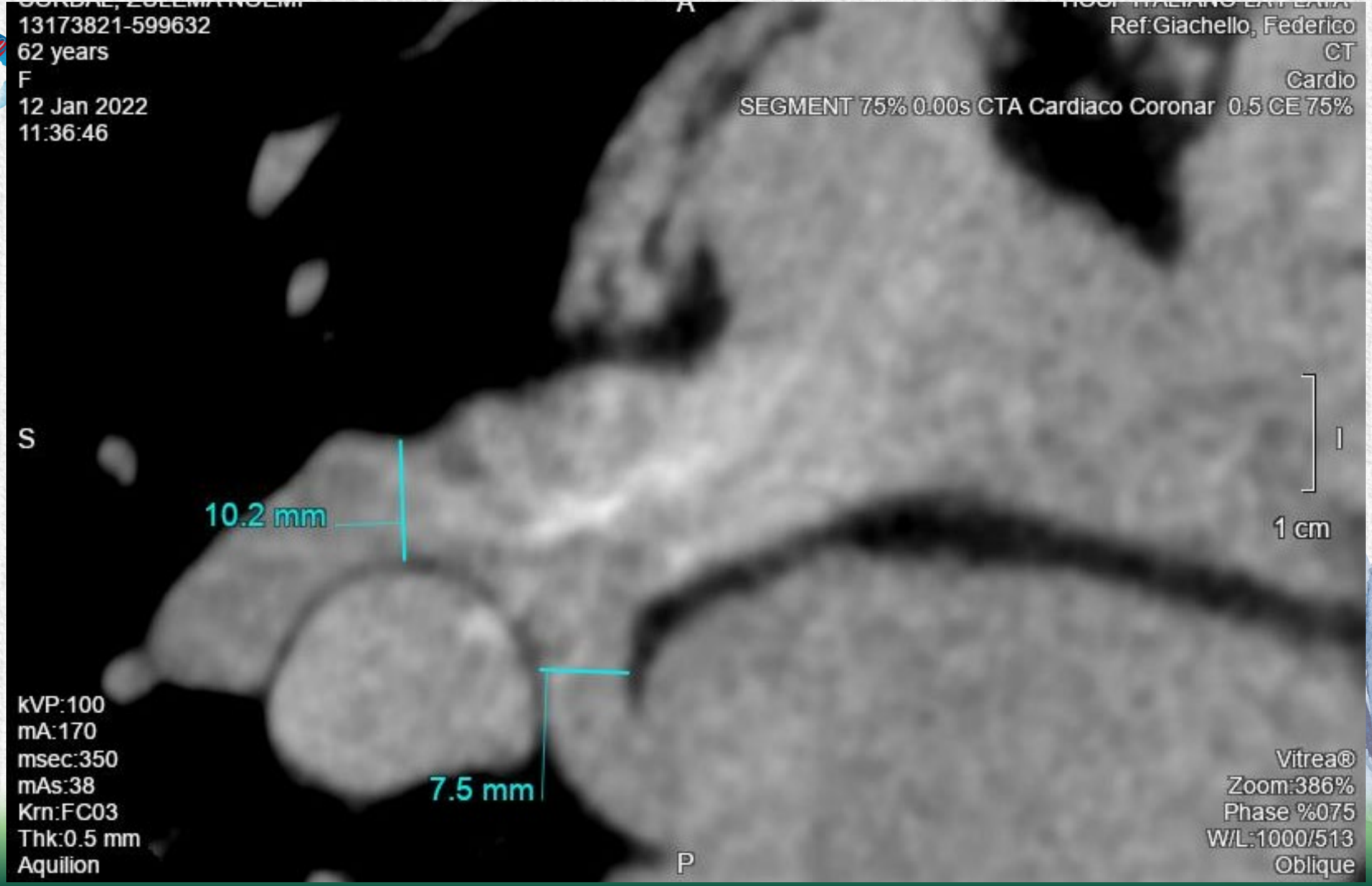
W/L:1000/535
Oblique 4.56mm MIP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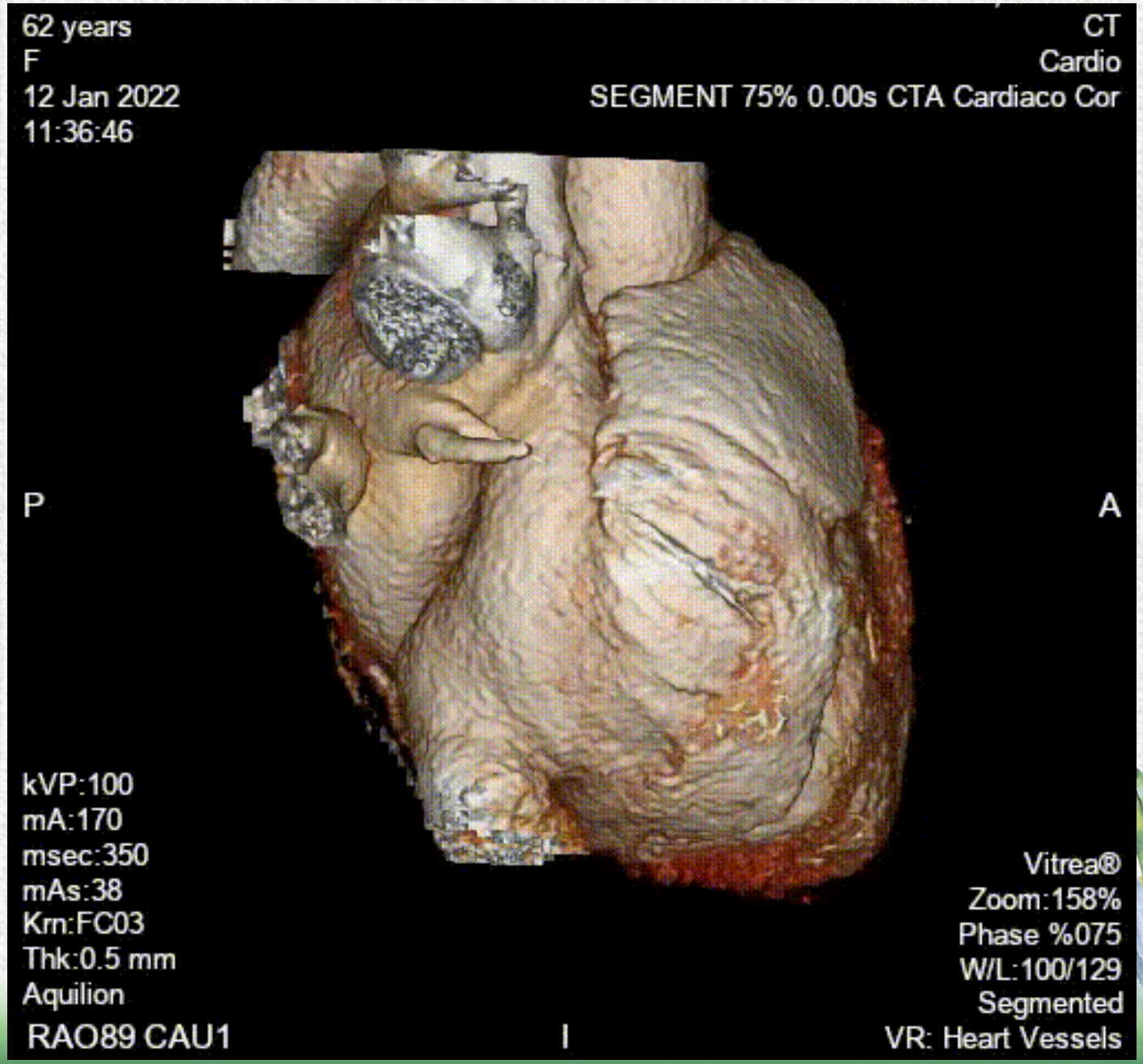
62 years
F
12 Jan 2022
11:36:46
A
Ref:Giachello, Federico
CT
Cardio
SEGMENT 75% 0.00s CTA Cardiaco Coronar 0.5 CE 75%
S
10.2 mm
7.5 mm
I
1 cm
kVP:100
mA:170
msec:350
mAs:38
Krn:FC03
Thk:0.5 mm
Aquilion
P
Vitrea®
Zoom:386%
Phase %075
W/L:1000/513
Oblique


62 years
F
12 Jan 2022
11:36:46
CT
Cardio
SEGMENT 75% 0.00s CTA Cardiaco Cor
P
A
kVP:100
mA:170
msec:350
mAs:38
Krn:FC03
Thk:0.5 mm
Aquilion
RAO89 CAU1
I
Vitrea®
Zoom:158%
Phase %075
W/L:100/129
Segmented
VR: Heart Vessels

PROCEDURE

- Approach: right femoral and yugular veins with 14 fr sheath
- Transseptal puncture.
- Anticoagulation (10000 UI)
- Positioning a Pig Tail catheter in SRPV and to measure its pressure

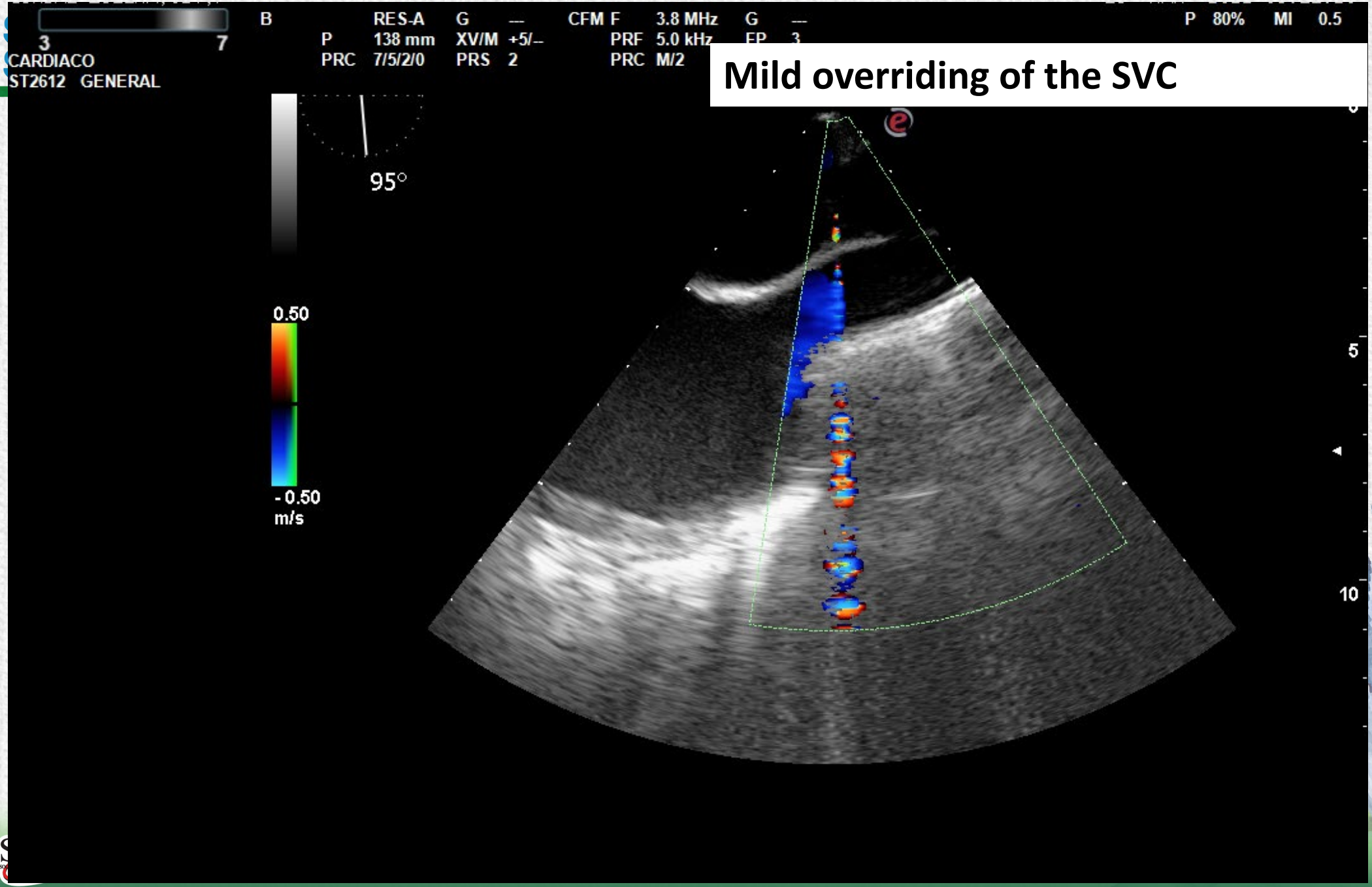
- Placement of an elastomeric balloon, performing occlusion tests at different heights of the superior vena cava and evaluation of right superior pulmonary vein pressure and simultaneous angiograms.

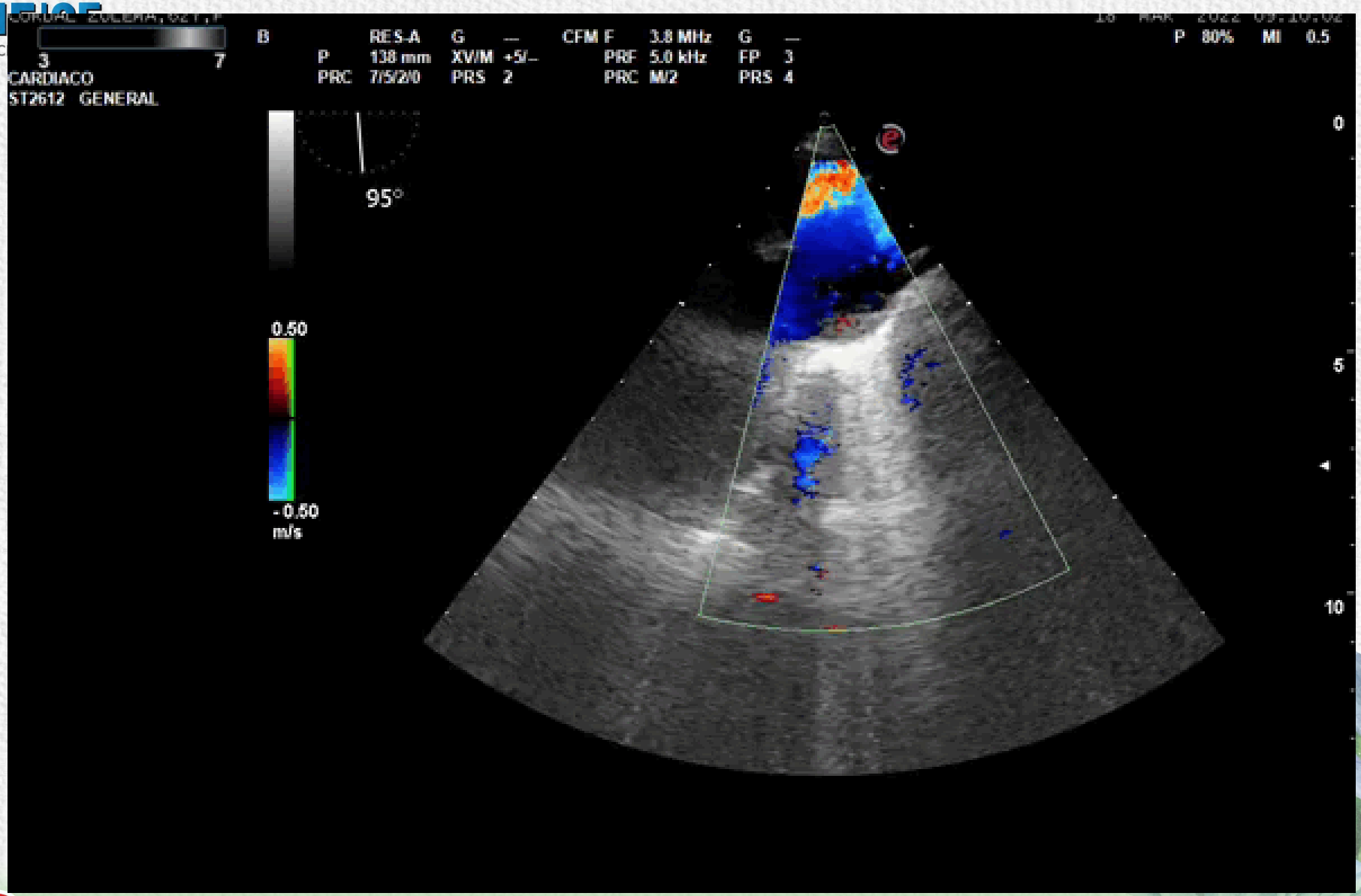
- Balloon placement 2 mm larger than the diameter of the pulmonary vein (CT scan?) with the balloon being NON-compliant

- Placement of the first stent 4 mm > the diameter of the superior vena cava and as long as possible

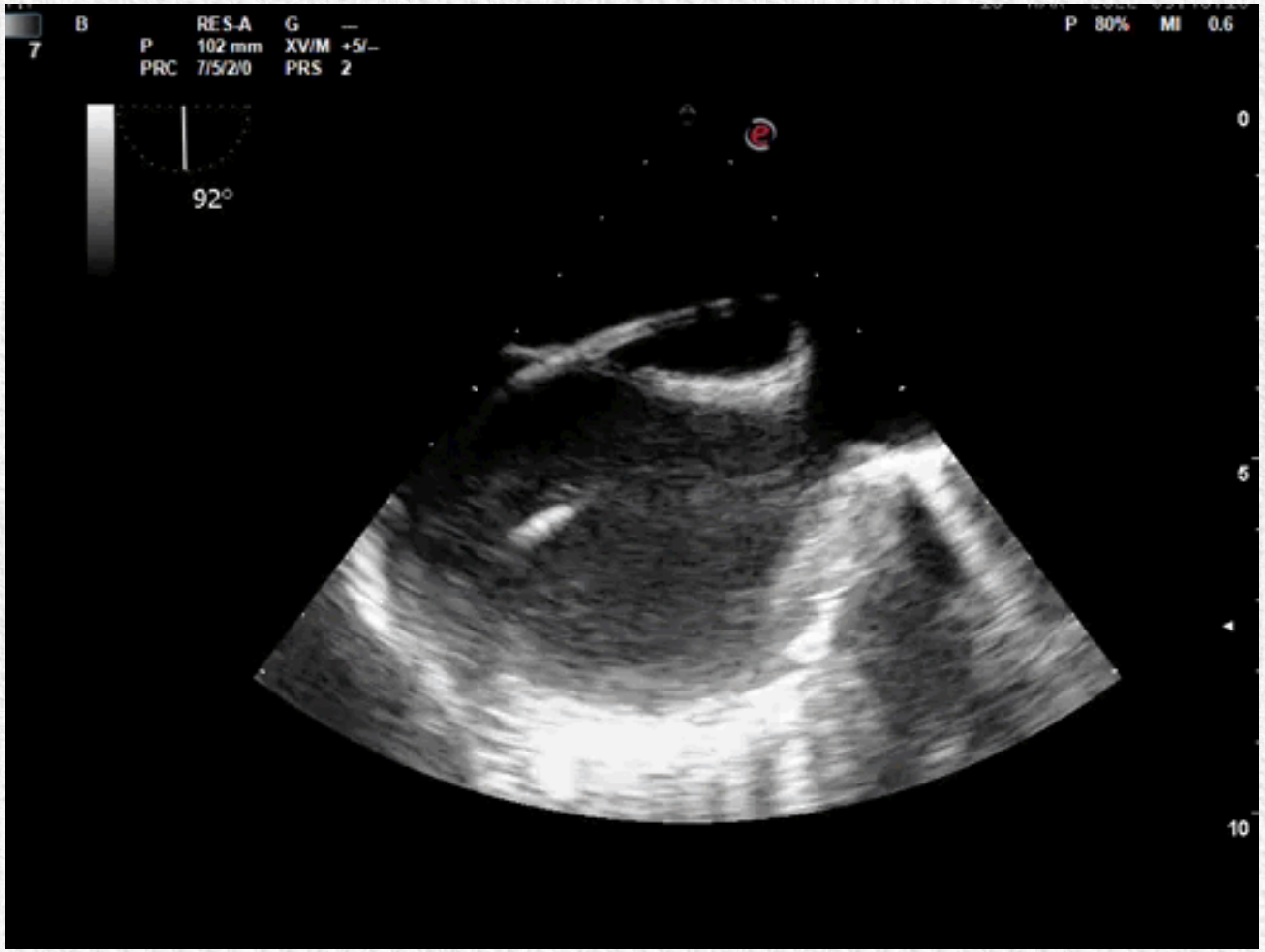
- Place second stent immediately below the floor of the innominate vein, overlapping the first stent
- If necessary, place a third, long, coated stent overlapping the first.
- Perform flare of the third stent
- ncrease the diameter of the third stent throughout its entire length, including the distal portion of the first stent, with large diameter balloons (we used 32 mm diameter).
- Control of CC and pulmonary vein pressure

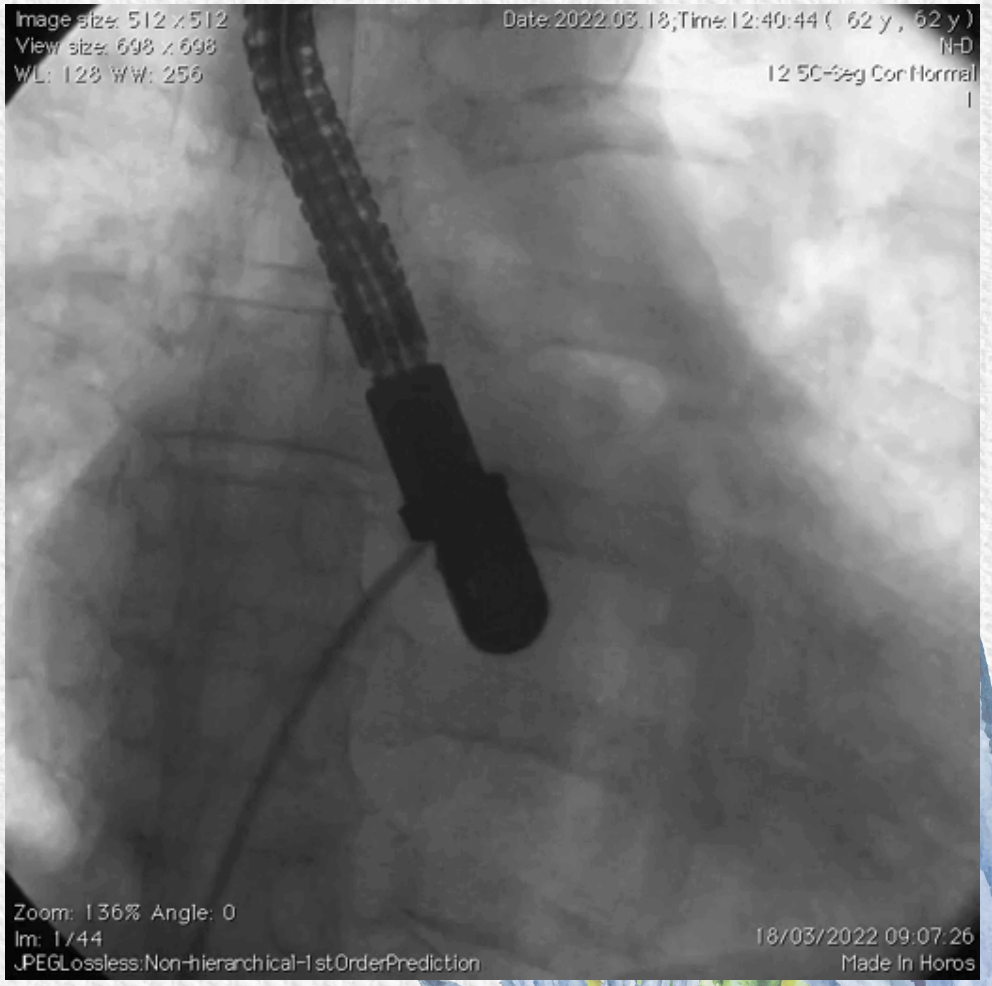
Mild overriding of the SVC

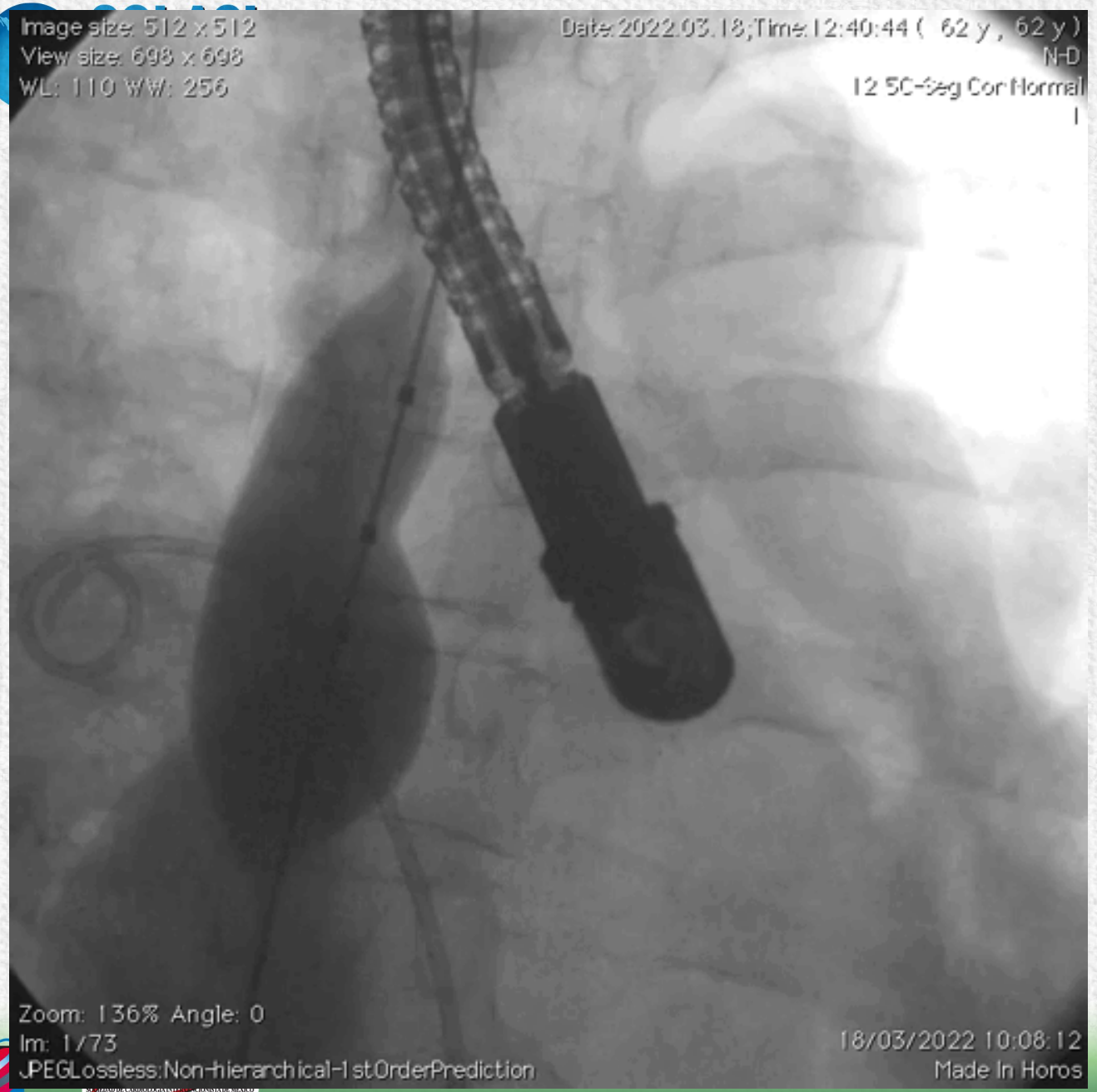



B
RES-A G —
P 138 mm XV/M +5/–
PRC 7/5/2/0 PRS 2
CFM F 3.8 MHz G —
PRF 5.0 kHz FP 3
PRC M/2 PRS 4
P 80% MI 0.5
3 7
CARDIACO
ST2612 GENERAL
95°
0.50
- 0.50
m/s
0
5
10

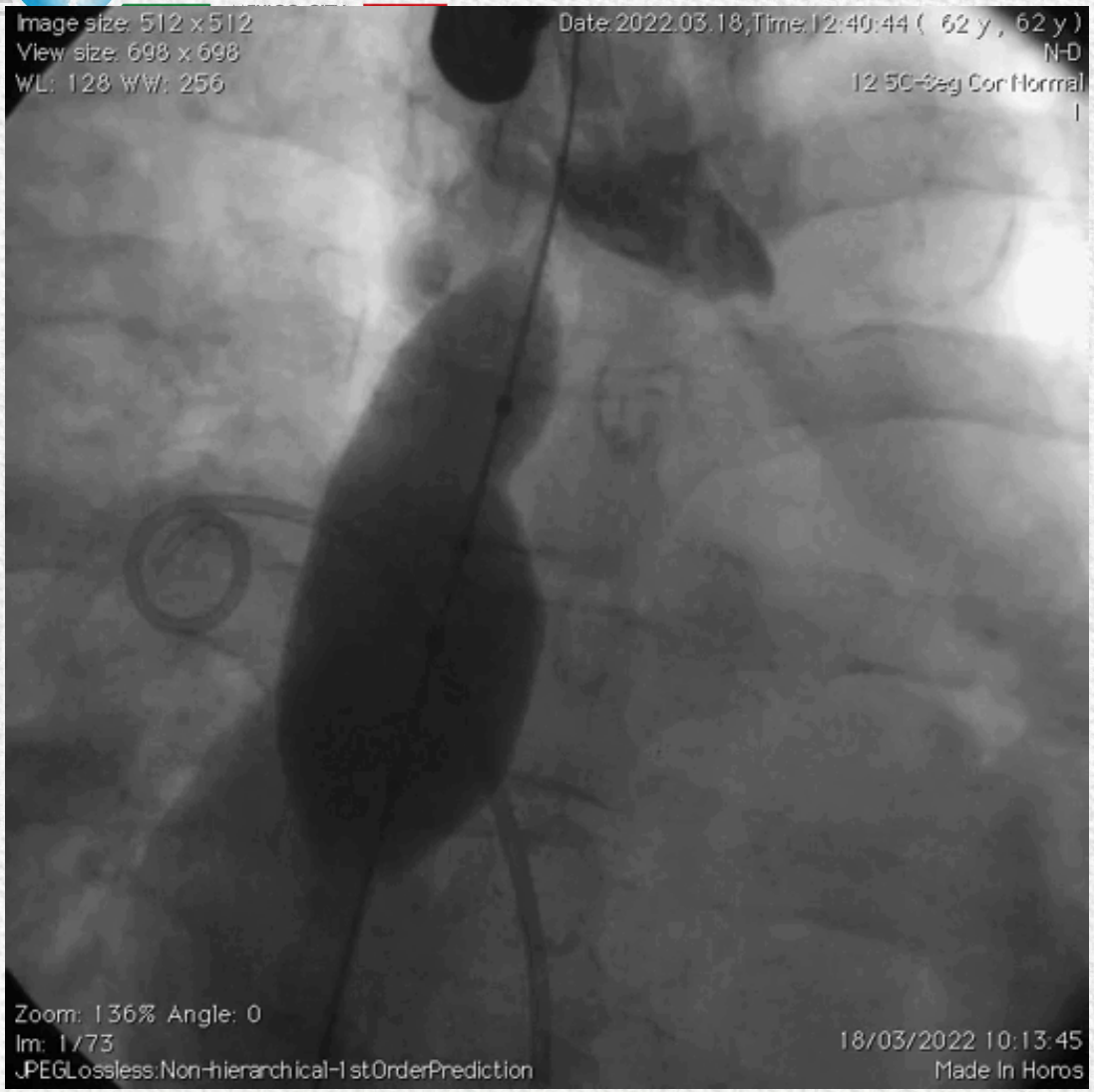
Transseptal Puncture



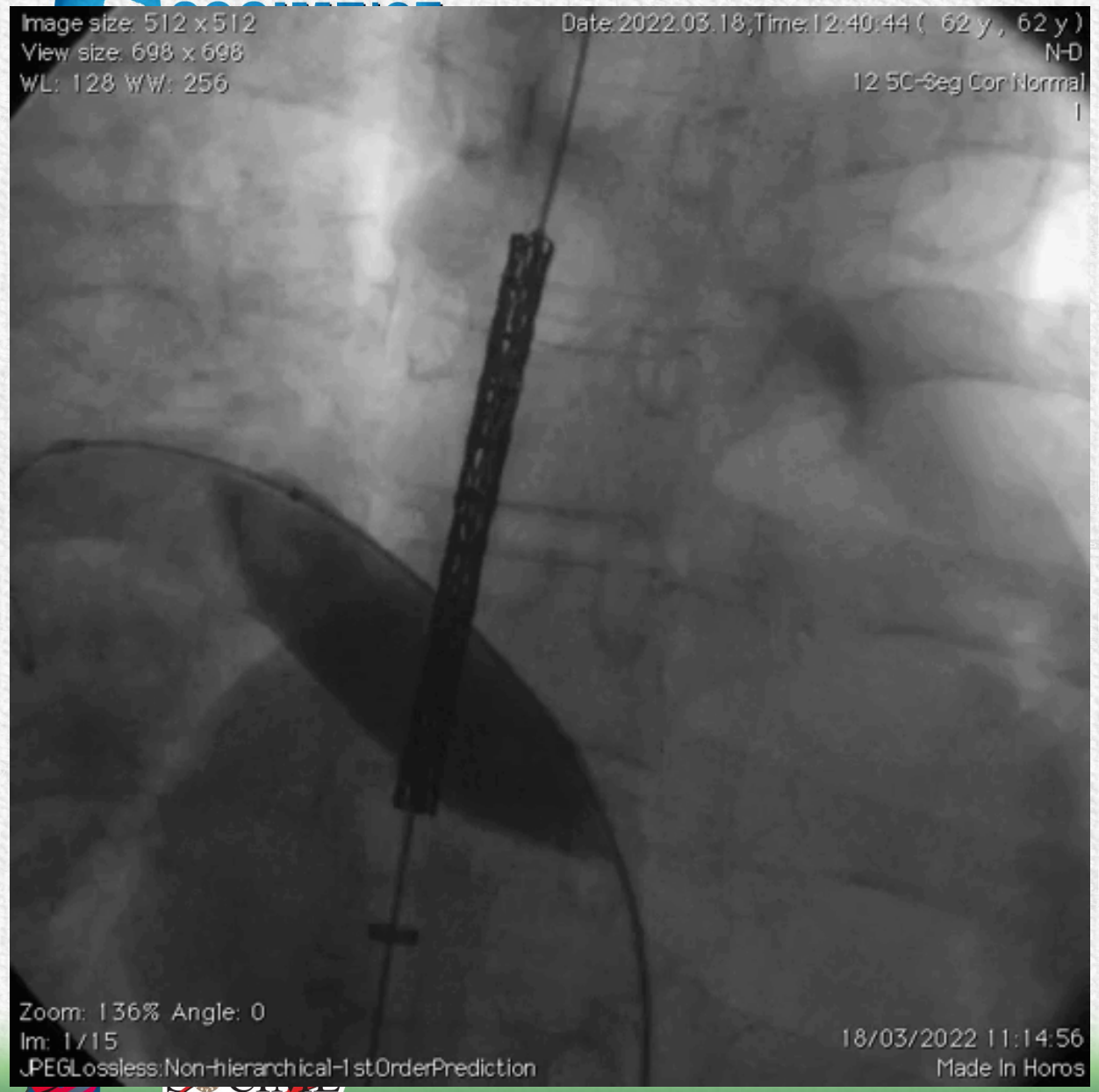




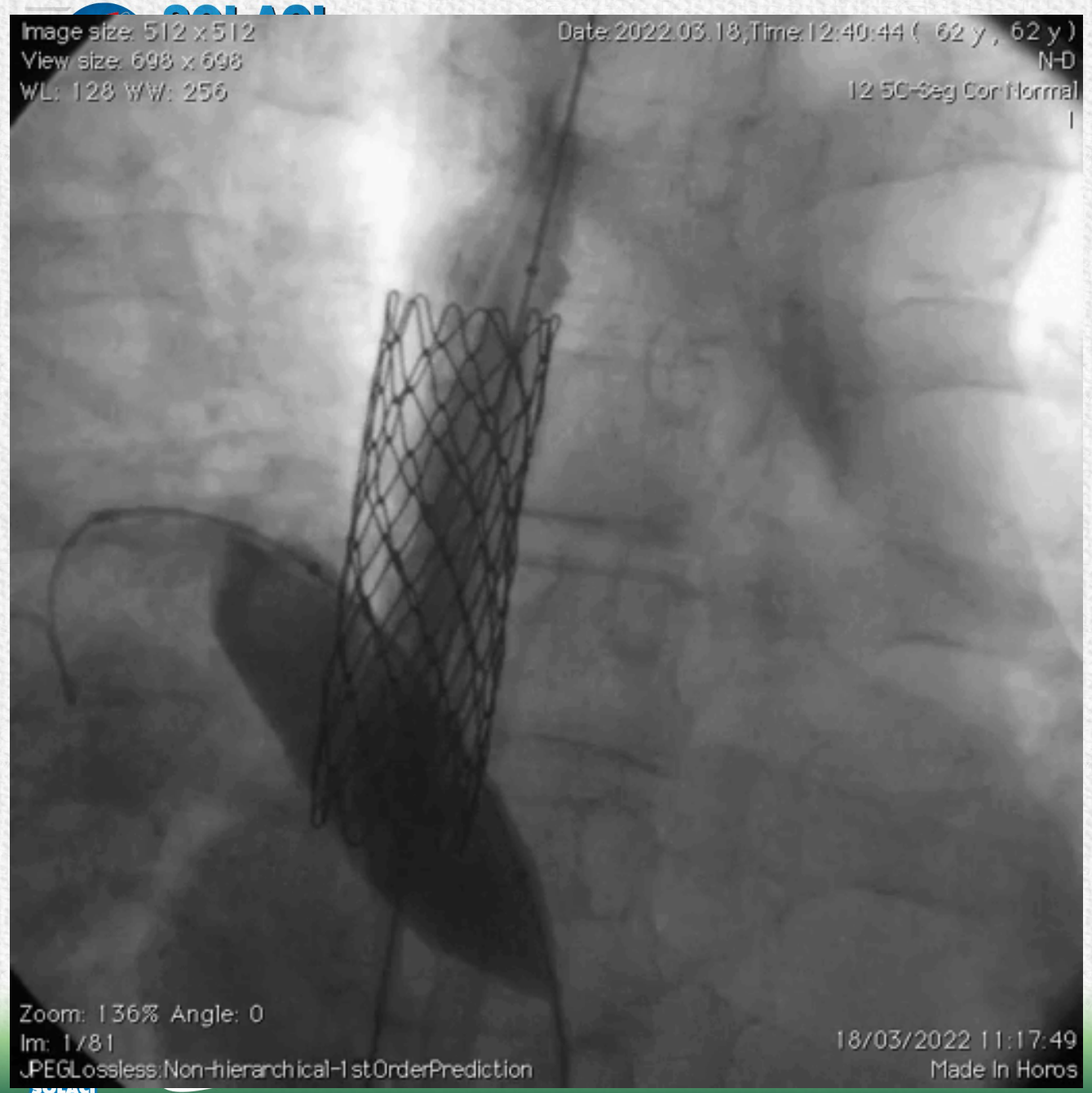
- **Complication during the angiography**



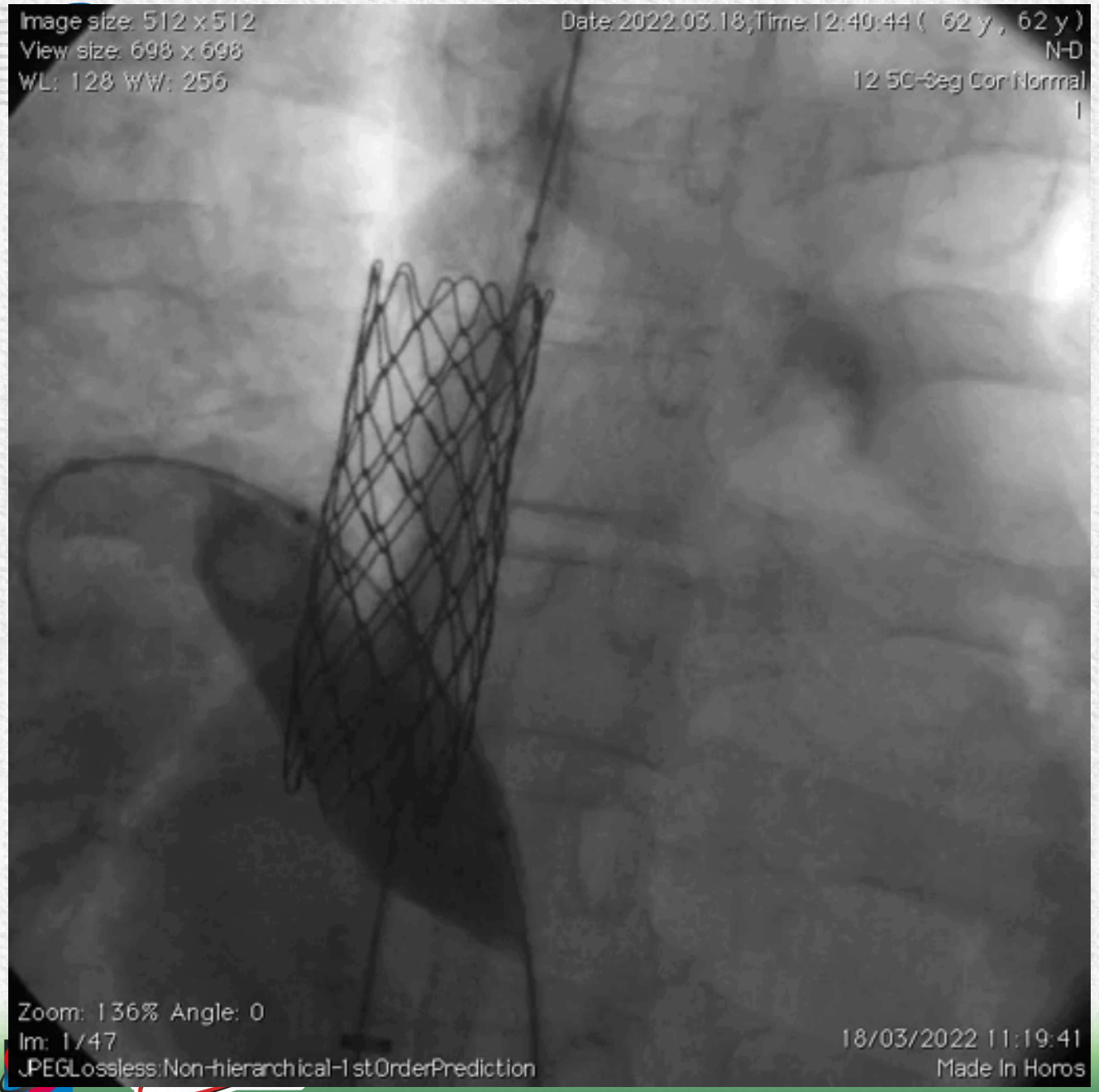
- INSUFLATION OF THE 30 MM ELASTOMERIC BALLOON NUMBER.
- VP PRESSURE 5 MMHG WHICH INCREASES TO 7 MMHG WITH BALLOON INSUFLATION



- **BALON ATLAS GOLD DE 16 X 6 EN VP**
- **CP COVERED STENT DE 10 ZIGS X 60**

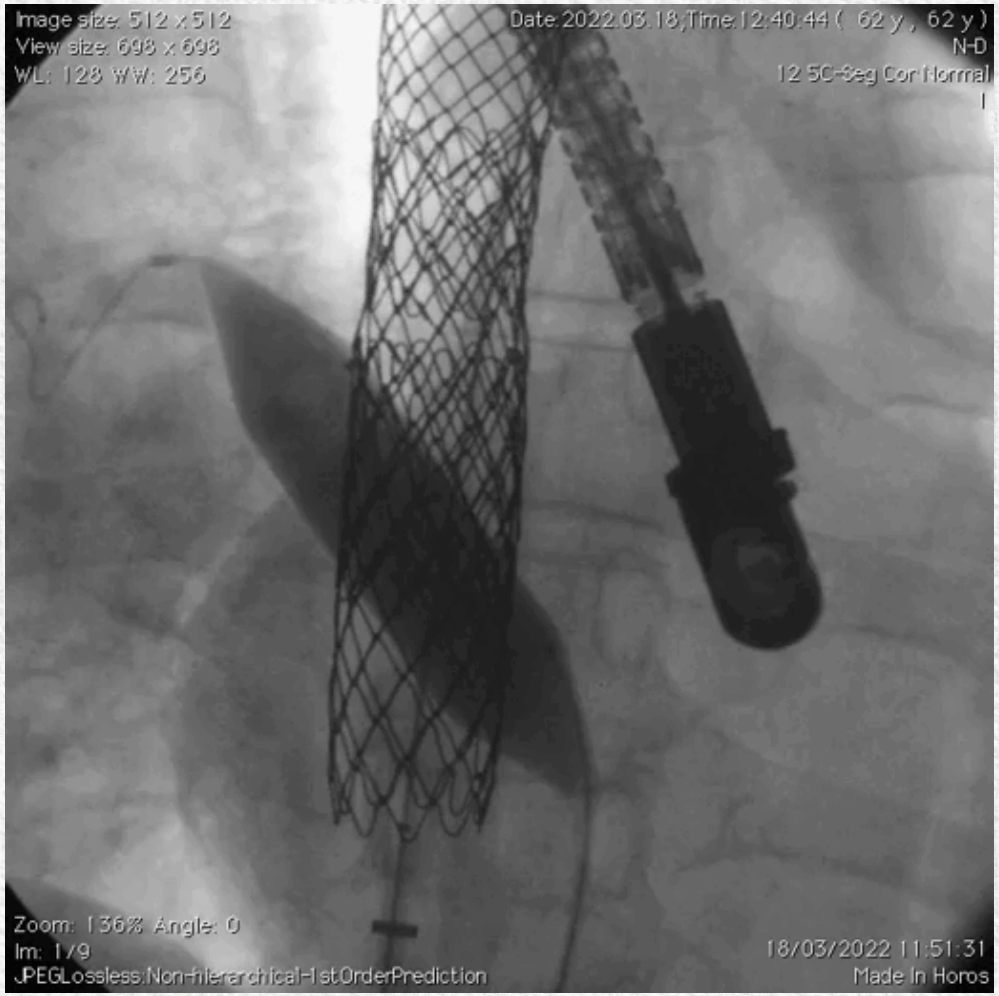


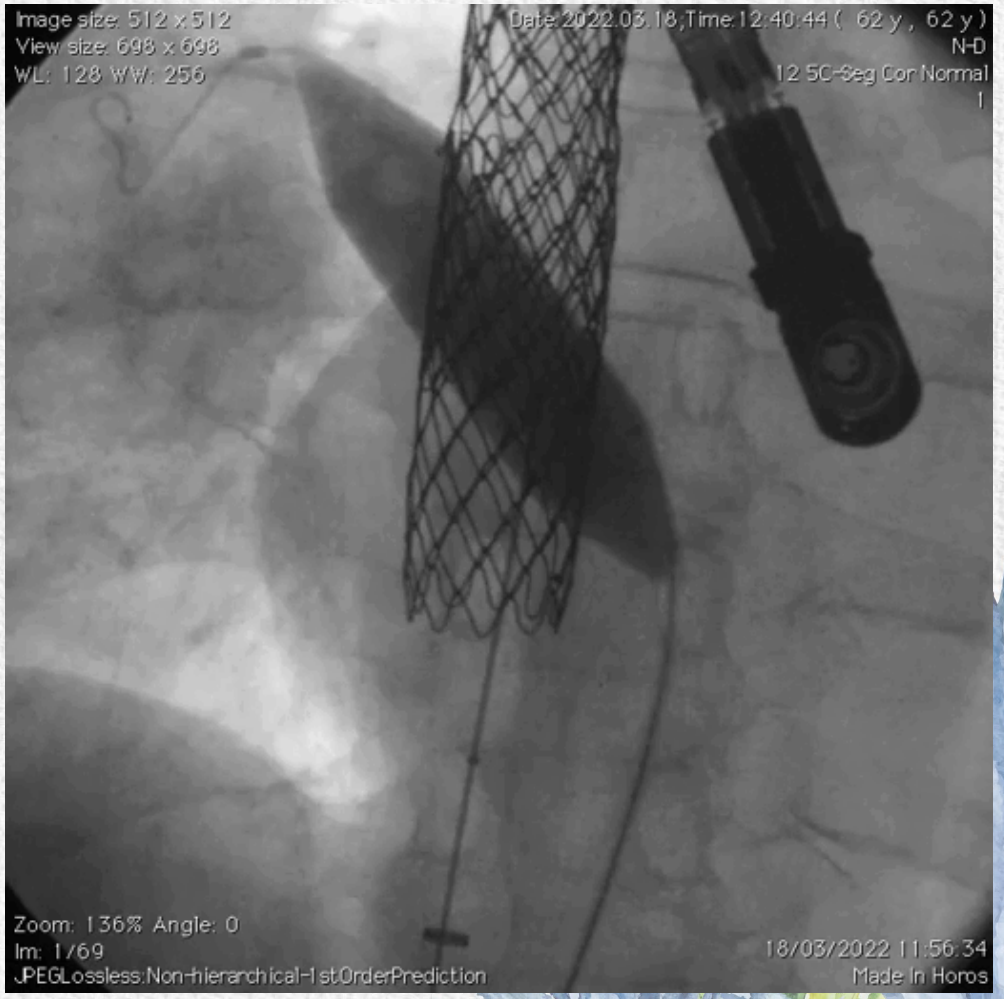
Insuflación con balón Z-med 22 x 6



CP stent free de 8 Zigs de 22 x 45

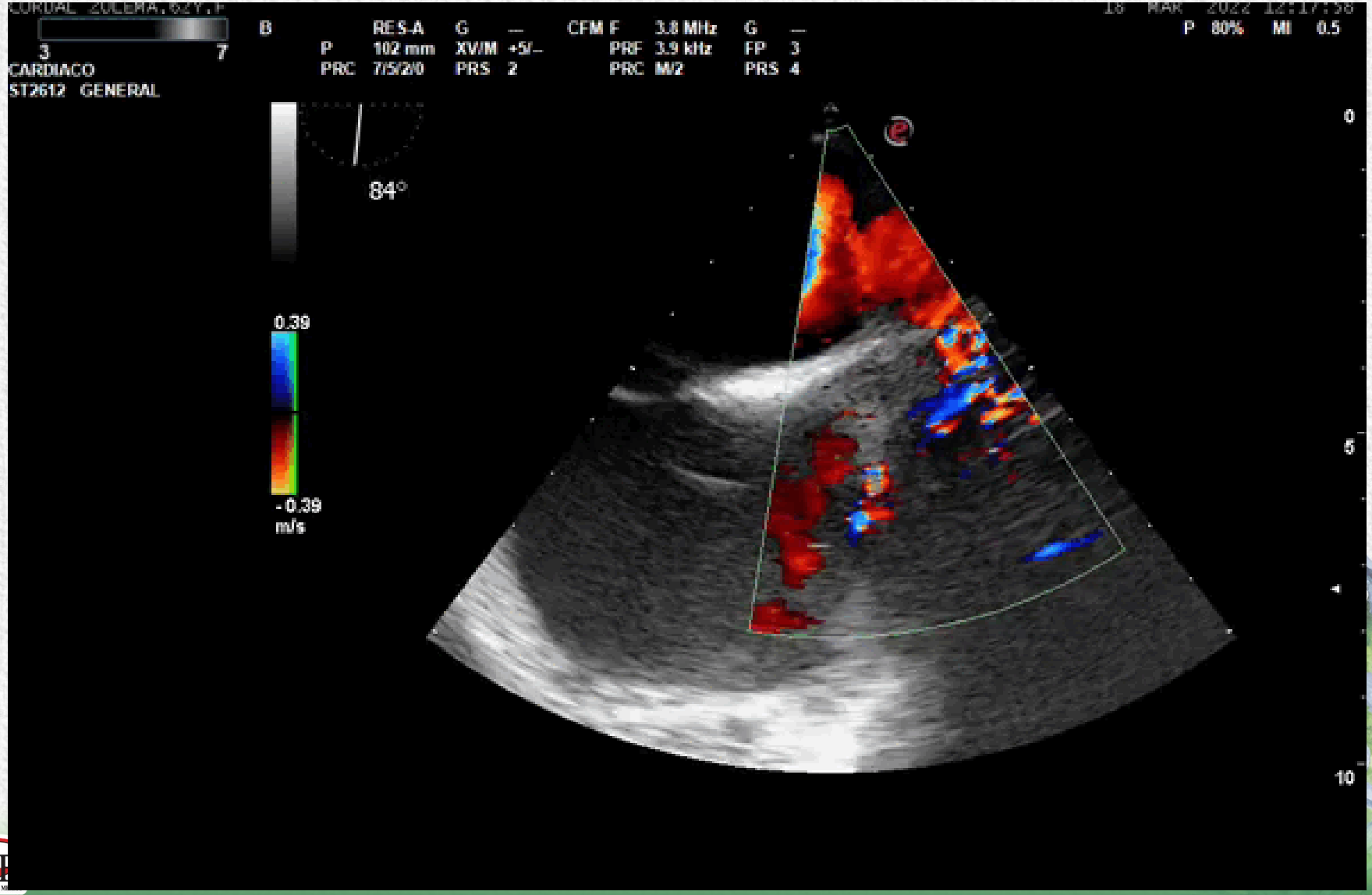
CP stent 10 Zigs 22 x 60

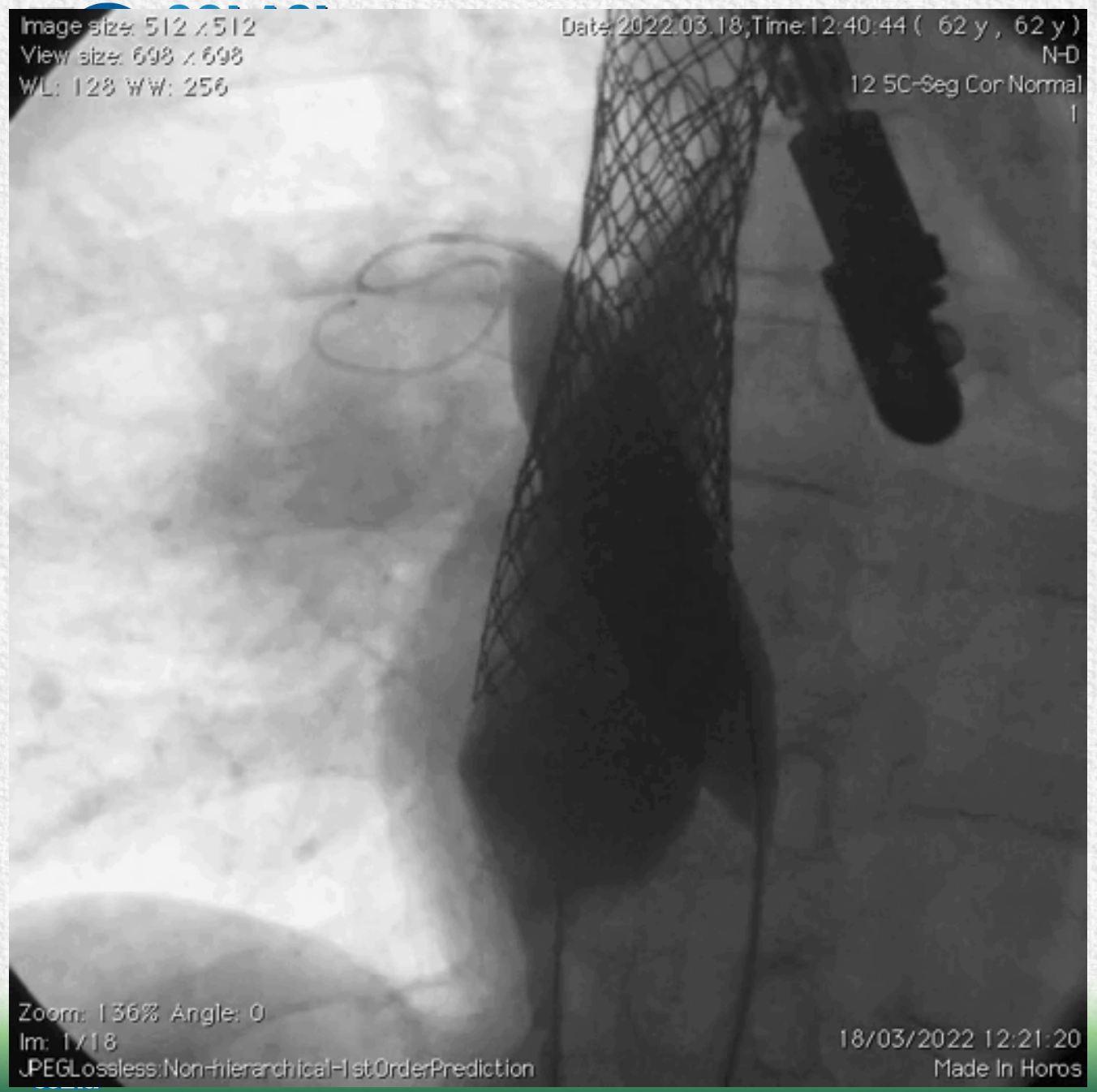




Insuflación con balón Z-Med 28 x 6

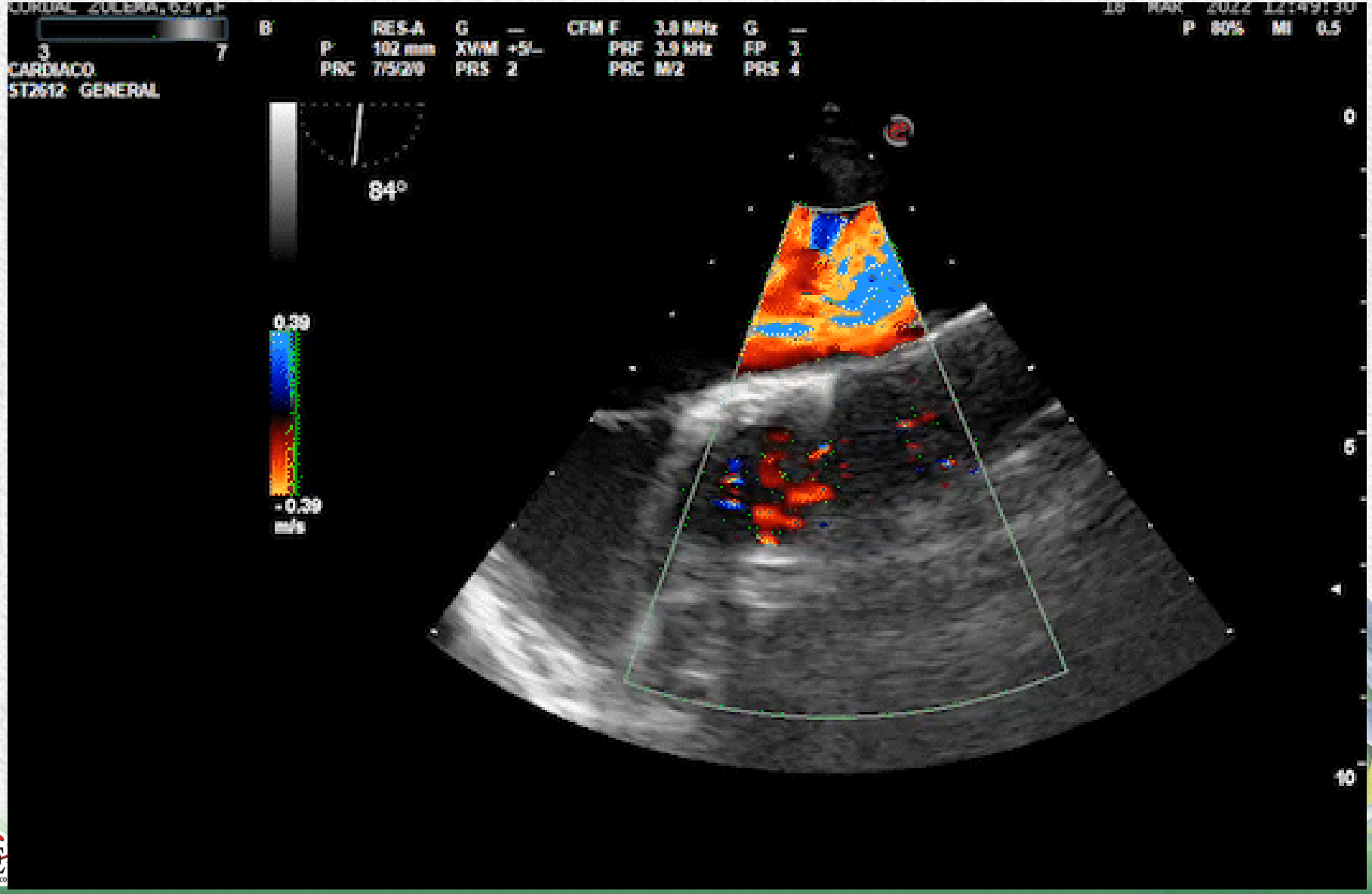
Cortocircuito residual





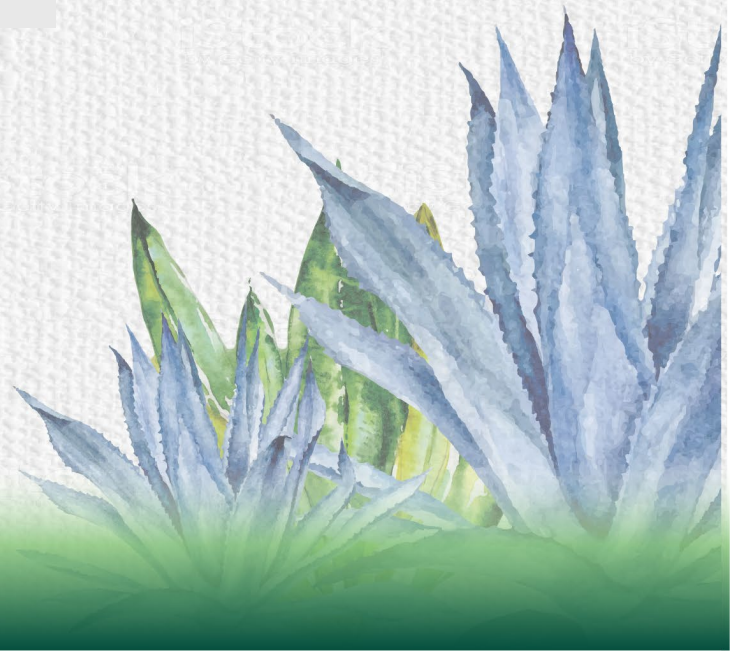
Insuflación con balón Z-Med 32 x 60

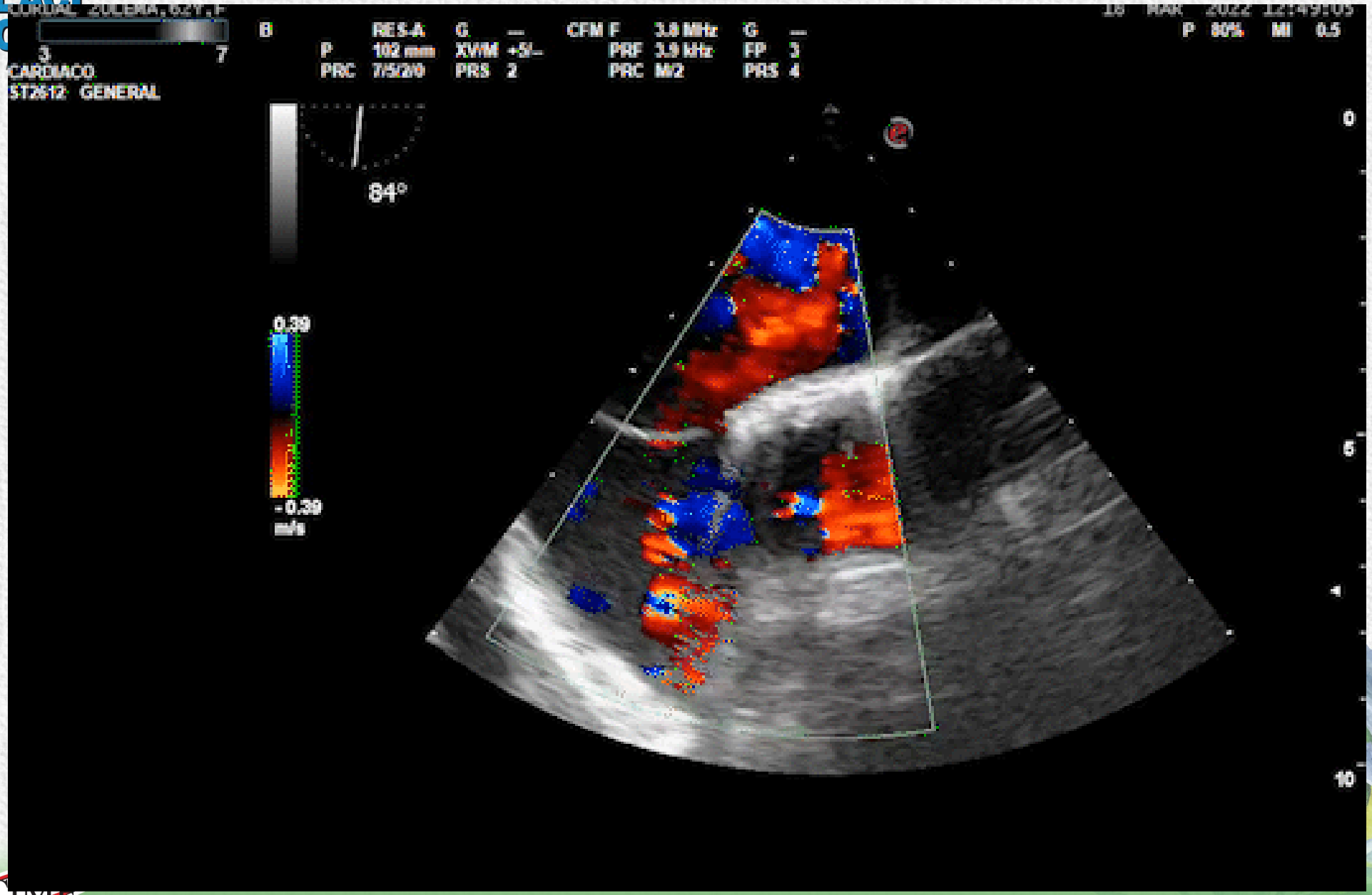
Sin Shunt residual



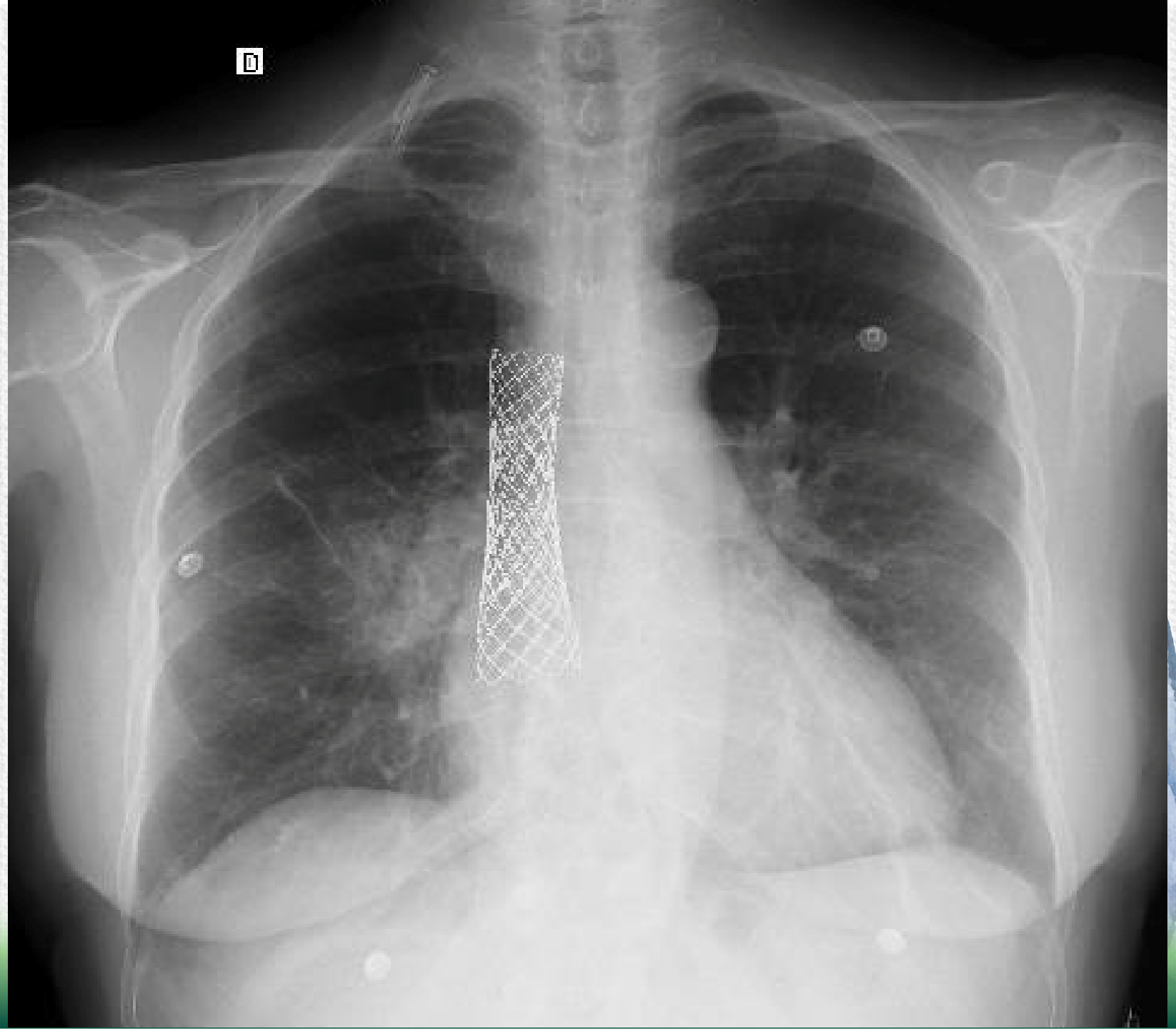
PRESSURE BETWEEN VP AND AI

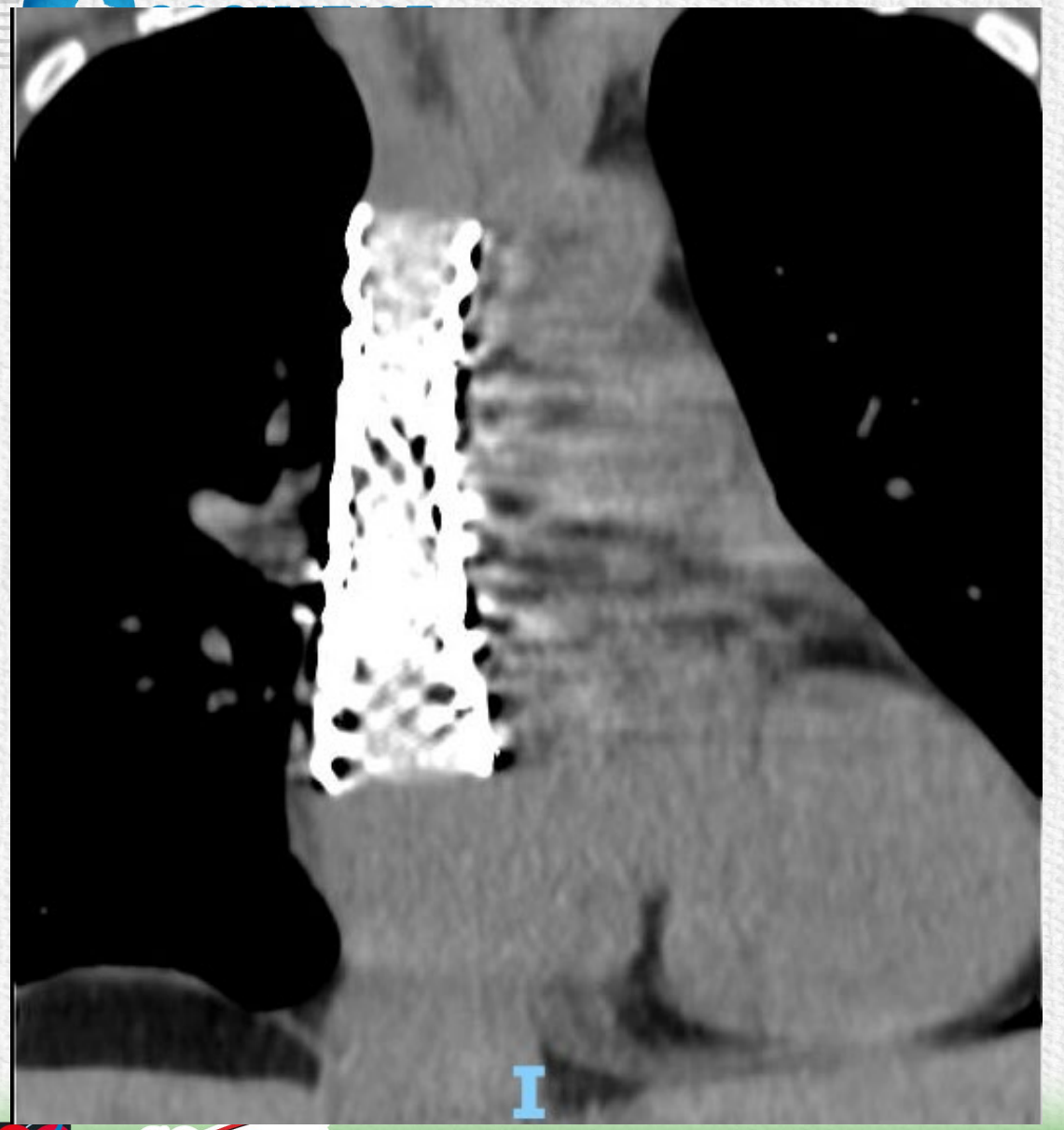
THERE WAS NO GRADIENT !!!!

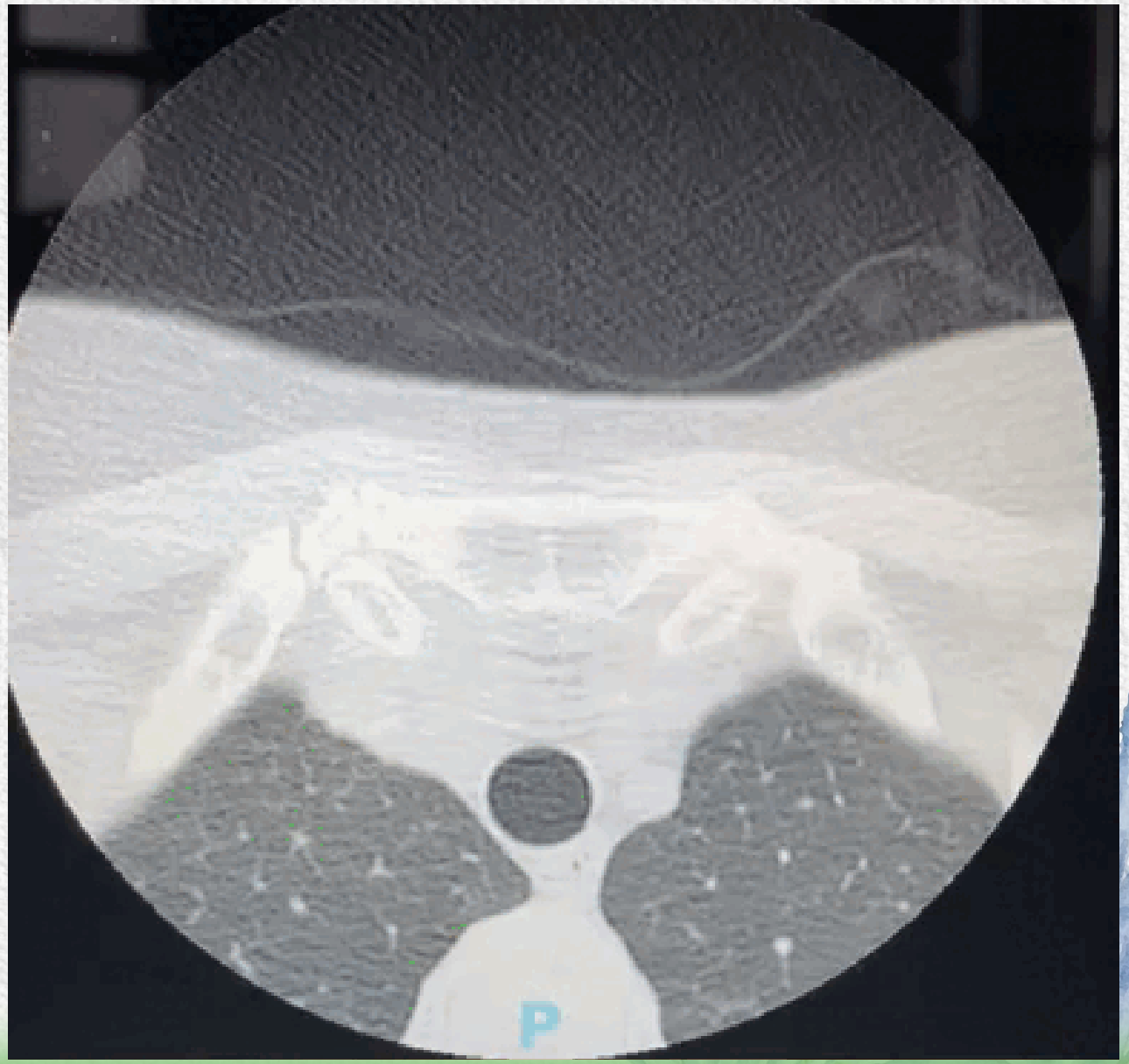



B
RES-A
G
CFM F
3.8 MHz
G
P
102 mm
XV/M +5/-
PRF
3.9 kHz
FP
3
PRC
7/5/20
PRS
2
PRC
M2
PRS
4
P 80%
MI
0.5
CARDIACO
GENERAL
84°
0.39
-0.39
m/s
0
5
10

RX TX a las 24 hs




I


P

Follow-up

1) 3 months with dual antiplatelet therapy.

2) Monthly monitoring with ECG, X-ray, and echocardiogram.

3) At 3 months, we allowed her to walk normally.

4) At 5 months, she started light training.

5) At 6 months, she was discharged and we started exercising again.

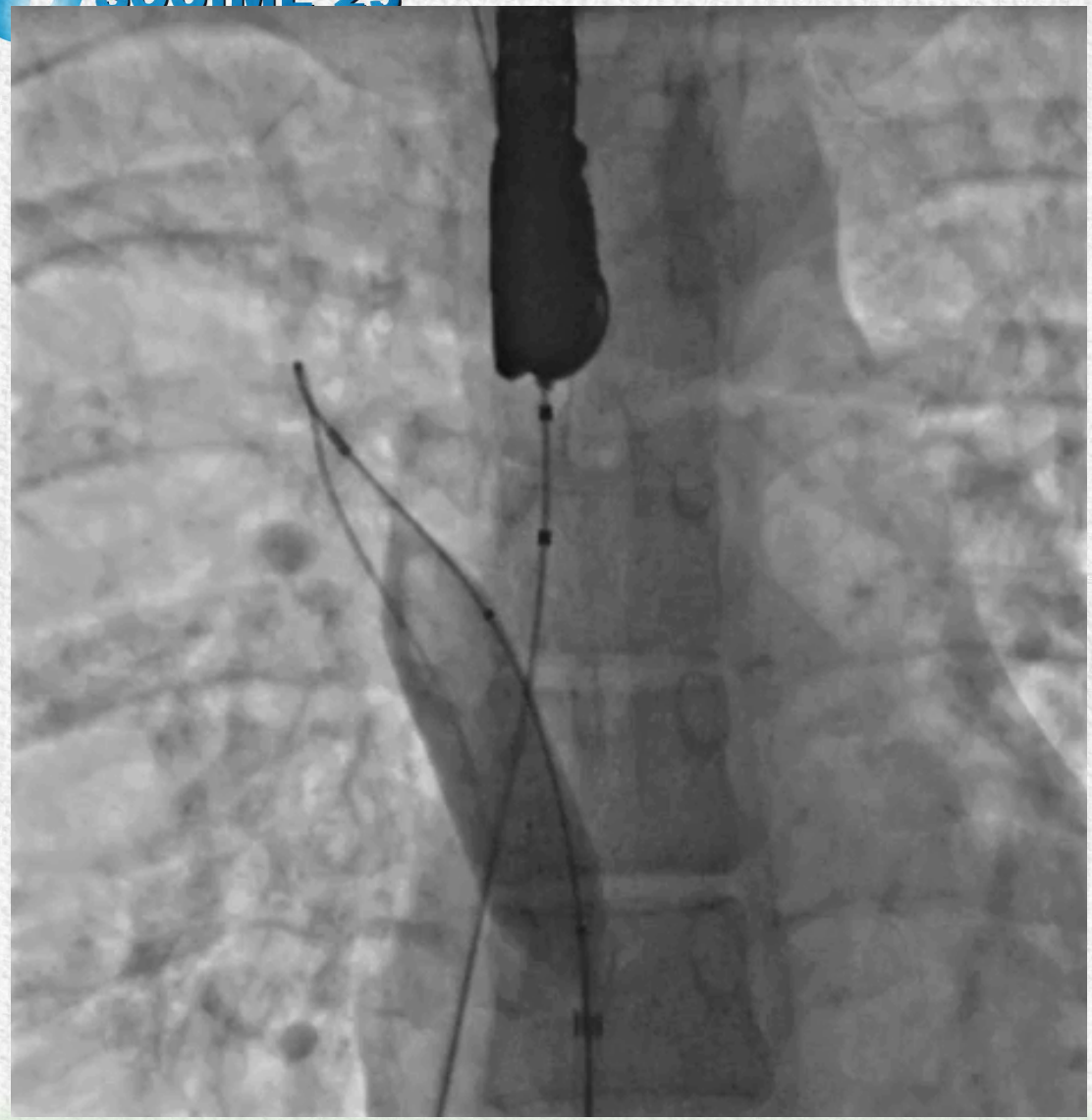
SOLACI SOCIME '25
MEXICO CITY

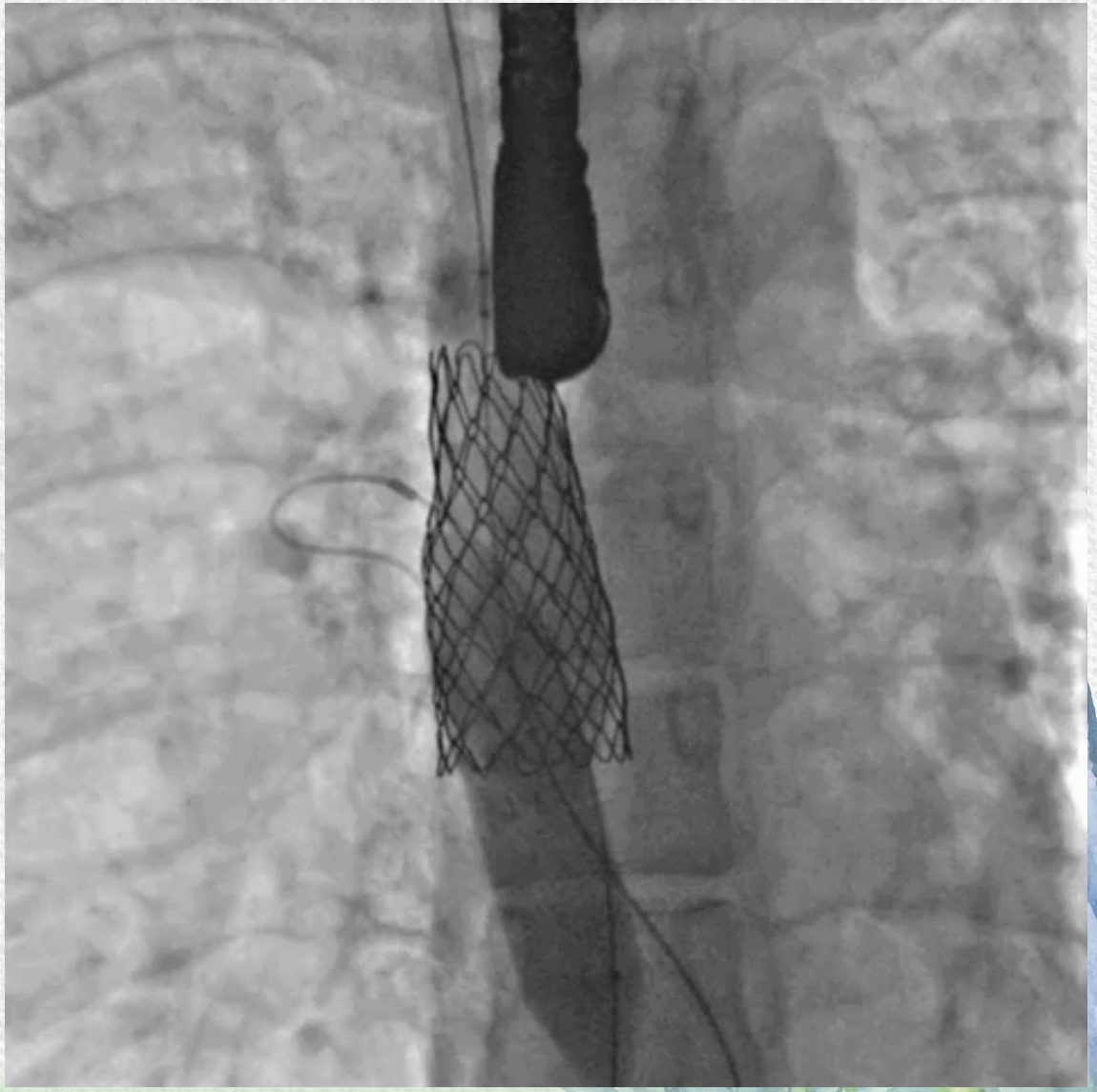
SOLACI

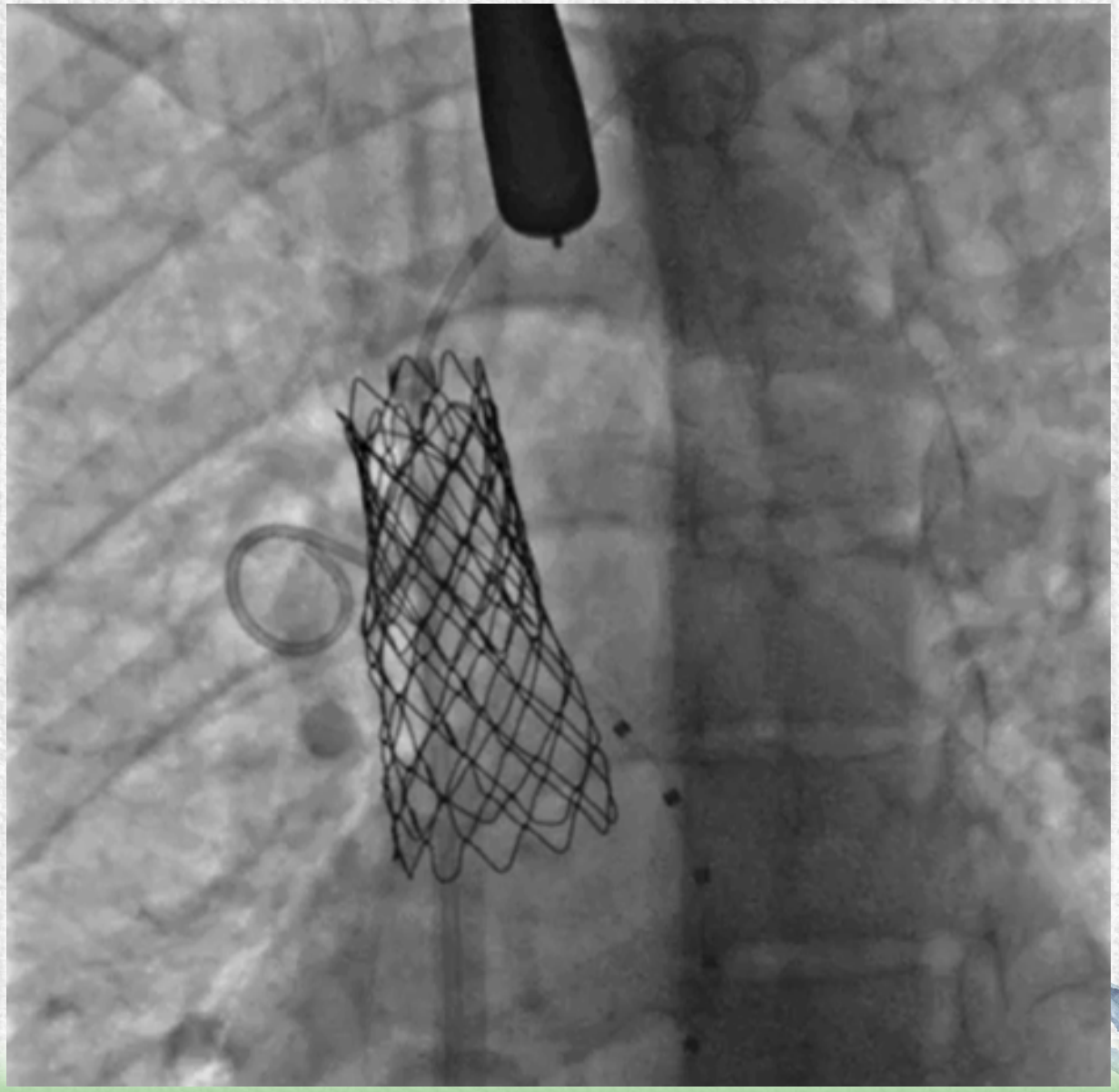
SOCIME
SOCIEDAD DE CARDIOLOGIA INTERVENCIONISTA DE MEXICO

- **Case 2:** Female patient, 35 years old. Two CP stents were placed. After 3 hours of the procedure, we decided to end the procedure and return in 3 months to place the last stent..

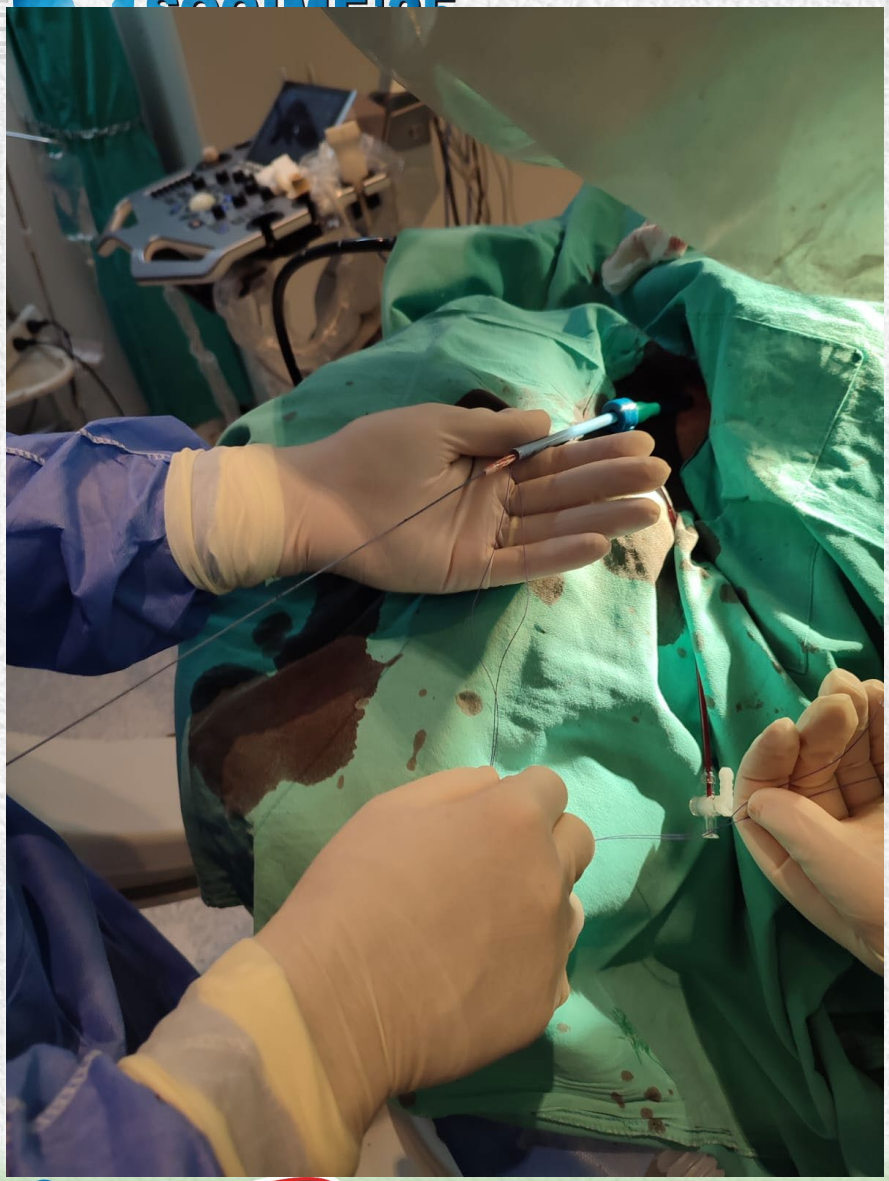
1º CAT

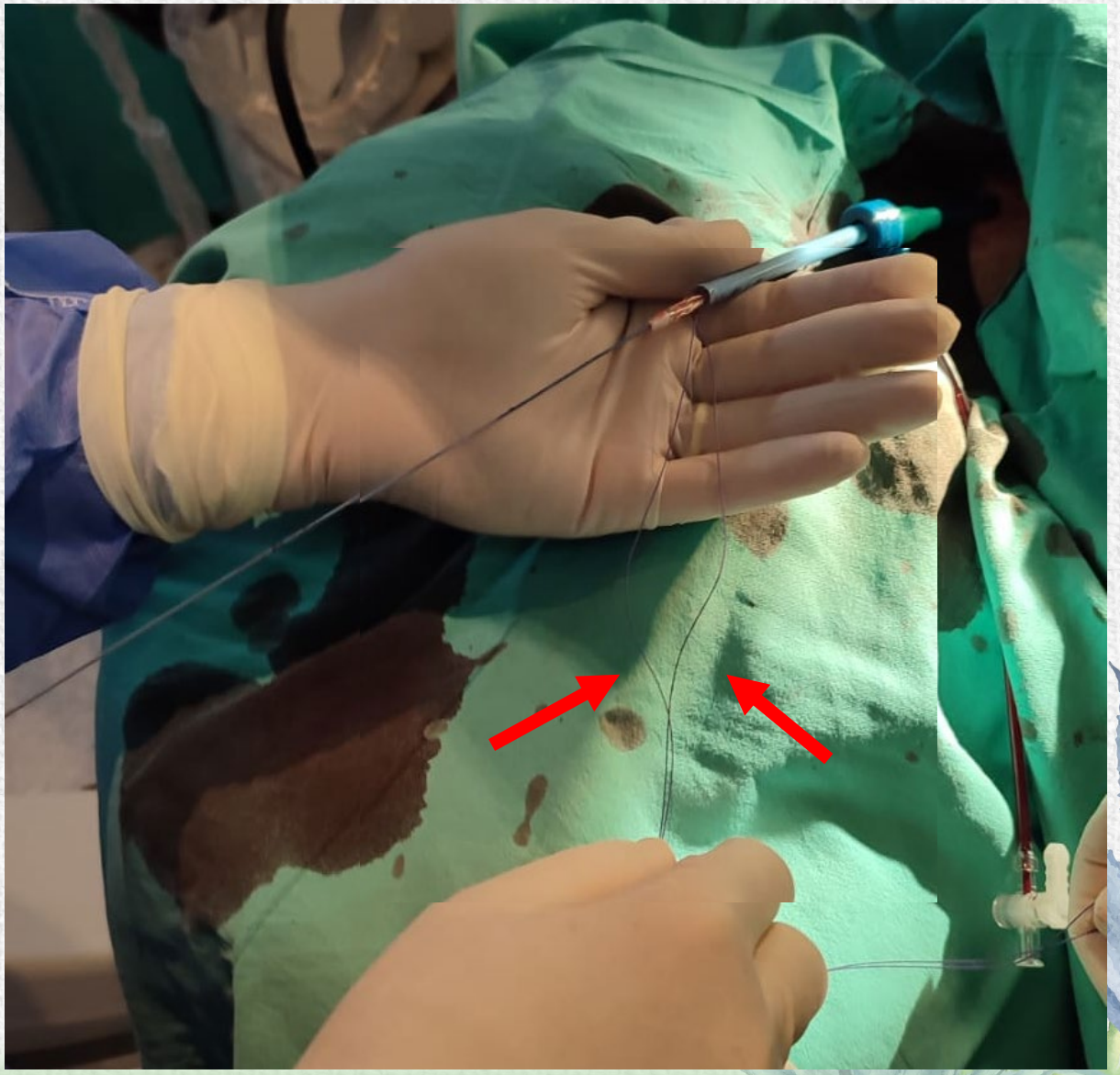


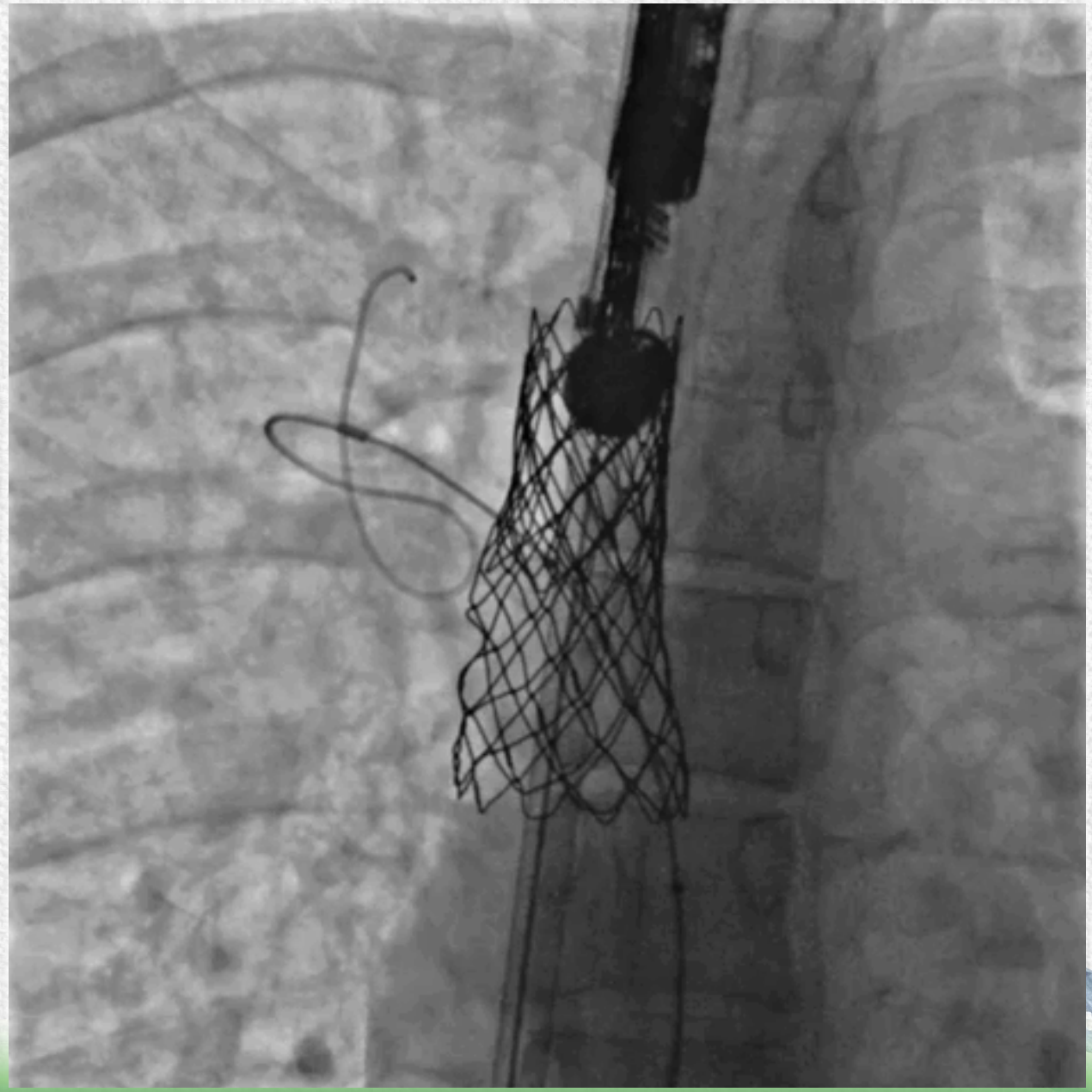


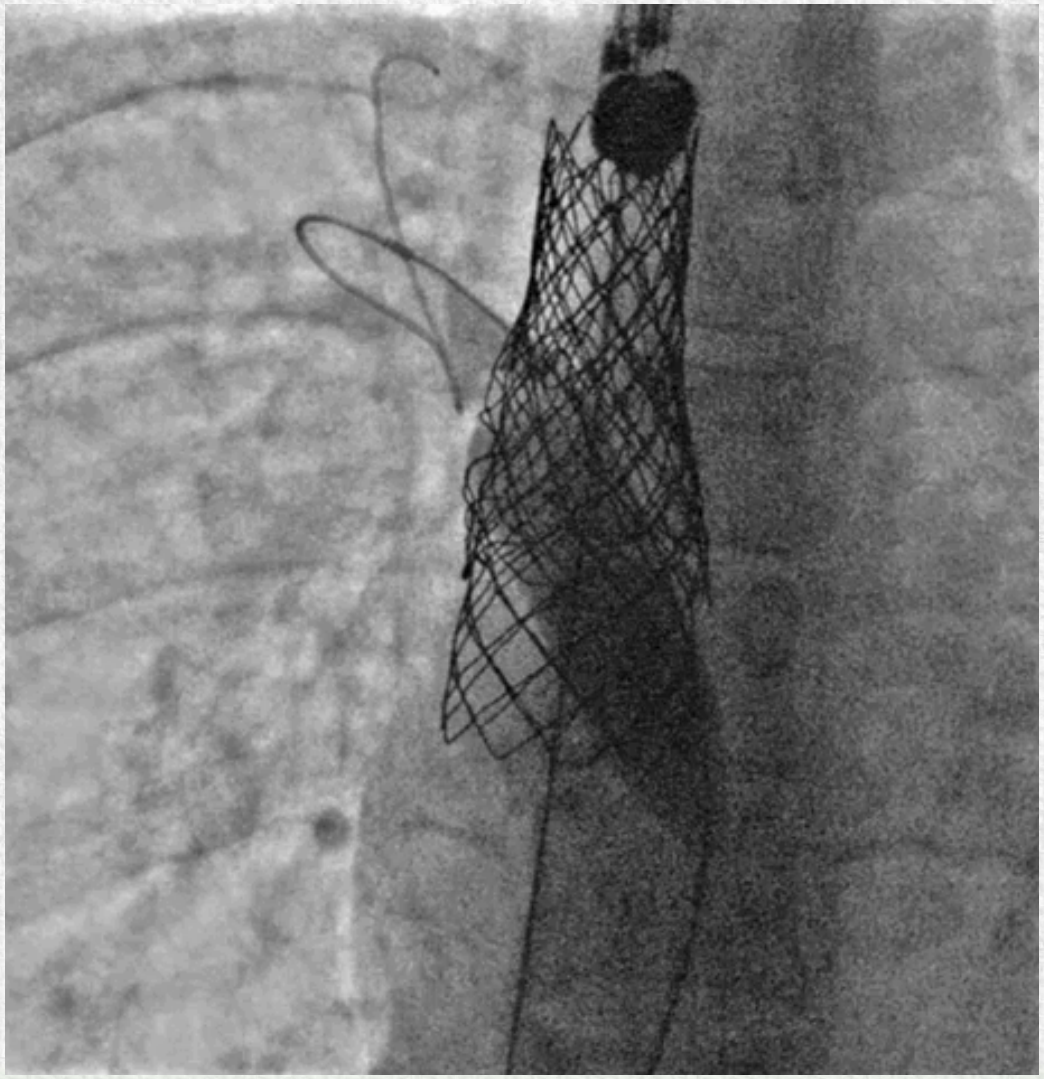


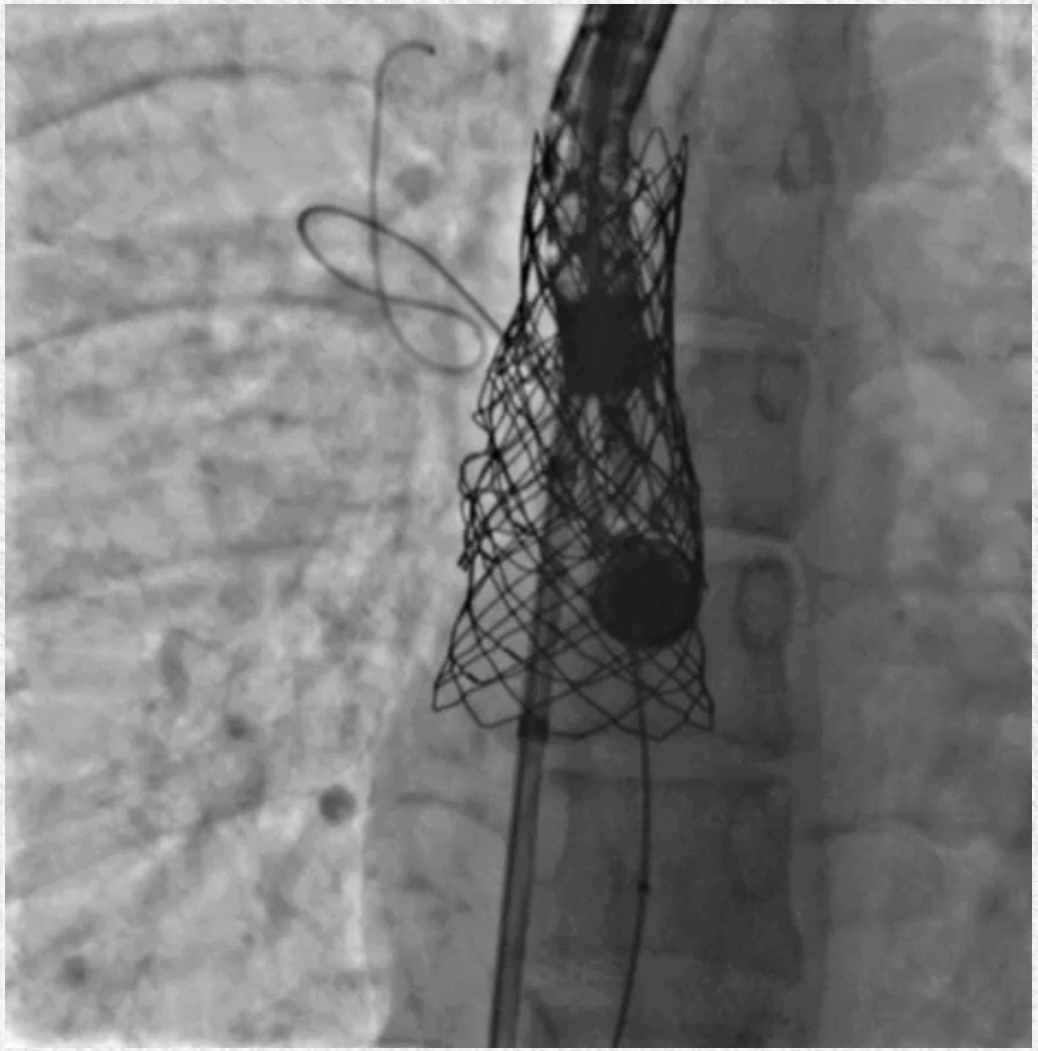
2º CAT

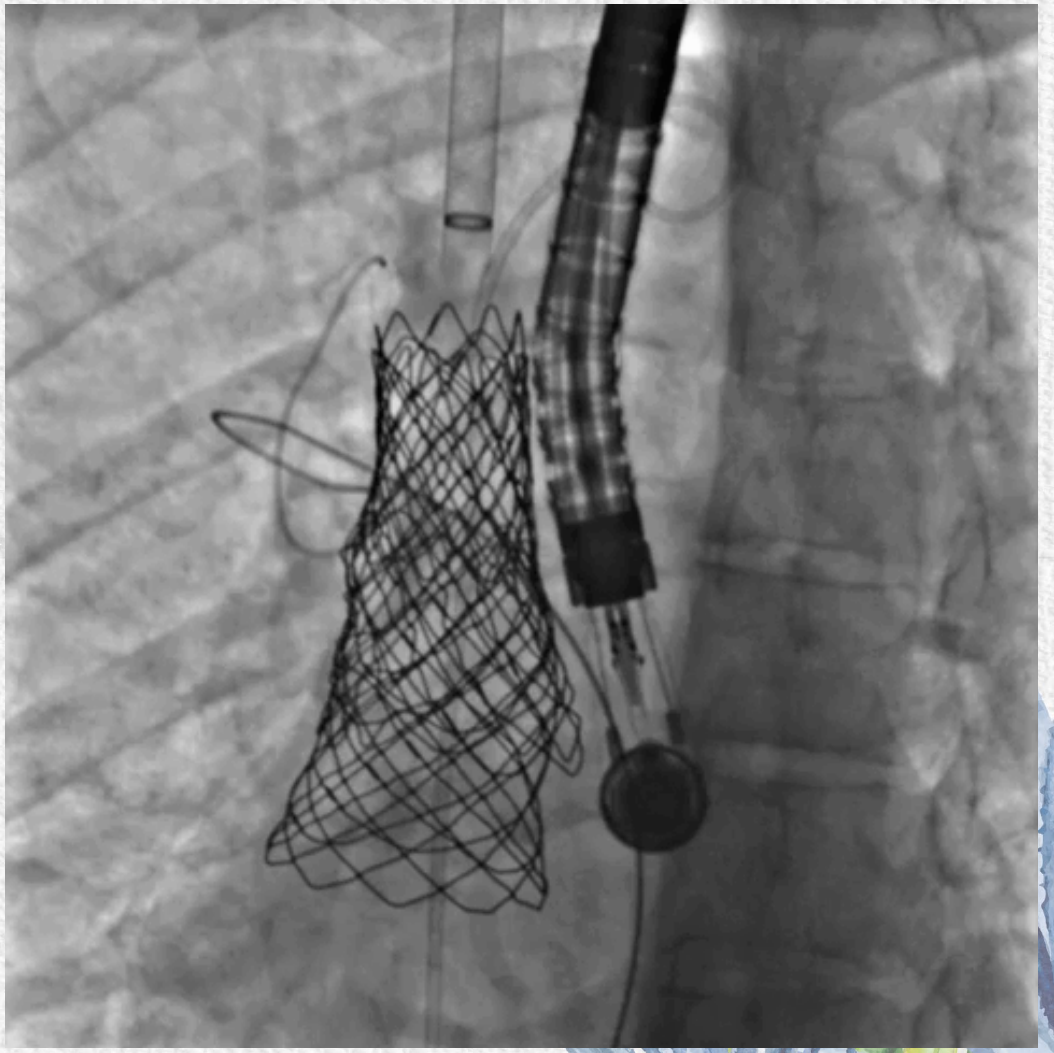


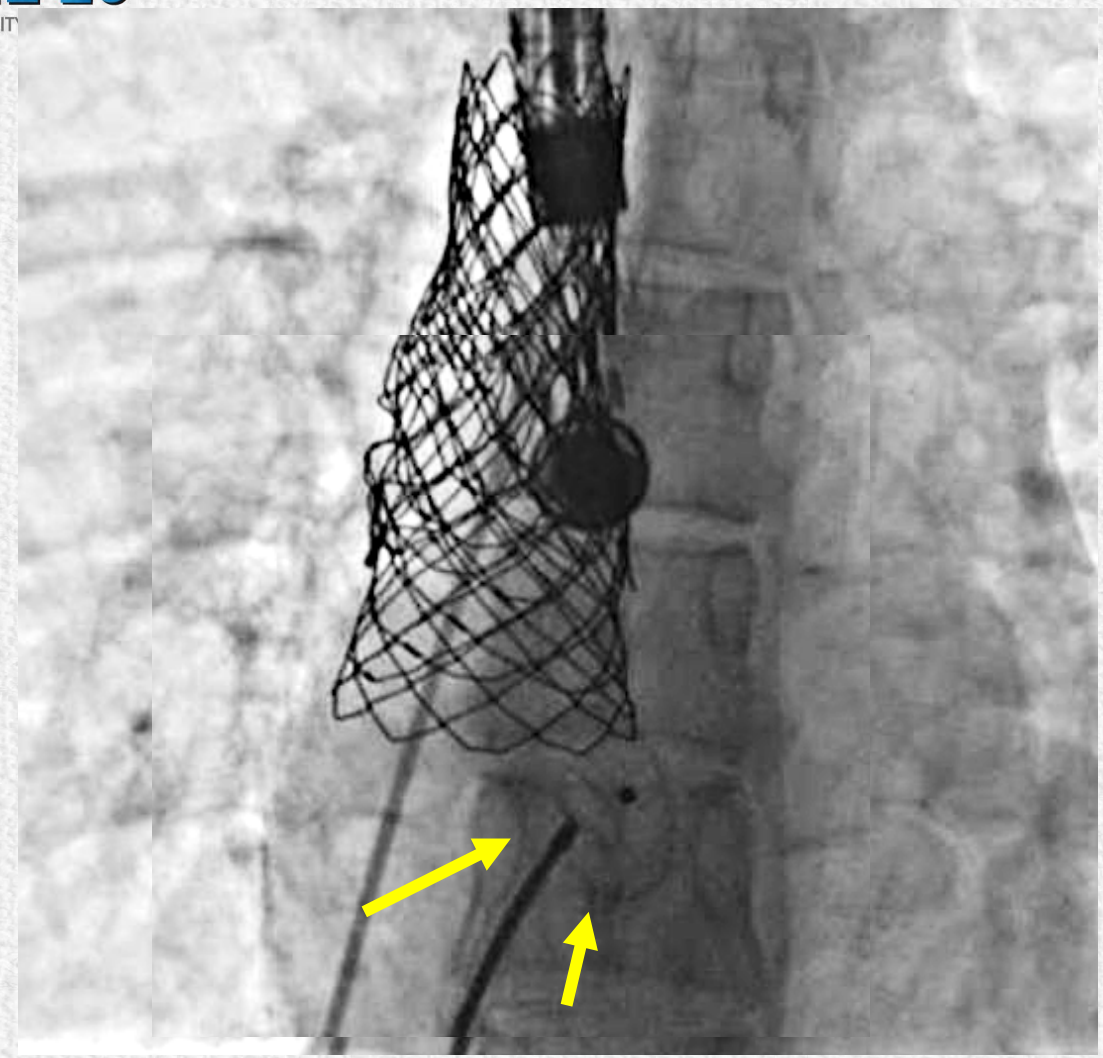






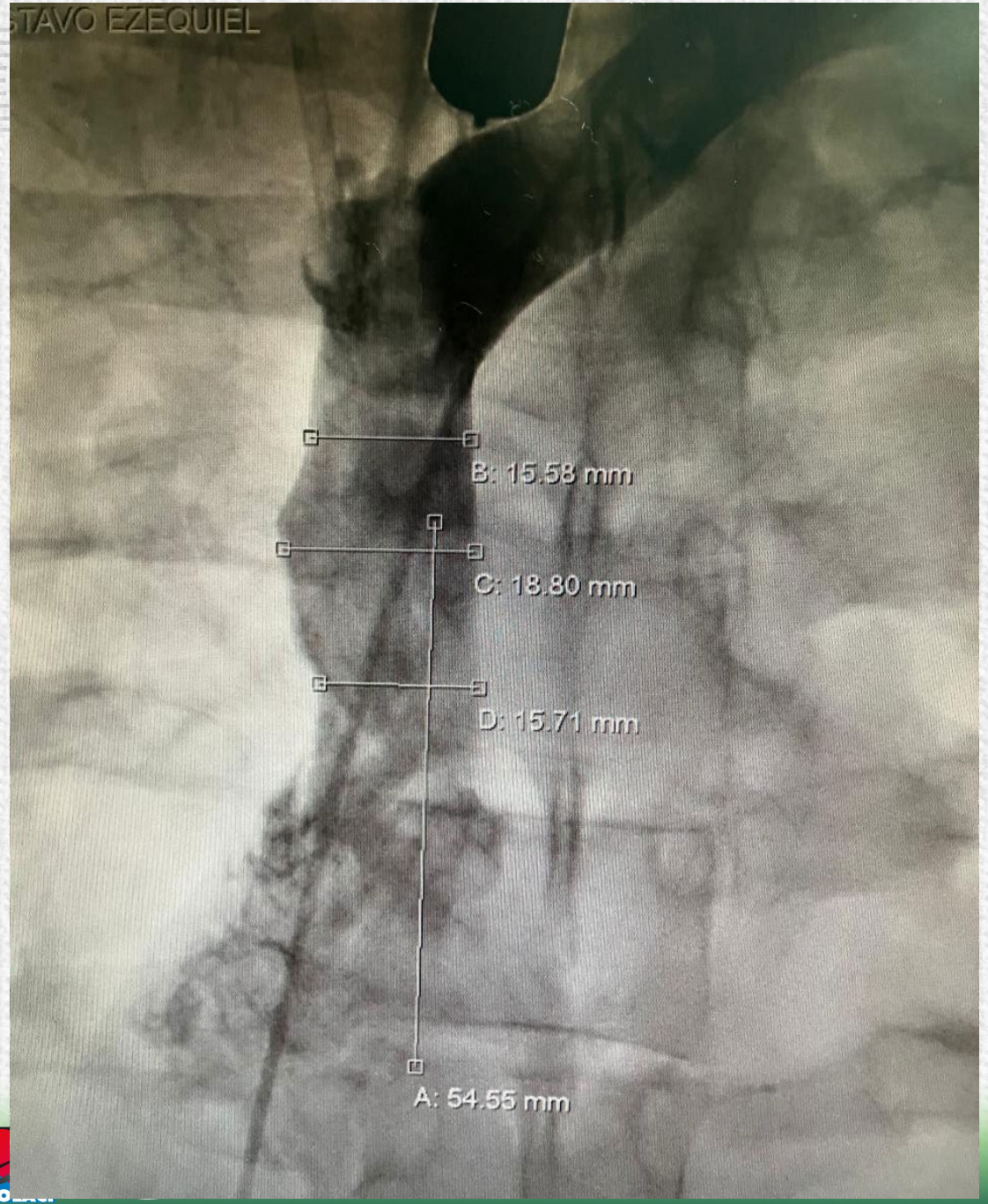


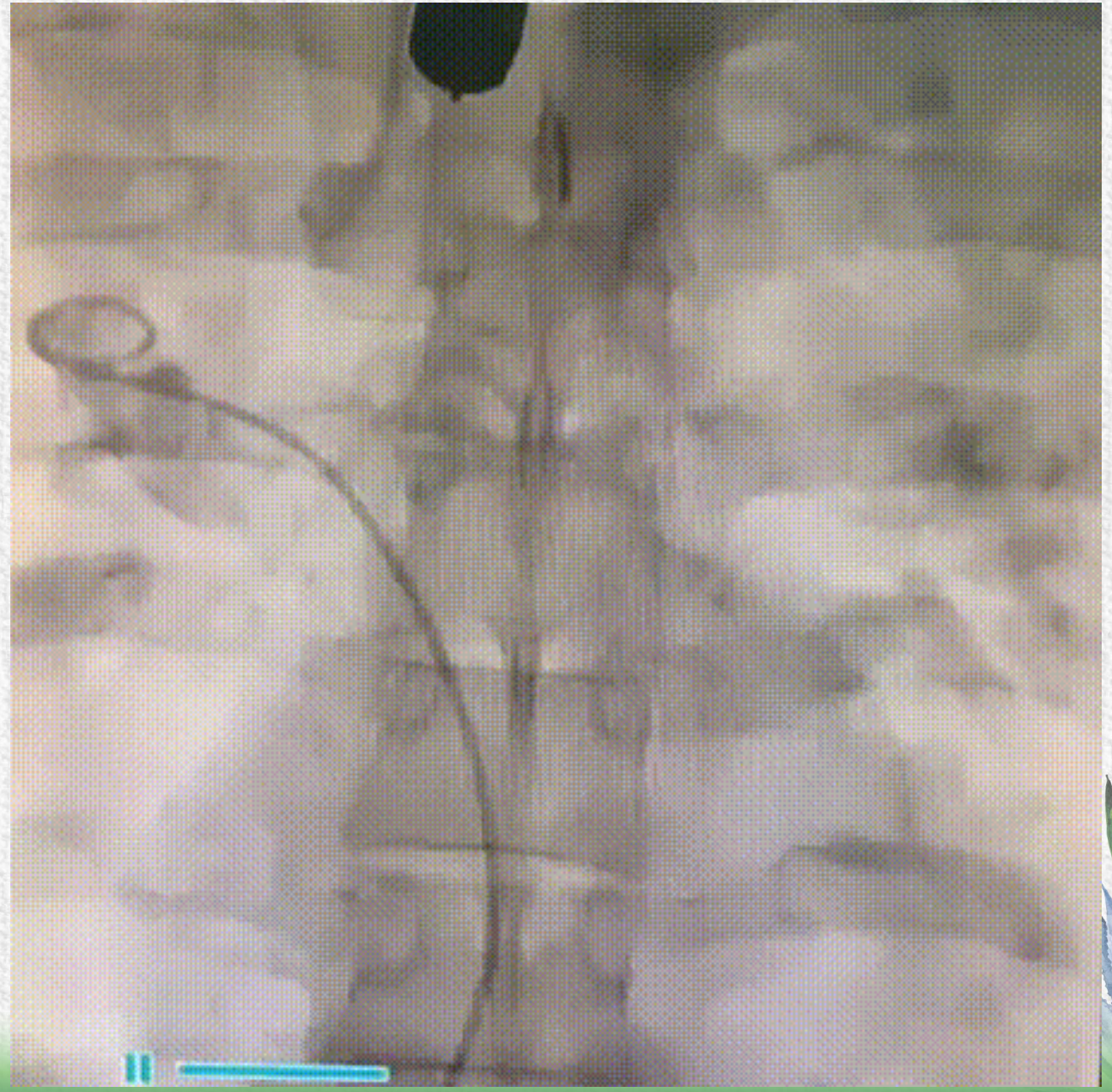


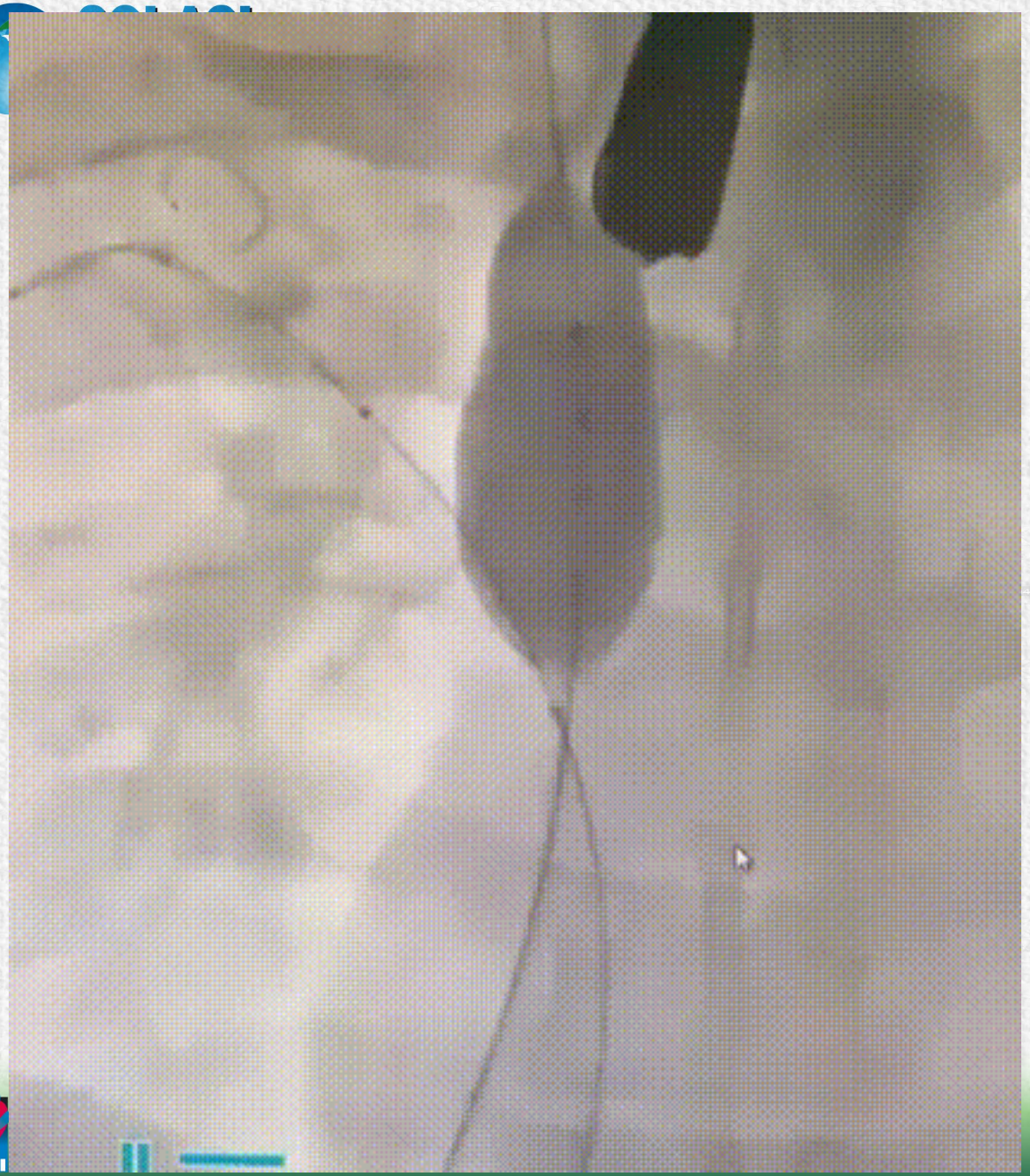


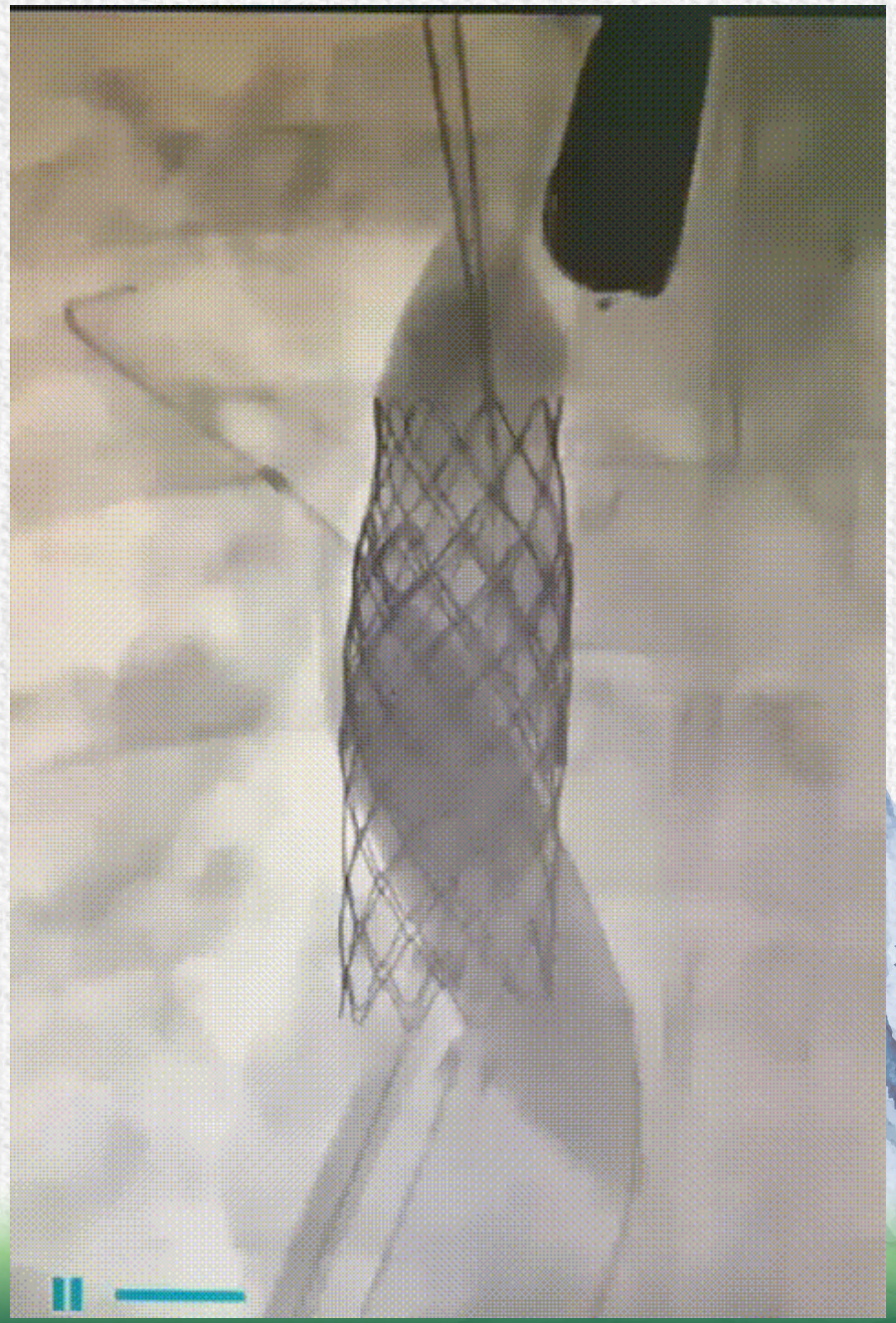
FOV device

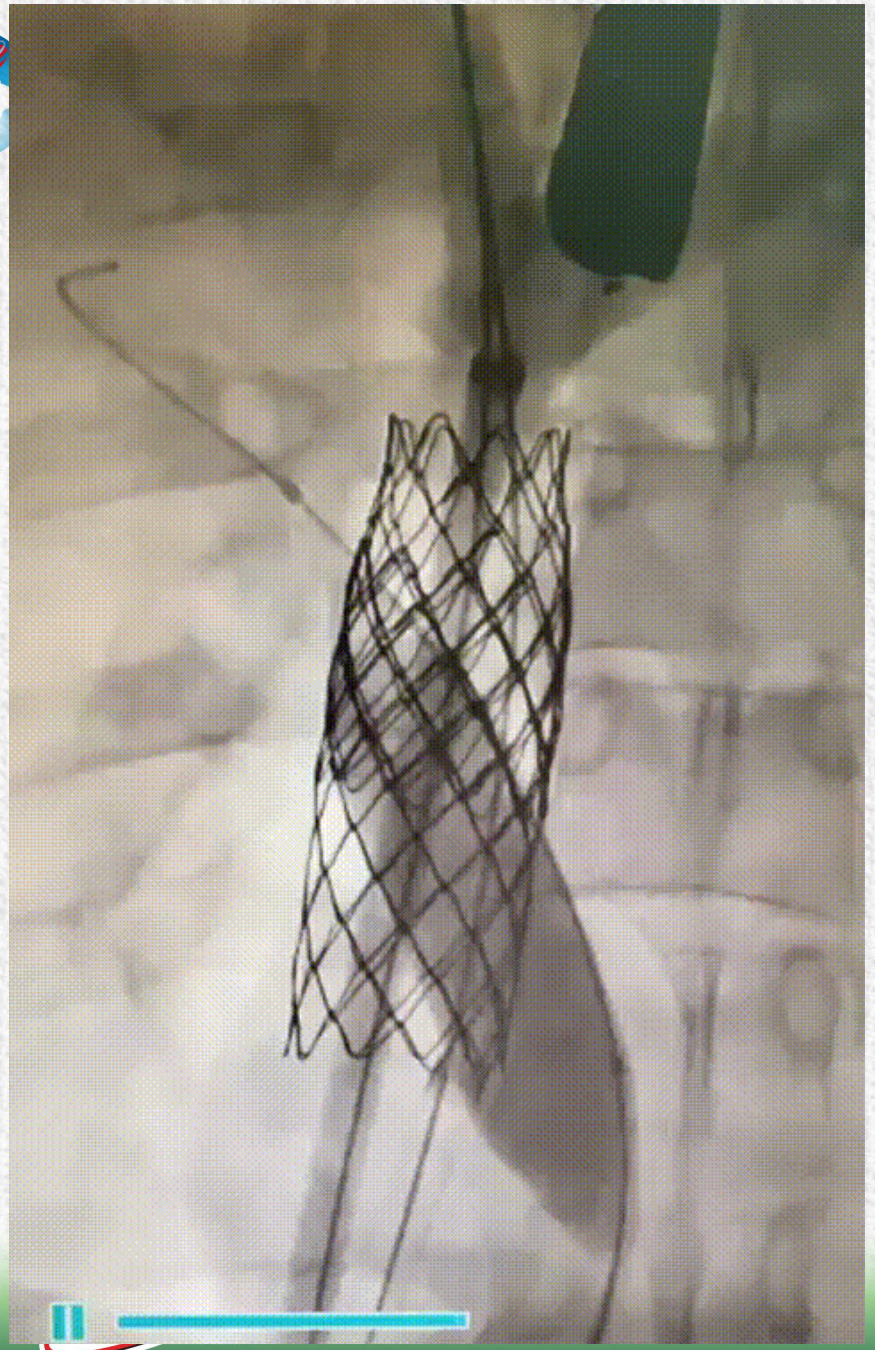
- **Caso 3:** A 38-year-old patient, a machinist, migrated to AD after the placement of two stents, so he was referred for surgery.

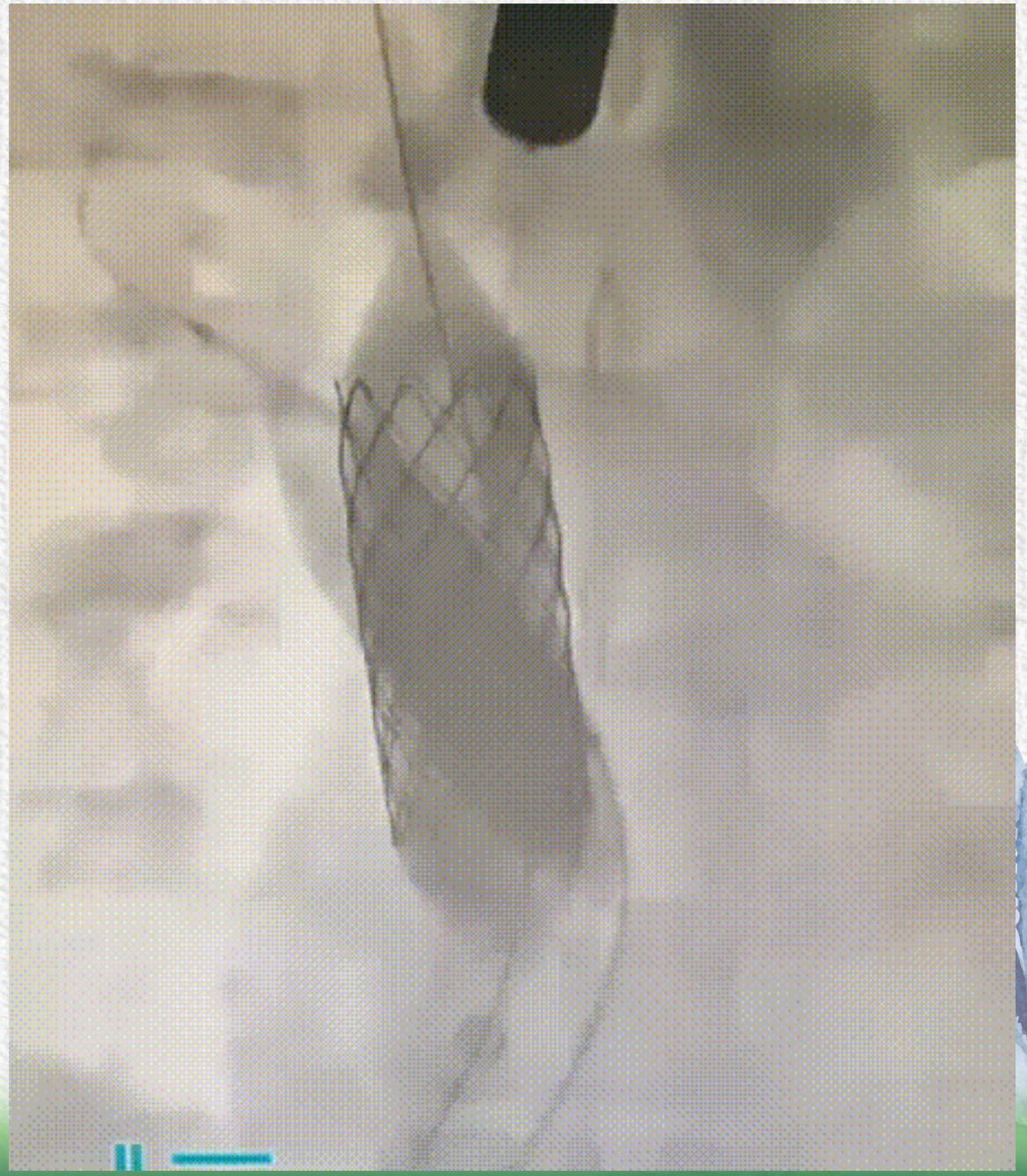

STAVO EZEQUIEL
B: 15.58 mm
C: 18.80 mm
D: 15.71 mm
A: 54.55 mm



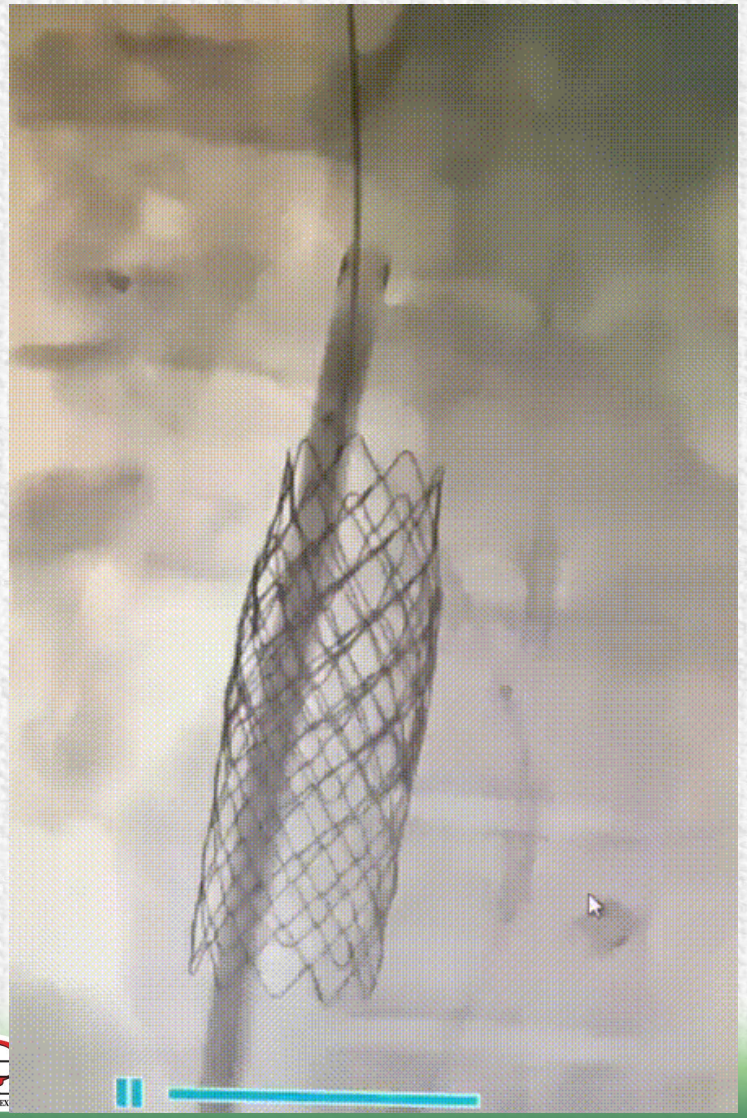


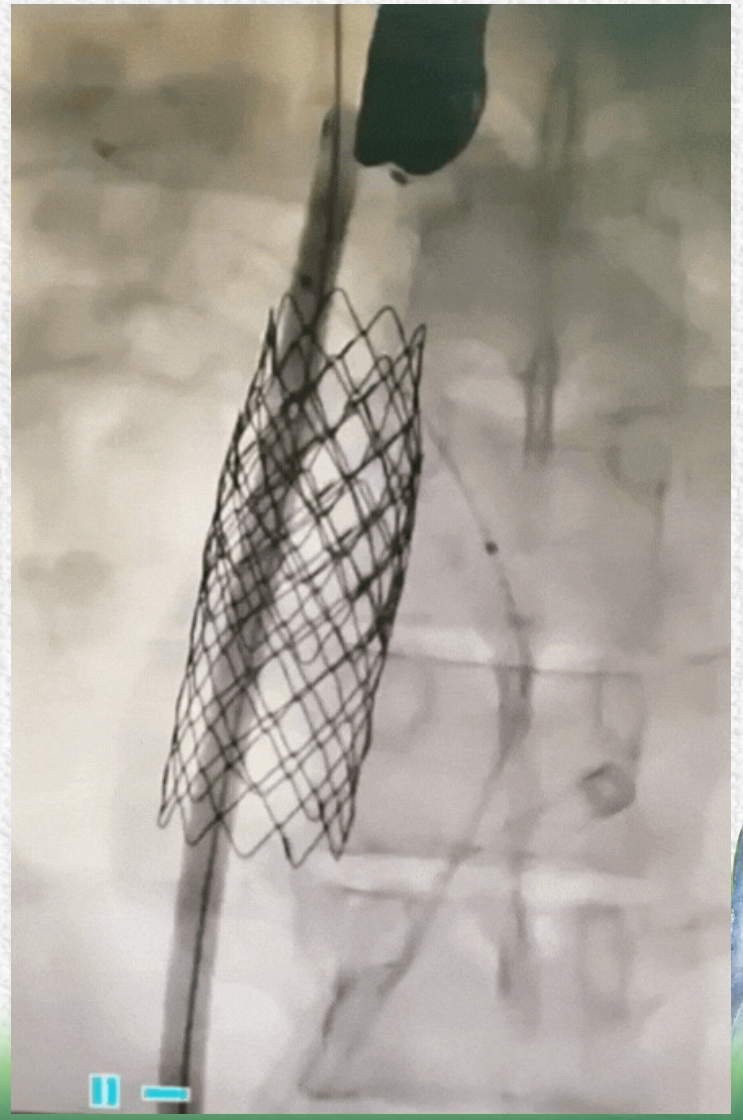




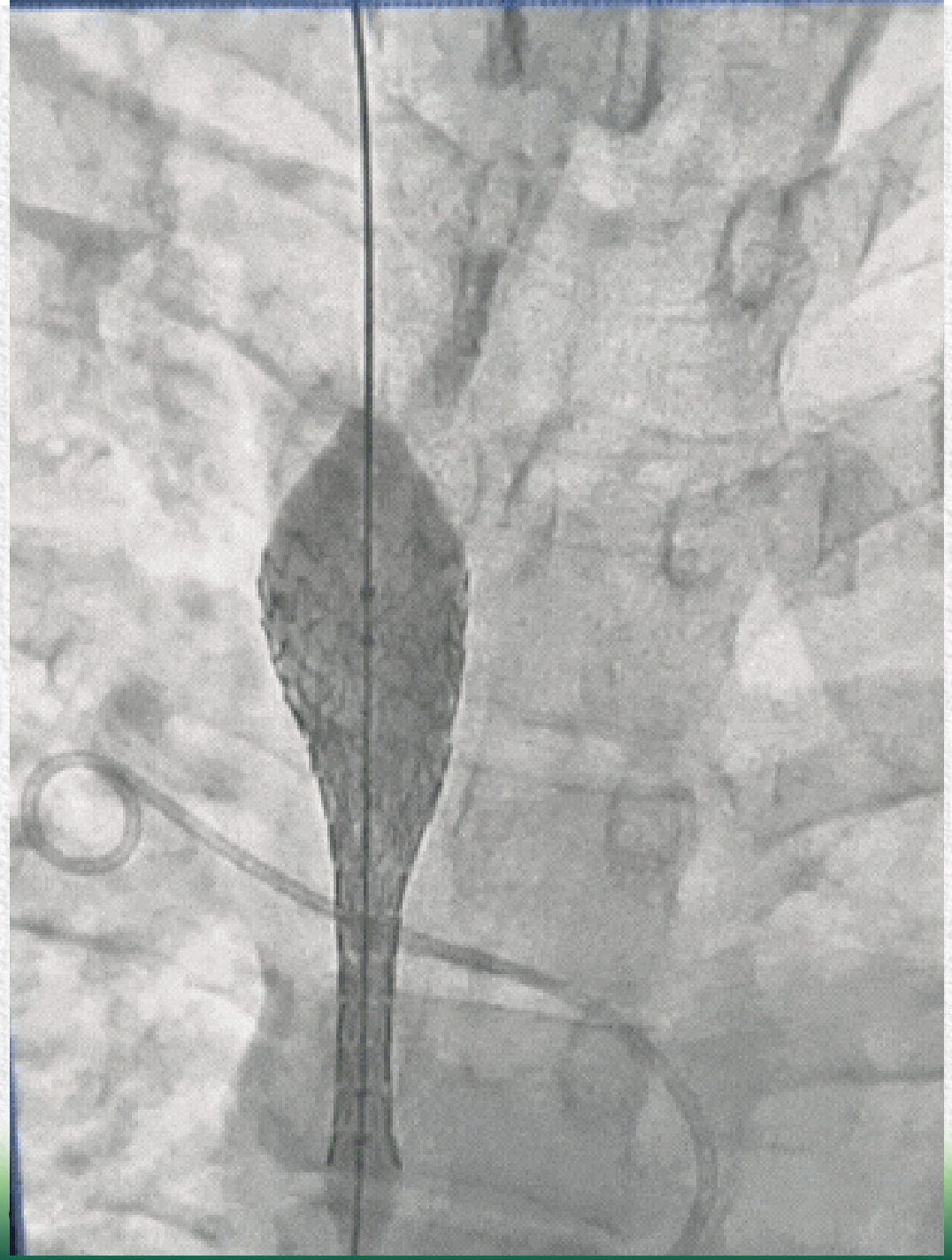


THE TUBE MIGRATED





- Caso 4



- 38-year-old male patient
- 80 mm Zephir stent

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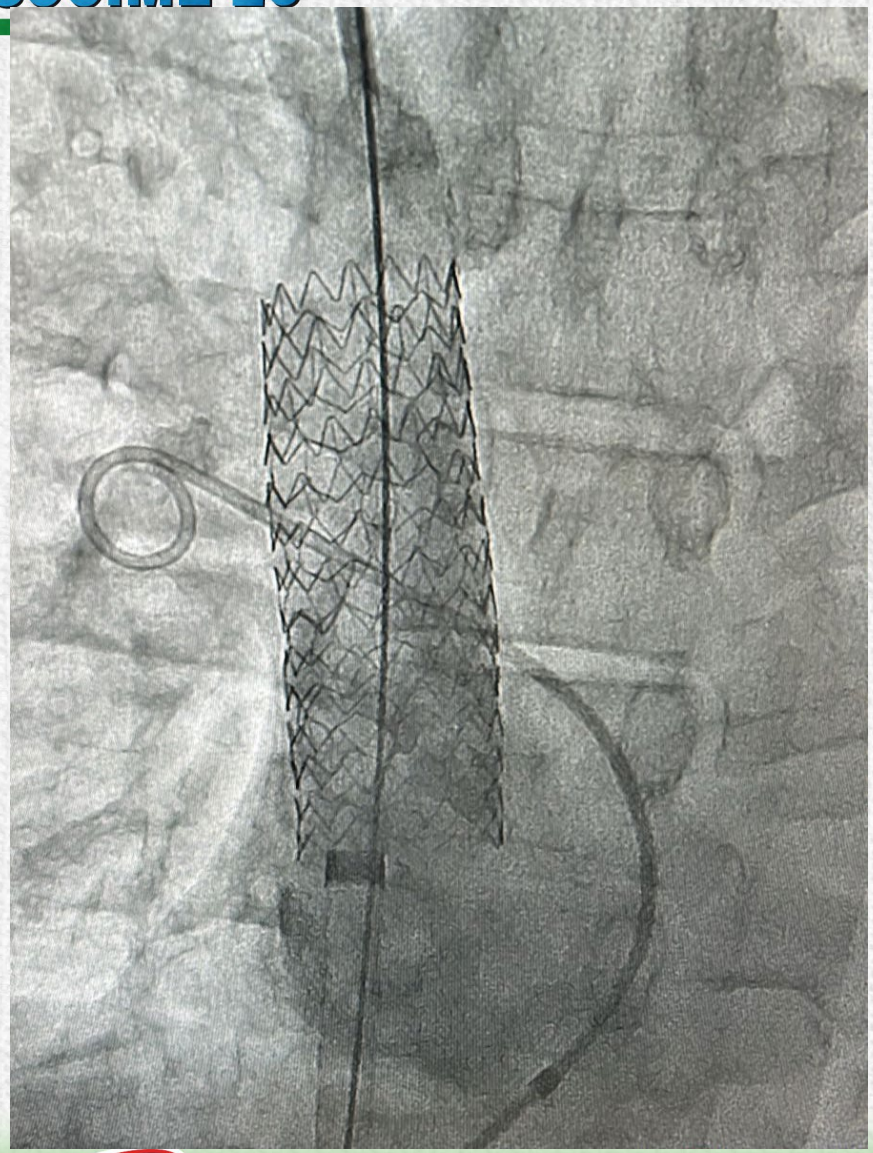

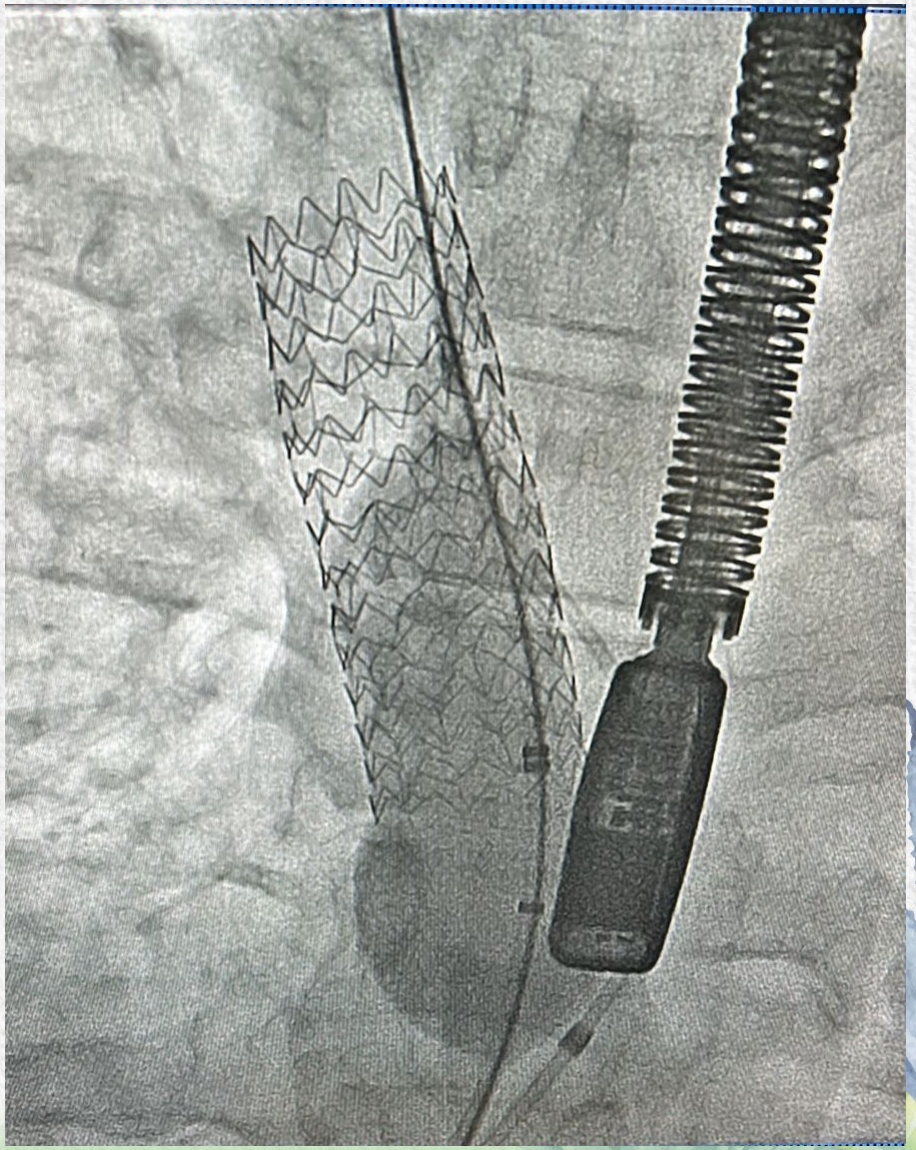

TAKE HOME MESSAGES

1) Once SV CIA is diagnosed in "adults" (adolescents are already being treated), CT is preferably performed

2) Evaluate:

a) ASD diameter

b) SVC diameter

c) Where the SVP enters, its diameter, and assess for other PVs

d) Possible presence of a foramen ovale

3) Discuss with the team the best treatment

Ópera “Carmen” de Bizet

GRACIAS POR SU ATENCIÓN