Interventional Cardiac Catheterization in Congenital Heart Diseases (II)

Difetto Interatriale

Forame Ovale Pervio

Chiusura di Difetto Interatriale
Indicazioni

- Difetto Interatriale Ostium Secundum
- Sintomi
- Segni di sovraccarico di volume delle sezioni dx (*livello I:B*)
- Pregressa embolia paradossa (*livello IIa/B*)

Caratteristiche anatomiche INDISPENSABILI per l'approccio transcatetere

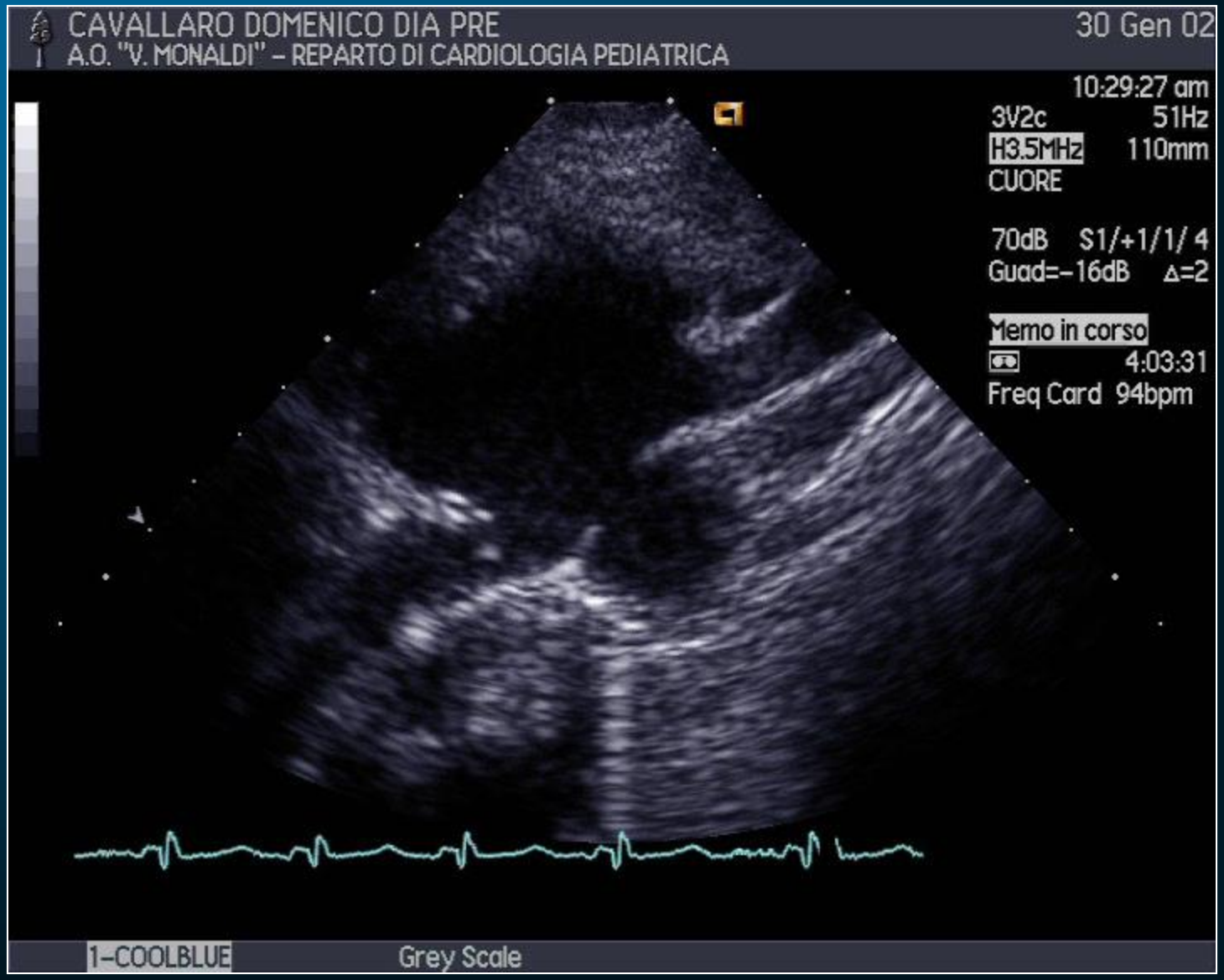
- Difetto tipo OS
- Adeguati margini peri-orifiziali
- Adeguata distanza da VCS, VCI, VVPP, seno coronarico, valvole A-V
- Adeguate rapporto difetto/setto totale (dimensioni del SIA > della protesi scelta)

- **DIA "semplice"**
* centrale
* dimensioni <50% del setto interatriale
* buoni margini peri-orifiziali

- **DIA "complesso"**
* >2 cm con scarso margine peri-orifiziale
* setto interatriale aneurismatico
* setto interatriale multifenestrato

Limiti

- Anatomia del SIA (aneurisma, multifenestrato, ecc)
- Dimensioni e sede del difetto e rapporto DIA/setto (<0.60)
- Margini peri-orifiziali adeguati (>5 mm)
- Discrepanza atrio sx/protesi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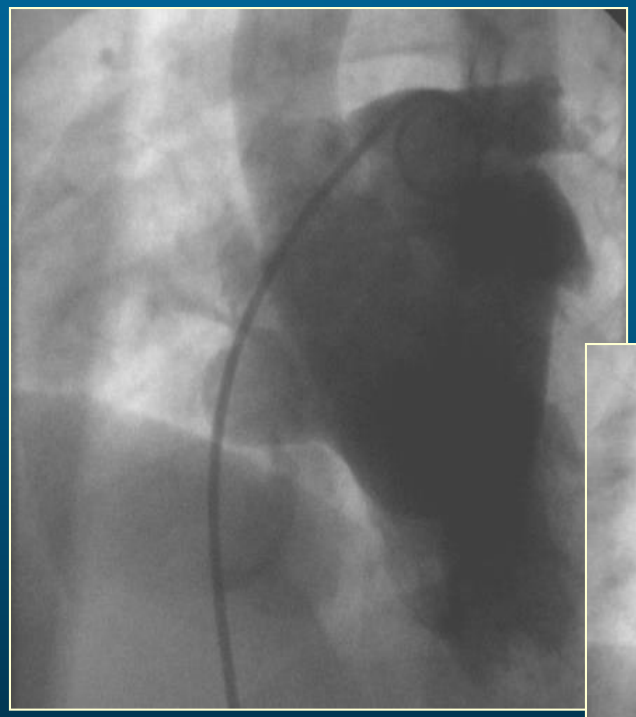

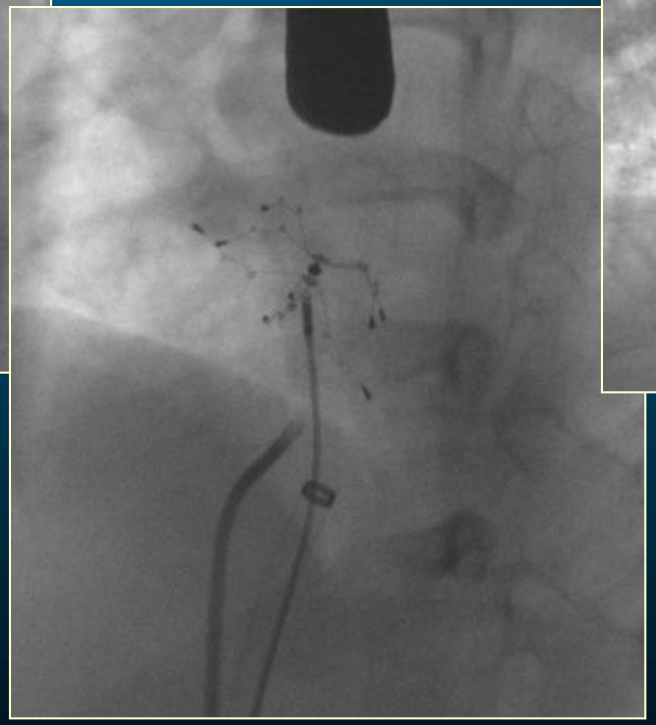

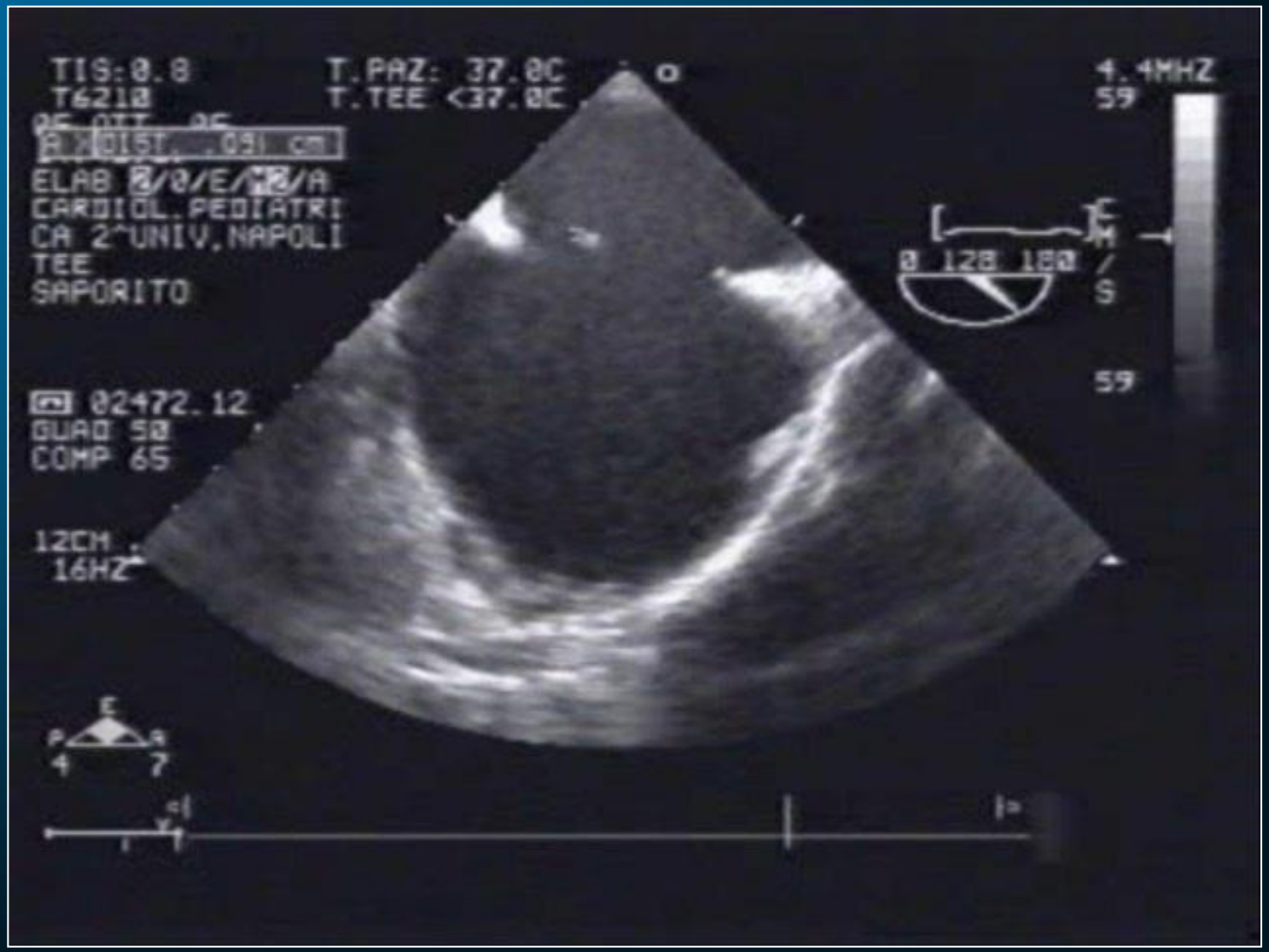
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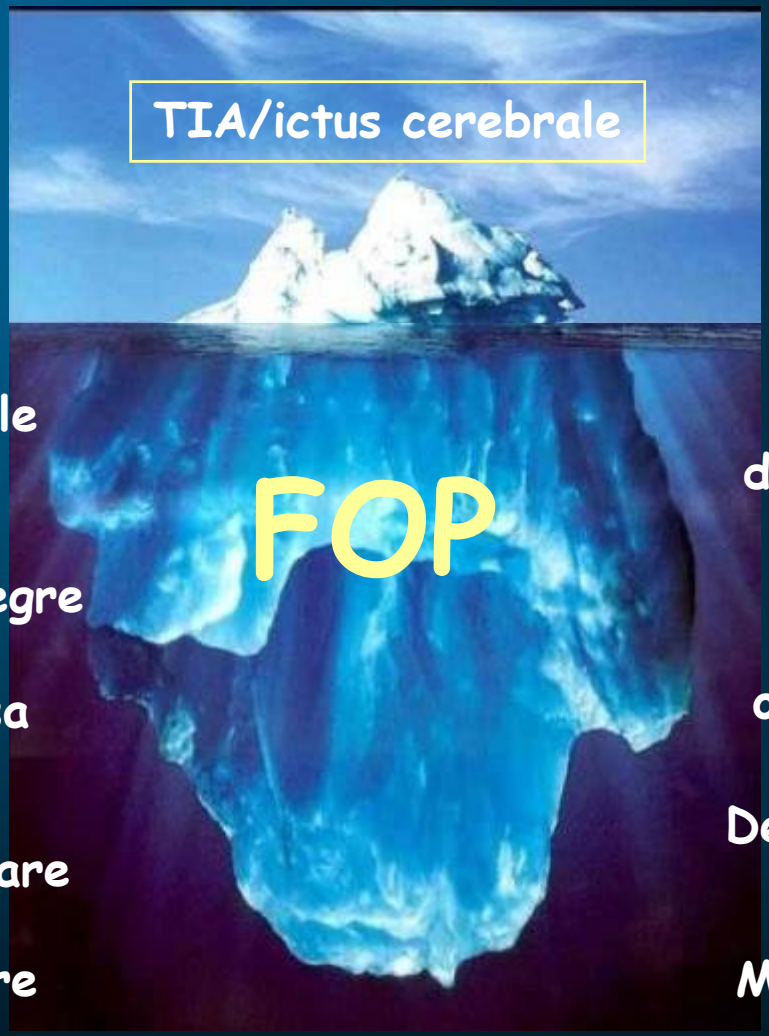
Chiusura di Forame Ovale Pervio Indicazioni

- L'applicazione clinica della chiusura transcatetere ha preceduto la precisa delineazione delle indicazioni al trattamento basata su studi clinici randomizzati-controllati

- Interesse scientifico-assistenziale nella prevenzione di patologie cardiovascolari o neurologiche ad elevata prevalenza nella popolazione generale ed altamente invalidanti
- Interesse economico da parte di industrie produttrici di protesi occludenti che ha indotto all'applicazione clinica utilizzando la via dell'Humanitarian Device Exemption



Ischemia cerebrale silente

IMA a coronarie integre

Embolia paradossa periferica

Emicrania non familiare

Demenza Vascolare

Malattia da decompressione nei subacquei

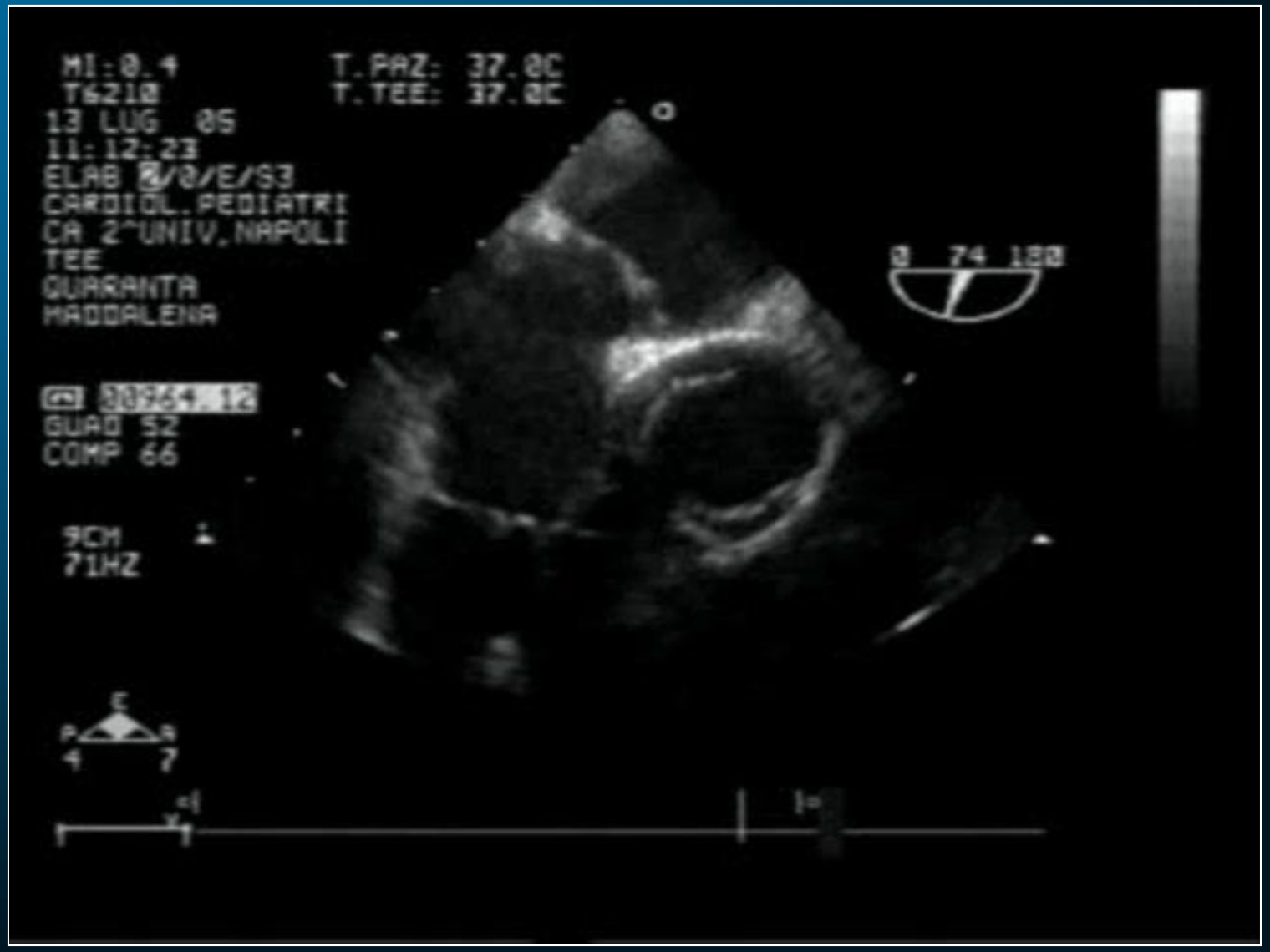
Sindrome ortodeoxia/platipnea

Desaturazione idiopatica

Morbo di Alzheimer

Altro ???

- Il potenziale mercato mondiale delle protesi per chiusura del FOP è di ≈2 miliardi di dollari/anno
- Ciascuna procedura ha un costo medio di ≈10000 dollari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AHA/ASA Guideline

Guidelines for Prevention of Stroke in Patients With Ischemic Stroke or Transient Ischemic Attack

A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association Council on Stroke

1. For patients with an ischemic stroke or TIA and a PFO, antiplatelet therapy is reasonable to prevent a recurrent event (Class IIa, Level of Evidence B). Warfarin is reasonable for high-risk patients who have other indications for oral anticoagulation such as those with an underlying hypercoagulable state or evidence of venous thrombosis (Class IIa, Level of Evidence C).

Circulation 2006; 113: e409 - e449

2. **Insufficient data exist to make a recommendation about PFO closure in patients with a first stroke and a PFO. PFO closure may be considered for patients with recurrent cryptogenic stroke despite optimal medical therapy (Class IIb, Level of Evidence C) (Table 7).**

Indicazioni "OFF-LABEL" in corso di valutazione in studi RANZOMIZZATI-CONTROLLATI

- Prevenzione primaria in *subacquei* con FOP a rischio di eventi clinici durante decompressione
- Prevenzione primaria o secondaria di una presunta embolia paradossa coronarica o periferica attraverso il FOP

- Prevenzione secondaria dell'ictus criptogenetico da presunta embolia paradossa attraverso il FOP in soggetti con *controindicazione alla terapia anti-coagulante* o come *alternativa alla terapia medica o alla chiusura chirurgica*
- Prevenzione secondaria dell'embolia paradossa cerebrale, coronarica o sistemica in soggetti con FOP e *condizioni di ipercoagulabilità*
- Prevenzione secondaria dell'embolia adiposa cerebrale post-traumatica attraverso il FOP

- Trattamento della deossigenazione sistemica da shunt dx-sx a livello del FOP in assenza di ipertensione polmonare (ad es. sindrome platipnea-ortodeossia, infarto ventricolare dx)
- Trattamento dell'*emicrania non familiare con o senza aura*

SPREAD

Stroke Prevention And Educational Awareness Diffusion

IV Edizione

Ictus cerebrale:

linee guida italiane di prevenzione e trattamento

Milano 2005

- Nei pazienti con ictus ischemico o TIA e forame ovale pervio (FOP), esenti da trombosi venose profonde e al primo evento trombo-embolico è indicato il trattamento con ASA

- Nel caso di ictus o TIA e:
  - FOP associato ad ASI e primo evento
  - FOP isolato e TVP o diatesi trombofilica
  - FOP isolato, con *shunt* di grosse dimensioni, e multipli eventi ischemici

Dopo avere escluso altre eziologie è indicato scegliere, sulla base del rapporto rischio/beneficio, tra terapia anticoagulante (INR 2-3) e chiusura transcatetere

- Nel caso di ictus o TIA e:

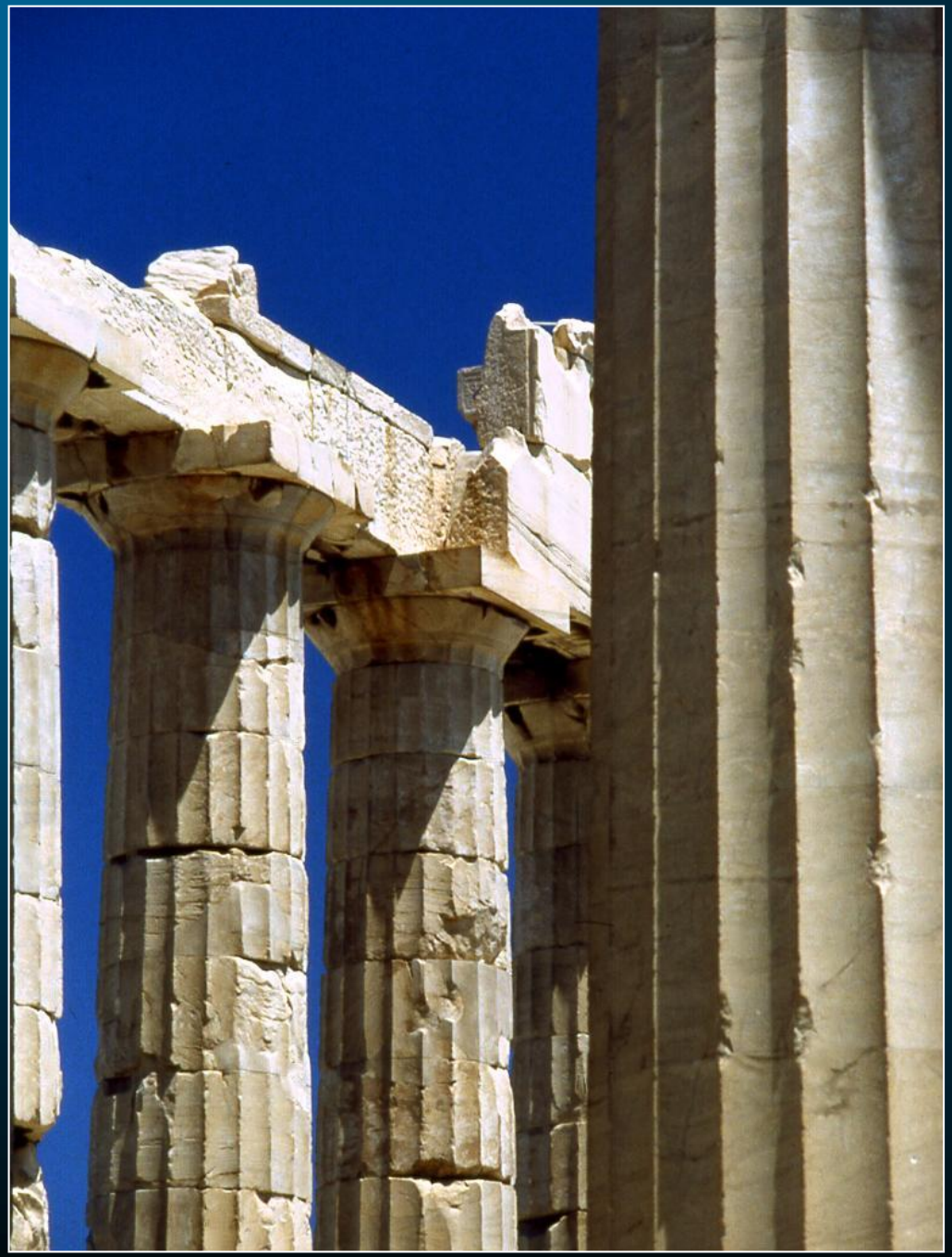
• FOP associato ad ASI al primo evento ma *con TVP o diatesi trombofilica* e *controindicazioni alla terapia anticoagulante*

• FOP con *sintomatologia recidivante* nonostante terapia anticoagulante

Dopo avere escluso altre eziologie è indicata la chiusura transcatetere e, in caso di fallimento, la chiusura chirurgica

Problemi da risolvere

- Prevenzione "primaria" in soggetti asintomatici con FOP+/-ASI e multipli focolai "gliotici" cerebrali
- Prevenzione "primaria" in soggetti con FOP +/- ASI ad alto profilo di rischio candidati a procedure chirurgiche ad alto rischio di embolia paradossa
- Prevenzione secondaria in soggetti con FOP +/- ASI e pregressa embolia polmonare/sistemica periferica



Dotto Arterioso Pervio

Chiusura PDA/malformazioni vascolari Indicazioni

- Sintomi da scompenso cardiaco
- Segni di sovraccarico di volume (*livello I:B*)
- Prevenzione dell'endocardite batterica o dell'embolia paradossa (*livello IIb:B*)

Limiti

- Età/peso del paziente (>1 mese e/o >4 kg)
- Caratteristiche anatomiche locali (fistole AV cerebrali/coronariche)
- Potenzialmente tutte trattabili !!!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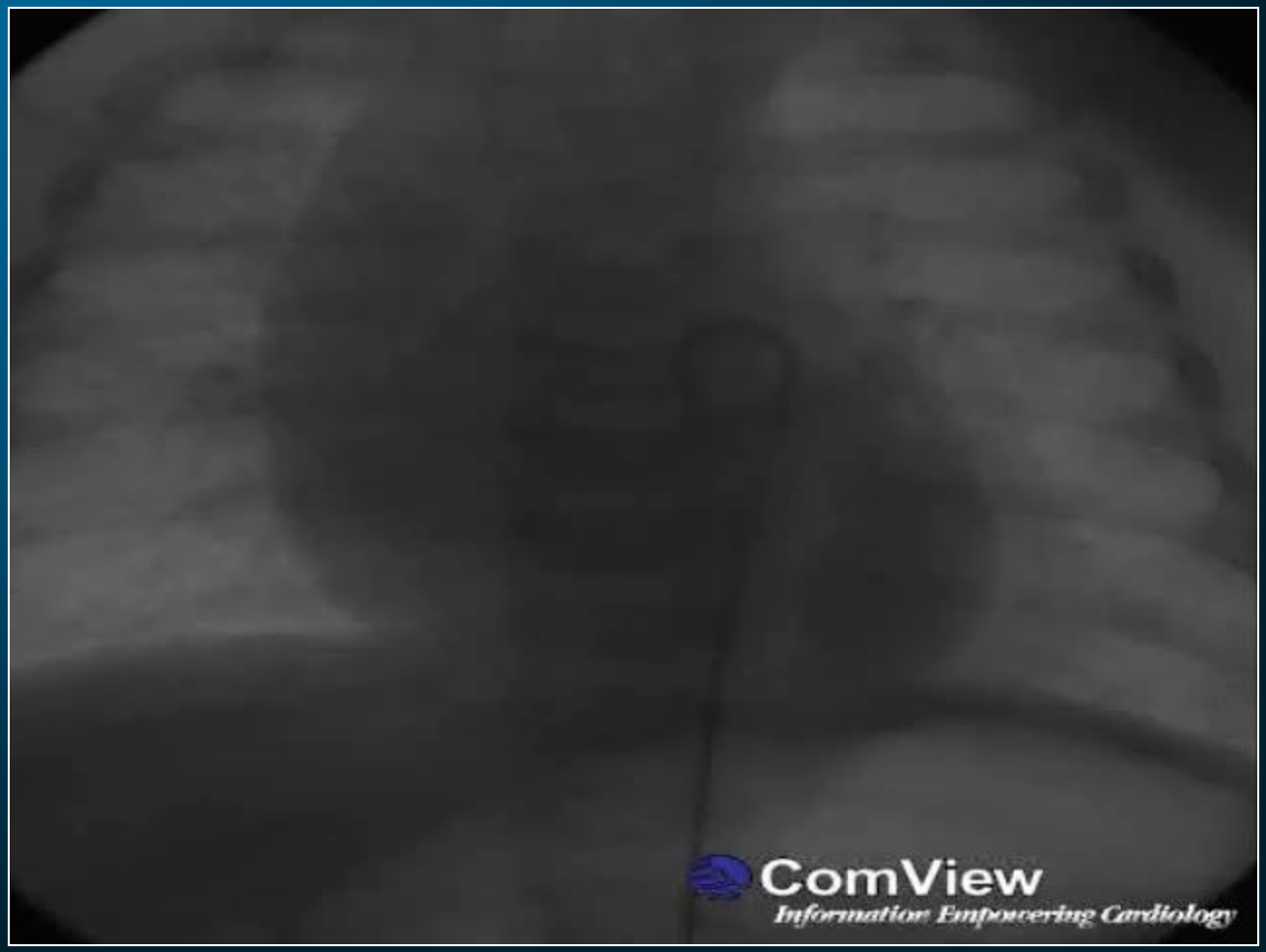
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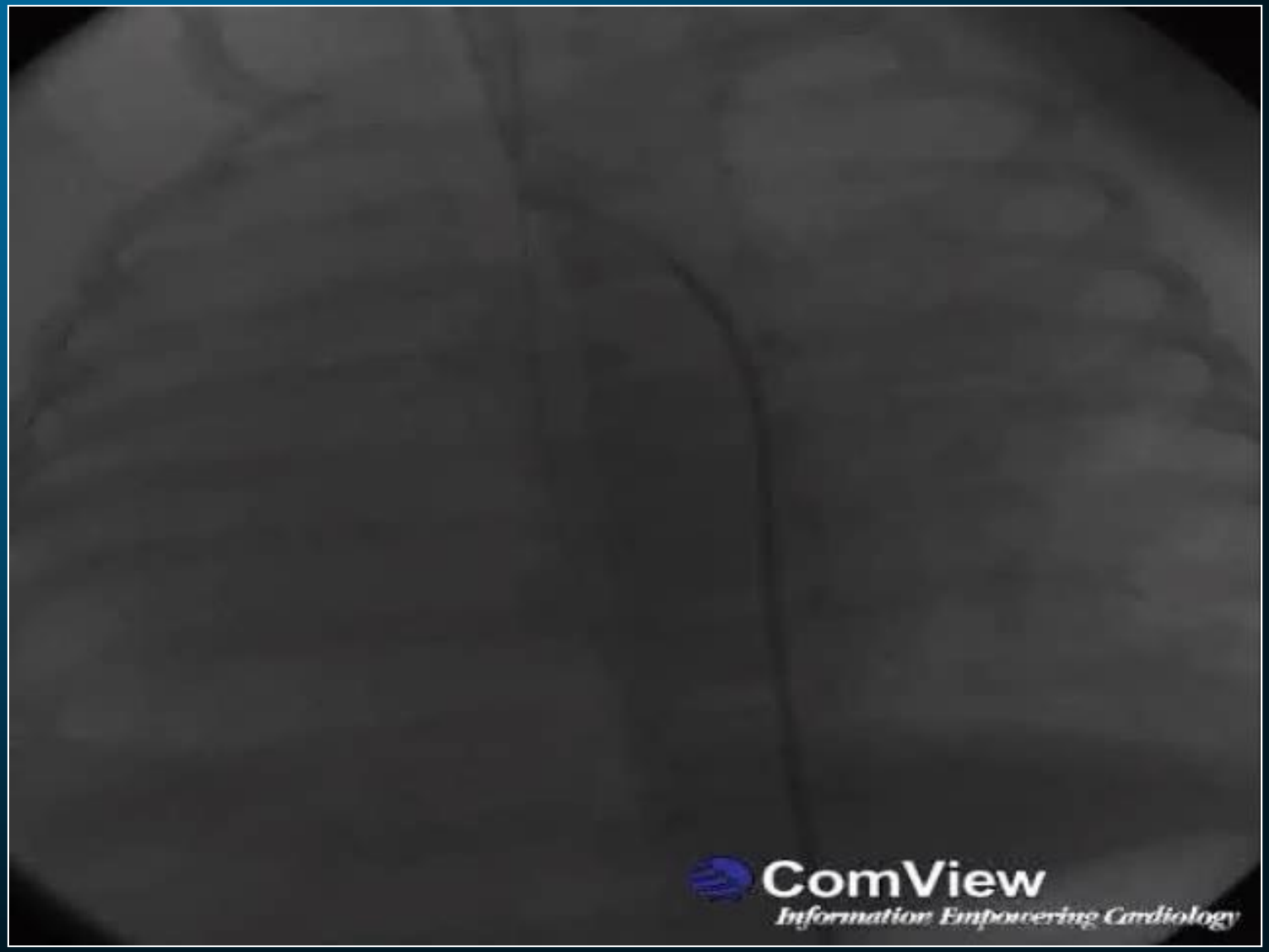
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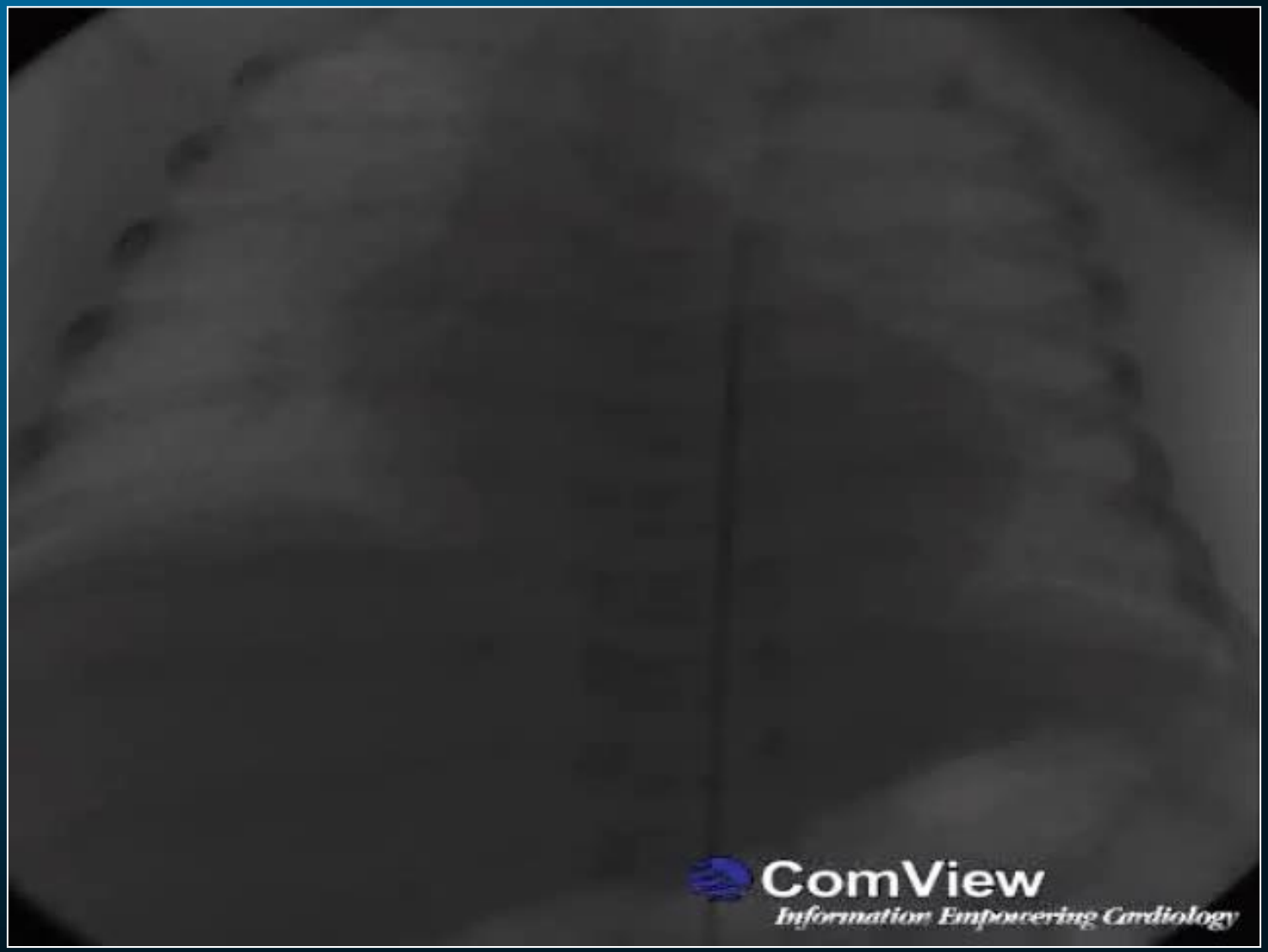
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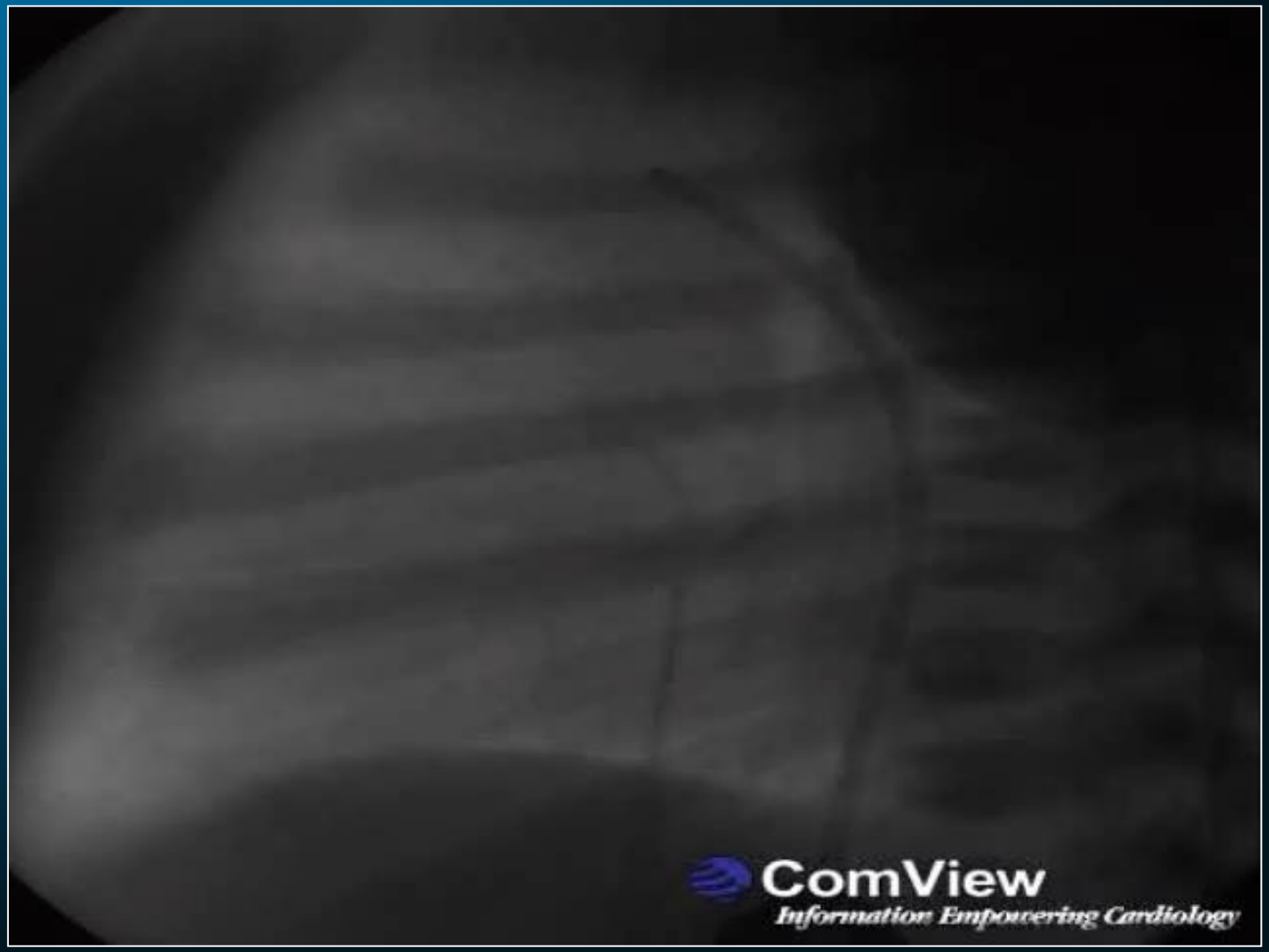
Trattamento di cardiopatie congenite "chirurgiche"

- Shunt sistemico-polmonare
- Difetto interventricolare (nativo, post-chirurgico o post-IMA)
- Lesioni multiple associate
- Impianto di protesi valvolare (polmonare o aortica)
- Altro

- Per tutte queste cardiopatie le indicazioni sono quelle "chirurgiche" ed i limiti sono fissati dalle caratteristiche anatomo-funzionali del singolo paziente e dall'abilità, spregiudicatezza, inventiva e fortuna dell'operatore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Emodinamica Interventistica nelle Cardiopatie Congenite

Chiusura di Difetto Interventricolare
Indicazione

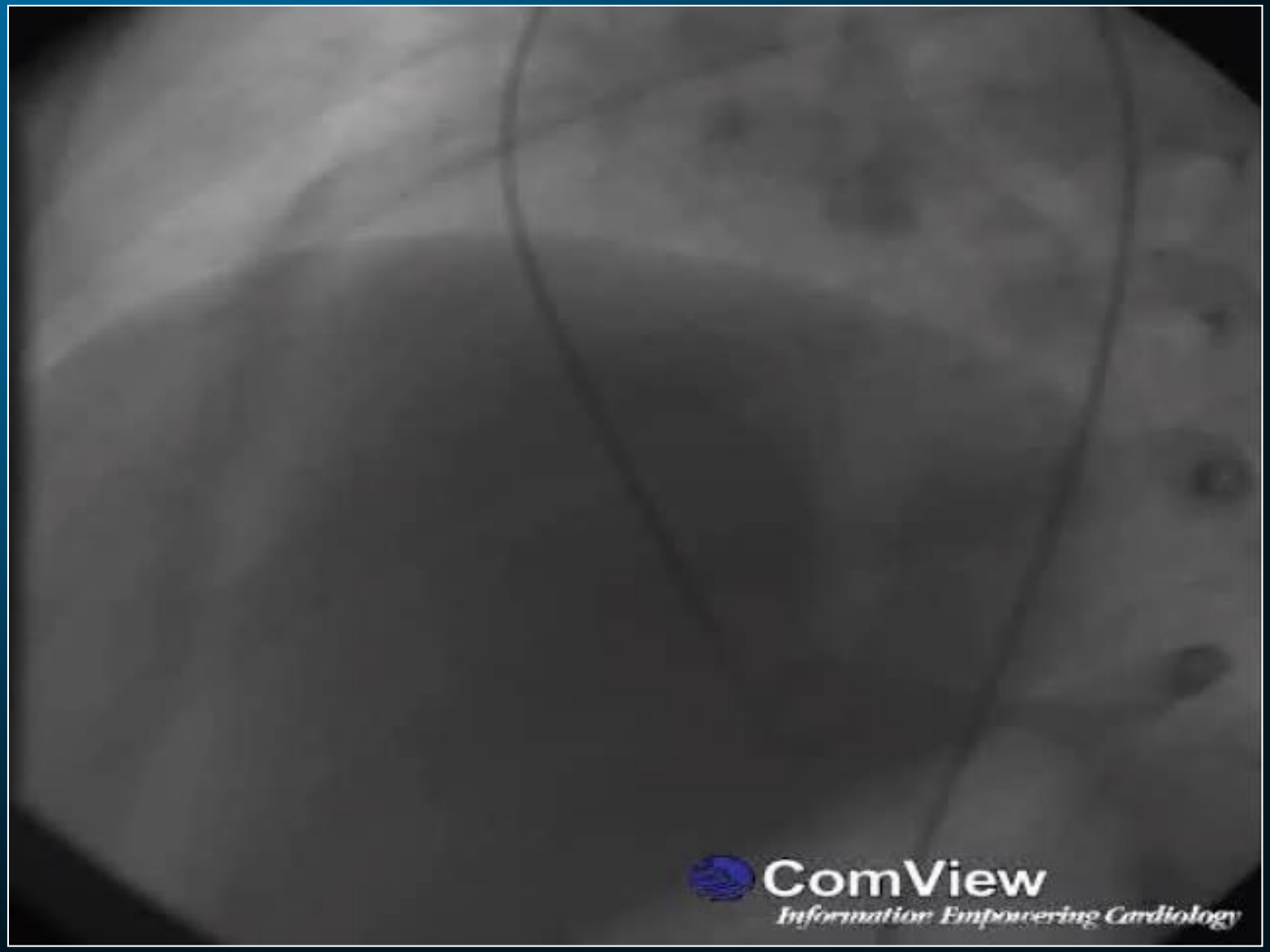
- Congenito
- Sovraccarico di volume
- QP/QS >1.5
- Profilassi dell'endocardite

(*livello IIb:B*)

- Post-IMA
- Difetto cronico (>2-3 settimane)

Limiti

- Età/peso del paziente (>4 anni e/o >20 kg)
- Anatomia del difetto (dimensioni, sede, aneurisma multi-fenestrato, ecc)
- Rapporto con le strutture anatomiche circostanti (valvola Ao, sistema di conduzione, ecc.)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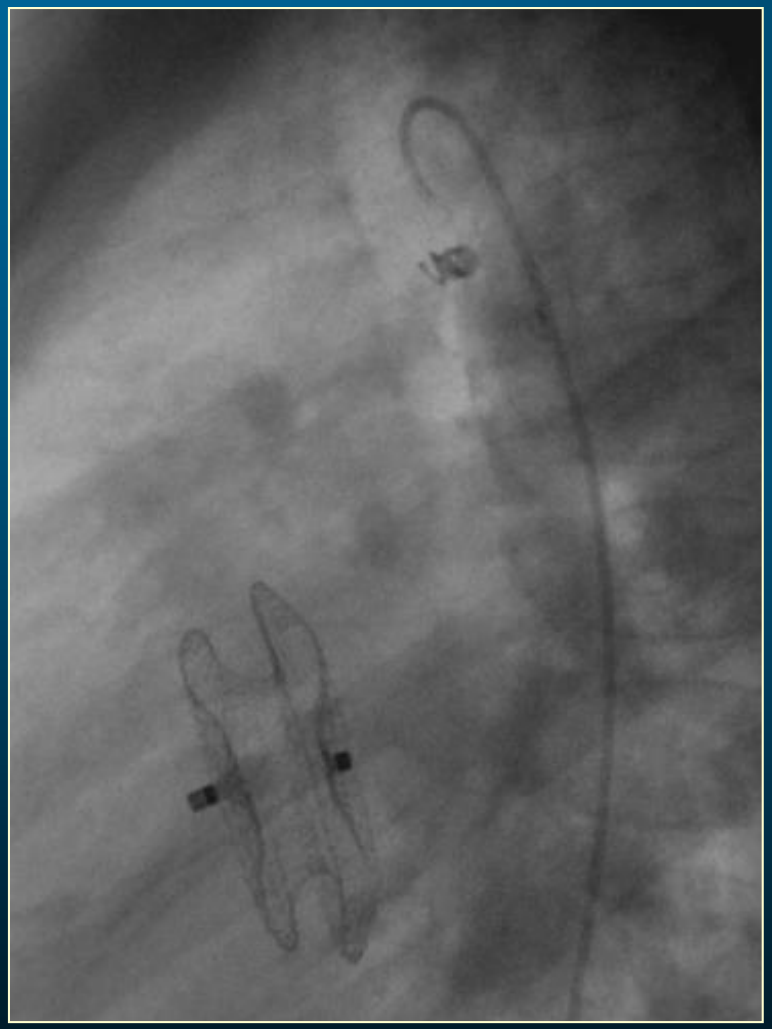

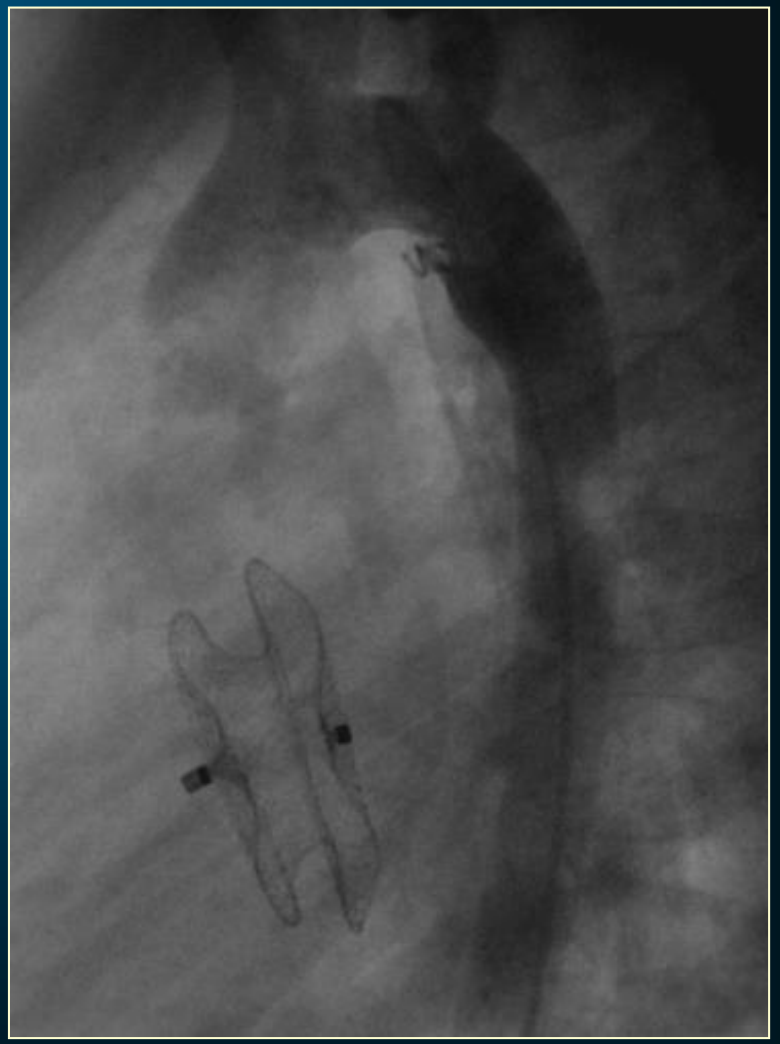

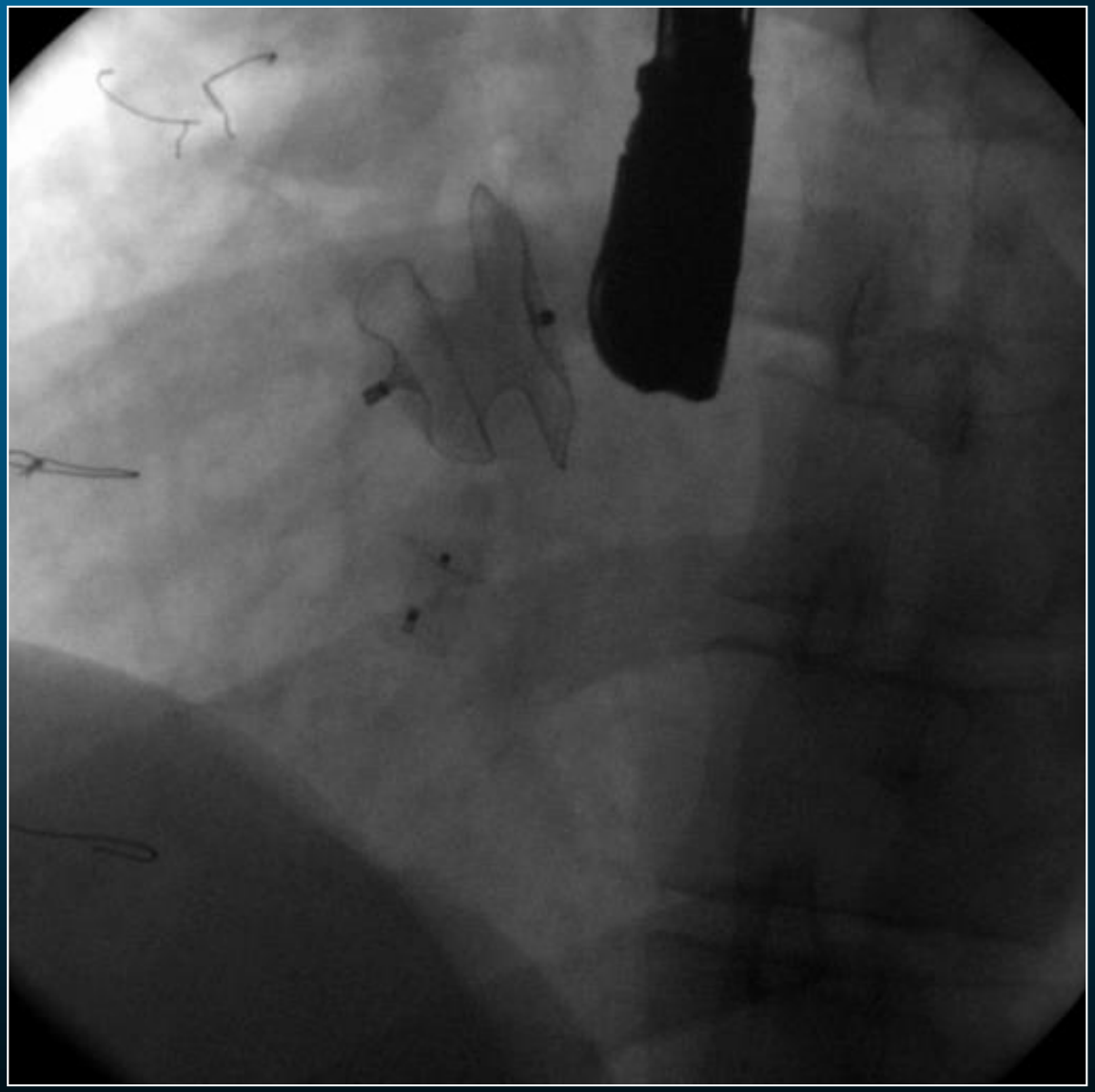

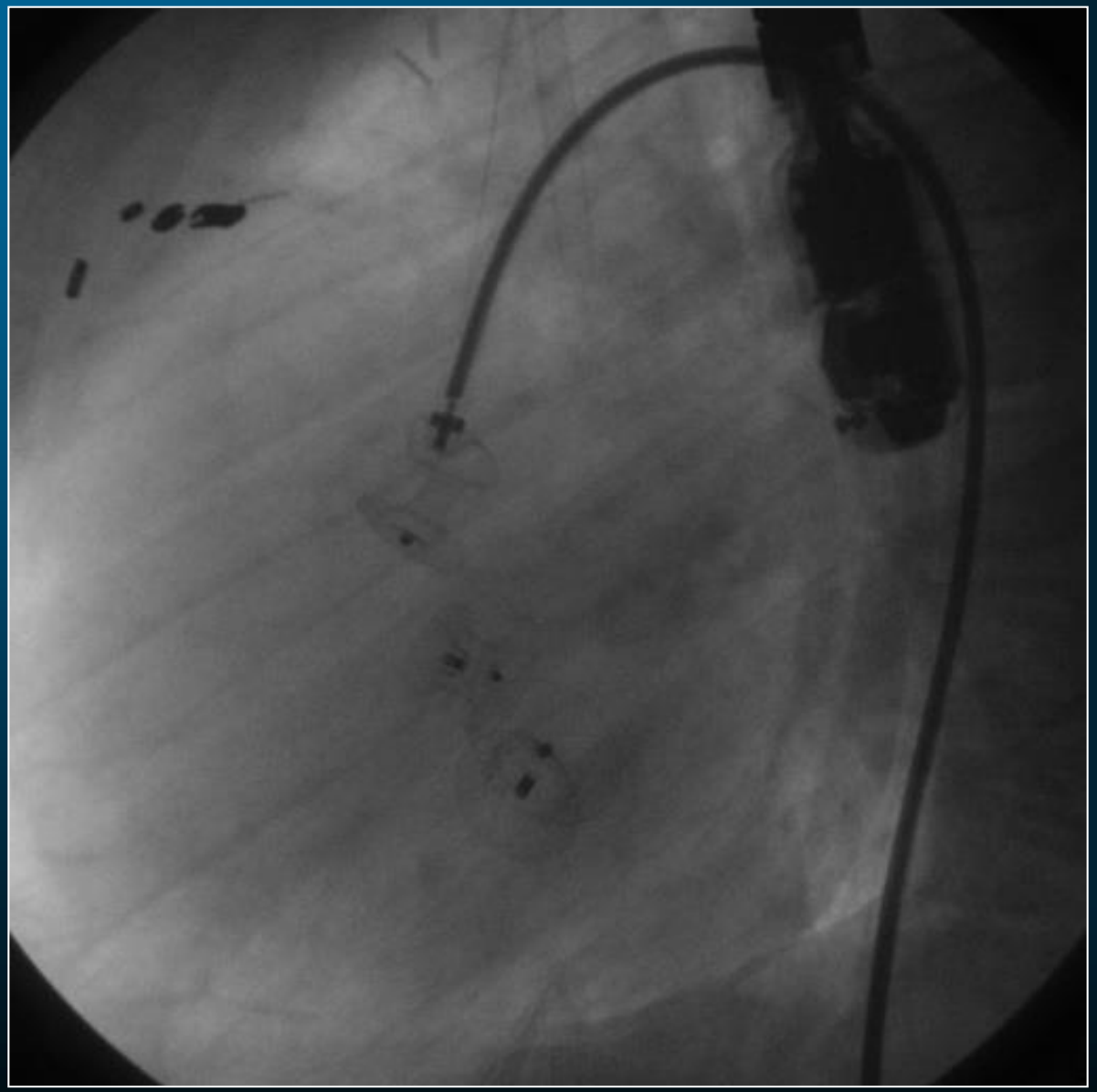

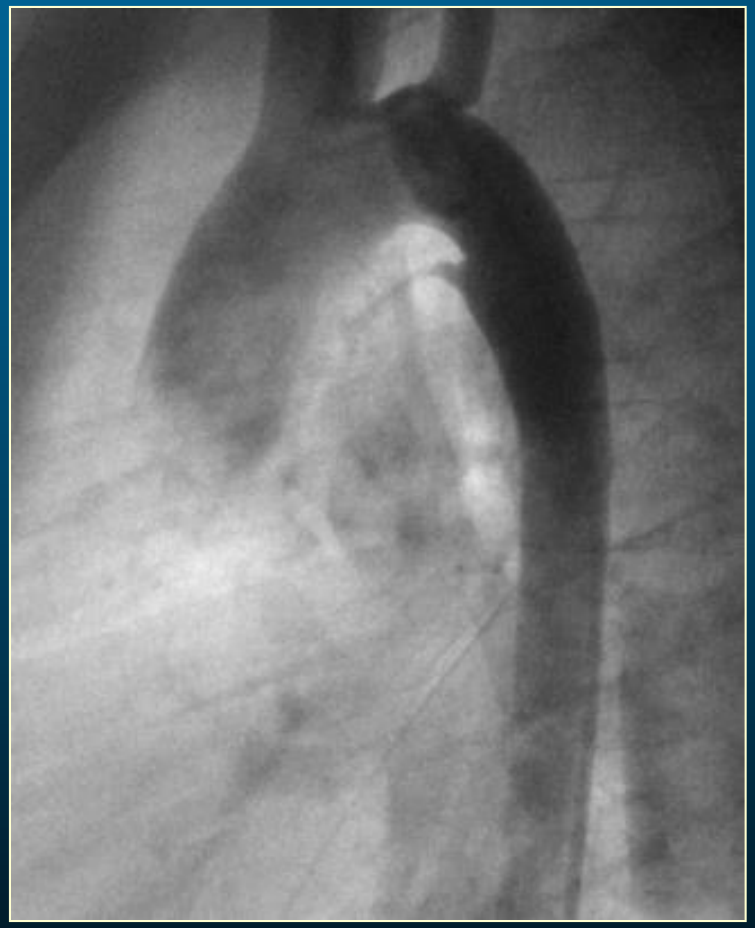


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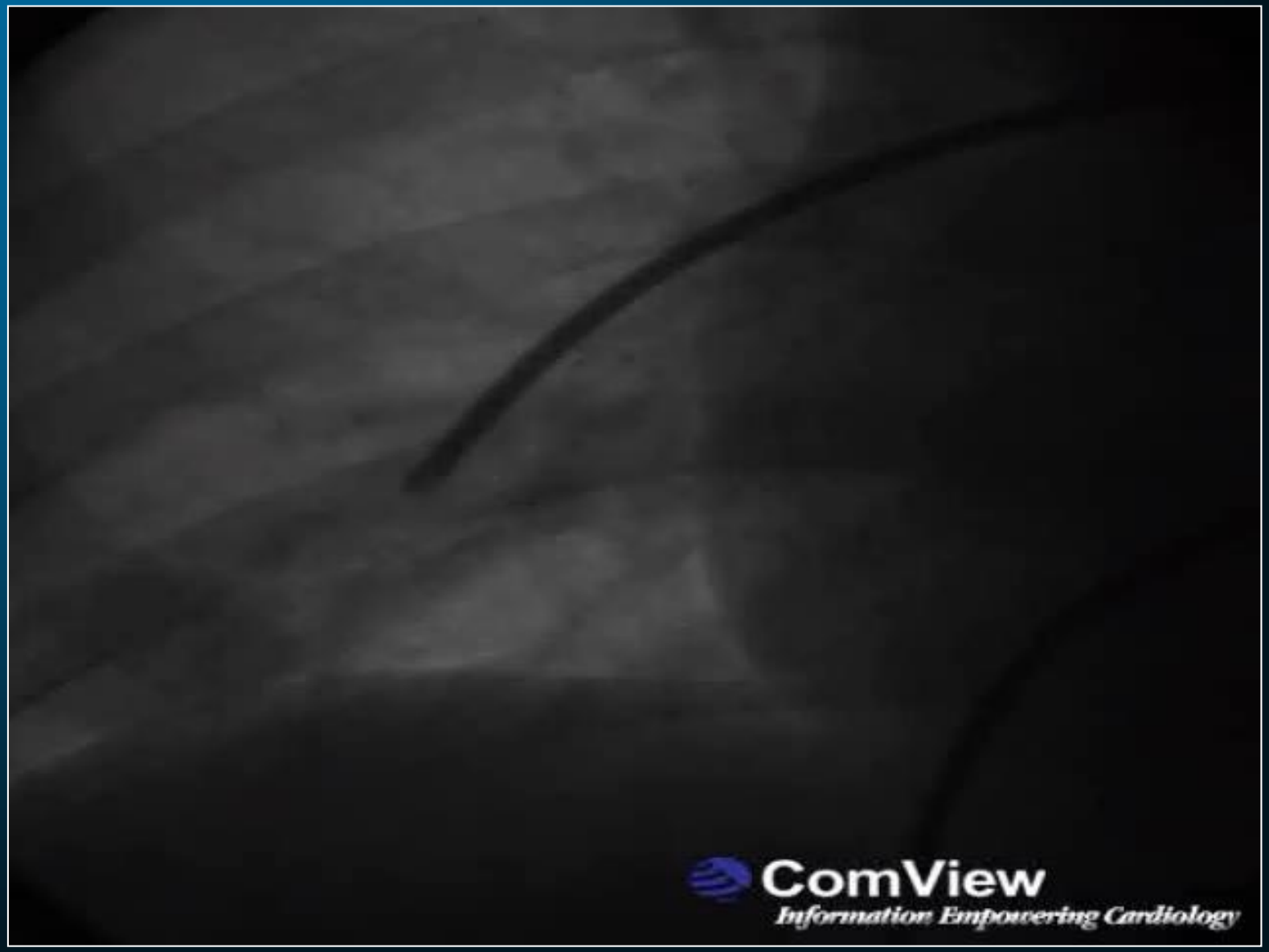
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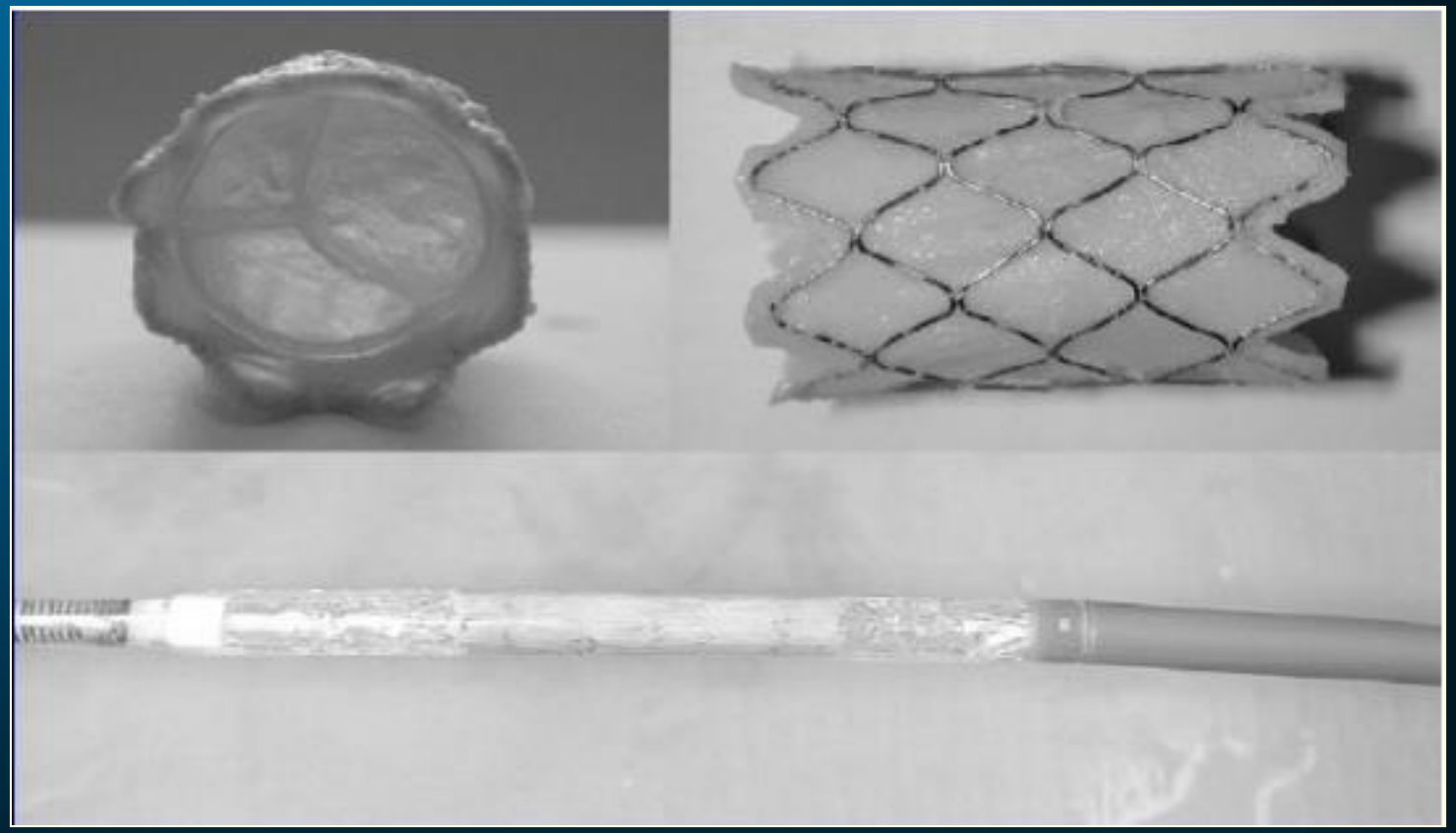
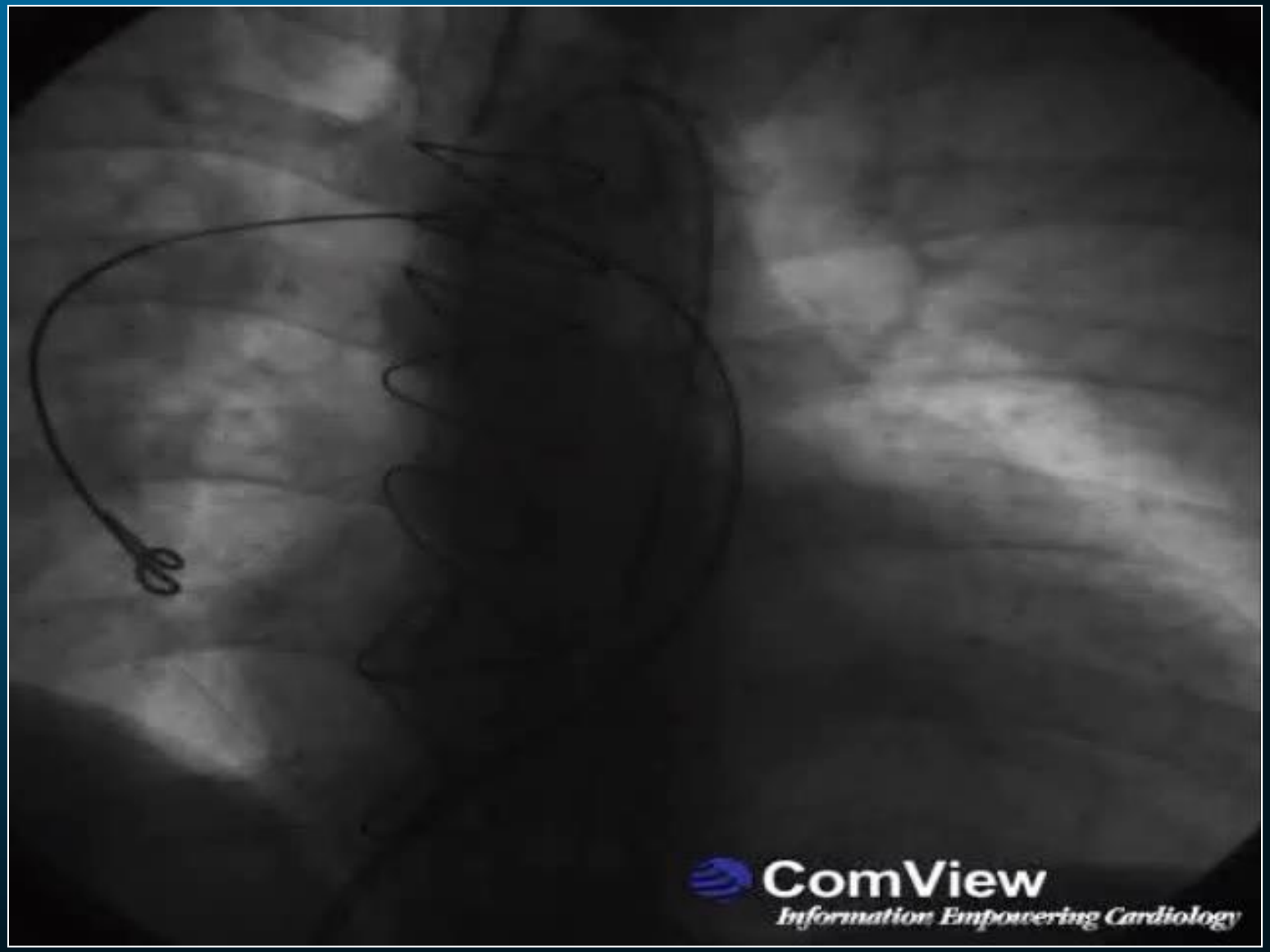


Bonhoeffer P, et al. Lancet 2000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Approccio combinato ("ibrido") alle cardiopatie congenite "chirurgiche"

- Hybrid Interventional/Surgical Approach is defined any combined catheter-based and surgical intervention performed in one setting or in a planned, close sequential fashion
- It typically incorporates an open approach to delivery a device

- Procedura "preparatoria" alla chirurgia correttiva
- Procedura di "completamento" post-chirurgico
- Approccio "combinato" sequenziale

- Ridurre i rischi della chirurgia correttiva
- Evitare la circolazione extracorporea
- Ridurre i tempi di intervento

Indications

- *Clinical*

→ low-weight patients (vascular access, patient/material size mismatch, etc)
→ co-morbidities (need for major or multiple surgical approaches, etc)
→ clinical unstability (basal or anticipated during percutaneous procedures)

- ***Anatomical***

→ poor vascular access (patient size, previous vascular accesses, etc)
→ tortuous vascular/cardiac course to the target lesion
→ unusual septal orientation

- *Techinical*

→ associated lesions requiring surgical repair
→ need for multiple surgical accesses in the same procedure
→ anticipated further surgery (cardiac or extra-cardiac)

History

- *Bhati BS, et al.* Closure of patent ductus arteriosus during open-heart surgery. *JTCS, 1972.*
- *Fishberger SB, et al.* Congenital heart disease: intraoperative device closure of VSDs. *Circulation, 1993*
- *Mendelsohn AM, et al.* Intraoperative and percutaneous stenting of congenital pulmonary artery and vein stenosis. *Circulation, 1993*
- *Gibbs JL, et al.* Stenting of the arterial duct combined with banding of the pulmonary arteries and atrial septectomy or septostomy: a new approach to palliation for the HLHS. *Br Heart J 1993*

Present Domains of Hybrid Therapy

- Muscolar VSD closure in low-weight or high-risk patients using per-ventricular or open heart approach and percutaneous devices
- Vascular stent implantation in clinical or anatomical challenging cases through cardiac or vascular surgical exposure

- Hypoplastic Left Heart Syndrome palliation or HLHS-like in high-risk neonates destined to Fontan track or as temporary bridge toward biventricular repair
- More and more … based on creativity and concord of the "therapeutic team"

➢ *Current perspectives*

→ valve perforation/angioplasty (critical PV stenosis/atresia; PA-VSD; aortic stenosis) in low-weight or critical patients

→ off-pump valve replacement

→ aortic coarctation angioplasty or stenting in complex cases

→ per-atrial ASD septal closure (complex cases in low-weight patients; during complex hybrid or conventional surgery)
→ peri-membranous VSD closure
→ intra-operative device interventions before/during/after "complex" surgical procedures

Hybrid Approach for per-ventricular MVSD closure: technical notes

→ sternotomic (or mini-thoracotomic or sub-xyphoid) approach

→ RV free wall exposure and purse string suture placement opposite to the VSD perpendicular to the septum

→ RV wall needle puncture through the pulse string
→ guide-wire probing the VSD and entry inside the LV
→ vascular sheath entry over the guide-wire
→ device deployment under TEE-guide

- ***Advantages vs conventional surgery***

→ minimal incision (potentially sub-xyphoid)

→ "off-pump" intervention or decrease by-pass time

→ easier approach to apical MVSD (avoiding ventricular incision and transection of the moderator band or other muscle debriding procedures)

→ real-time evaluation of the results by intra-operative TEE/angiography

➢ *Advantages vs conventional cath*

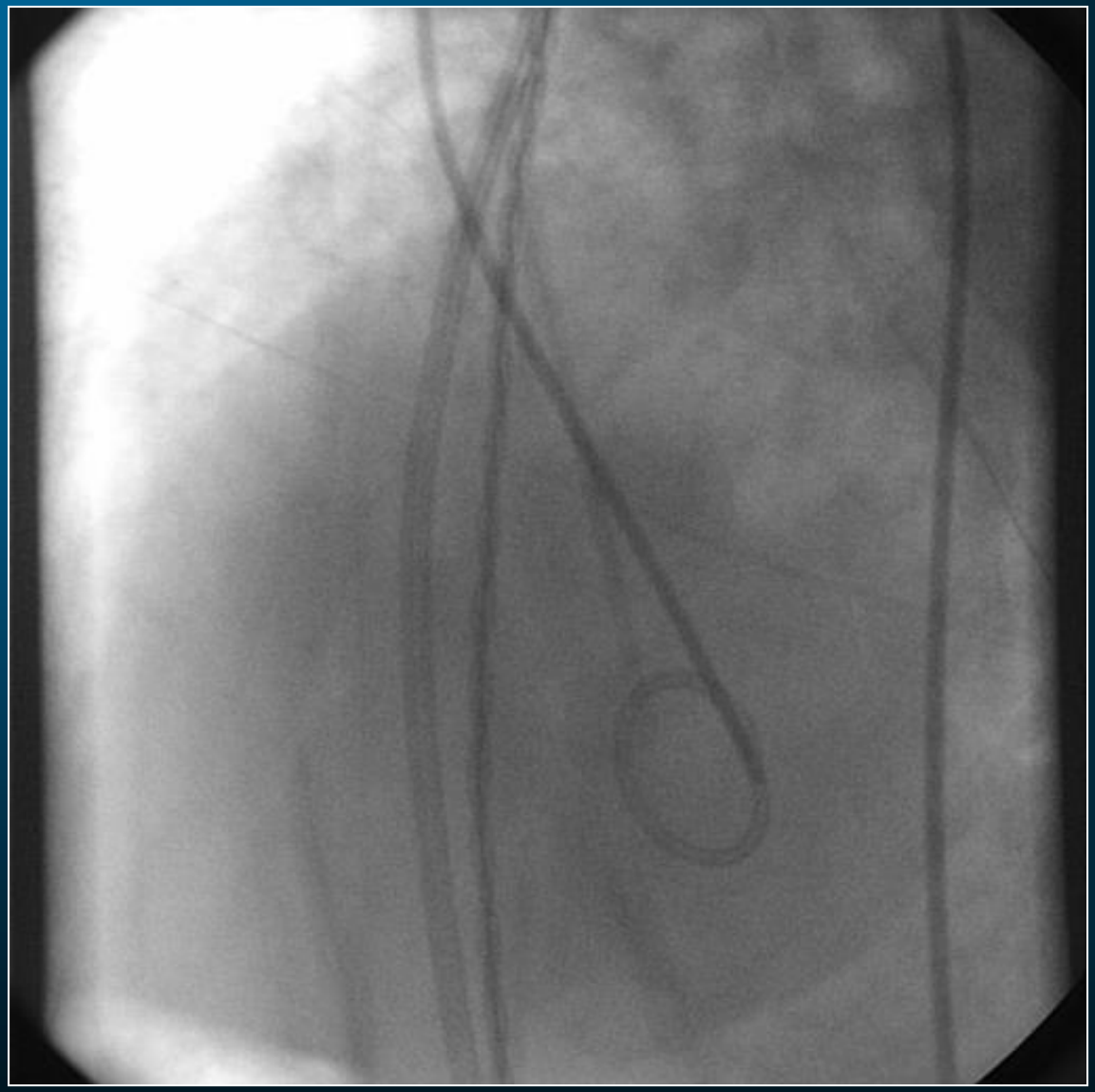
→ free access to the ventricular septum regardless of patient size/VSD location

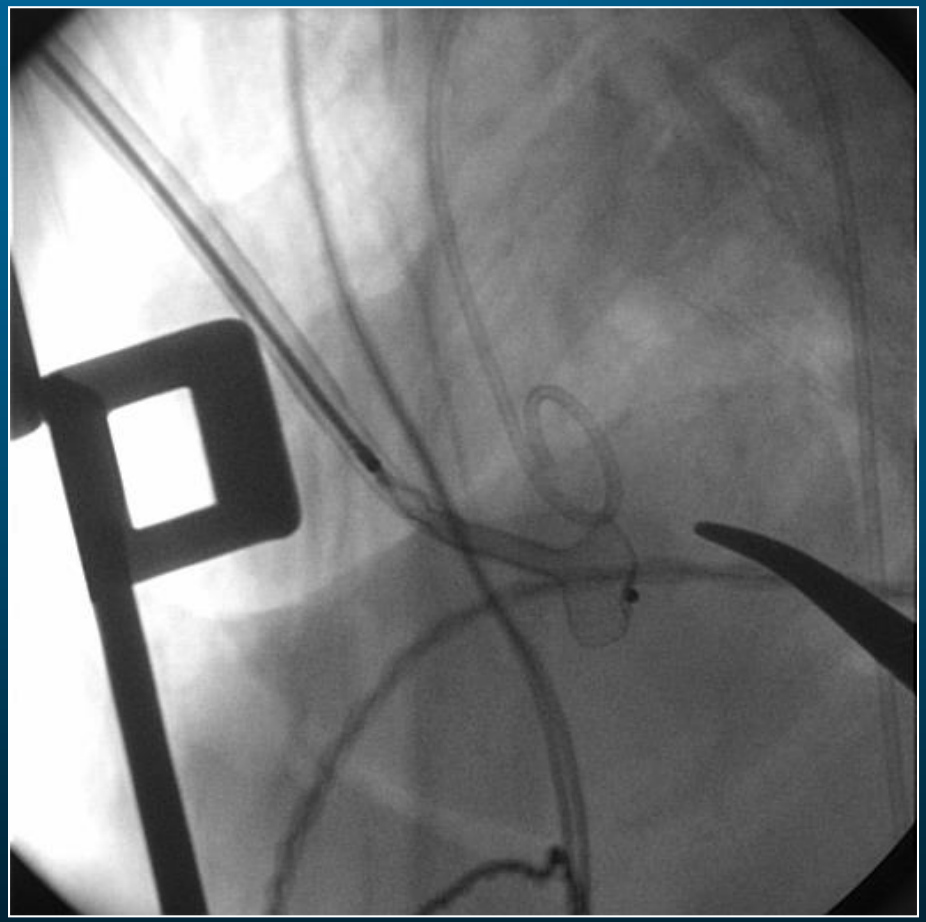
→ straighter course to the target lesion (critical in unstable patients)

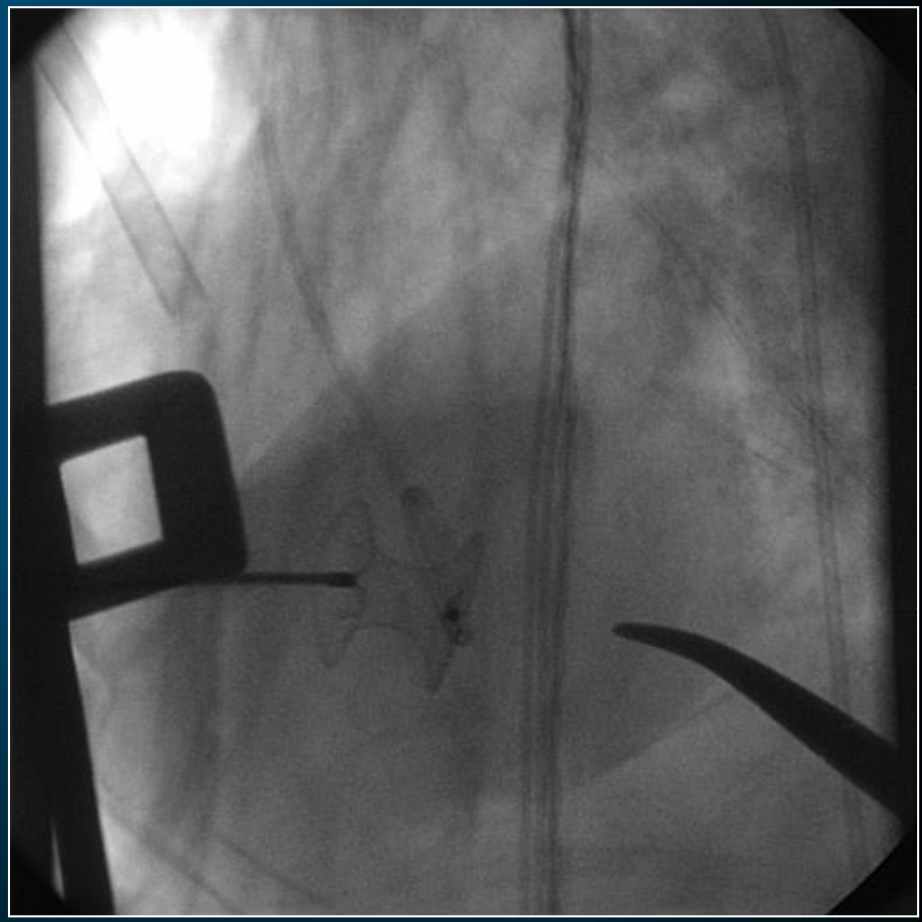
→ no limitation for large delivery sheaths or unusual septal orientation

→ better management of complications (device embolization, AV valve malfunction, etc)

→ possibility of rescue (VSD) surgery or concomitant surgical repair







➢ *Intra-operative pulmonary vessel stenting: technical notes*

→ sternotomic or mini-thoracotomic approach
→ vascular exposure
→ purse string suture placement, guide-wire entry and vascular sheath insertion

→ angiographic visualization in multiple views to choose the stent lenght/diameter
→ guide-wire negoziation of the stenosis
→ stent deployment under direct vision or fluroscopic/angiographic guide

➢ *Advantages vs conventional surgery*

→ "off-pump" intervention or decrease by-pass time

→ easier treatment of distal and/or complex vascular stenoses

→ better structural support to the repaired PA (either vascular wall collapse or external compression)

→ real-time evaluation of the results by intra-operative angiography

➢ *Advantages vs conventional cath*

→ free access to circulation regardless anatomic issues

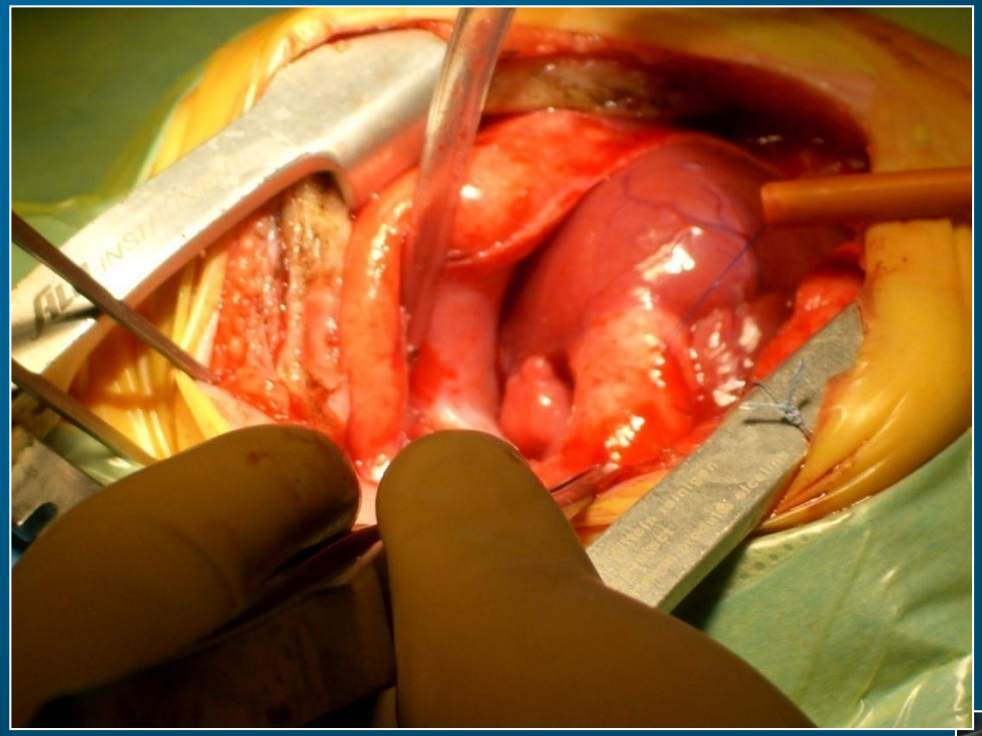
→ straighter course to the target lesion in tortuous vessels

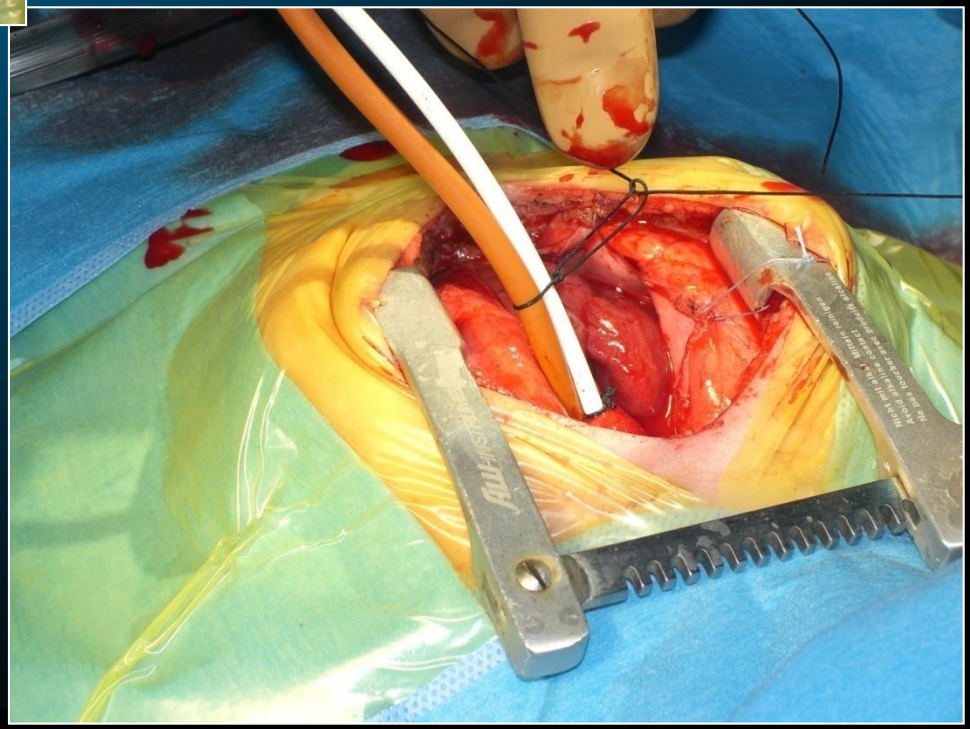
→ no limitation for large delivery sheaths

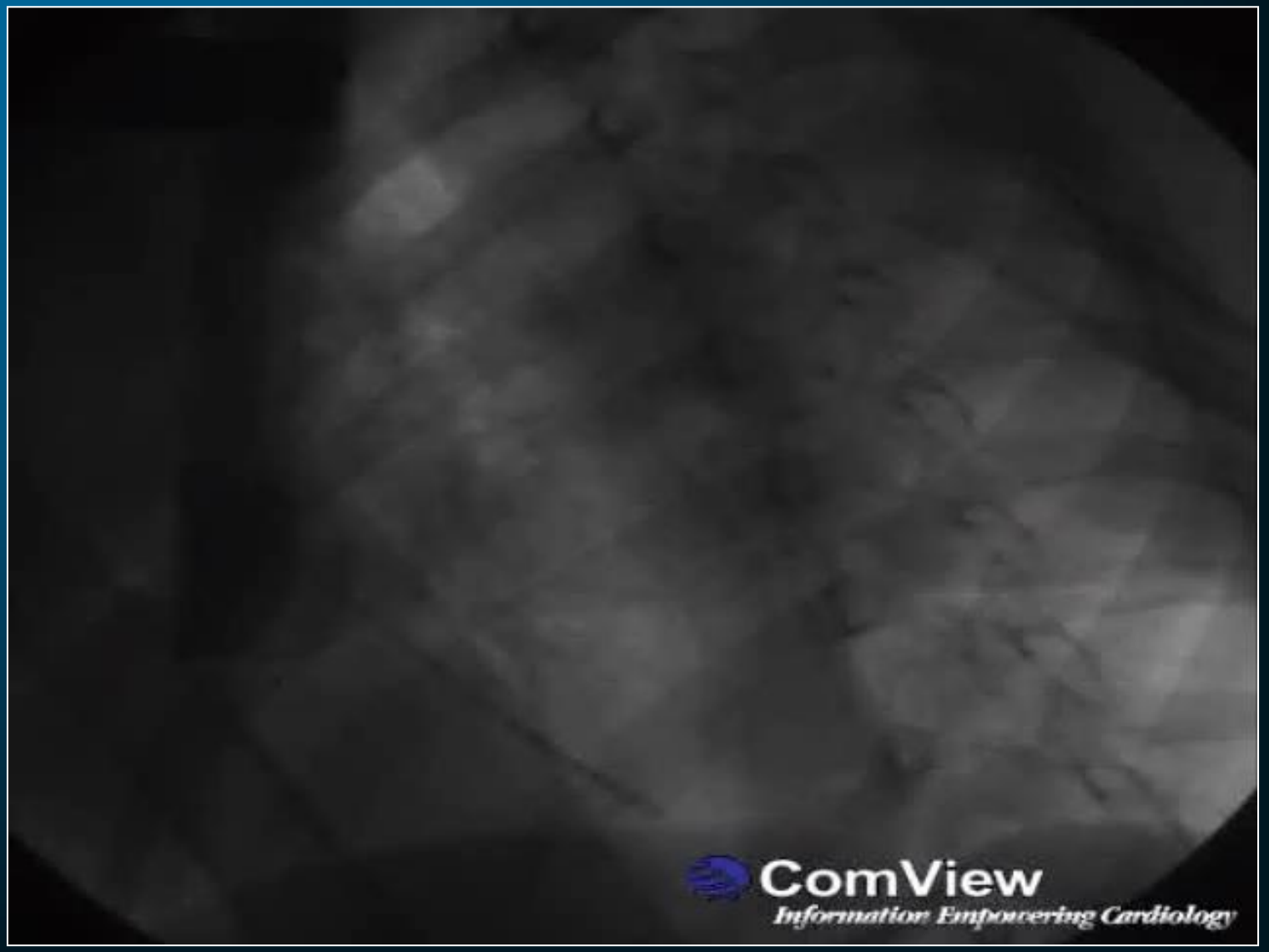
→ use of stents of "adult" diameter (or potentially re-expandable to "adult" size)

→ better management of complications (vessel tear, balloon rupture, stent migration, etc)

→ possibility of concomitant surgery



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Conclusioni

- Grazie al miglioramento dei materiali ed all'affinamento delle tecniche procedurali, l'emodinamica interventistica pone ormai come valida alternativa al trattamento chirurgico di molte cardiopatie congenite sia ad esordio neonatale che infantile

- In alcuni casi, inoltre, essa costituisce una efficace opzione terapeutica palliativa per stabilizzare il neonato prima dell'intervento chirurgico correttivo oppure, utilizzando tecniche "ibride" volte ad eseguire una correzione chirurgica meno complessa e/o a minor rischio