TO CLOSE OR NOT TO CLOSE :
TOUGH DECISIONS IN ADULT ASD WITH BORDELINE PHYSIOLOGY

COMUNICACIÓN INTERAURICULAR EN EL ADULTO MAYOR: CONSIDERACIONES CUANDO, COMO CERRAR Y CUANDO NO CERRAR

Dr. Carlos Guerrero Maya

Cardiologo Intervencionista en Cardiopatías Cingénitas

Clinica Santa Maria

Santiago de Chile

2025

Clínica Santa María
Especialistas en ti

Equipo /Colegas /UNIDAD

Dr. Luis Cárdenas – Cardiólogo Intervenvionista Cardiopatías Congénitas

Dr. Daniel Pérez – Cardiólogo Intervencionista

En Cardiopatias congenitas

Dr. Carlos Guerrero - Cardiólogo Intervencionista Cardiopatías Congénitas

Dr. Andres Fantuzzi – Cardiologo Intervencionista Cardiopatias Congénitas Adulto

Universidad de los Andes

Disclosure

- No disclosure

Lenguaje

Universal TECNICO/CIENTIFICO: **INGLES /ENGLISH**

SOLACI : **CASTELLANO /ESPAÑOL**

- Preguntas
- Interrogantes
- Enigmas
- Casos clínicos
- Respuestas

PORTUGUES (No) → Articulos/Paper]/Revisiones (English/Ingles)

ASD

- Atrial septal defect (ASD) is the most common congenital heart disease in **adults.**

Shaban, Q., & Hijazi, Z. M. (2025). Secundum atrial septal defects in adults: all you need to know with an emphasis on outcome. Expert Review of Cardiovascular Therapy, 23(4), 165–178

Pregunta 1

- Desde enfoque pediatrico, que debemos saber en CIA (ASD) adultos?

1. Grupo Etareo en crecimiento
2. Fisiologia (LV) del VI condiciona el resultado cardiovascular
3. CIA (ASD) con Hipertension pulmonar NO SE mencionará

(SOLACI _ sesión PAH)

Conceptos no familiares

Comorbilidades del adultos

Disfuncion del ventrículo izquierdo

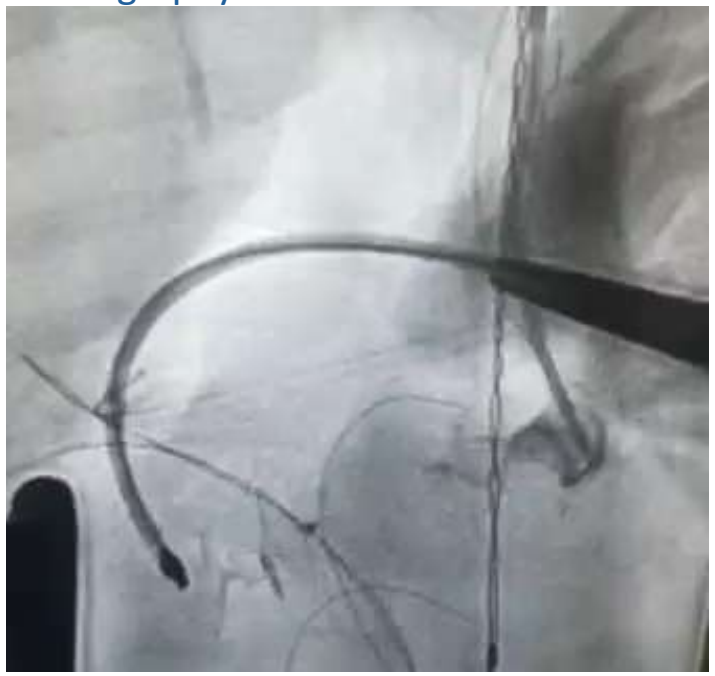
Pediatrics

- LV Bordeline
- ASD under 5-10 kg

ASD closure
< 5 kg

•**Procedure**: Hybrid closure via the right atrial appendage.(LAA for angio)

- Device used: Amplatzer Duct Occluder II (ADO II) 6x4 mm.
- Guidance: Epicardial echocardiography."



"CASE

Scimitar Syndrome

•Status post collateral closure with an 8 mm AVP II device.

•Status post corrective surgery + atrial septal defect (ASD) for decompression (no closure in surgery) – Risk Pulmonary hypertension crisis

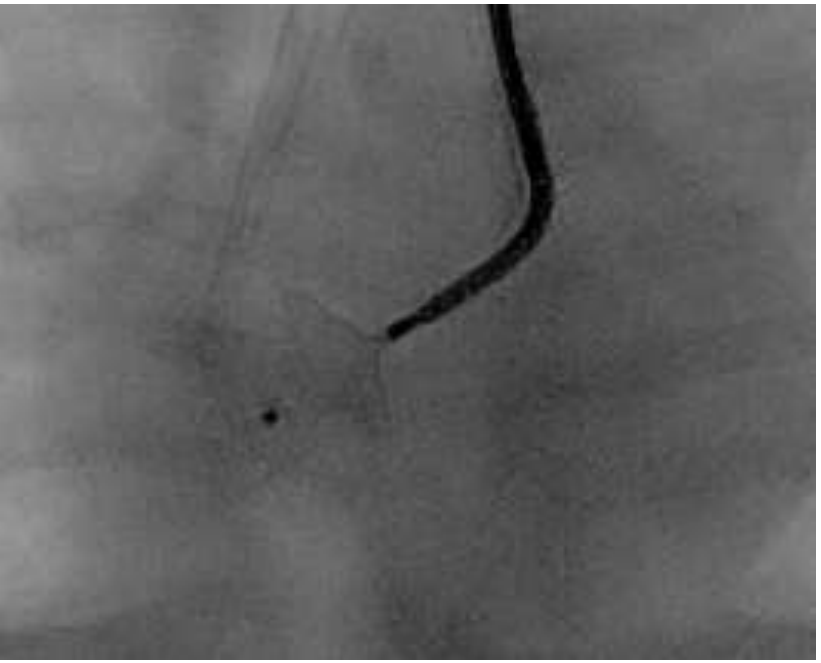
•**Age**: 4months.

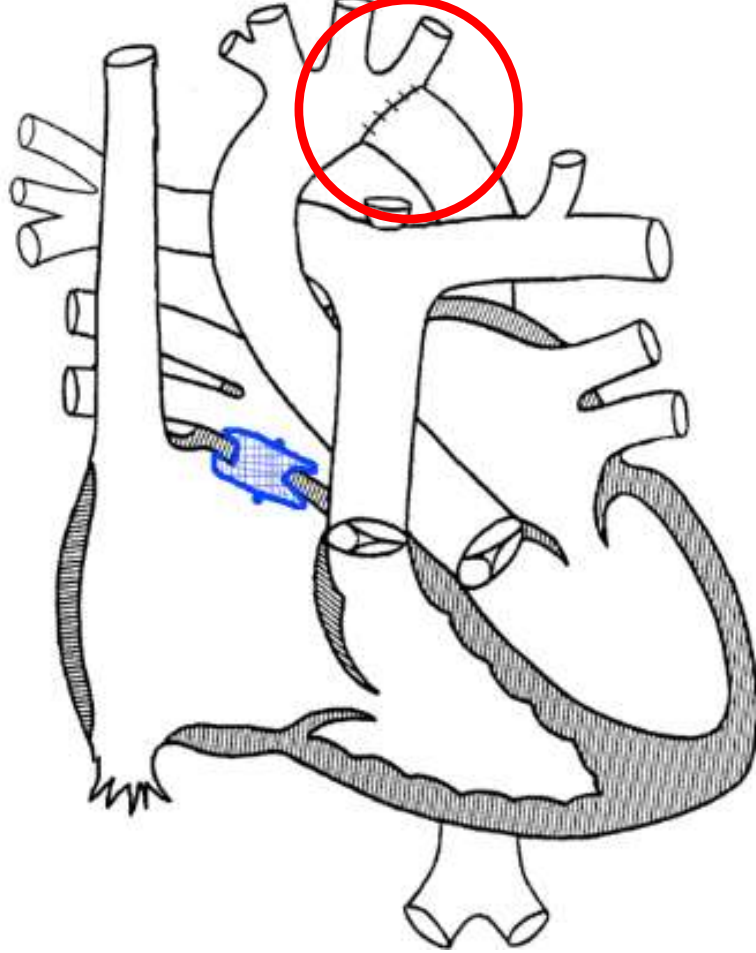
•**Weight**: 4.5 kg.

•**Presentation**: Heart failure. ASDefect 5mm

•**Findings**: Systemic venous return anomaly with thrombosis.

baseline left atrial pressure increased 14-15 mmHg → 18 mmHg.
Discussion with the entire heart team → to proceed with device release.





no signs of acute pulmonary edema, left ventricular failure, or pulmonary hypertension crisis.

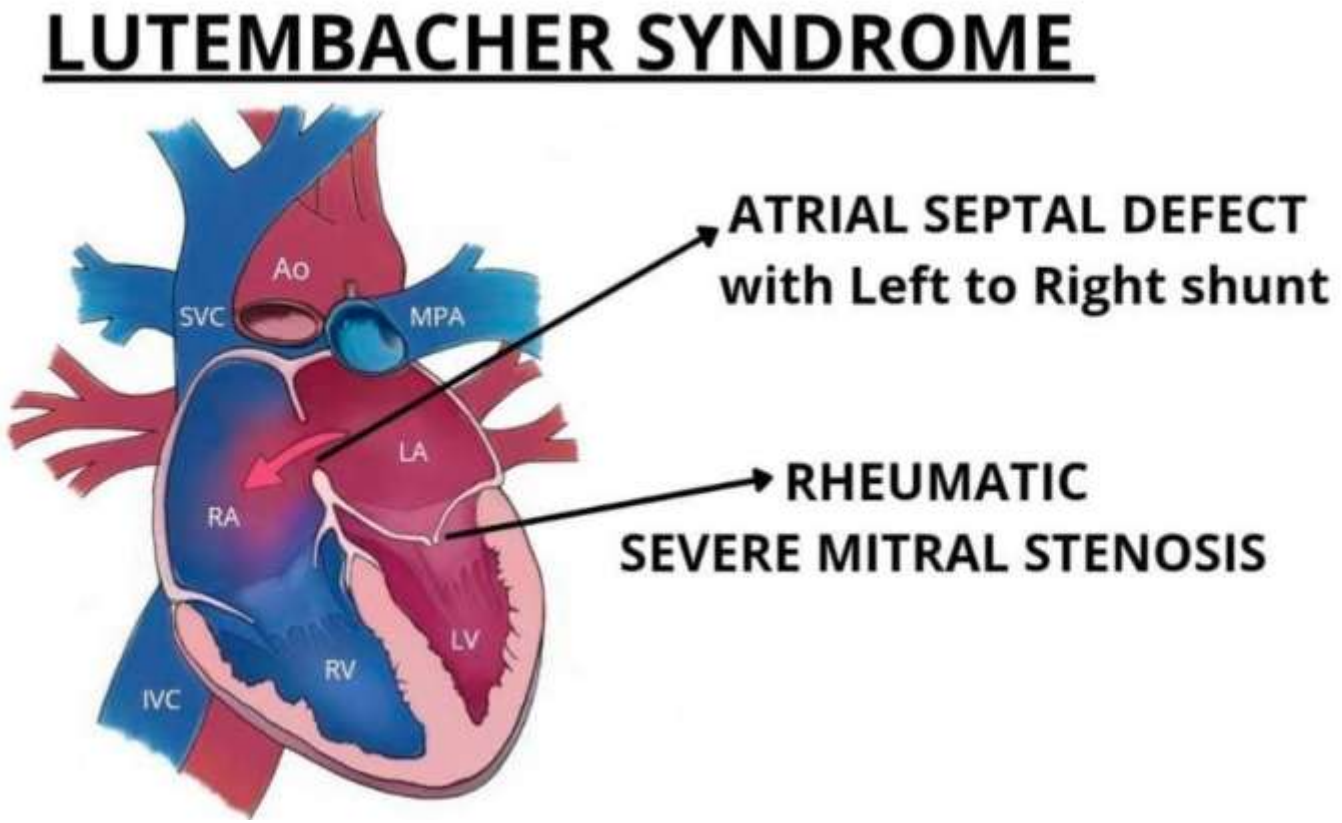
non-compliant left ventricle

De la sténose mitrale avec communication interauriculaire

R Lutembacher

Arch Mal Coeur 9, 237-260, 1916

The hemodynamic profile of this atrial septal defect is reminiscent of Lutembacher syndrome, though mitral valve pathology is absent. The underlying issue is a non-compliant left ventricle, which is a hallmark of this condition and is similarly seen in older patients with diastolic dysfunction



Pregunta 2

Cerrar el defecto a esta edad

(Adulto mayor- elderly)?

2022 ESC Guidelines:
Transcatheter ASD Closure in Elderly Adults

1. Indications for Closure

Class I Recommendation (Level B Evidence):

Closure is indicated in symptomatic adults (≥60 years) with:

Hemodynamically significant ASD *(Qp:Qs ≥1.5:1 or RV enlargement).*

Paradoxical embolism *(with documented shunt).*

Class IIa (Level C Evidence):

Asymptomatic patients with RV dysfunction or borderline Qp:Qs (1.5–2:1) **after rigorous hemodynamic assessment**.

European Heart Journal, 2022; 43(38): 3618–3691

2022 ESC Guidelines:
Transcatheter ASD Closure in Elderly Adults

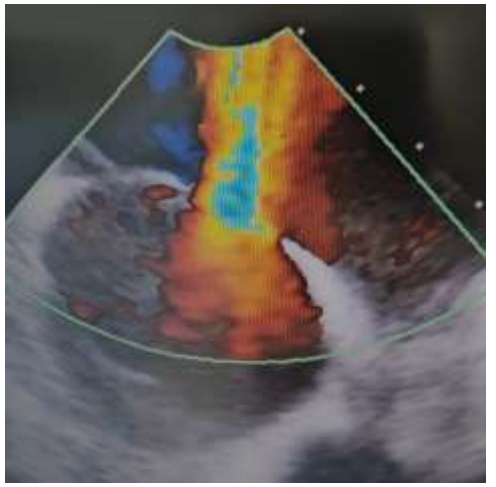
- **Class III (Level B):**
- **Severe irreversible PAH** (PVR >5 WU at baseline or >8 WU with vasodilators).
- **Fixed LV diastolic dysfunction** (LA pressure ≥18 mmHg during balloon occlusion)

European Heart Journal, 2022; 43(38): 3618–3691

Studies on Transcatheter ASD Closure in Elderly Adults (≥60 Years)

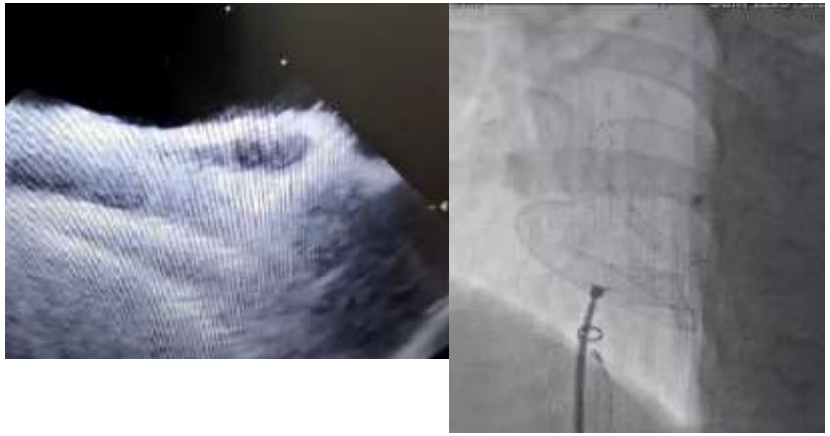
Study (Year)	*Population*	*Key Findings*	*Limitations*	*Reference*
Majunke et al. (2020)	N=1,012 (≥60 years)	***- 85% symptom improvement (NYHA I-II). - 30% reduction in AF at 5 years. - 10-year survival: 92% vs. 78% (medical therapy).***	Retrospective, selection bias.	*JACC Cardiovasc Interv.* 2020;13(12):1494-1503
Humenberger et al. (2018)	N=230 (≥65 years, LVDD focus)	- 22% developed severe diastolic dysfunction post-closure. - LA pressure ≥15 mmHg during occlusion predicted complications.	Single-center, limited follow-up.	*Circ Cardiovasc Interv.* 2018;11(6):e006157
Alkhouli et al. (2021)	N=347 (≥70 years)	- Survival matched age-adjusted controls. - 6MWT improved by +75 meters post-closure.	No randomized controls.	*EuroIntervention.* 2021;17(8):e672-e679.
Toyono et al. (2019)	N=145 (≥60 years, LV strain)	- LV global longitudinal strain improved post-closure (↓ LA overload). - No change in E/e' if baseline >14.	Small sample, short-term follow-up.	*J Am Soc Echocardiogr.* 2019;32(7):841-850
Kenny et al. (2022)	N=200 (≥75 years)	- 94% technical success. - 15% required diuretics for LV overload post-procedure.	Industry-sponsored (Abbott).	*Catheter Cardiovasc Interv.* 2022;100(1):140-149

CHALLENGING CASES
Pediatric & Adult

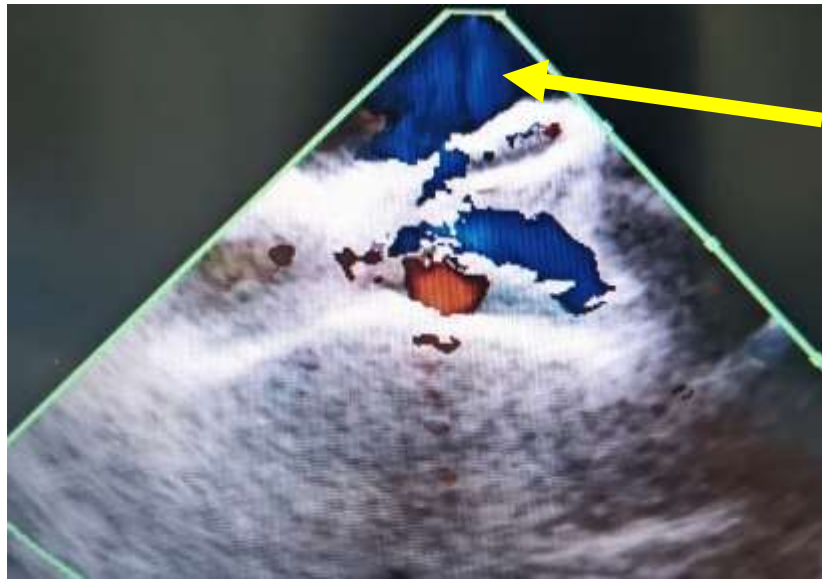


Multiple ASD

Very big is possible



Elderly patient
(LV no compliant)



ANATOMICO VS HEMODINAMICO

Pregunta 3

A quien ocluir transitoriamente con balón

Cuanto tiempo?

Que valores son predictores?

Hay valores absolutos o pueden ser modificados?

Pre-Procedural Assessment
Mandatory Tests:
Balloon Occlusion Test (BOT):

Purpose of the Test

The **balloon occlusion test (BOT)** is a critical hemodynamic assessment performed during transcatheter ASD closure to:

1. **Predict left atrial (LA) tolerance** to acute volume load post-device deployment.
2. **Identify high-risk patients** (e.g., those with diastolic dysfunction) who may develop **acute pulmonary edema** or **LV failure**.

Study (Year)	Population	BOT Protocol	Predictive Threshold	Clinical Impact	Reference
Humenberger et al. (2018)	N=230 (≥65 years)	- **10-minute occlusion** with simultaneous LA pressure monitoring.	**LA pressure ≥15 mmHg**	- **22% developed severe diastolic dysfunction** post-closure. - OR 3.1 for complications.	*Circulation: Cardiovasc Interv. 2018*
Toyono et al. (2019)	N=145 (≥60 years)	- **5-minute occlusion** + echocardiographic strain analysis.	**E/e' >14 + LA pressure >12 mmHg**	- No improvement in diastolic function if baseline E/e' >14.	*JASE 2019*
Kenny et al. (2022) (CLASP-2D)	N=200 (≥75 years)	- **15-minute occlusion** + vasodilator challenge (nitroprusside).	**LA pressure >18 mmHg** (after nitroprusside)	- **15% required diuretics** post-procedure. - 100% procedural success if LA pressure normalized.	*Catheter Cardiovasc Interv. 2022*

Summary Table: LA Pressure Thresholds for ASD Closure

LA Pressure (mmHg) During BOT	Recommendation	Device Strategy	Risk of Complications
≤12	Proceed with closure	Standard device	Low (<5%)
12–18	Fenestrated device	4–6 mm fenestration	Moderate (10–20%)
>18	Avoid closure	Medical management	High (30–40%)

Summary:

PCWP –LAP - LVEDP

Perform BOT for ≥10 min with continuous PCWP (monitoring).

If PCWP rises >20 mmHg (or Δ >10 mmHg):
Abort procedure.

- **If PCWP 16–20 mmHg:** Use a **fenestrated device (4–6 mm)**.

Pregunta 4

- Cuando y como debo optimizar manejo medico en pacientes adultos mayores?

Prophylactic diuretics reduced pulmonary edema risk by 50% in patients with LA pressure >12 mmHg during BOT

Diuretic Therapy

Indication:

Patients with **signs of volume overload** (elevated JVP, peripheral edema) or **LV diastolic dysfunction** (E/e' >14, LA volume index ≥34 mL/m²).

Regimen:

Furosemide 20–40 mg/day (or equivalent) for **3–7 days pre-procedure**.

Goal: Euvolemia (BNP <200 pg/mL, clinical decongestion).

Kenny et al. (2022

Catheter Cardiovasc Interv. 202

Milrinone improved LV strain during balloon occlusion in high-risk elderly

Milrinone or Inodilators

Indication:

Borderline LV systolic/diastolic function (LVEF 40–50% or PCWP >15 mmHg on prior testing).

Regimen:

Milrinone 0.25–0.5 µg/kg/min IV for **24–48 hours pre-procedure** (inpatient setting).

Alternative: Oral phosphodiesterase inhibitors (e.g., sildenafil) if PAH component exists.

Rationale:

Improves LV compliance and reduces afterload, mitigating post-closure acute hemodynamic shifts.

Toyono et al. (2019): (*J Am Soc Echocardiogr.*)

- **Anticoagulation/Bridging**
- **For Patients with AF or Prior Thromboembolism:**
  - **DOACs/warfarin** continued up to **24 hours pre-procedure** (based on bleeding risk).
  - **Bridging with heparin** if high thrombotic risk (e.g., CHA_2DS_2-VASc ≥4).

Beta Blockade

- **Indication:**
  - Tachycardia (HR >80 bpm) exacerbating diastolic dysfunction.
- **Regimen:**
  - **Low-dose metoprolol or bisoprolol** titrated over **1–2 weeks pre-procedure**.

Pregunta 5

Predictores de disfunción diastólica del VI

- Cuales comorbilidades me podrían predecir Disfuncion diastólica del VI?

Comorbidities Predicting Diastolic Dysfunction or Need for BOT in Elderly ASD Patients

Age-Independent Predictors

(Associated with LV diastolic impairment regardless of age)

Age-Dependent Predictors

More prevalent/severe in elderly, exacerbating diastolic dysfunction

Age-Independent Predictors

Associated with LV diastolic impairment regardless of age

Hypertension (HTN)

Mechanism: Chronic afterload elevation → LV hypertrophy + impaired relaxation.

Evidence:

ESC 2022 Guidelines: HTN increases risk of post-closure pulmonary edema (OR 2.1) even in patients <60 years.

BOT Implication: *Mandatory if LV mass index >95 g/m² (women) or >115 g/m² (men).*

Atrial Fibrillation (AF)

Mechanism: LA remodeling → elevated baseline LA pressure.

Evidence:

Alkhouli et al. (2021): AF patients had 3× higher odds of LA pressure >15 mmHg during BOT

Chronic Kidney Disease (CKD; eGFR <60 mL/min)

Mechanism: Volume overload + uremic cardiomyopathy.

BOT Implication: *Higher false-negative rates due to non-compliant LA.*

Age-Independent Predictors

(More prevalent/severe in elderly, exacerbating diastolic dysfunction)

Heart Failure with Preserved EF (HFpEF)

Mechanism: Age-related myocardial stiffness + comorbidities.

Evidence:

Reddy et al. (2023, JACC Heart Fail): HFpEF prevalence **in ASD patients ≥70 years was 38% vs. 8% in <60 years**.

BOT Implication: 92% required diuretics post-closure if E/e' >14.

Diabetes Mellitus (DM)

Mechanism: Advanced glycation end-products → myocardial fibrosis.

Threshold: HbA1c >7% → 2.5× higher risk of LVDD (ESC 2022).

Coronary Artery Disease (CAD)

Mechanism: Ischemia-induced diastolic impairment.

Evidence:

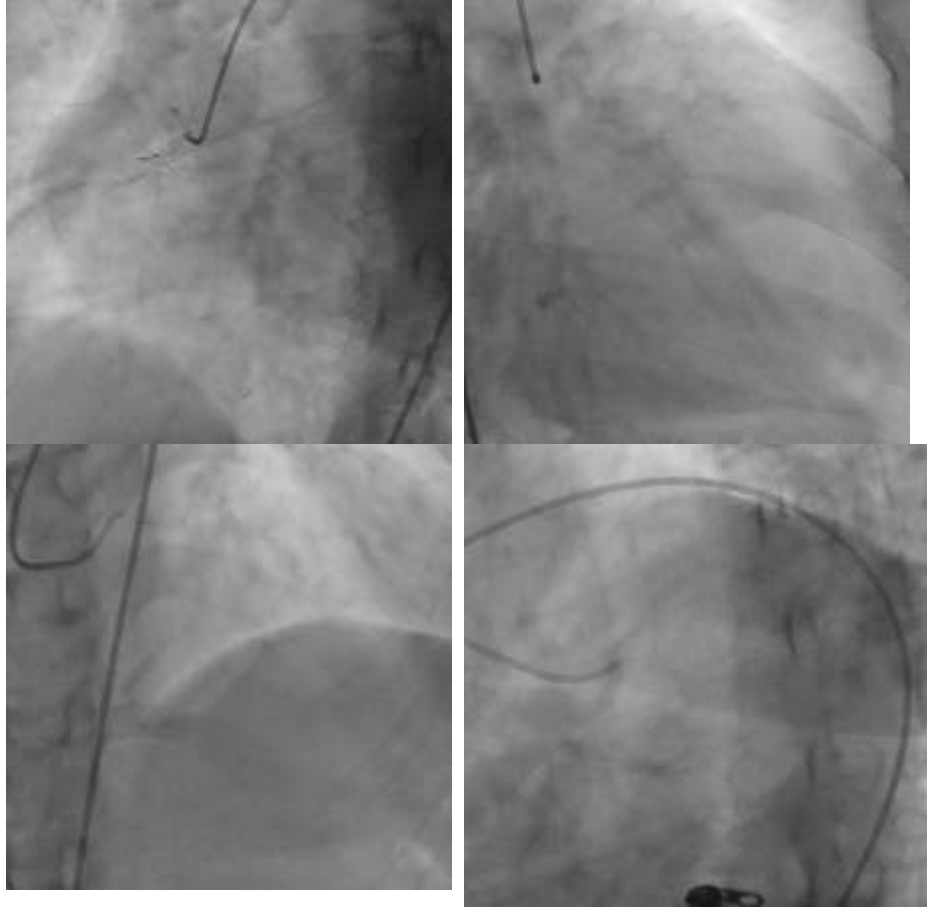
CLASP-2D Registry (2022): CAD increased BOT failure rates by 40% in patients ≥75 years.

Predictive Model for BOT Necessity

Risk Factor	Odds Ratio (OR) for BOT Failure	Clinical Action
Age ≥75 years	2.8	**Always perform BOT.**
HFpEF	4.2	**Pre-procedural diuretics + milrinone.**
AF + LA volume ≥34 mL/m²	3.5	**Consider fenestrated device.**
CKD Stage ≥3	1.9	Monitor LA pressure trends (not absolute values).

- PREGUNTA 6

Debo realizar coronariografía a todos los pacientes adultos con CIA?



Indications for Coronary Angiography in Elderly ASD Closure Candidates

(Based on Age, Risk Factors, and Current Evidence)

Age Group	Recommendation	Supporting Evidence
≥60 years	Consider angiography if ≥1 cardiovascular risk factor (e.g., DM, HTN, smoking).	*Jalal et al. (2021)*: 28% of ASD patients ≥60y had occult CAD (*JACC: Cardiovasc Interv*).
≥70 years	Routine angiography recommended (ESC Class IIa).	*ESC 2022 ACHD Guidelines*: CAD prevalence 35–40% in ASD patients ≥70y.
≥75 years	Mandatory angiography (unless contraindicated).	*CLASP-2D Registry (2022)*: 18% required PCI prior to ASD closure (*Catheter Cardiovasc Interv*).

Indications for Coronary Angiography in Elderly ASD Closure Candidates
Risk Factor-Driven Indications

Risk Factor	Odds Ratio for CAD	Angiography Timing
Diabetes Mellitus	3.2	Pre-procedural (within 30d).
Typical Angina Symptoms	4.8	Simultaneous with BOT.
Abnormal Stress Test	5.1	Pre-procedural.
LVEF <50%	2.7	Simultaneous with ASD closure.

Pregunta 7

- Si el paciente no califica en primer cateterismo por presiones de llenado elevadas, que debo hacer?

- OPTIMIZA MANEJO MEDICO

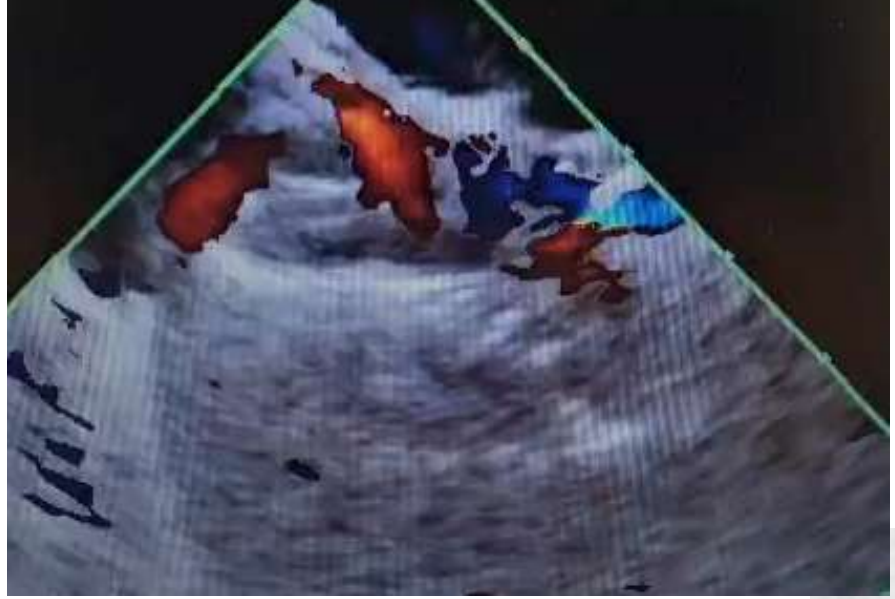
If PCWP >18 mmHg (High-Risk):

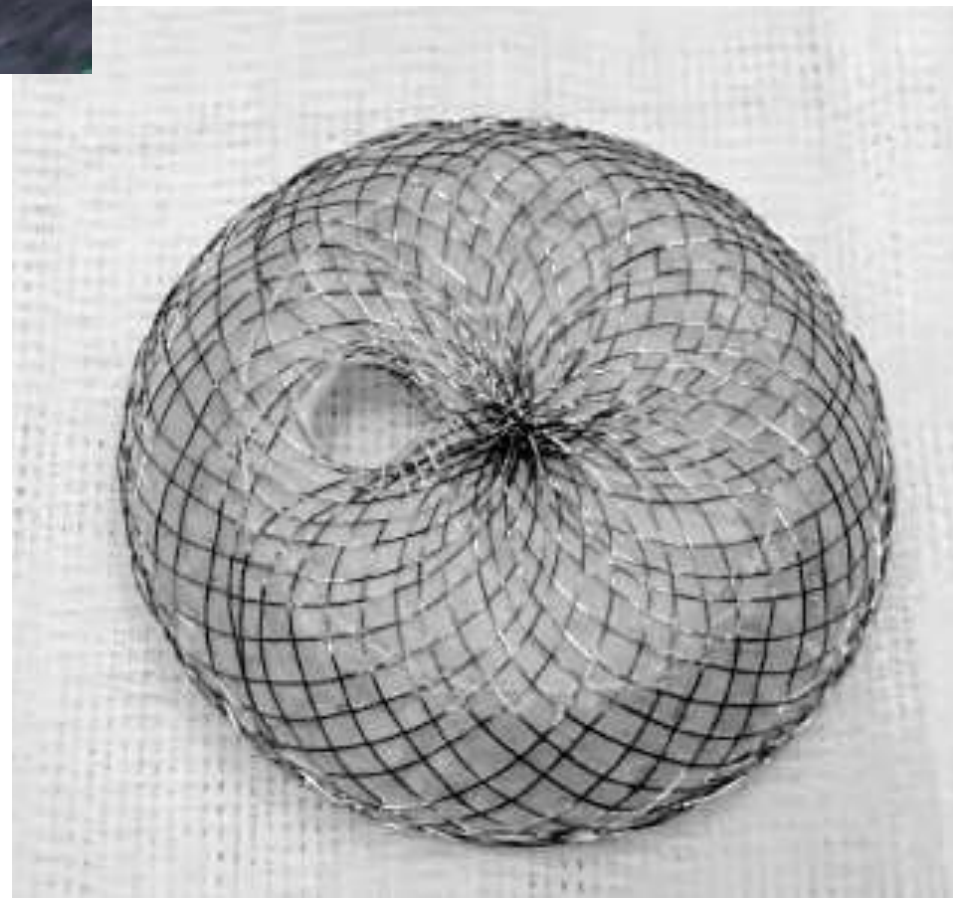
Step	Action	Rationale	Evidence
1	**Initiate HFpEF therapy**: - Diuretics (furosemide) - SGLT2 inhibitors (empagliflozin) - Nitrates (if HTN)	*Reduce LV filling pressures.*	*JACC Heart Fail 2023*
2	**Re-evaluate after 3–6 months**: - Repeat BOT - Assess LVEDP, E/e', and PVR	*Determine if hemodynamics improve.*	*ESC 2023*
3	**Consider fenestration if PCWP drops to 12–18 mmHg**	*Controlled shunting prevents pulmonary edema.*	*FENESTRATE-ASD Trial*
4	**If PCWP remains >18 mmHg**: - PAH therapy (if PVR elevated) - Palliative care consult	*No benefit from closure; focus on symptom management.*	*CLASP-2D Registry*

Pregunta 8

- Hay algún dispositivo preferible para CIA en adulto mayor?

No





Device Selection & Technique

Preferred Devices:

Amplatzer Septal Occluder or

Occlutech Figulla Flex II And/or
Ceraflex (Lifetech) (for calcified rims)

Or

GORE

Fenestrated devices (BOT)

Adjunctive Measures:

Diuretics post-procedure *if LVDD present (ESC recommends prophylactic use in high-risk cases).*

Fenestrated Device Selection for ASD Closure with Elevated LV Filling Pressures

Indications for Fenestration

Hemodynamic Criteria:

Balloon occlusion test (BOT) results:

LA pressure 12-18 mmHg (ESC 2022 Class IIa recommendation)

>10 mmHg gradient between LA and RA during occlusion

Echocardiographic findings:

LVEDP **>15 mmHg**

E/e' ratio **>14** (indicating diastolic dysfunction)

Clinical Scenarios:

Age **≥65 years** with multiple comorbidities (HTN, DM, AF)

Borderline **pulmonary vascular resistance (PVR 3-5 WU)**

Device Selection Algorithm

Parameter	Consideration	Evidence
Defect Size	Choose device **1-2 mm larger** than stretched diameter to ensure stability while permitting controlled shunting	*Kenny et al. (2022), Catheter Cardiovasc Interv*
Fenestration Size	**4-6 mm fenestration** (permits Qp:Qs ~1.2-1.5:1)	*Toyono et al. (2019), J Am Soc Echocardiogr*
Device Type	**Occlutech Fenestrated ASD Occluder** or **custom-fenestrated Amplatzer** (used off-label)	*CLASP-2D Registry (2022)*

Pregunta 9

- Y la cirugía para cierre de Comunicación interauricular en adulto mayor?

Recovery & Long-Term Outcomes

Metric	Transcatheter	Surgery
Hospital Stay	1–2 days	5–7 days
Return to ADLs	7 days	6–8 weeks
10-Year Survival	92%	88%

ASD-CLOSURE Registry (2024): No survival difference at 10 years, but **surgery had 2× more HF admissions** (*JACC*)

1. **Transcatheter closure is preferred** for most elderly patients (Class I, ESC 2023).
2. **Surgery is reserved for:**
    1. Anatomic contraindications to devices.
    2. Need for combined cardiac procedures.
3. **Fenestrated devices** reduce risks in borderline hemodynamics

Pregunta 10…en el seguimiento

- Aspirina se administra en forma estándar?
- 6 meses
- O considero doble antiagregante
- Y otras comorbilidades?
- En pacientes mayores de 70 años? (fragilidad)

Antithrombotic Therapy After Transcatheter ASD Closure: Evidence-Based Recommendations

Patient Group	Recommended Therapy	Duration	Key Evidence	Reference
Standard Care (No Comorbidities)	Aspirin 75-100 mg/day	**6 months**	98% device endothelialization at 6 months with aspirin monotherapy	Masura et al. (2007)
High Thrombotic Risk	Dual antiplatelet therapy (Aspirin + Clopidogrel)	**1-3 months**	No added benefit beyond 3 months; increased bleeding risk	Amin et al. (2018)
Atrial Fibrillation (CHA_2DS_2-VASc ≥2)	DOAC or Warfarin (INR 2-3)	**Lifelong**	OAC superior to antiplatelets for stroke prevention	ESC 2022 Guidelines
AF + Recent PCI	DOAC + Clopidogrel (Avoid triple therapy)	**1-12 months (based on stent)**	Lower bleeding risk vs warfarin-based triple therapy	CLASP-2D Registry (2022)
Elderly (>75 years)	Consider aspirin monotherapy or shortened DAPT (1 month)	**1-6 months**	Age >75 increases bleeding risk 2.5-fold	REDUCE Trial (2021)

Abbreviations: DOAC (direct oral anticoagulant), DAPT (dual antiplatelet therapy), PCI (percutaneous coronary intervention)

Outcomes & Follow-Up

Expected Benefits:

85–90% symptom improvement (NYHA class reduction).
RV reverse remodeling (90% at 1 year).

Risks:

5–8% acute pulmonary edema (elderly cohort).
10–15% new-onset atrial arrhythmias (higher in ≥70 years).

Special Considerations for Elderly

Multidisciplinary Team (MDT) Evaluation:

Involve congenital cardiologists, HF specialists, and geriatricians.

Long-Term Monitoring:

Annual echocardiography (focus on LV filling pressures).
Lifelong anticoagulation if AF develops post-closure.

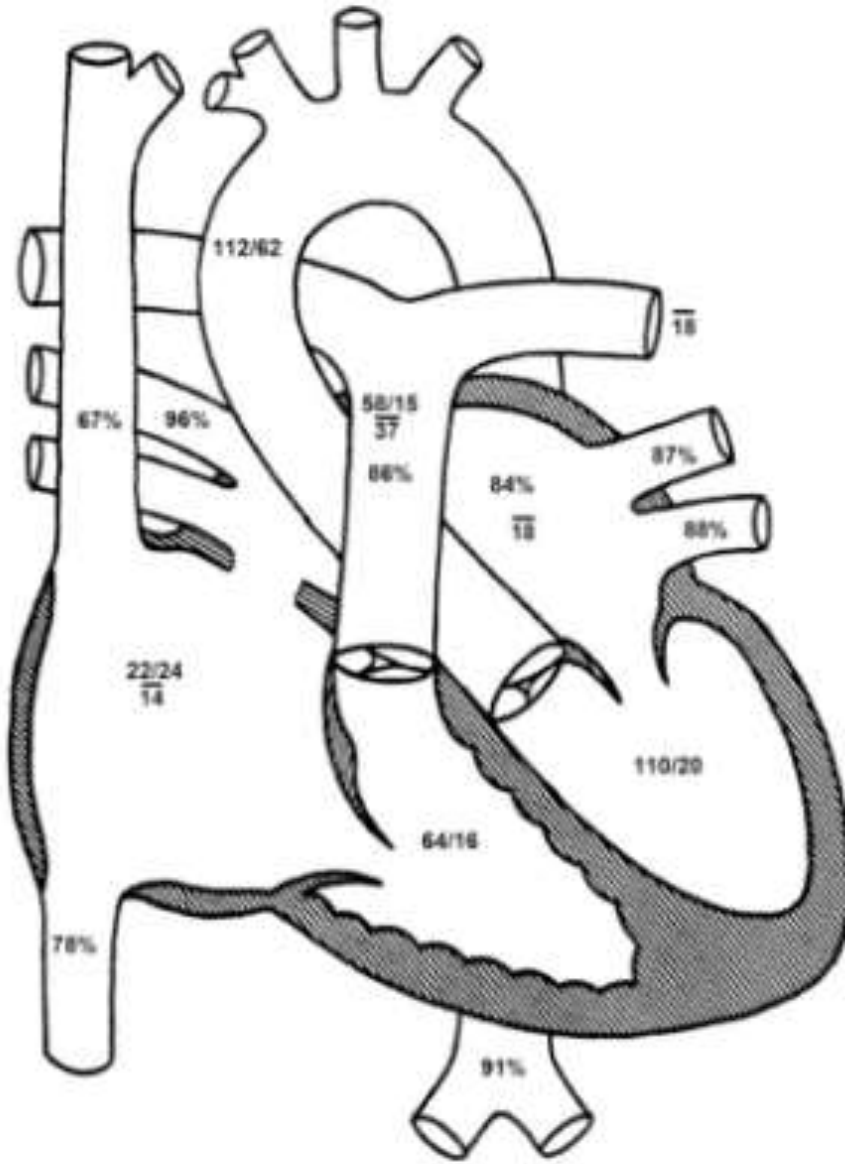
CASO….

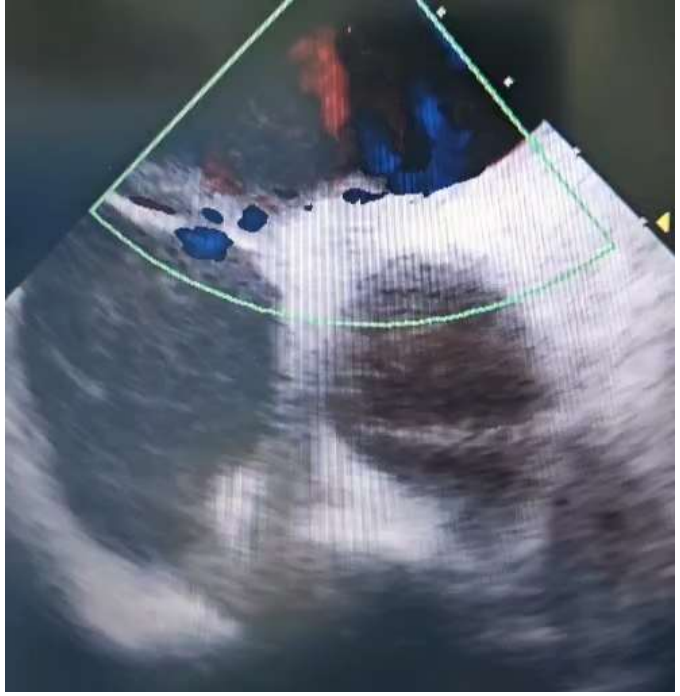
- Caso
- 75 años
- HTA
- Eco: TEE CIA 18mm
- 1er cath
- Basal QpQs 2.8
- PAI: 18mmHg
- BOT 24 (PAI)

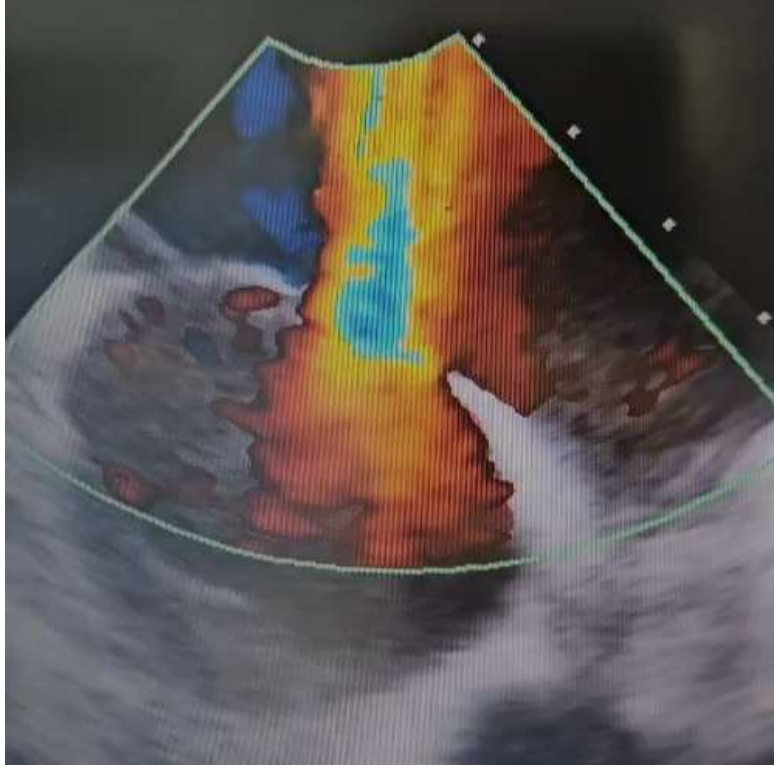
- **MANEJO MEDICO**

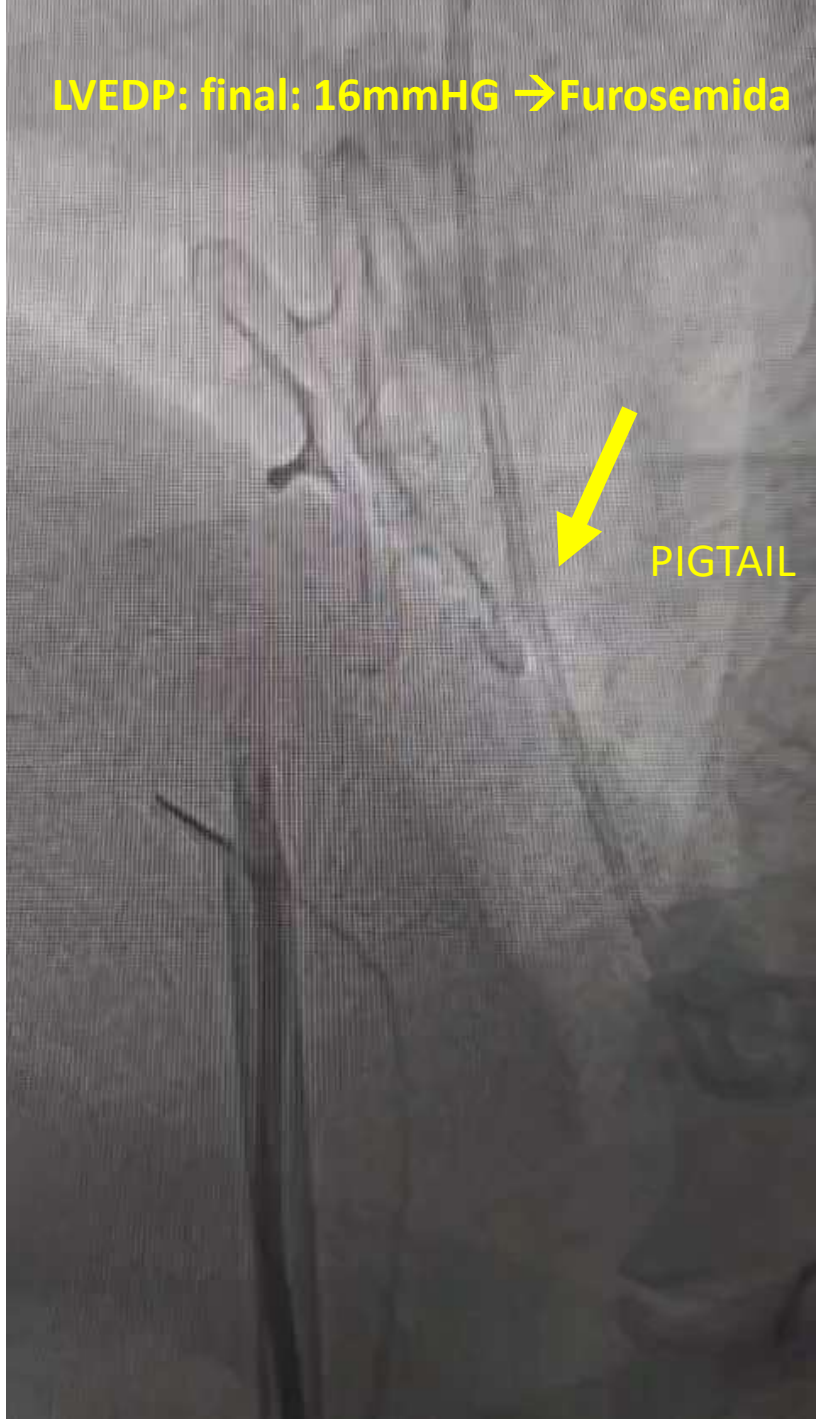
- 3 meses:
- 2do cateterismo
- Premedicacion
- **Milrinona**
- **Furosemida**

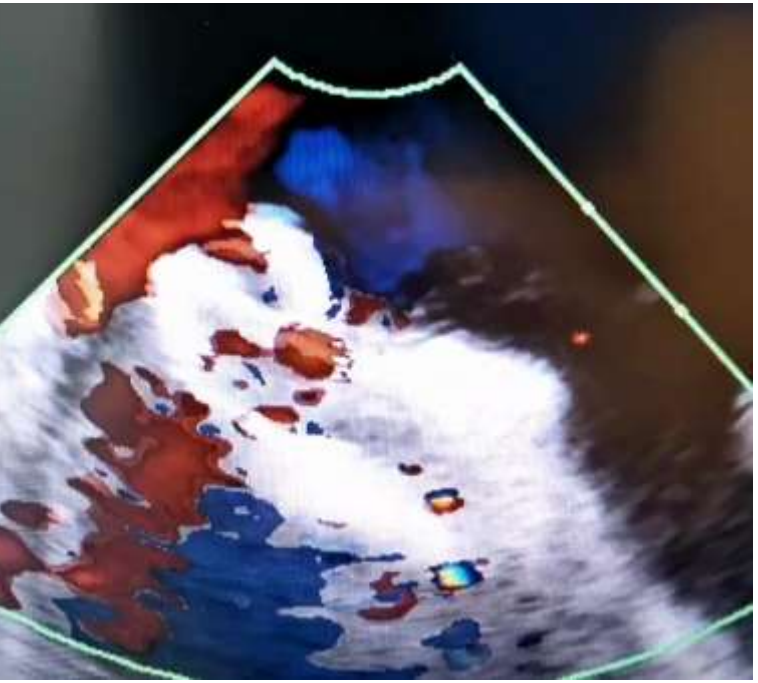
PAI: 15 BOT 18

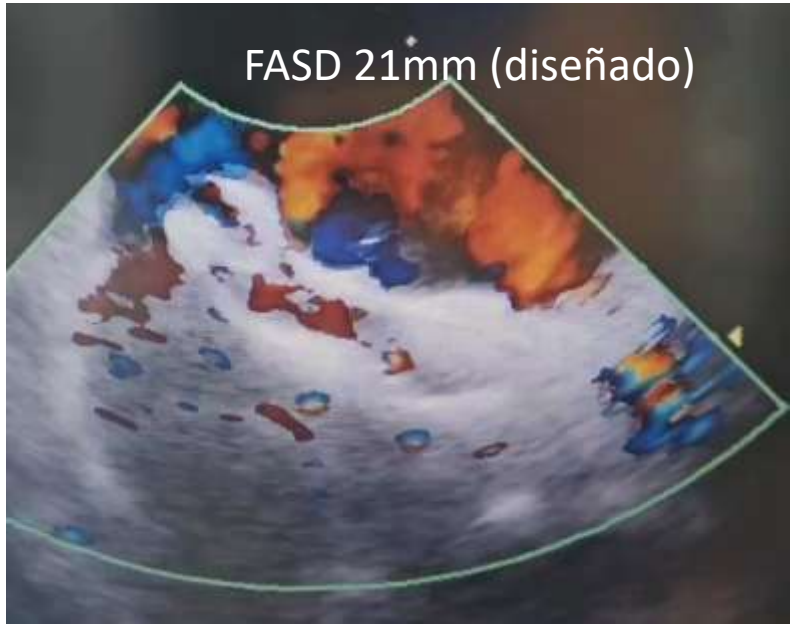







LVEDP: final: 16mmHG →Furosemida
PIGTAIL



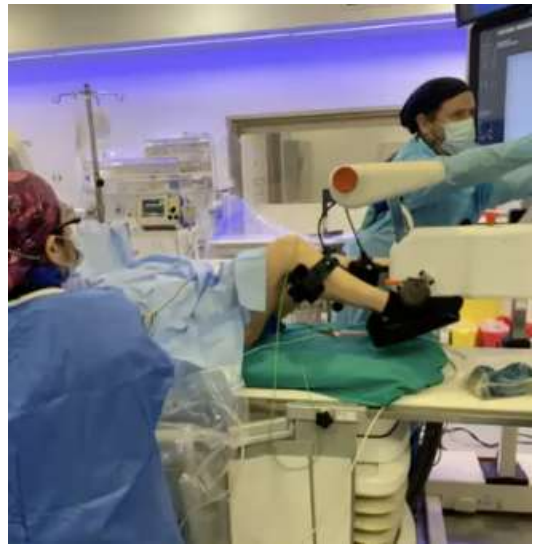

FASD 21mm (diseñado)

NUEVO PARADIGMA

- ADULTOS
- COMPLIANCE DEL VI
- INTEGRAR GRUPOS DE TRABAJO
- FALLA CARDIACA
- CARDIOLOG INTERVENCIONISTA ADULTO
- CARDIOLOGO INTERVENCIONISTA CONGENITOS (PEDIATRICO)

Heart Failure with Preserved EF (HFpEF)

75 años, falla cardiaca con función sistólica conservada



Test cardiopulmonar alterado

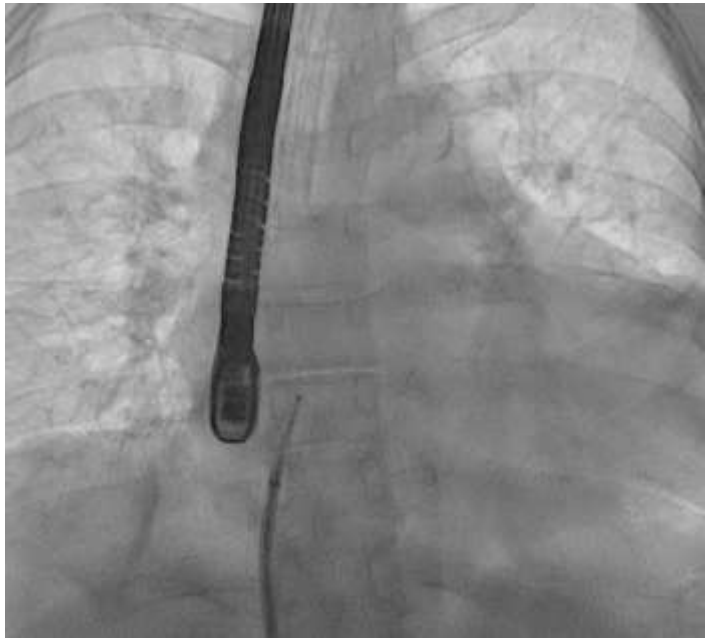
Cateterismo ejercicio :
presión pulmonar basal normal , con ejercicio se eleva .

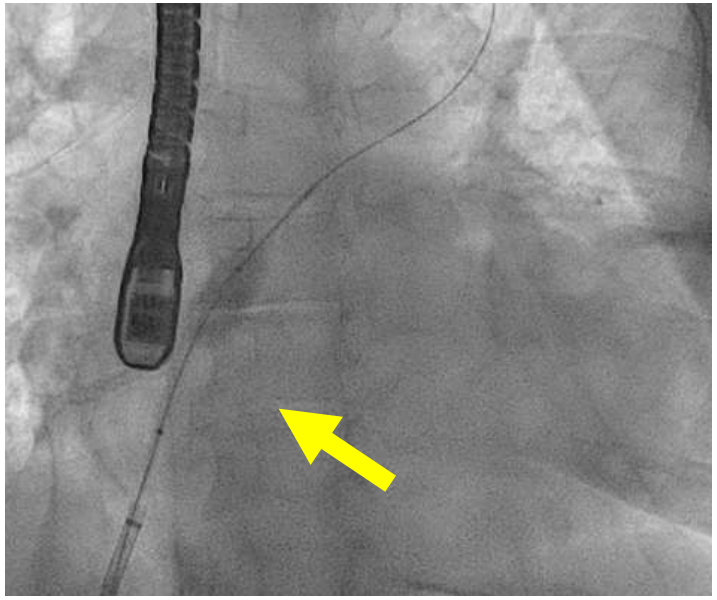
Lactico normal basal, se eleva!

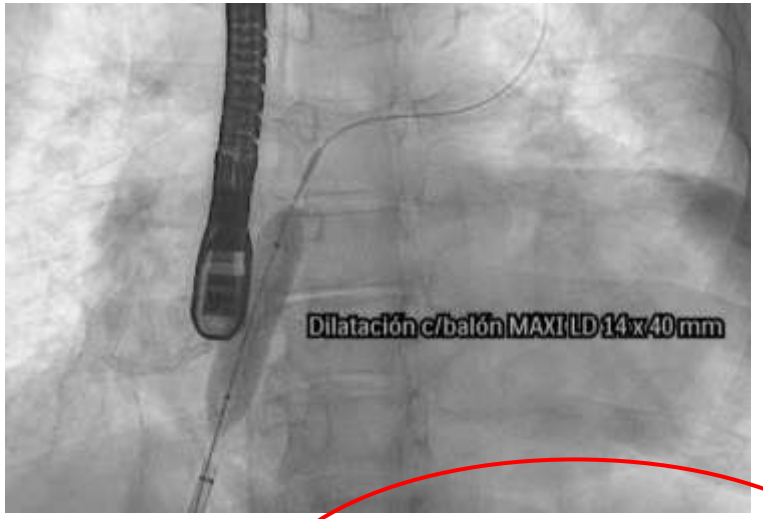
Presion de fin de diástole basal18 se eleva a 28mmHg !

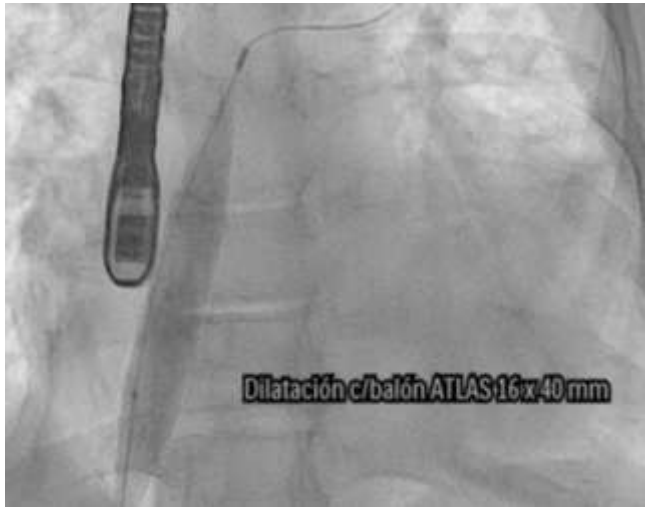
Despues de discutir caso en equipo…
Atrioseptostomia con balón (ECOTEE)

-



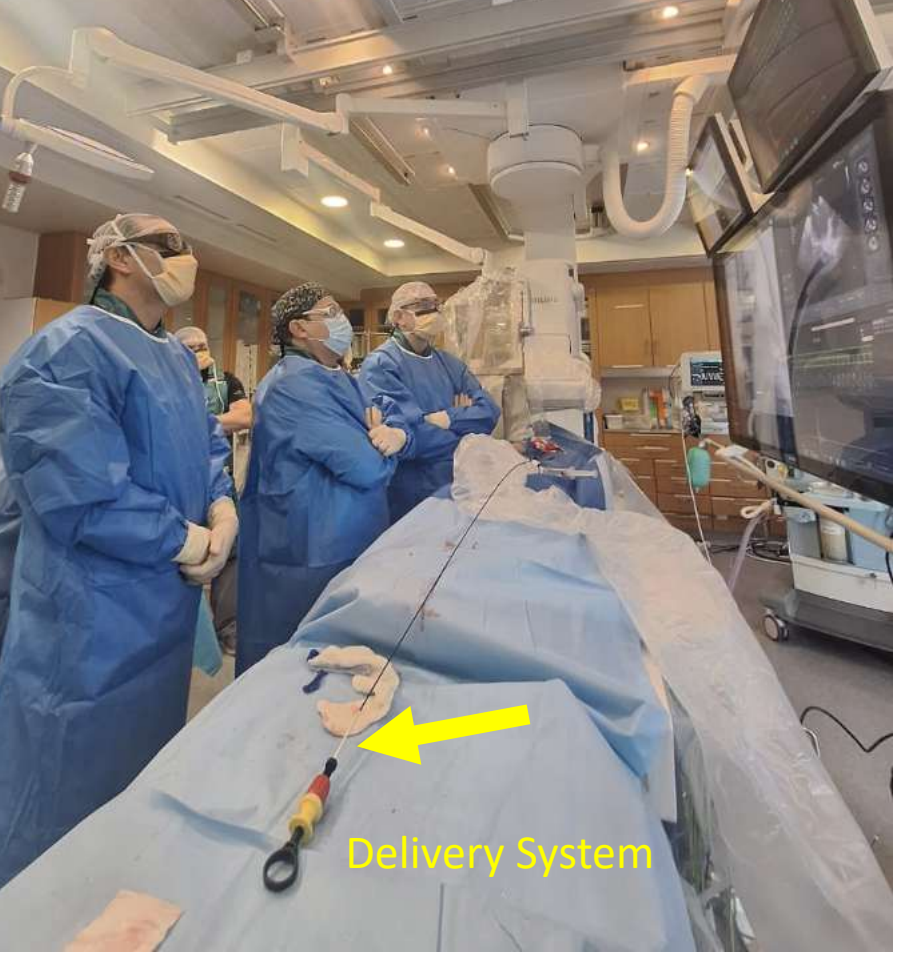


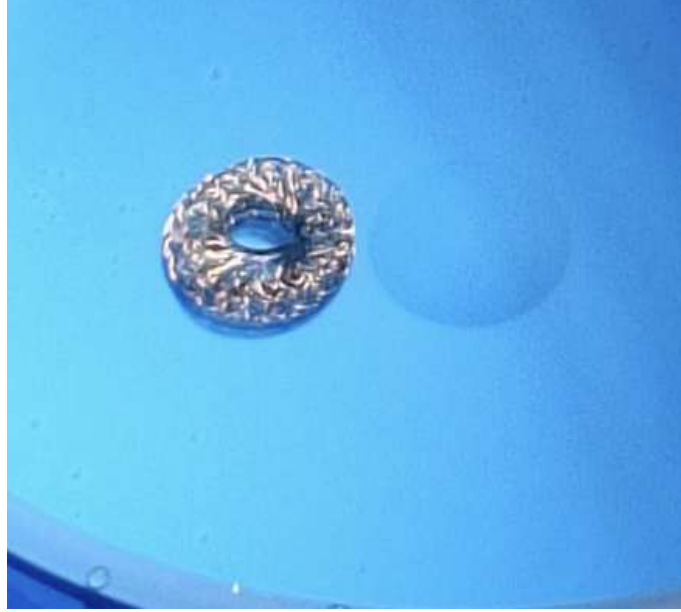




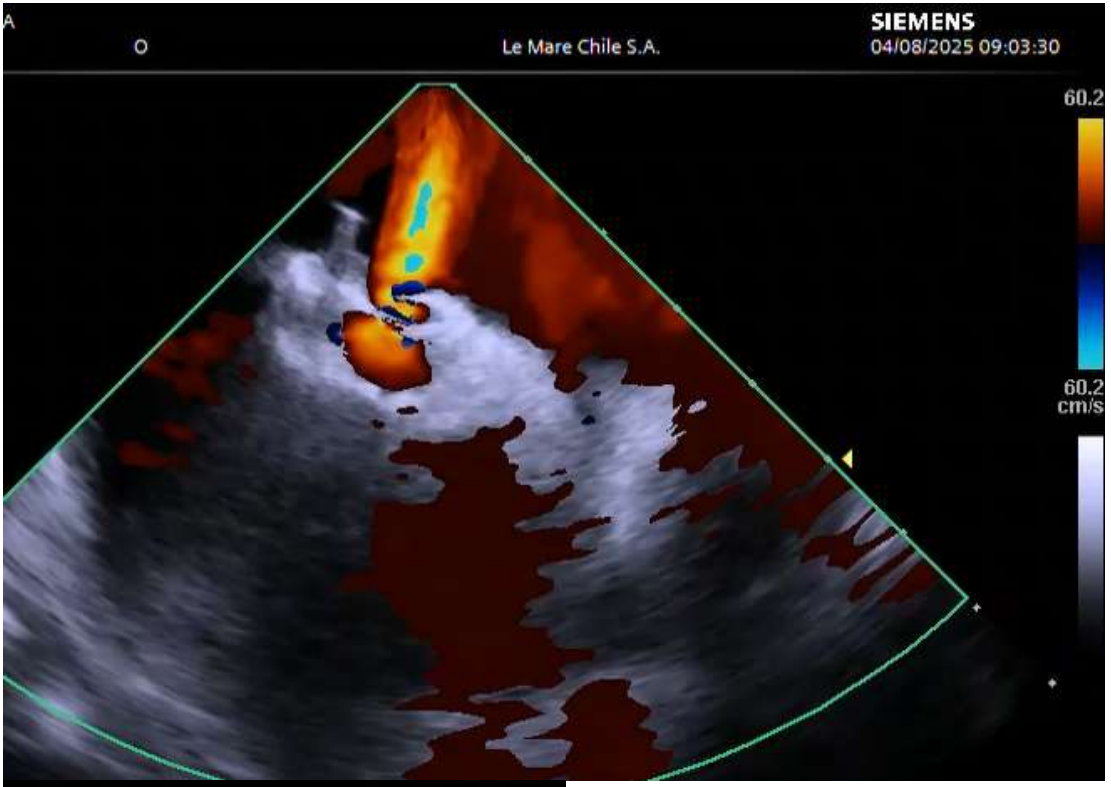
Mejoria sintomática
Mejoria de CF (Test de consumo)

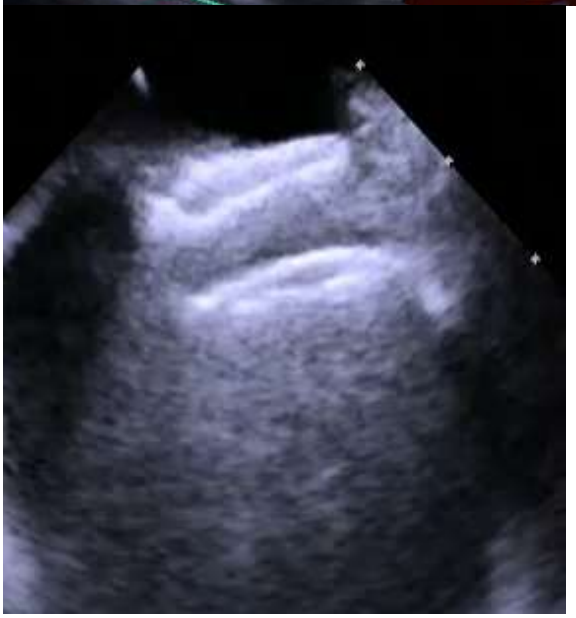
AFR implantation (ICE)





HF Team

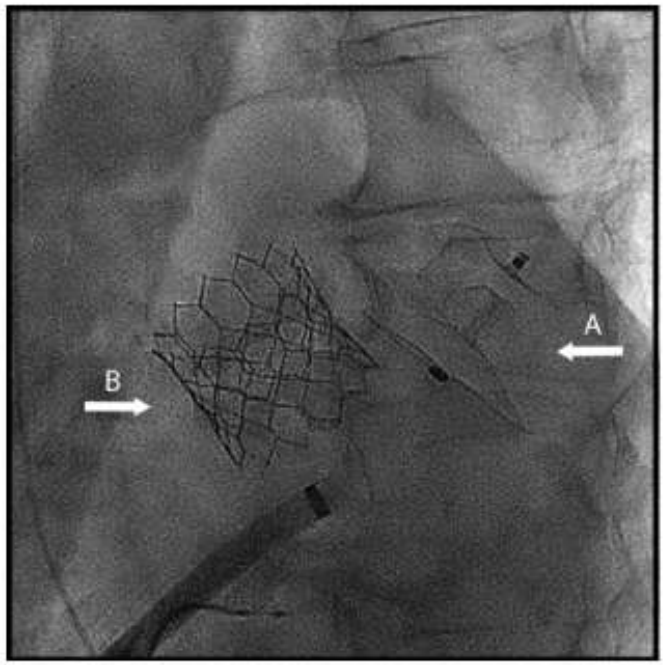

SIEMENS
Le Mare Chile S.A.
04/08/2025 09:03:30
60.2
60.2
cm/s




8F
Intracardíaco
Pot trans 100%
IM 0.56
ITT 0.4
ITO 1.5
5.0 MHz
8224 Hz
Muestra 3.0 mm
10 dB
12 fps
60.2
60.2
cm/s
12 mm
8 cm
60
40
20
cm/s
-20
-40
-60

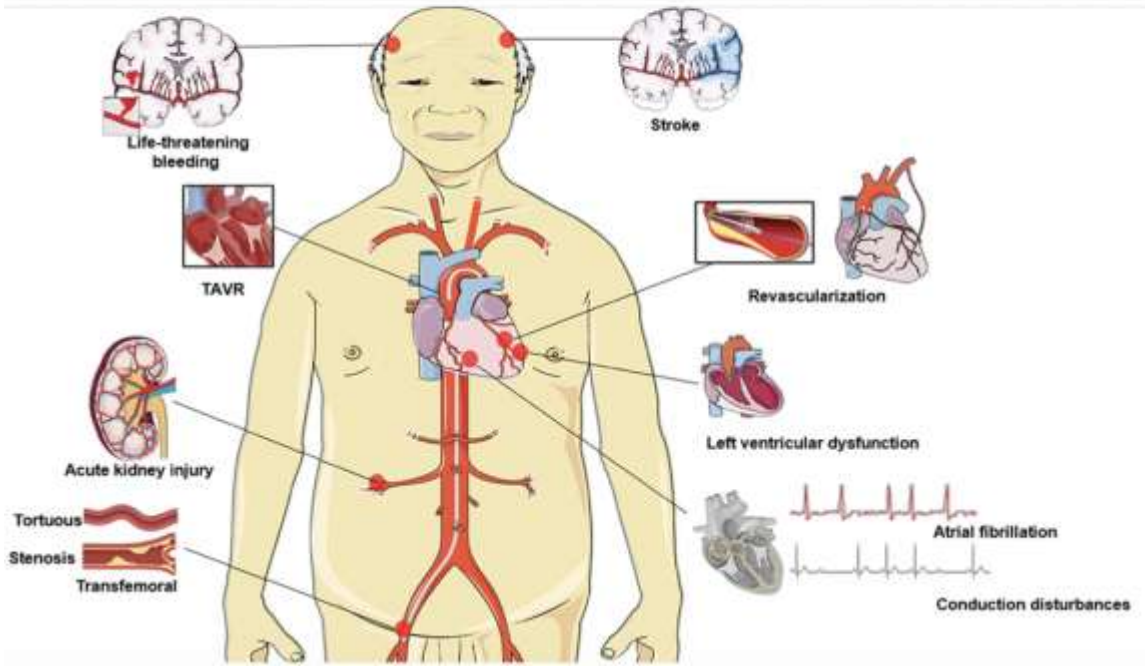
Transcatheter Aortic Valve Replacement in Elderly Patients: Opportunities and Challenges

FIGURE 1 Fluoroscopic Image of a Combined Procedure



(A) Amulet 25-mm left atrial appendage occluder. **(B)** Edwards SAPIEN 3 26-mm transcatheter heart valve.

Figure 1. Impending issues and challenges among elderly individuals undergoing TAVR: ineligible for transfemoral access, timing of revascularization, atrial fibrillation, stroke, conduction disturbances prevention (indications for permanent pacemaker implantation), left ventricular dysfunction, acute kidney injury, life-threatening or major bleeding. TAVR, transcatheter aortic valve replacement.



Conclusion

- GRUPO MULTIDISCIPLINARIO

CONCLUSION:

- From childhood detection to geriatric management, ASD care requires seamless transition - where pediatricians and adult cardiologists share equal responsibility:

- **In elderly ASD patients, success hinges on:**
  -

- **Right patient**,
- **Right device**,
- **Right prep for LVDD**
- **Right comorbidity control**
- **Right follow-up**

GRACIAS!!

gracias


SAVE THE DATE
ICEC 2025
16 - 17 OCT
TERCER CURSO DE INTERVENCIONISMO EN CARDIOPATÍA ESTRUCTURAL DE CONCEPCIÓN
Organiza
PULSUS
Centro Cardiovascular
Información e Inscripciones
CARDIOESTRUCTURAL.CL