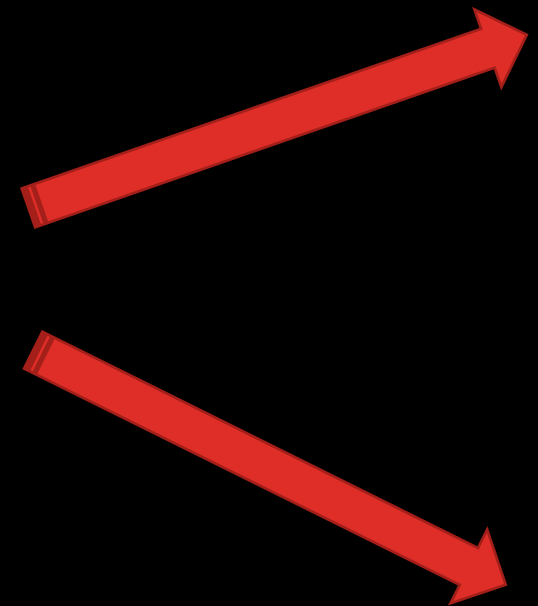


2.3.4 Juin 2021

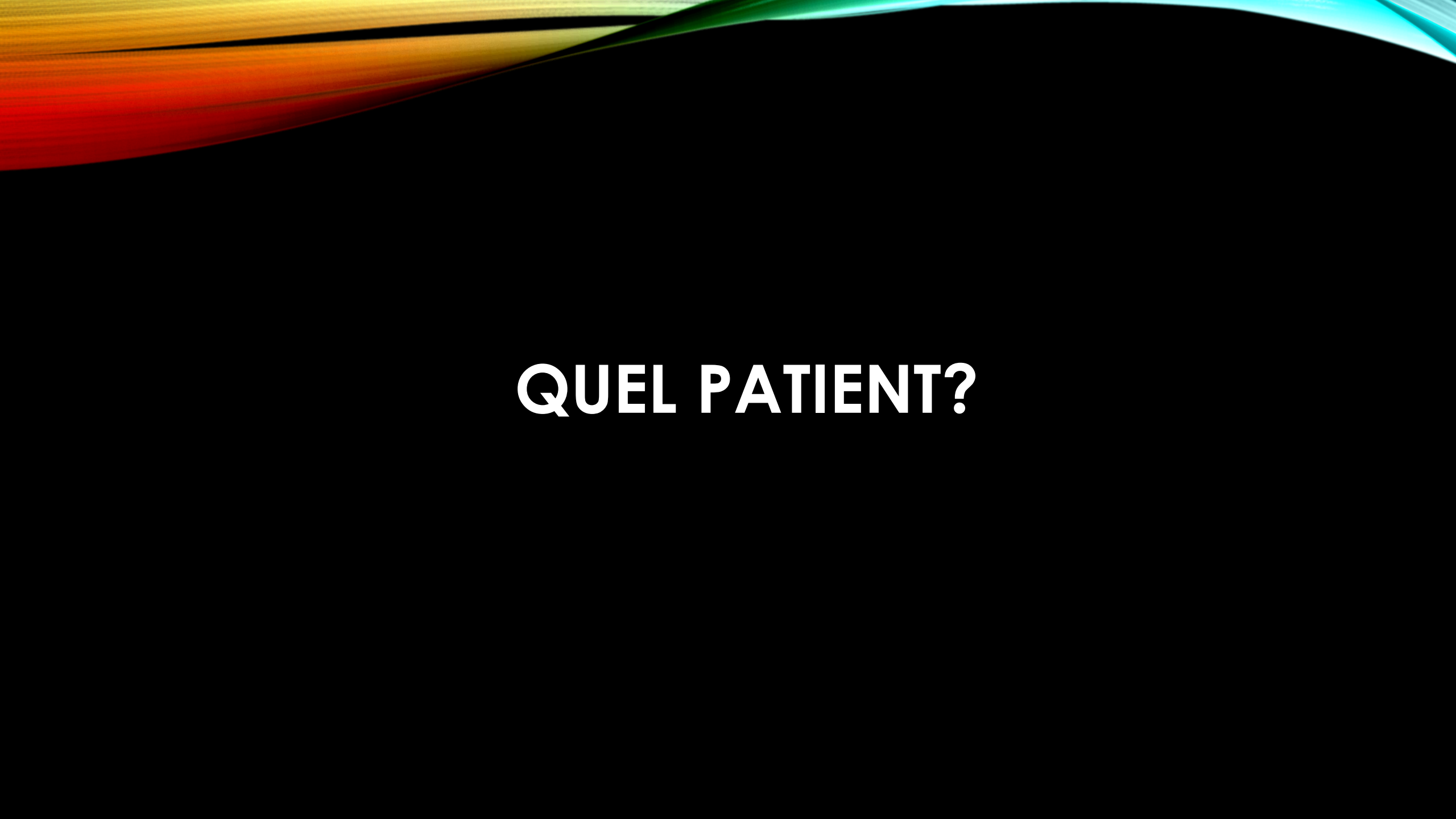
# LES INDICATIONS NON NEUROLOGIQUES DE LA FERMETURE DE FOP. OÙ EN EST-ON ?

Christian Pristipino  
Hôpital San Filippo Neri  
Rome, Italie



**QUEL PATIENT?**

**QUEL TRAITEMENT?**



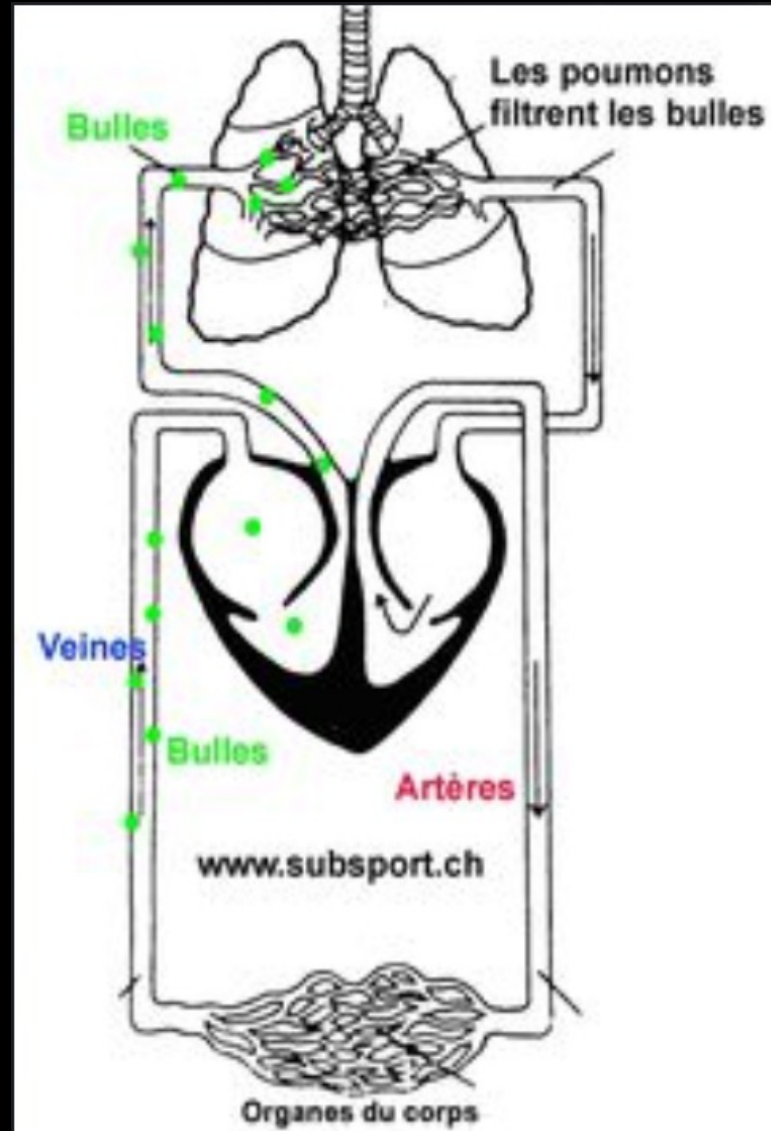
**QUEL PATIENT?**

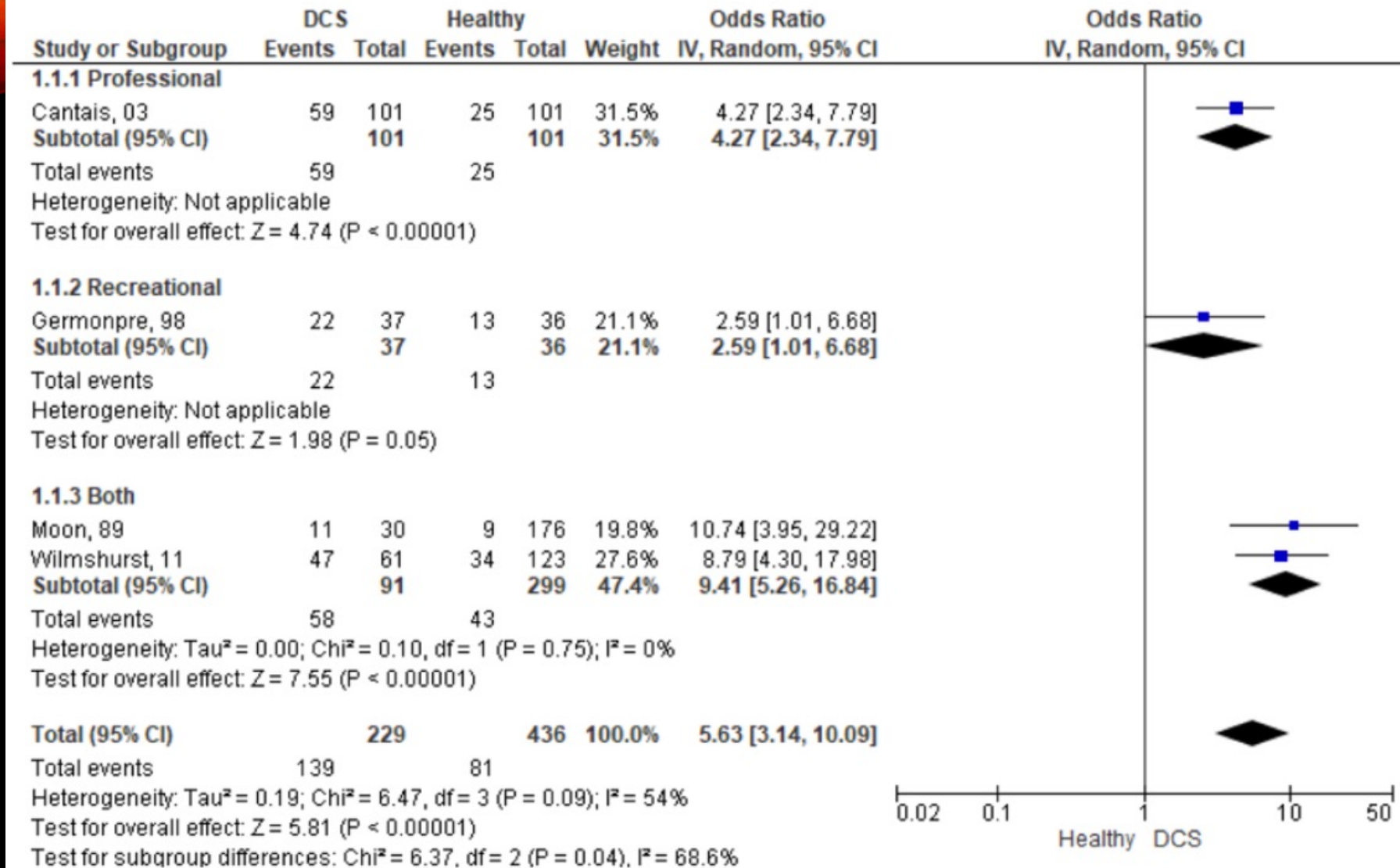
# European position paper on the management of patients with patent foramen ovale. Part II - Decompression sickness, migraine, arterial deoxygenation syndromes and select high-risk clinical conditions



**Christian Pristipino, MD<sup>1\*</sup>, Peter Germonpré, MD<sup>2</sup>, Danilo Toni, MD<sup>3</sup>, Horst Sievert, MD<sup>4,5,6</sup>, Bernhard Meier, MD<sup>7</sup>, Fabrizio D'Ascenzo, MD<sup>8</sup>, Sergio Berti, MD<sup>9</sup>, Eustaquio Maria Onorato, MD<sup>10</sup>, Francesco Bedogni, MD<sup>11</sup>, Jean-Louis Mas, MD<sup>12</sup>, Paolo Scacciatella, MD<sup>13</sup>, David Hildick-Smith, MD<sup>14</sup>, Fiorenzo Gaita, MD<sup>8</sup>, Paul A Kyrle, MD<sup>15</sup>, John Thomson, MD<sup>16</sup>, Genevieve Derumeaux, MD, PhD<sup>17</sup>, Dirk Sibbing, MD<sup>18</sup>, Massimo Chessa, MD<sup>11</sup>, Marius Hornung, MD<sup>4</sup>, Jose Zamorano, MD<sup>19</sup>, Dariusz Dudek, MD<sup>20,21</sup>,**

# MALADIE DE DECOMPRESSION

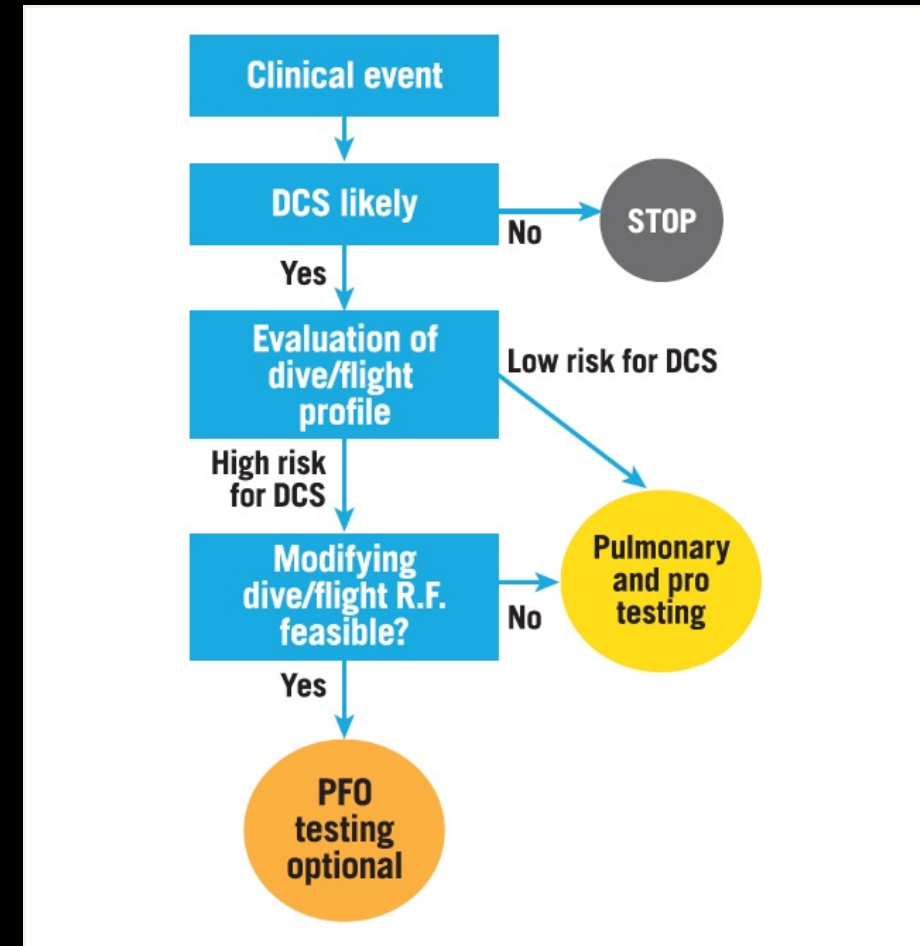






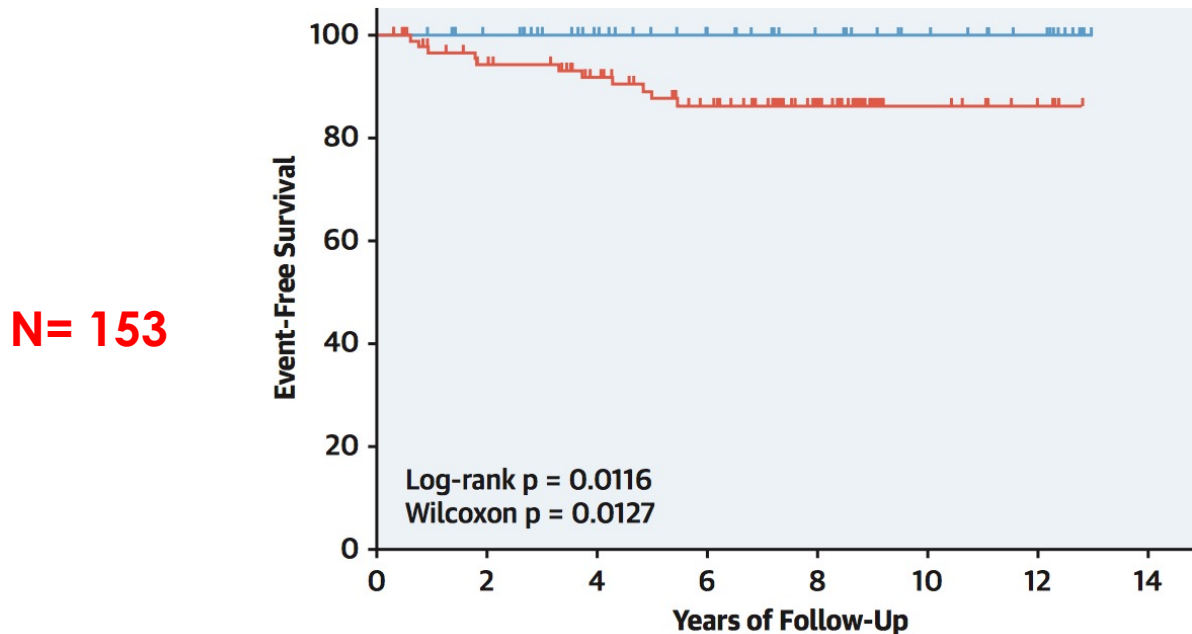
# EVALUATION DE L'ADD

- Diagnostic ADD fait par un médecin hyperbarique/aérospatial
- Evaluation du risque de l'activité (provocative/non provocative)
- Dépistage du FOP dans des centres expérimentés



# MALADIE DE DECOMPRESSION

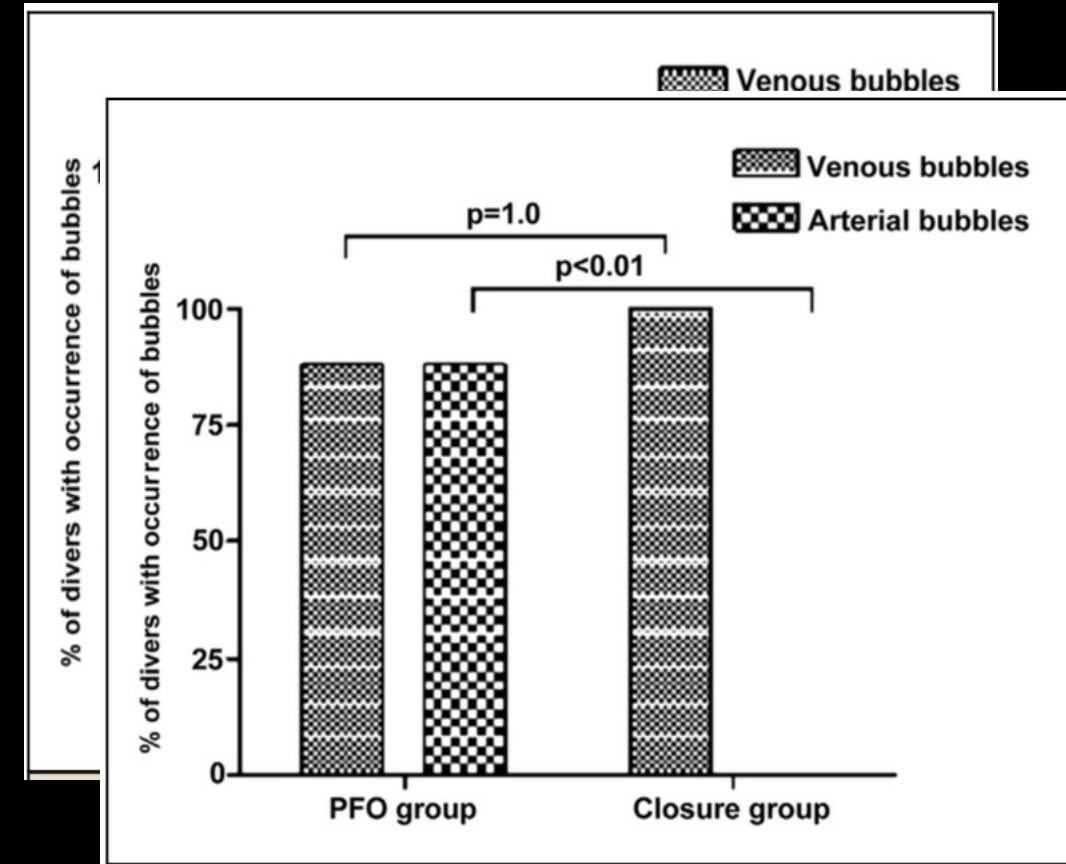
**FIGURE 1** Unprovoked Decompression Sickness Occurrence



No. at risk:

|                      |    |    |    |    |    |    |    |
|----------------------|----|----|----|----|----|----|----|
| — Closure Group      | 55 | 50 | 41 | 34 | 25 | 16 | 11 |
| — Conservative Group | 98 | 83 | 71 | 57 | 34 | 11 | 6  |

Survival free from unprovoked decompression sickness in divers after catheter-based patent foramen ovale closure (closure group) and with a high-grade patent foramen ovale (conservative group).



Honek, JACC CVI 2014

Honek, JACC 2020

# ... SUR LE PLAN PRATIQUE

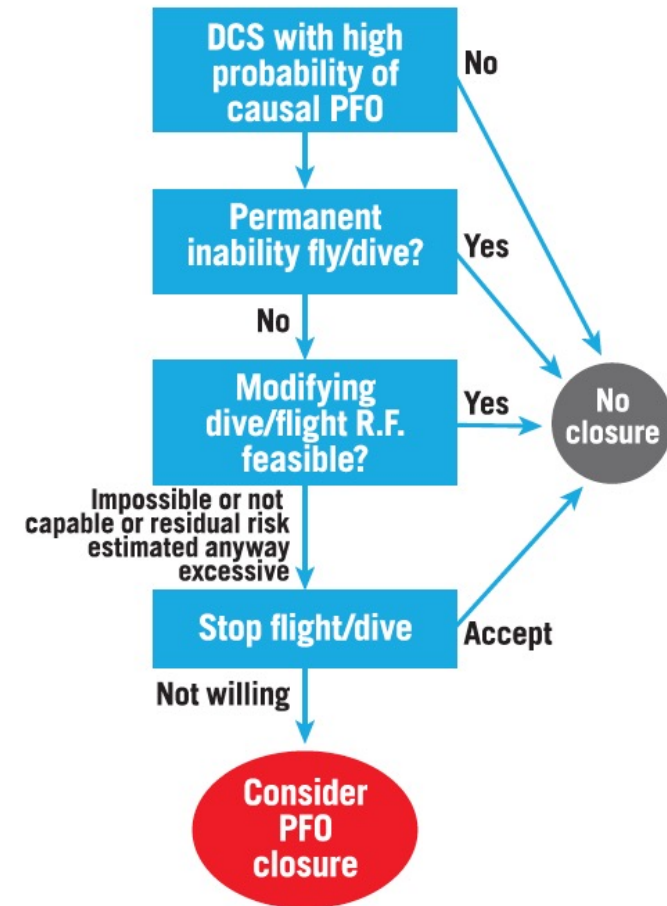
## PRACTICAL SUMMARY 1: DECOMPRESSION SICKNESS

### WHAT TO DO

- PFO screening in DCS cases with no obvious risk factors or with high but non-modifiable risk for DCS
- After a DCS, primarily prevent bubbles with behavioural and technical (B&T) changes
- If B&T changes are not possible or not effective, PFO closure can be proposed with shared decision making underscoring the lack of evidence
- Resume unrestricted activity only after confirmed PFO sealing post intervention

### WHAT NOT TO DO

- Primary PFO screening
- Deny conventional flight or diving after incidental finding of PFO
- High-risk recreational dives after incidental finding of PFO
- Propose PFO closure if B&T changes can be made and are effective



# SYNDROMES DE DESATURATION ARTERIELLE

| DISEASE                               | SHUNT CAUSES                                                                                                                                                                                                                                                                                                                                                                     | CLINICAL CONSEQUENCES                                                                                | PFO PATHOGENIC ROLE |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------|
| Platypnoea-orthodeoxia syndrome (POS) | <ul style="list-style-type: none"><li>- Pulmonary hypertension (ventilation/perfusion mismatch) [182]</li><li>- Preferential blood flow towards the PFO from the inferior vena cava (through prominent Eustachian valve or deformation of atrial structures, due to cardiac valve disease, or diaphragmatic, pulmonary, vertebral column, or aortic disease [184-191])</li></ul> | <ul style="list-style-type: none"><li>- Upright position dyspnoea relieved by lying supine</li></ul> | VERY FREQUENT [80]  |

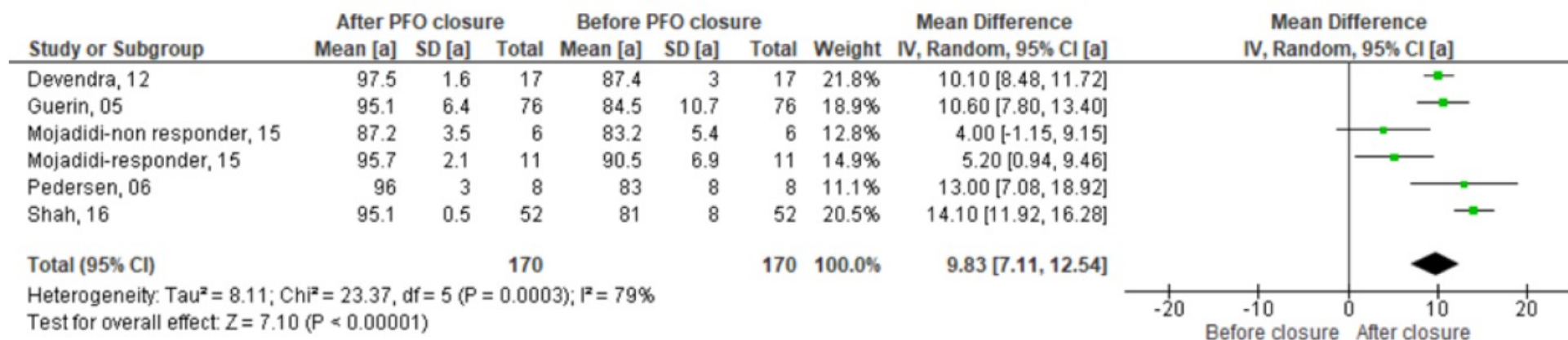
| <b>DISEASE</b>                           | <b>SHUNT CAUSES</b>                                                                                                                                                                                                                                | <b>CLINICAL CONSEQUENCES</b>                                                                                                                                                                                     | <b>PFO PATHOGENIC ROLE</b> |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Obstructive sleep apnoea syndrome (OSAS) | <ul style="list-style-type: none"> <li>- Intermittent and then persistent pulmonary hypertension due to apnoea with hypoxaemia and hypercapnia causing vasoconstriction</li> <li>- Fluctuations in intrathoracic pressure during apnoea</li> </ul> | <ul style="list-style-type: none"> <li>- Exacerbation of hypoxaemia during apnoeic episodes [169-171]</li> <li>- More OSAS-related symptoms and at an earlier stage than in those without a PFO [169]</li> </ul> | POSSIBLE                   |

|                       |                          |                              |                     |
|-----------------------|--------------------------|------------------------------|---------------------|
| Exercise desaturation | - Pulmonary hypertension | - Reduced exercise tolerance | UNDER INVESTIGATION |
|-----------------------|--------------------------|------------------------------|---------------------|

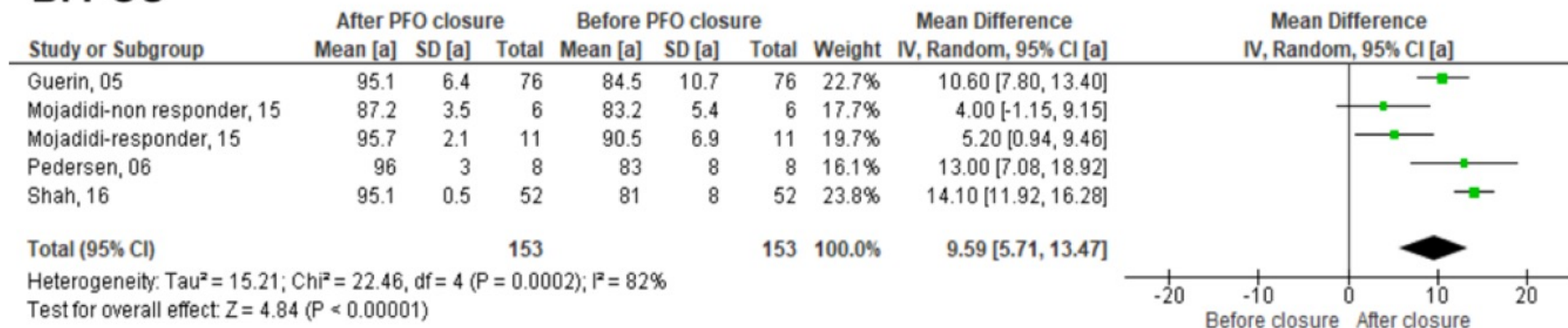
| <b>DISEASE</b>                              | <b>SHUNT CAUSES</b>                              | <b>CLINICAL<br/>CONSEQUENCES</b>                       | <b>PFO<br/>PATHOGENIC<br/>ROLE</b> |
|---------------------------------------------|--------------------------------------------------|--------------------------------------------------------|------------------------------------|
| High-altitude<br>pulmonary<br>oedema (HAPO) | - Pulmonary hypertension due to<br>hypoxia [177] | - Aggravation of<br>hypoxaemia and<br>pulmonary oedema | UNDER<br>INVESTIGATION             |

# LES ETUDES

## A. EXERCISE DESATURATION



## B. POS



# ... SUR LE PLAN PRATIQUE

## PRACTICAL SUMMARY 3: ARTERIAL DEOXYGENATION SYNDROMES

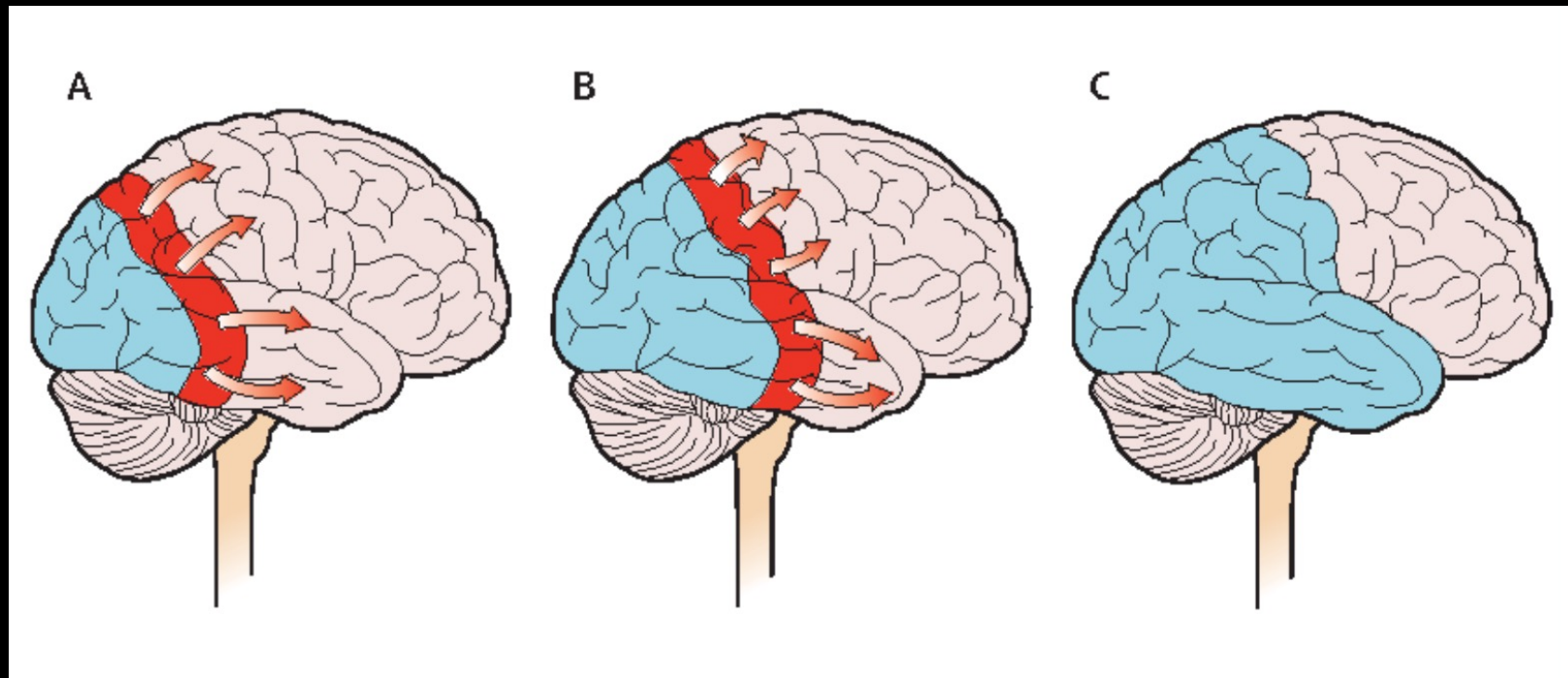
### WHAT TO DO

- Individually assess and weigh the role of all factors involved in the desaturation syndrome
- Whenever possible obtain invasive evidence of the PFO role
- Where appropriate, propose PFO closure with shared decision making underscoring the lack of evidence

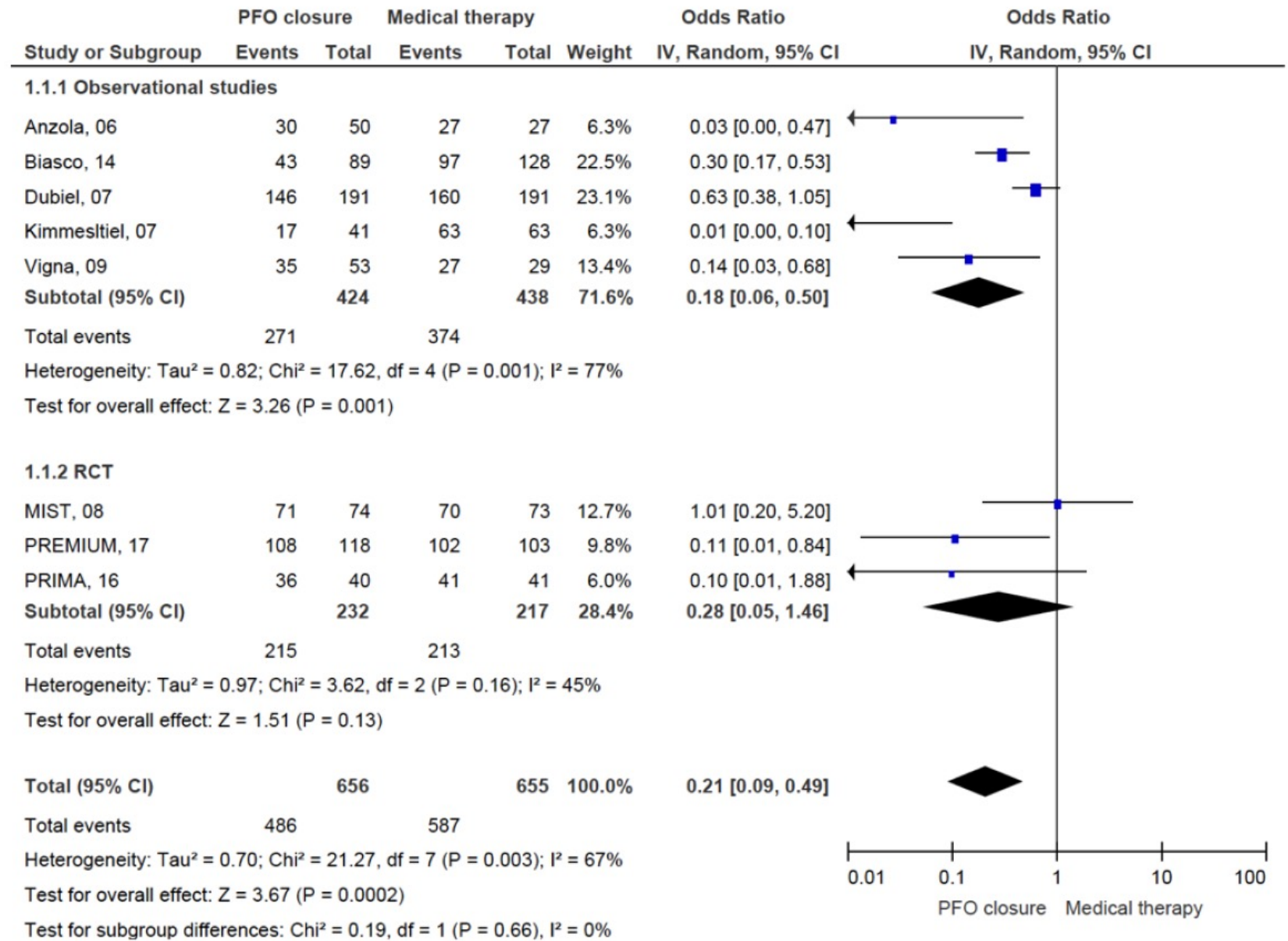
### WHAT NOT TO DO

- Routinely close PFO
- Close a PFO in the presence of severe chronic pulmonary hypertension
- Close a PFO without clear evidence of a crucial role in desaturation

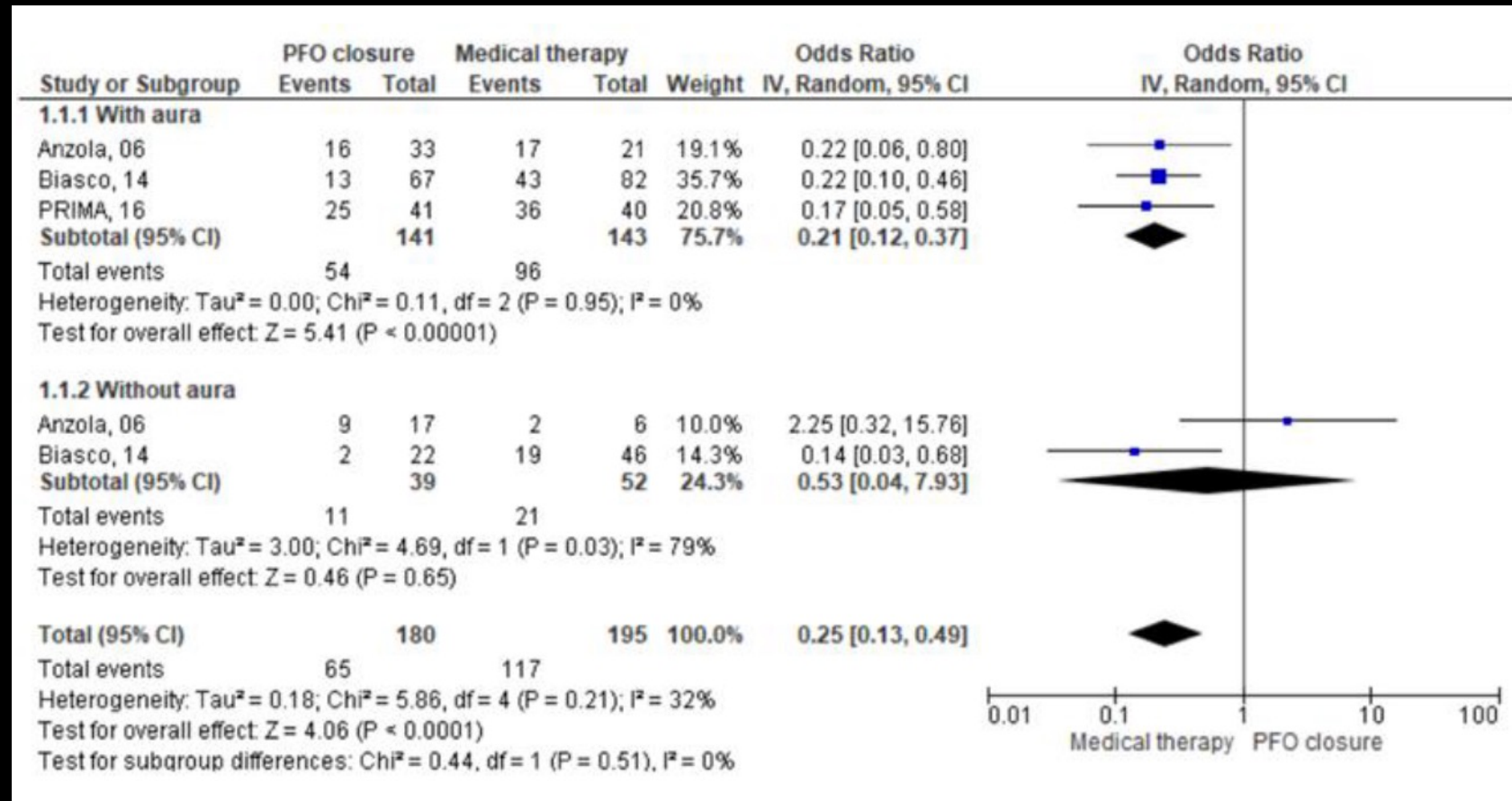
# MIGRAINE



# INCIDENCE DE MIGRAINE PERSISTENTE - Études avec 2 cohortes -

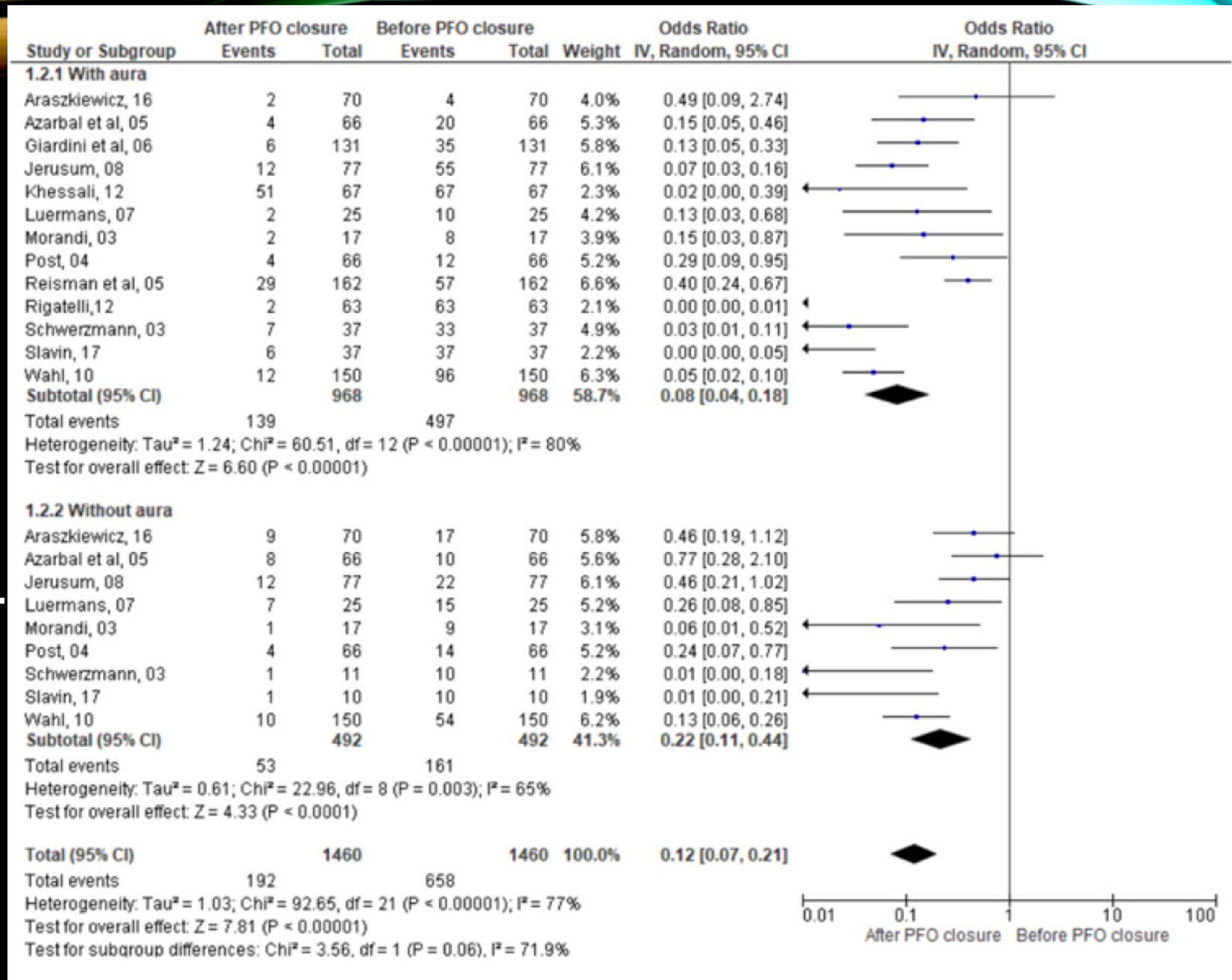


# INFLUENCE DE L'AURA



# INCIDENCE DE MIGRAINE PERSISTENTE

- Études observationnelles-



# ... SUR LE PLAN PRATIQUE

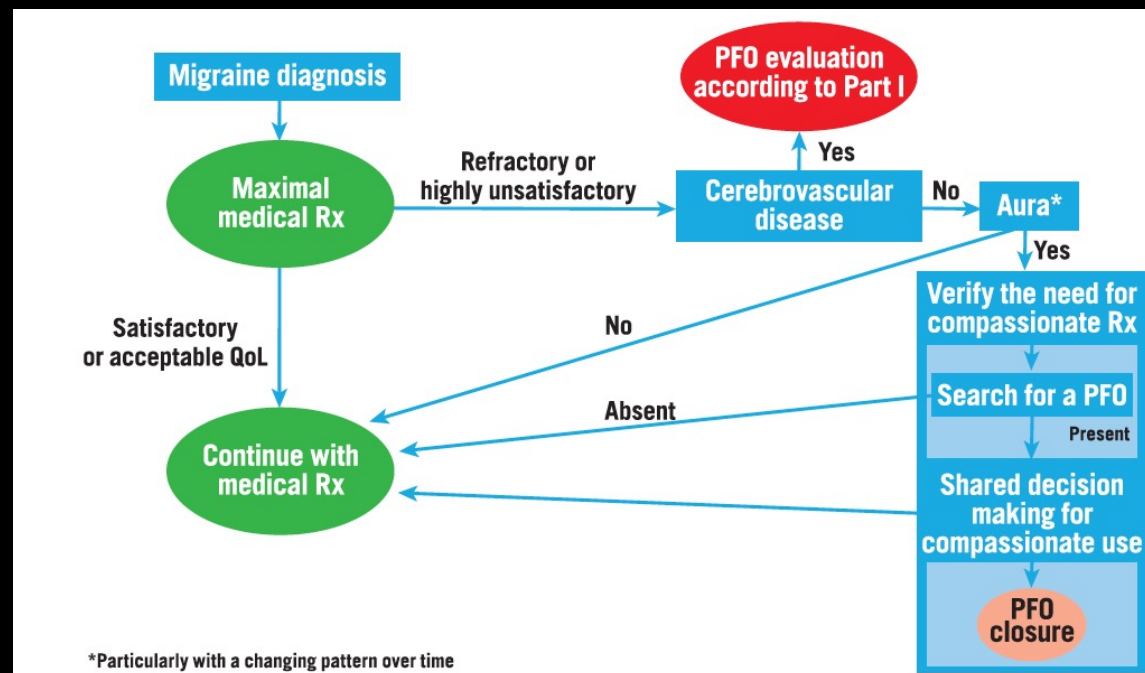
## PRACTICAL SUMMARY 2: MIGRAINE

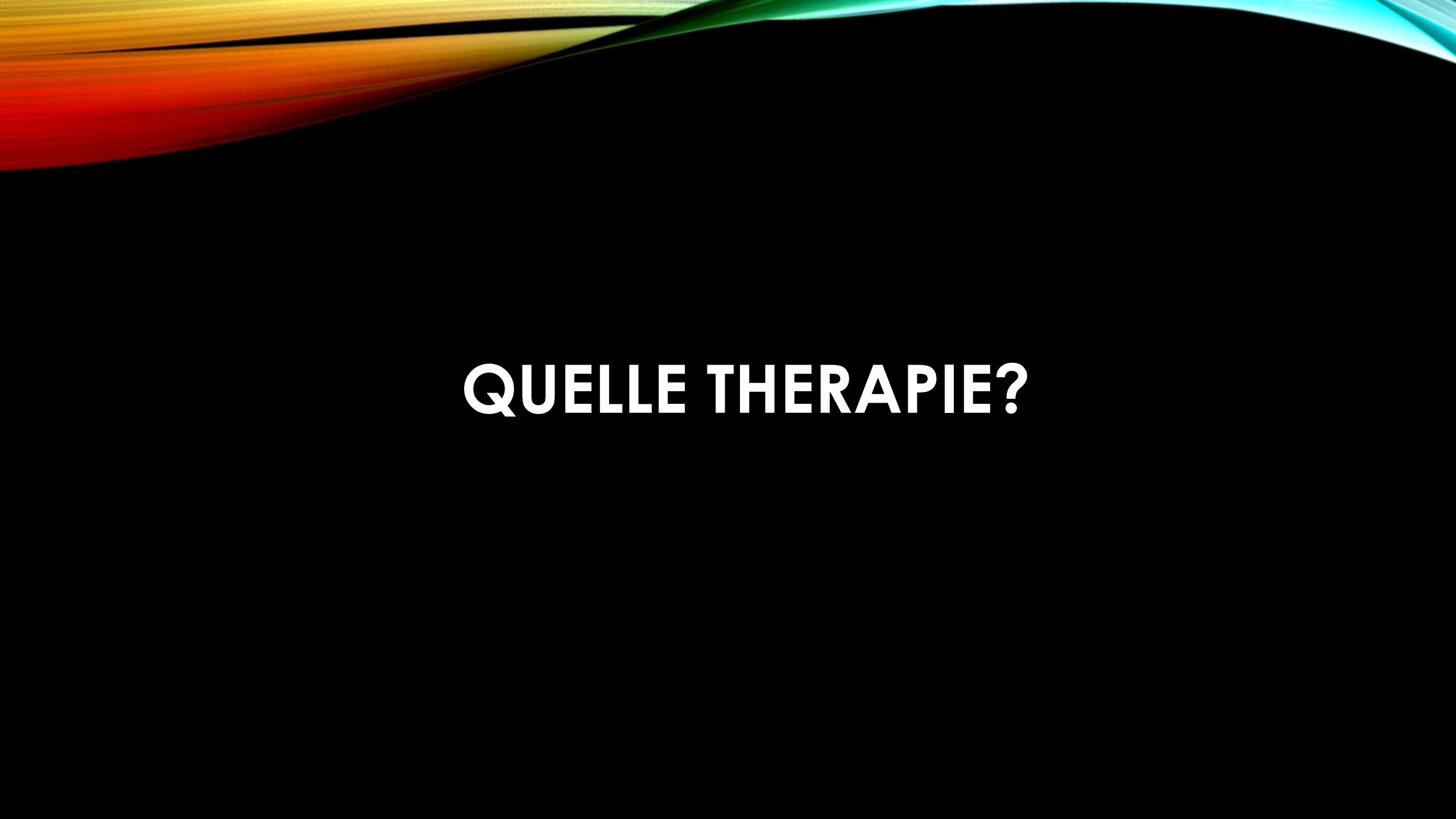
### WHAT TO DO

- Treat migraine with conventional therapies
- Consider PFO closure only in clinical trials or for compassionate use in migraine with aura

### WHAT NOT TO DO

- Consider PFO closure as part of a routine treatment algorithm



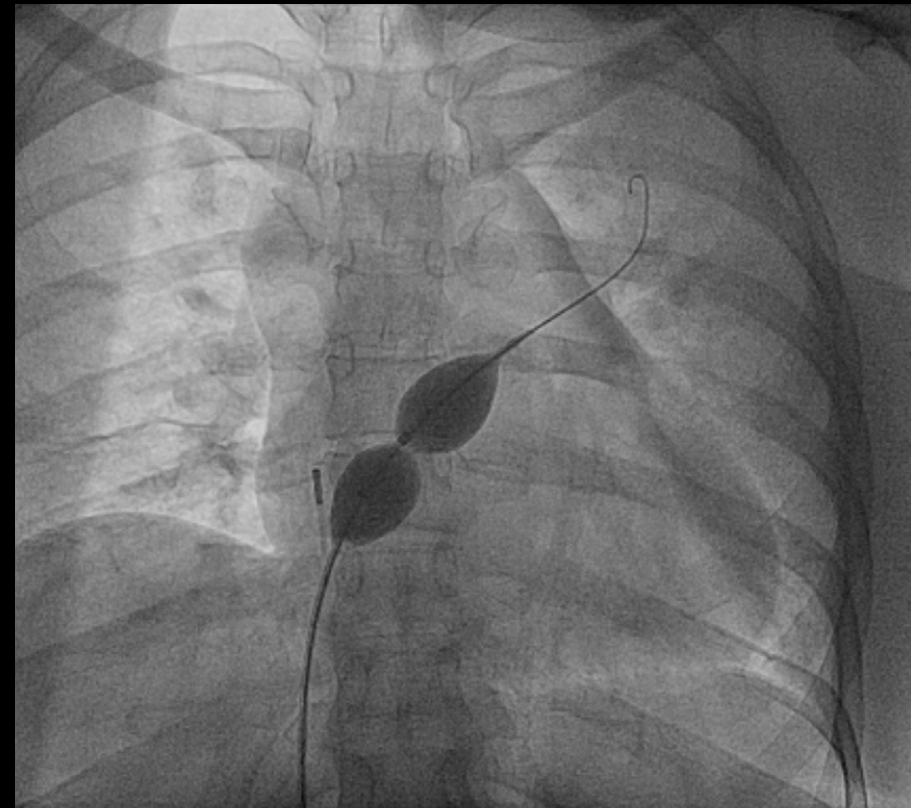
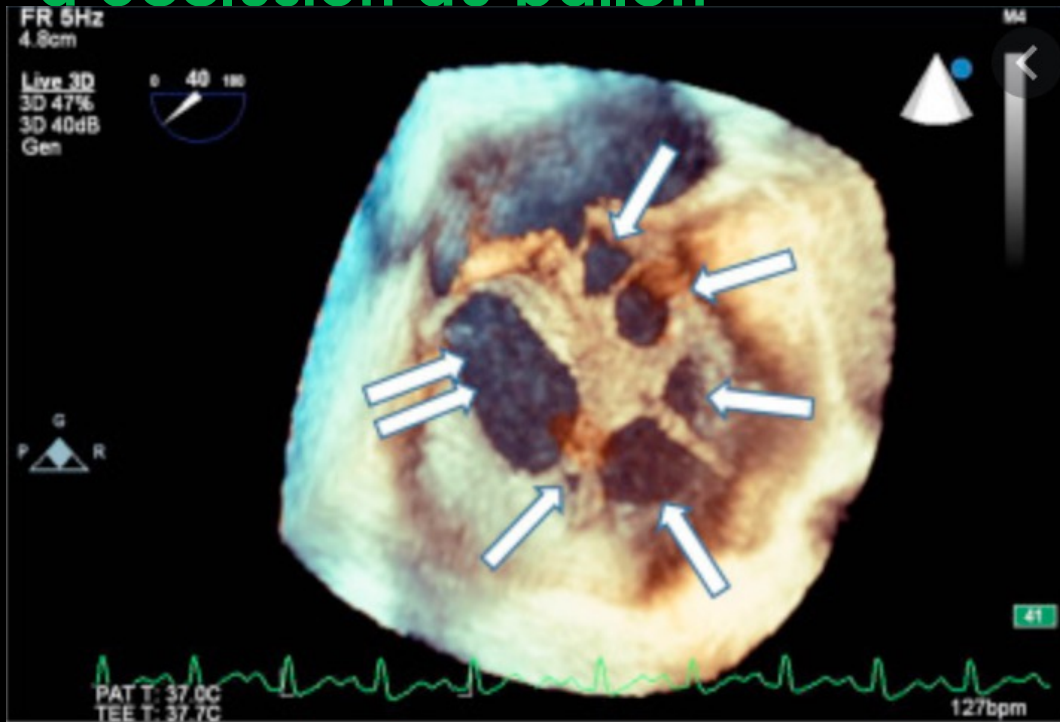
The image features a solid black background. At the top, there is a decorative, wavy border with a color gradient. From left to right, the colors transition from a warm orange-red to a bright yellow, then to a vibrant green, and finally to a light blue on the far right. The waves of the border are fluid and organic in shape.

**QUELLE THERAPIE?**

# TECHNIQUES ET PROTHESES

## MAXIMISATION DU SCELLEMENT

- **DEPISTAGE FENESTRATIONS (ETO 3D ) + avant et après largage ± Test d'occlusion au ballon**



# TECHNIQUES ET PROTHESES

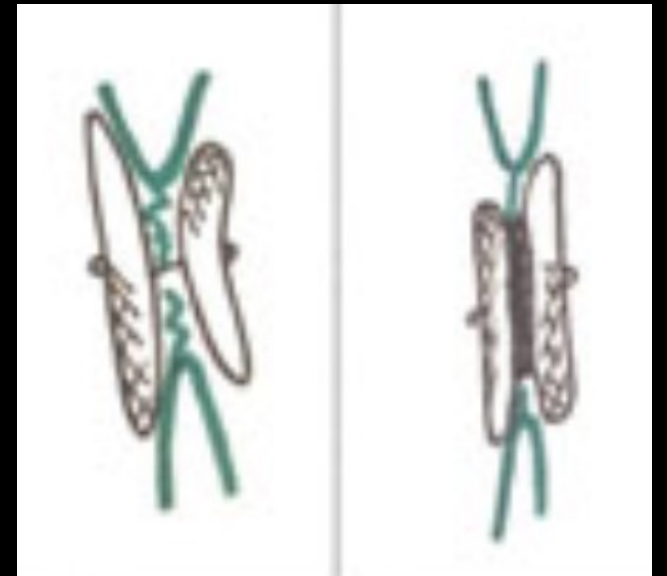
## MAXIMISATION DU SCELLEMENT

- DEPISTAGE FENESTRATIONS (ETO 3D ) + avant et après largage ± Test d'occlusion au ballon
- **Sizing par ballon –septostomie dans les cas SP rigide ou tunnel long**

# TECHNIQUES ET PROTHESES

## MAXIMISATION DU SCHELEMENT

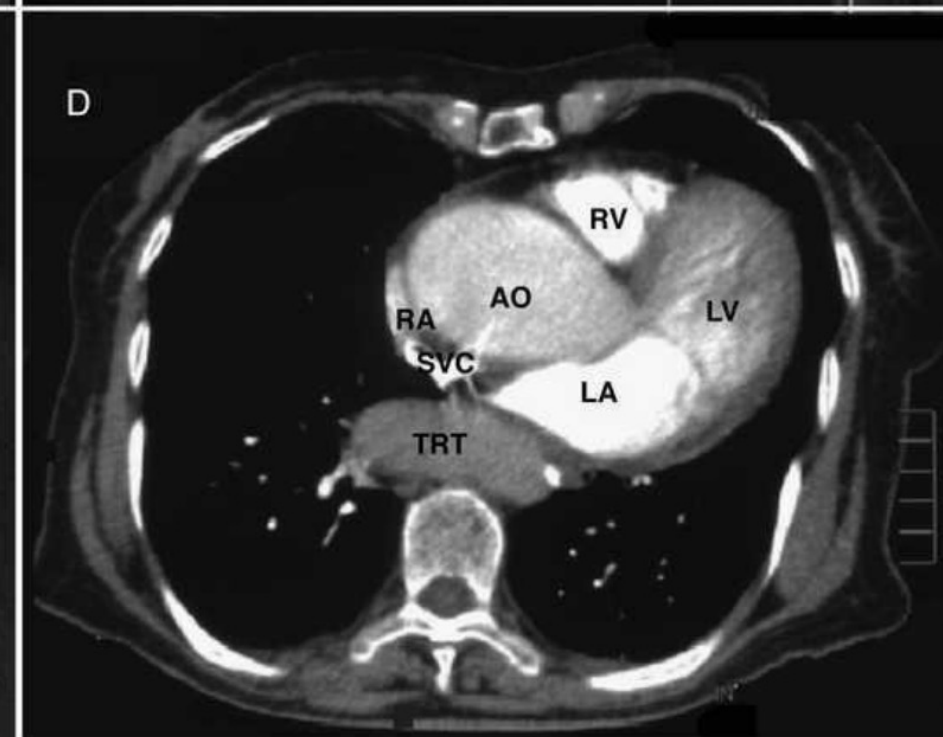
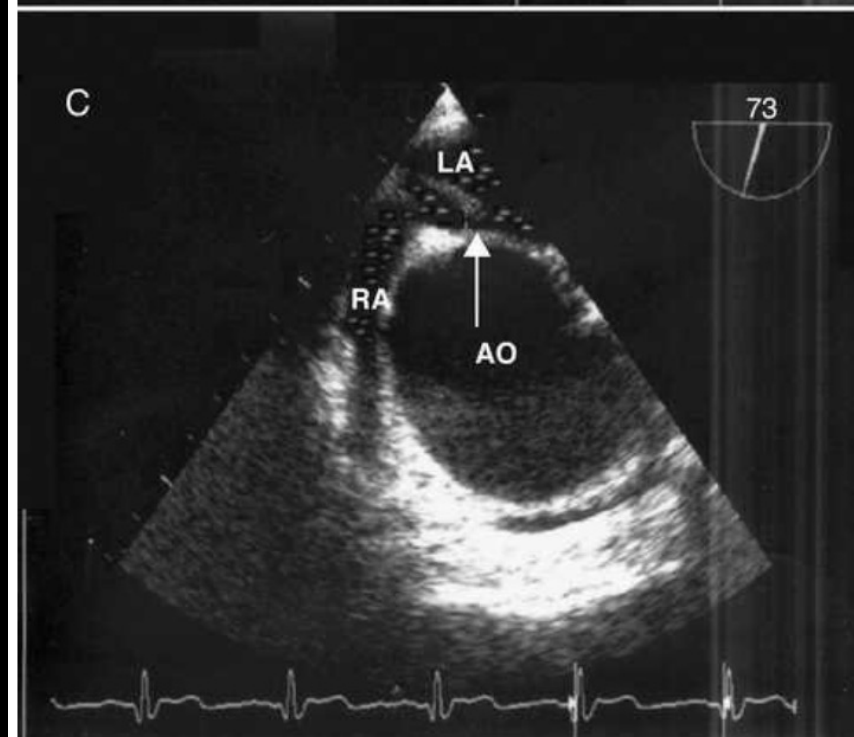
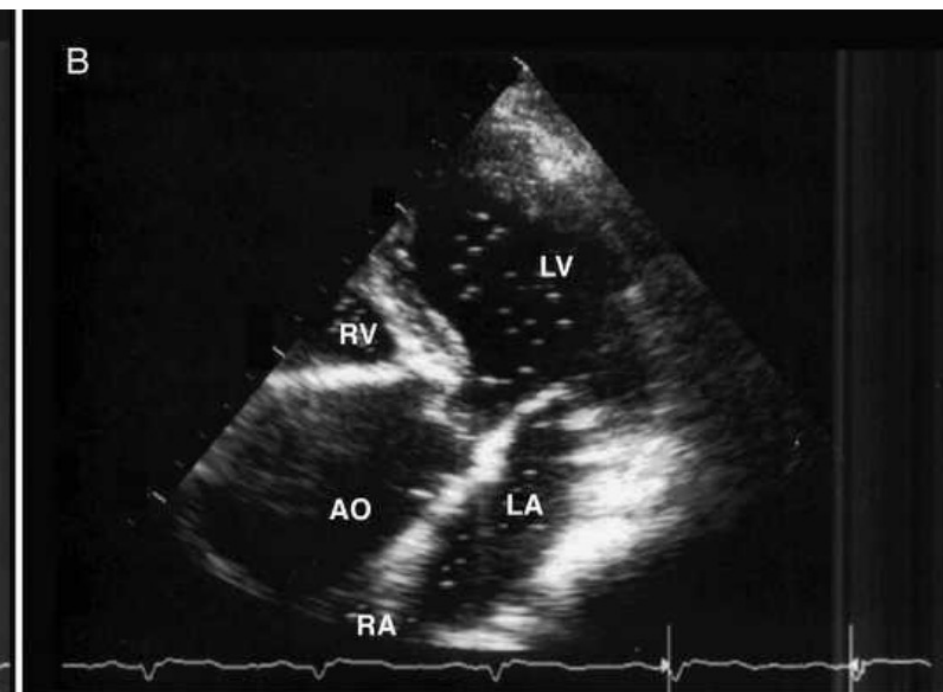
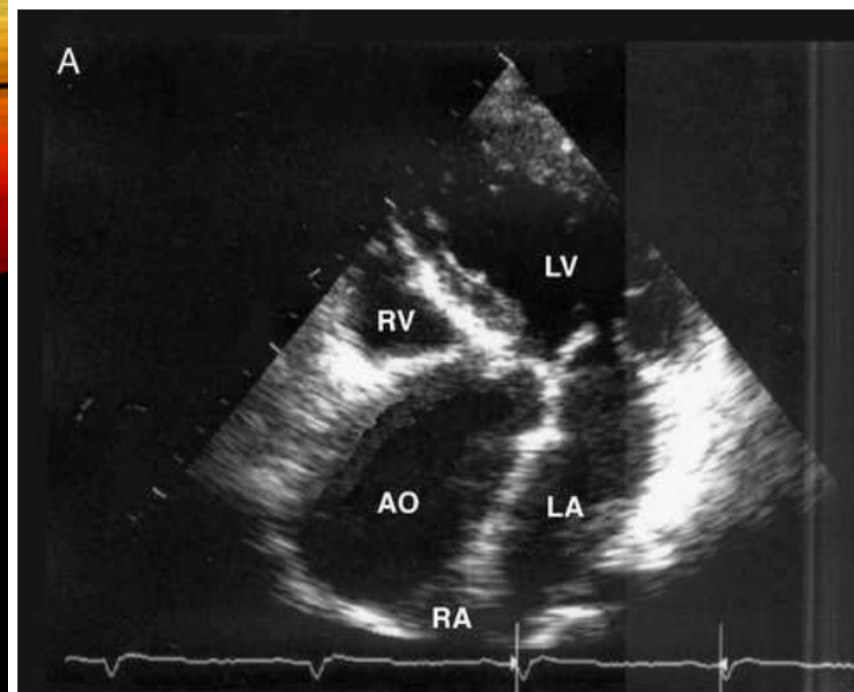
- DEPISTAGE FENESTRATIONS (ETO 3D ) + avant et après largage ± Test d'occlusion au ballon
- Sizing par ballon –septostomie dans les cas SP rigide ou tunnel long
- **Utilisation de device à plus forte tension radiale (double disc, dimensions plus petites)**
- **Diametres plus importants (SS épais OU ASIA)**



# TECHNIQUES ET PROTHESES

## MAXIMISATION DU SCELLEMENT

- DEPISTAGE FENESTRATIONS (ETO 3D ) + avant et après largage ± Test d'occlusion au ballon
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- Diametres plus importants (SS épais OU ASIA)
- **Dilatation aortique, septums épais: éviter prothèses non-autocentrantes**



# TECHNIQUES ET PROTHESES

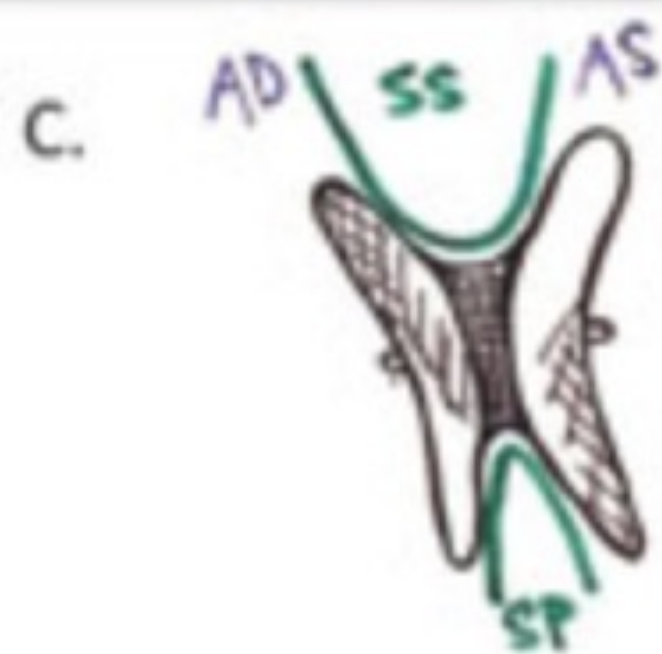
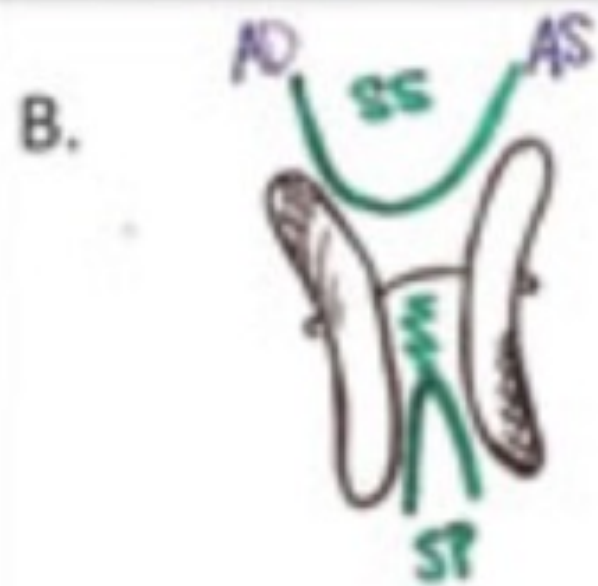
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- diametres plus importants (SS épais OU ASIA)
- Dilatation aortique, septums épais: éviter prothèses non-autocentrantes
- **Occlusions intra-tunnel (ASD avec ± septostomie préalable )**

# TECHNIQUES ET PROTHESES

## MAXIMISATION DU SCELLEMENT

- DEPISTAGE FENESTRATIONS (ETO 3D ) + avant et après largage ± Test d'occlusion au ballon
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- Dilatation aortique, septums épais: éviter prothèses non-autocentrantes
- Occlusions intra-tunnel (ASD avec ± septostomie préalable )
- **Vérification par test aux bulles intraprocédural (eventuel changement: CIA/CIV => ASIA, TUNNEL COURT, ANGULATION SEPTALE)**

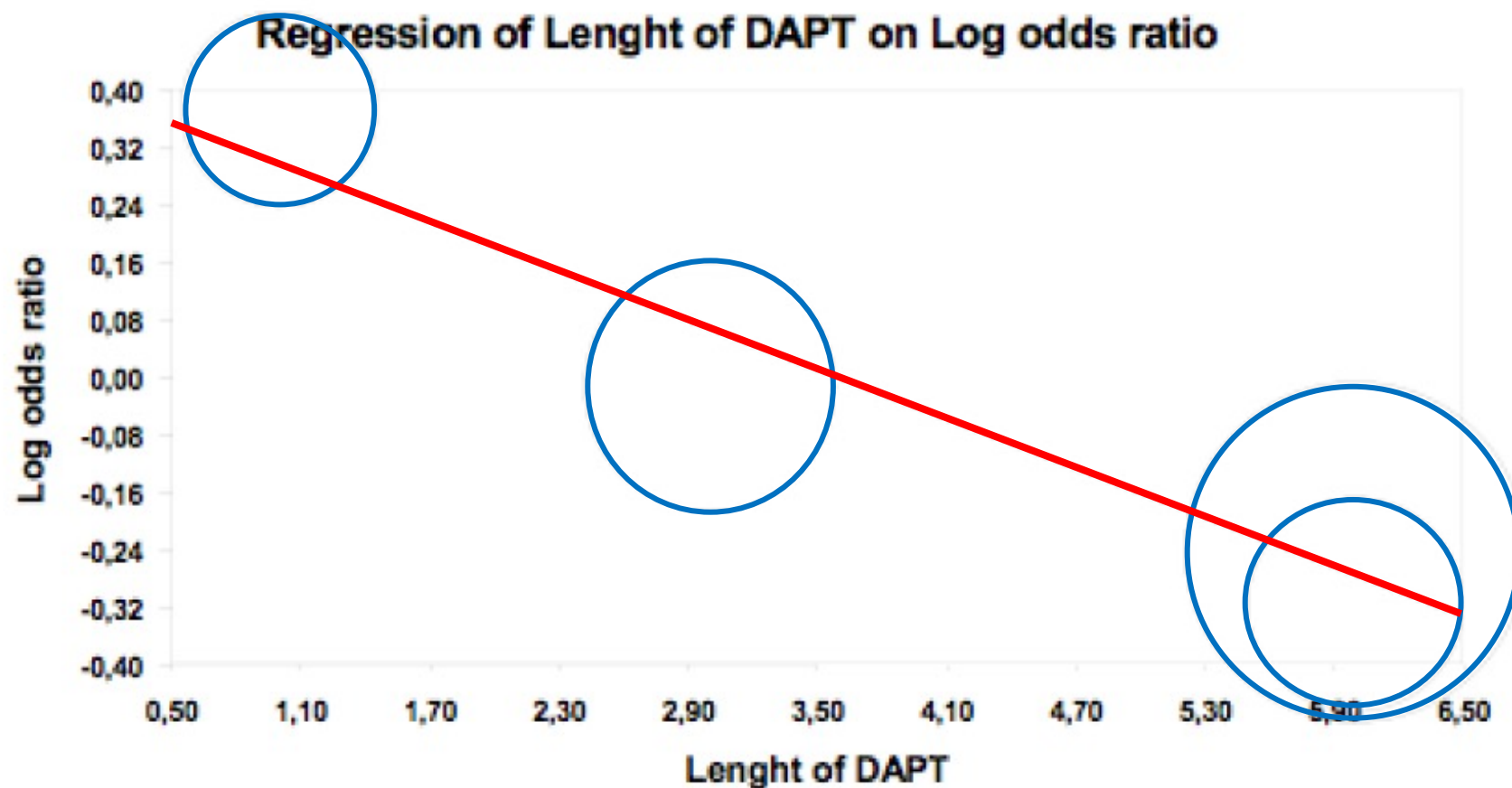


# TECHNIQUES ET PROTHESES

## MAXIMISATION DU SCHELEMENT

- DEPISTAGE FENESTRATIONS (ETO 3D ) + avant et après largage ± Test d'occlusion au ballon
- Sizing par ballon –septostomie dans les cas SP rigide ou tunnel long
- Utilisation de device à plus forte tension radiale (double disc, dimensions plus petites)
- Diametres plus importants (SS épais OU ASIA)
- Dilatation aortique, septums épais: éviter prothèses non-autocentrantes
- Occlusions intra-tunnel (CARDIA ASD),
- Vérification par test aux bulles intraprocédural (eventuel changement: CIA/CIV => ASIA, TUNNEL COURT, ANGULATION SEPTALE)
- **Utilisation de betabloquants dans le suivi**

## A. TIA



# CONCLUSIONS

- LES INDICATIONS POUR LA FERMETURE DU FOP VONT AU DELA DES ACV
- LA SELECTION DES PATIENTS EST FONDAMENTALE
- LES INDICATIONS ET LE TRAITEMENT PERSONALISES SONT  
INDISPENSABLES
- LES TECHNIQUES ET LES PROTHESES VARIENT EN FONCTION DE  
L'OBJECTIF