

PFO Closure for Stroke Prevention and Migraine Treatment

Bernhard Meier, MD

**Conflicts of interest:
Research grants and speaker fees
from AGA**

Swiss Cardiovascular Center Bern
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Within the past 12 months, Bernhard Meier has had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship

Company

Grant/Research Support

AGA

Disclosure Statement of Financial Interest

History of Interventional Cardiology

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Nurse, 39 Years, Mother of 2 Teenage-Boys



Nurse, 39 Years, Mother of 2 Teenage-Boys **permanently aphasic** after stroke



MIST Serious Adverse Events

74 patients

implant group

tamponade

pericardial effusion

retroperitoneal bleed

atrial fibrillation

chest pain

73 patients

sham group

incision site bleed

anemia

nose bleed

brainstem stroke

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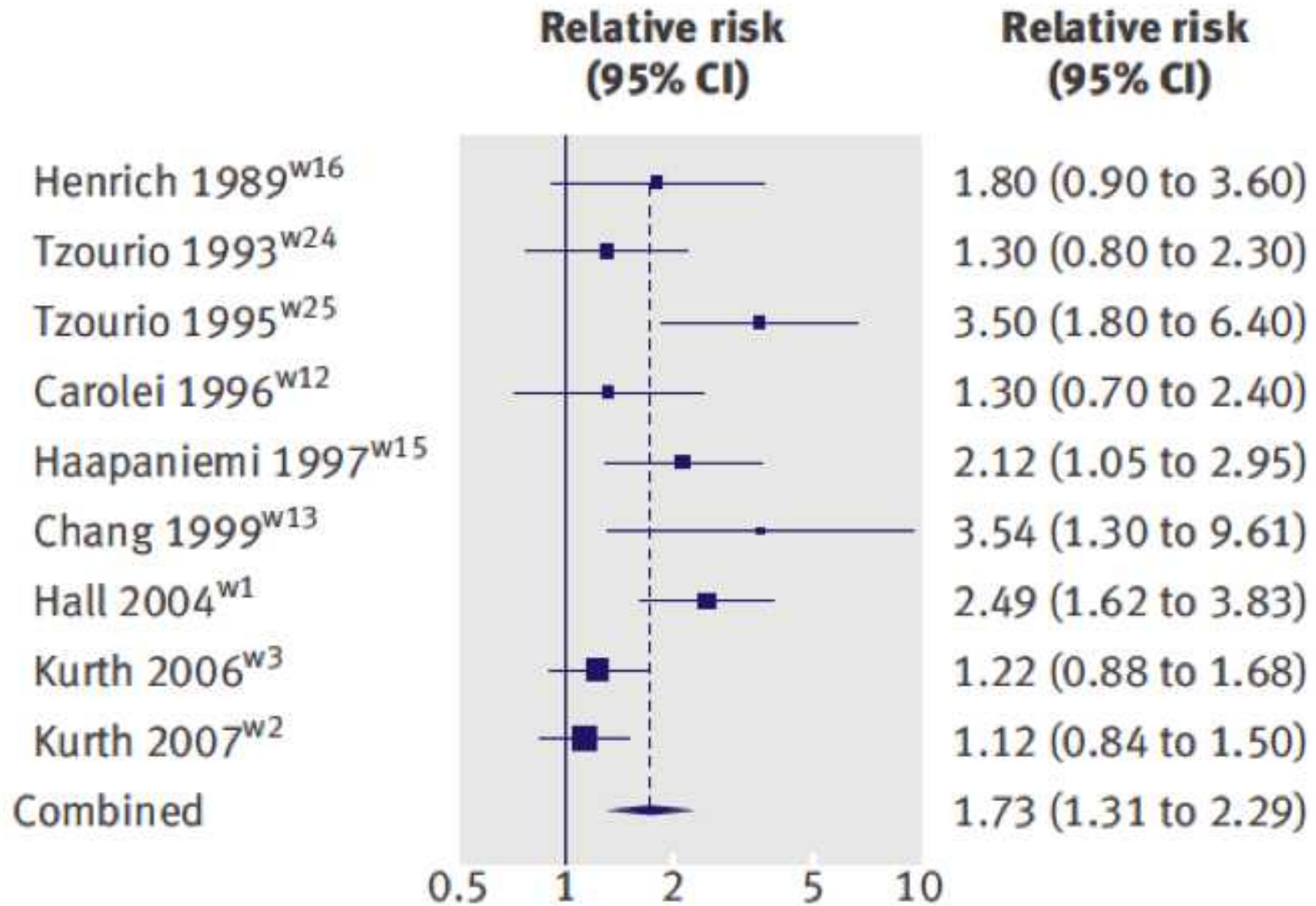
anemia

nose bleed

brainstem stroke

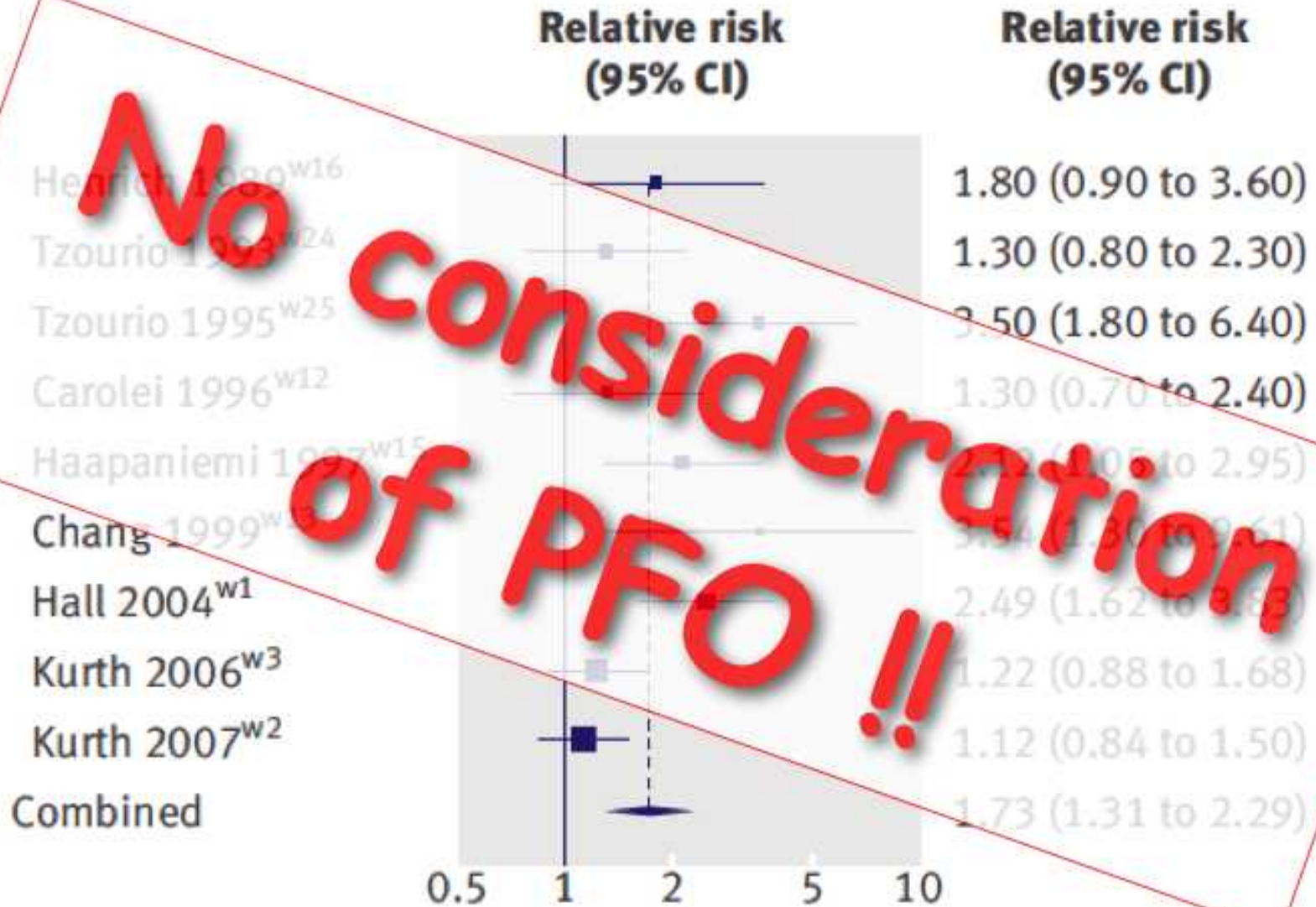
Migraine and Stroke

Metaanalysis



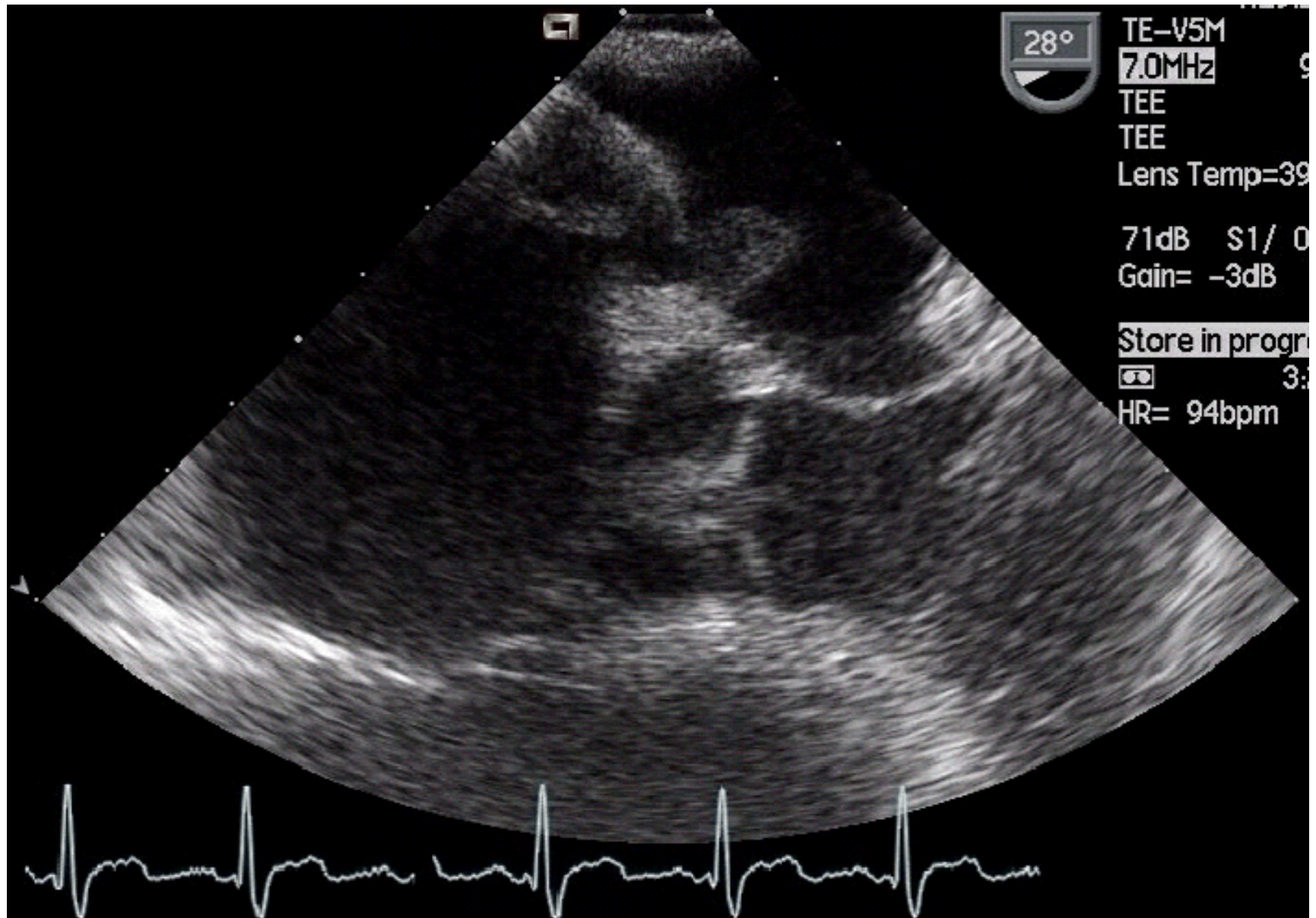
Heterogeneity: $Q=22.9$, $df=8$, $P=0.004$, $I^2=65\%$

Migraine and Stroke Metaanalysis



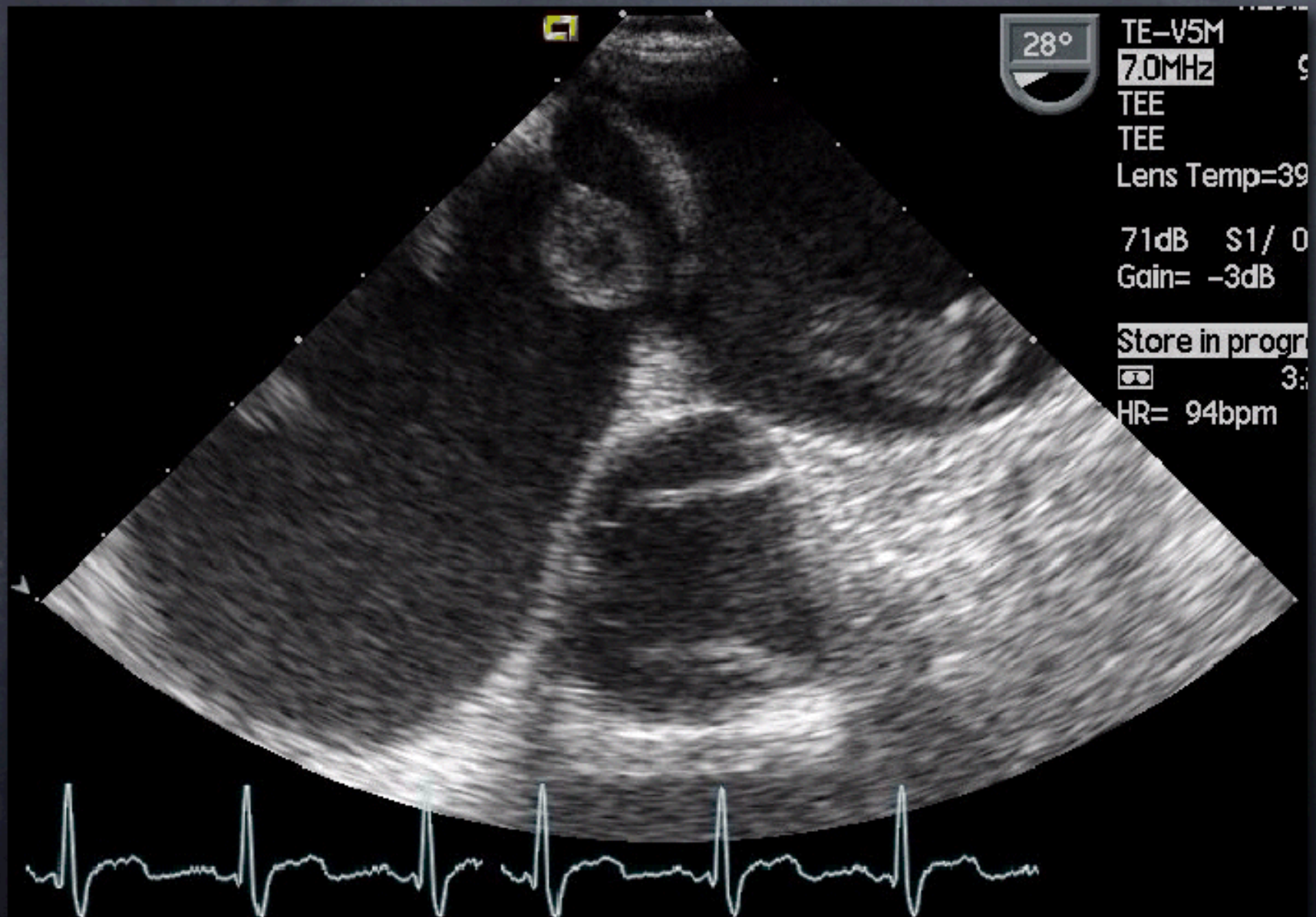
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„Caught in the act“: thrombus stuck in PFO



Paradoxical Embolism (45-year-old man)

„Caught in the act“: thrombus stuck in PFO



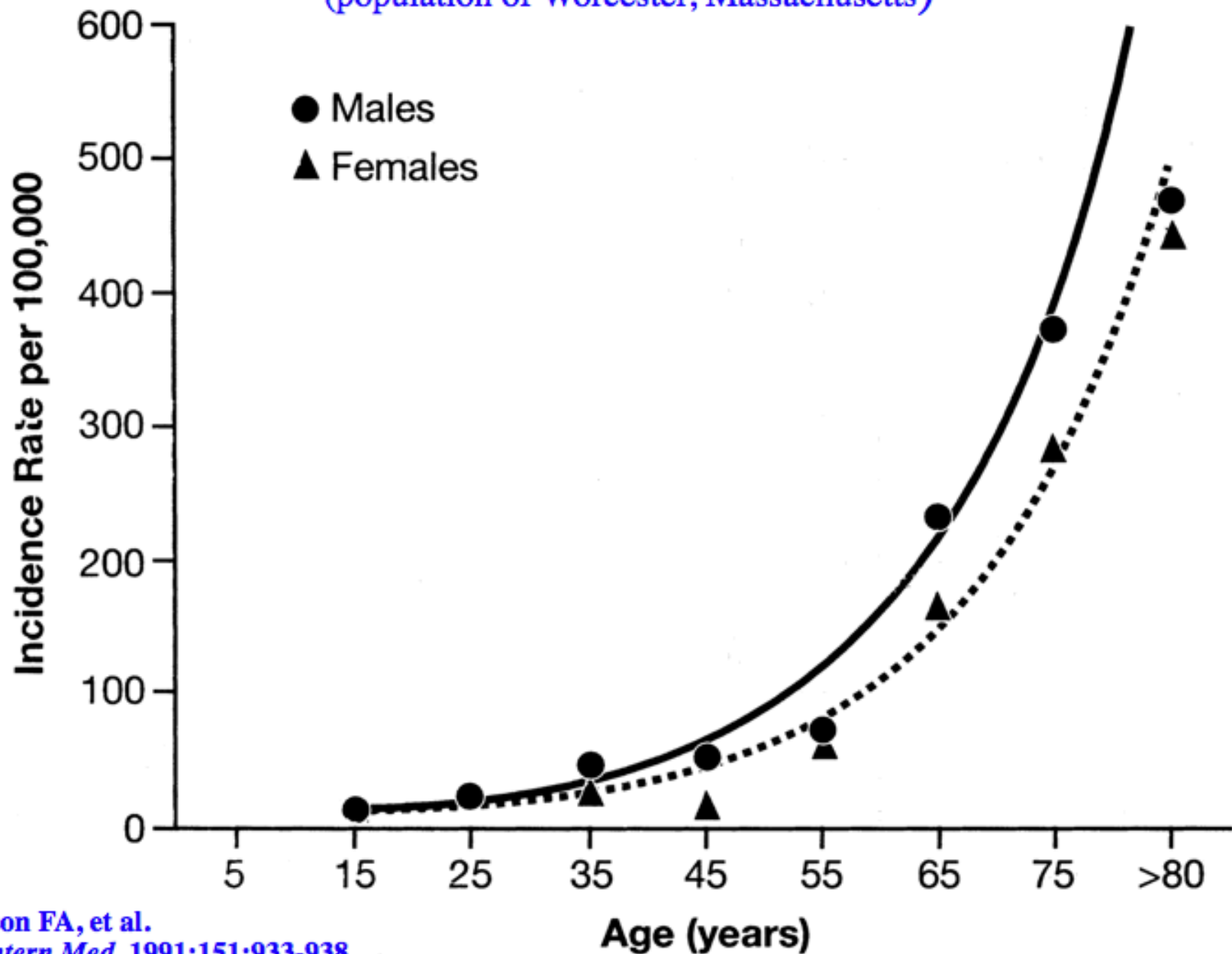
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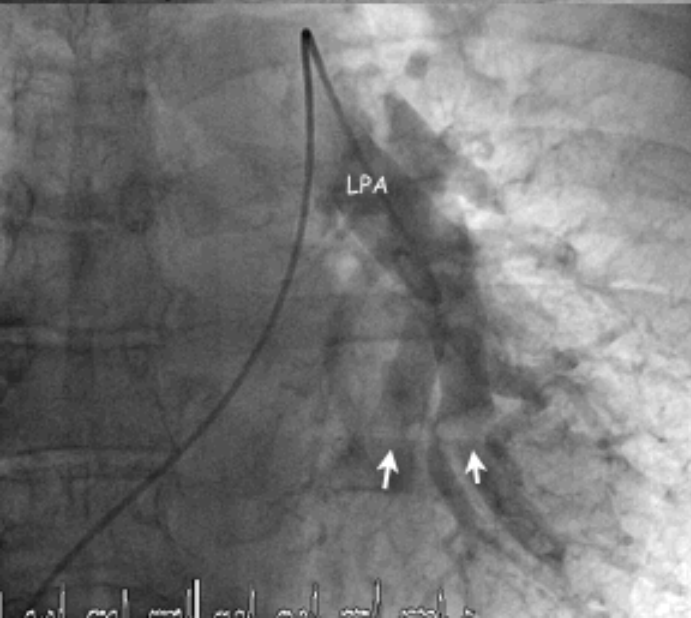
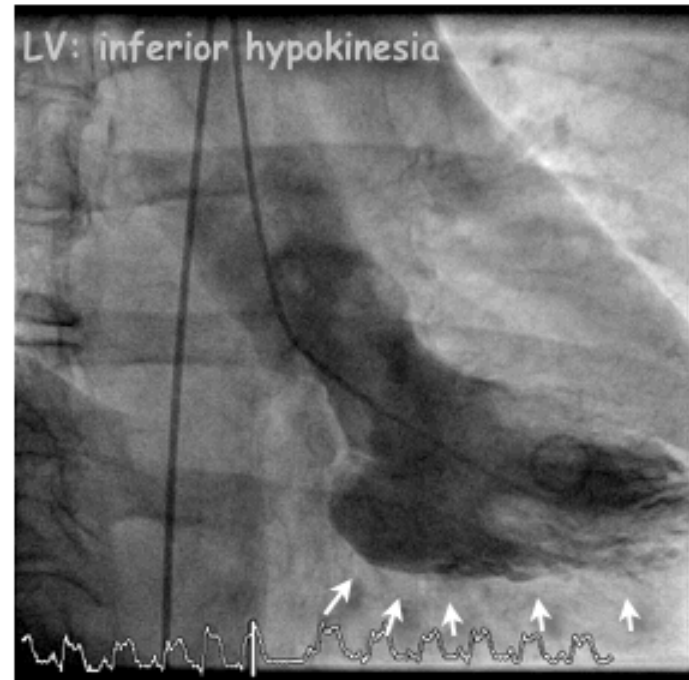
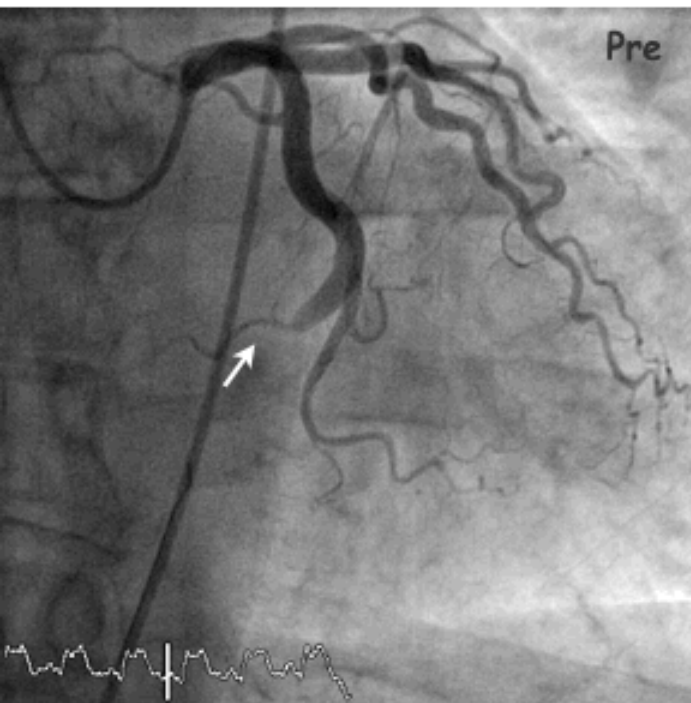


Annual Incidence of Venous Thrombotic Events

(population of Worcester, Massachusetts)

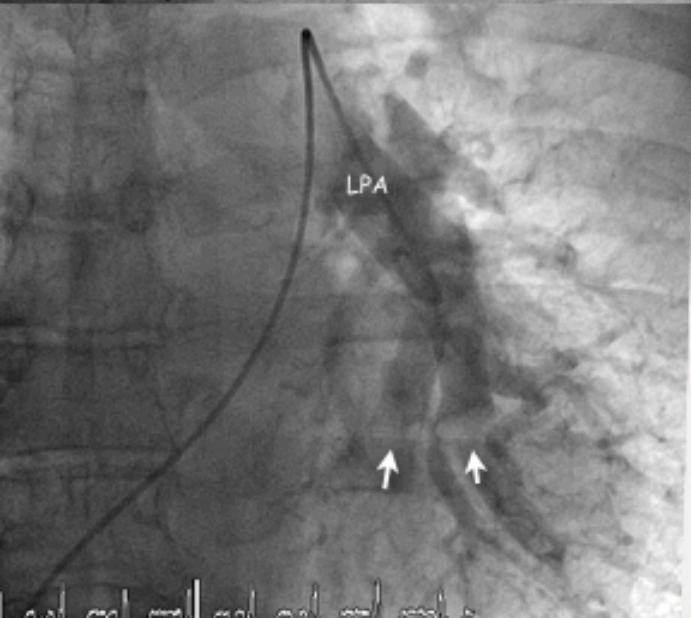
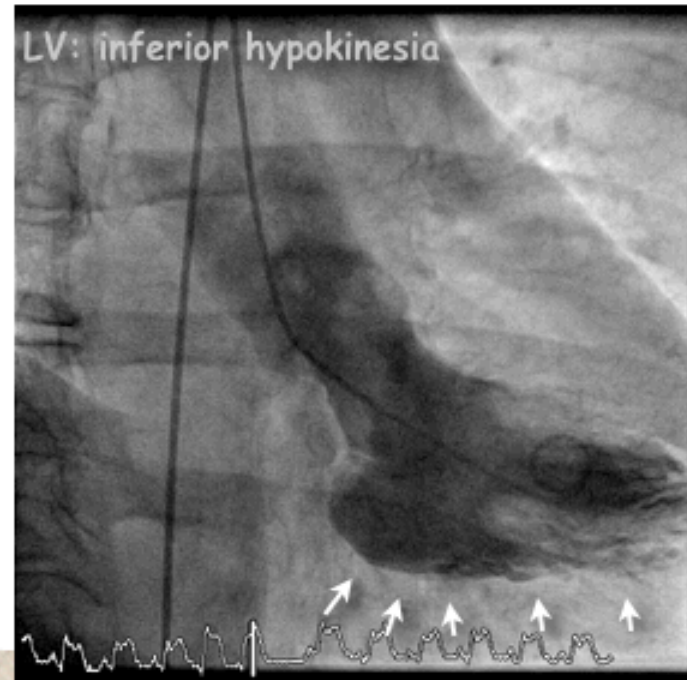
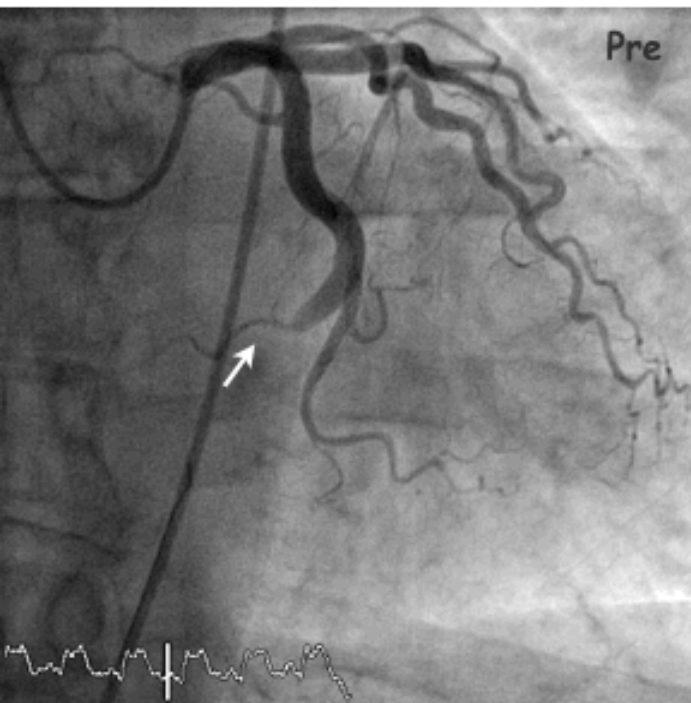


Pulmonary Embolism and Simultaneous Paradoxical Embolism to Dominant LCX with Inferior MI
(Woman, 69 y, 8-hour train ride with pre-syncope, severe dyspnea at rest, and inferior ST-elevation the next morning)

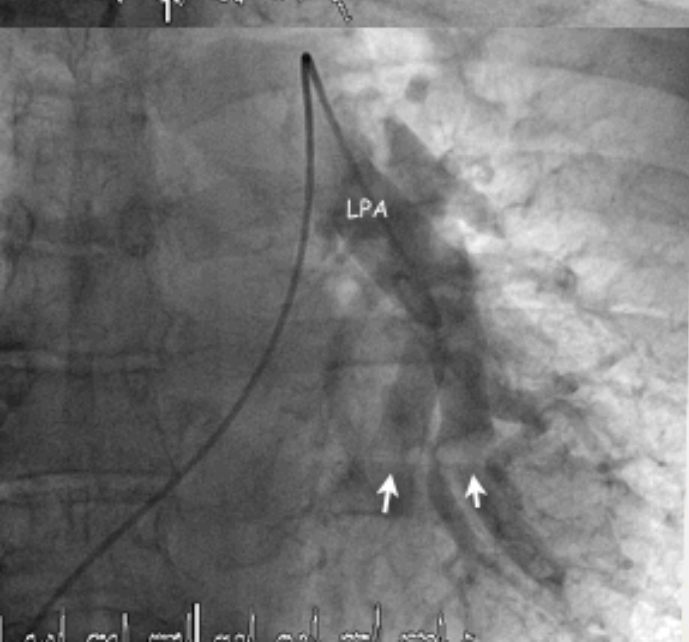
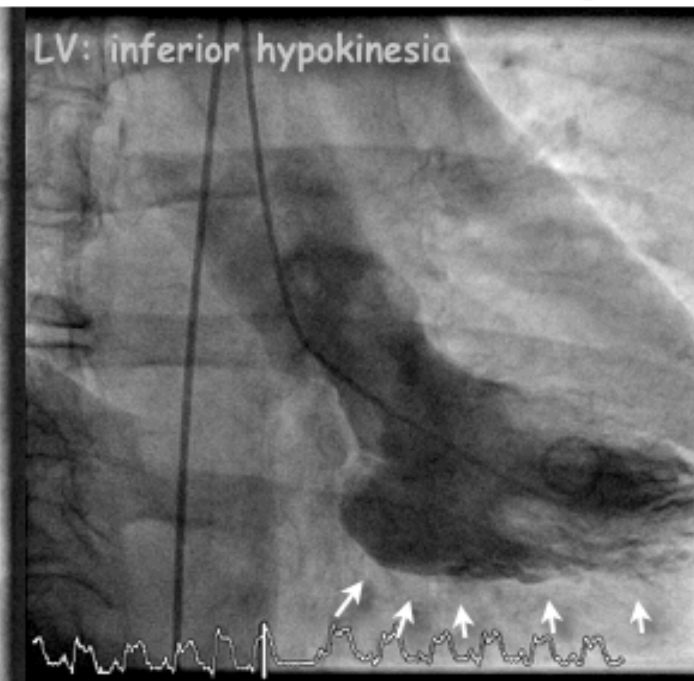
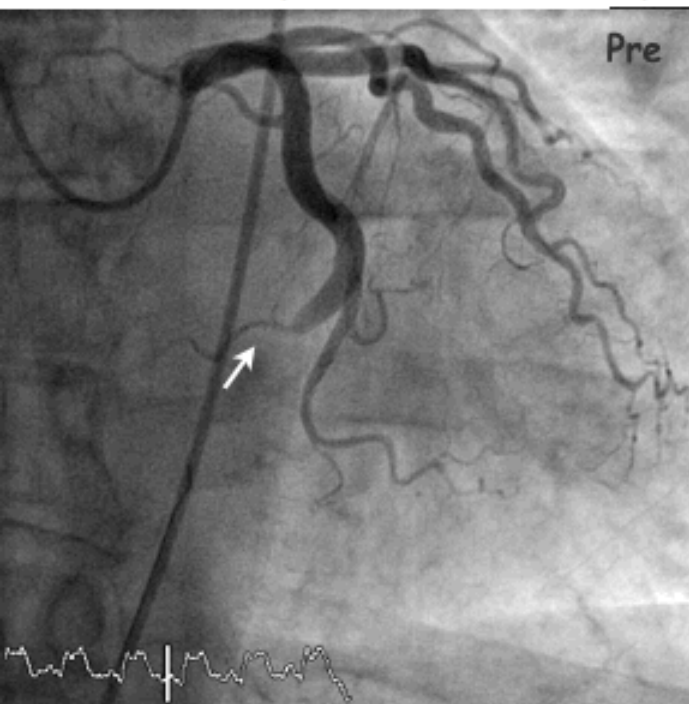


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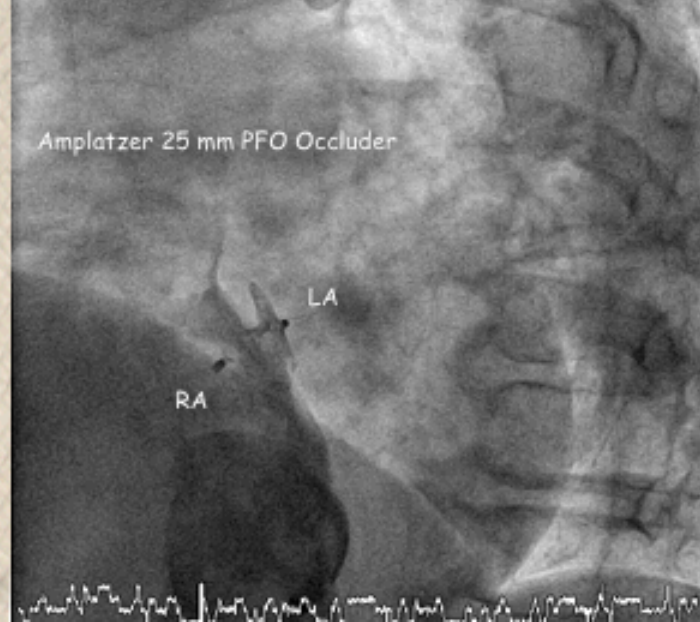
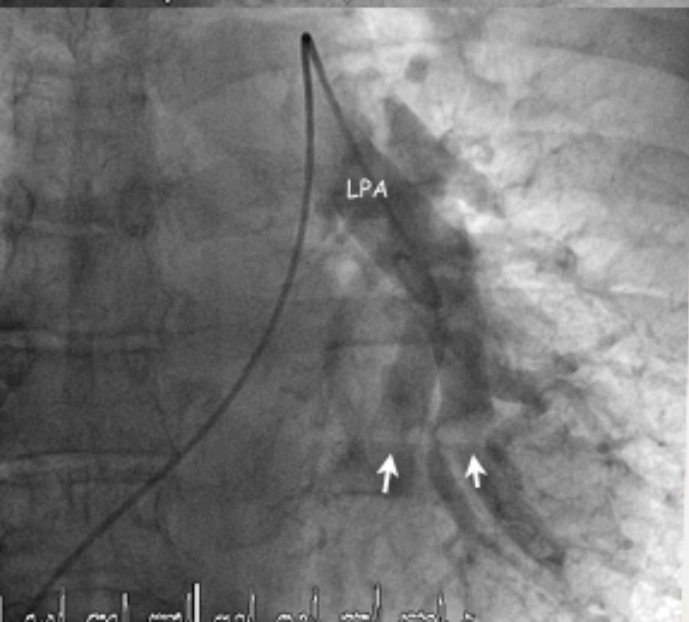
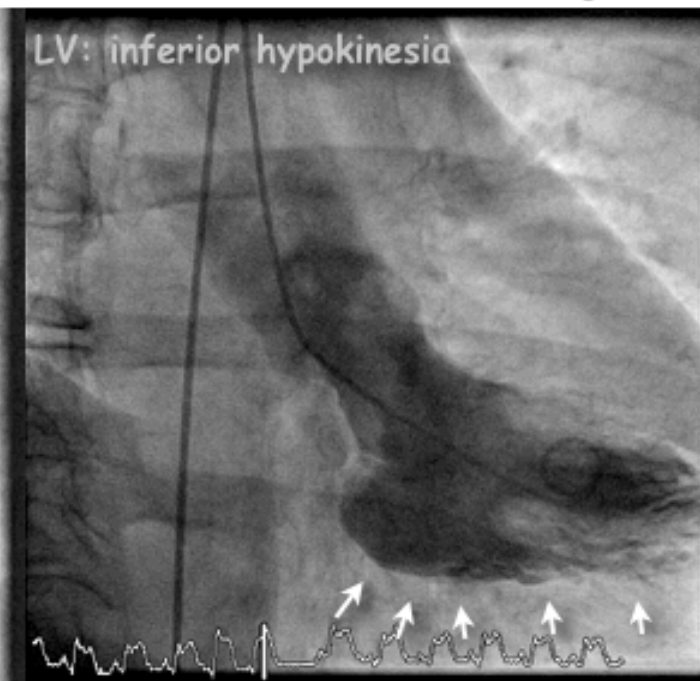
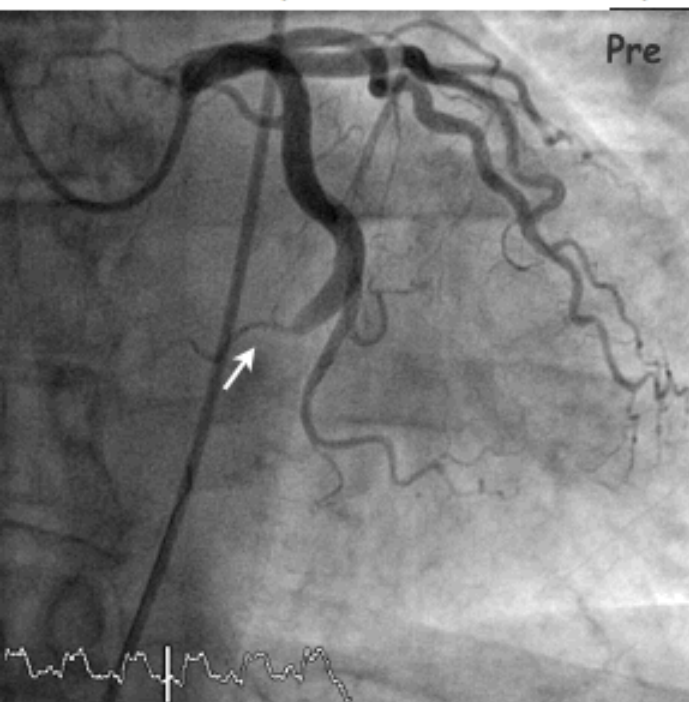


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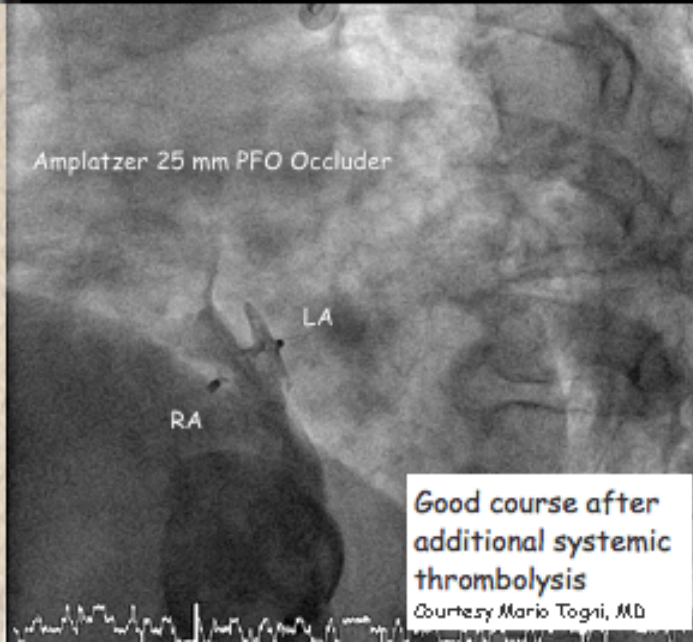
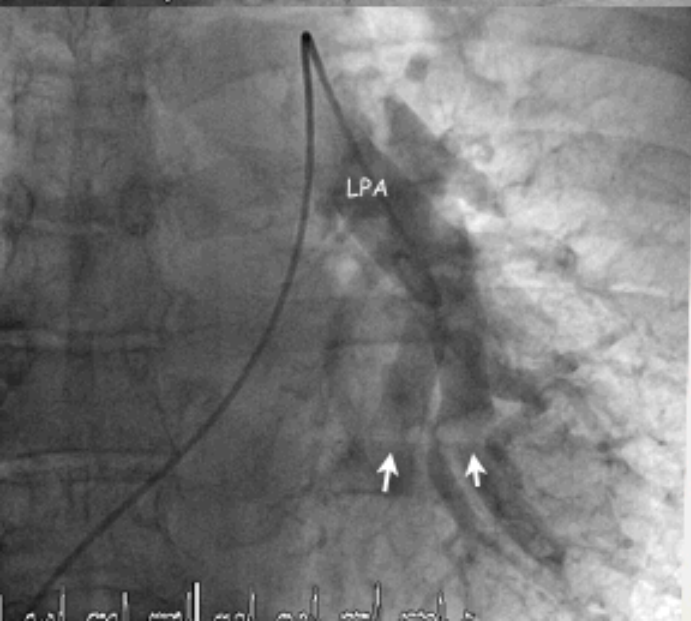
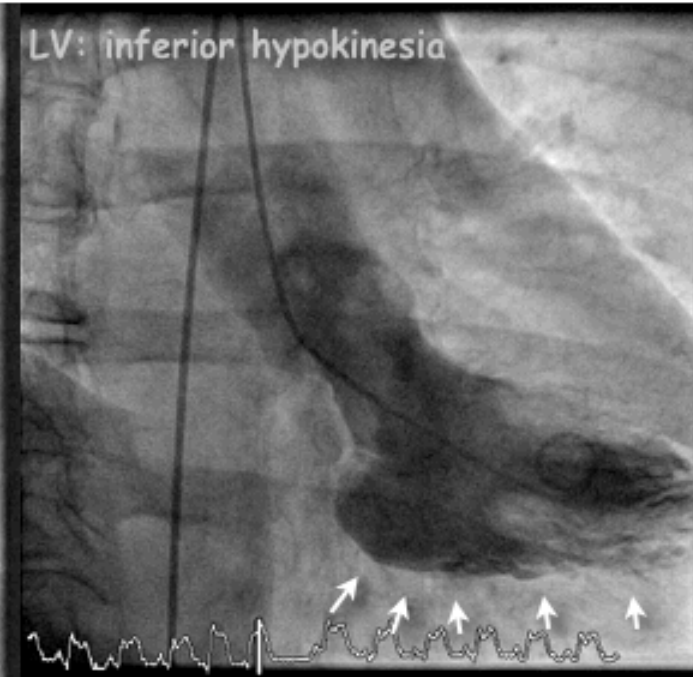
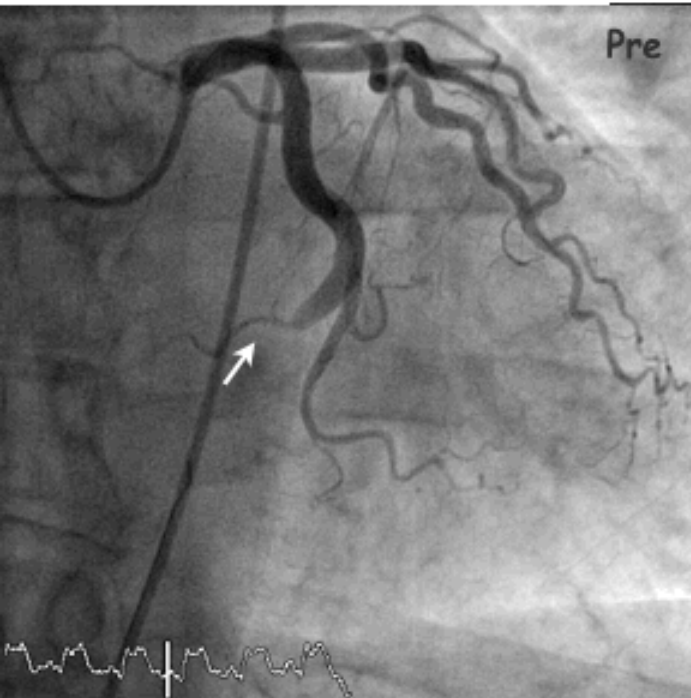
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Good course after additional systemic thrombolysis
Courtesy Mario Togni, MD

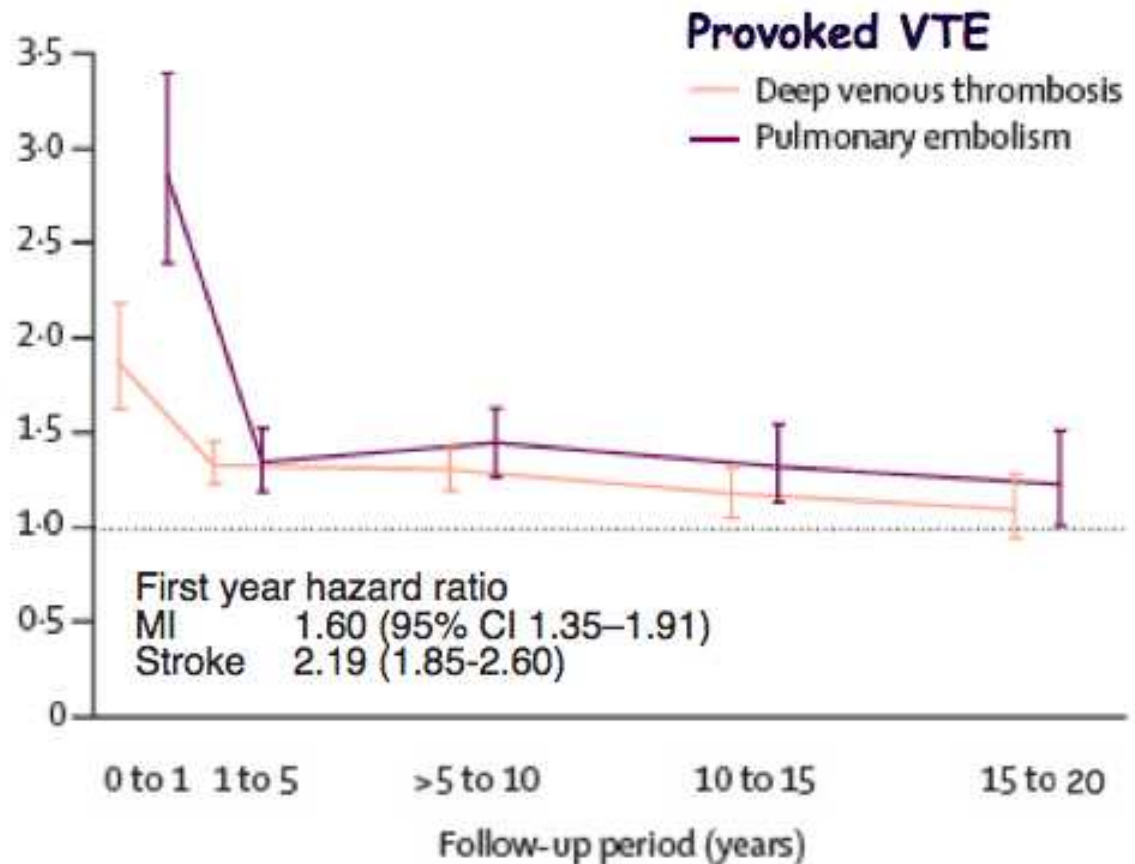
Venous Thromboembolism (VTE) and Stroke/MI

- 20-year population-based cohort study
- Danish medical databases
- No known cardiovascular disease
- 25 199 patients with deep venous thrombosis
- 16 925 patients with pulmonary embolism
- 163 566 population controls

Paper
Sørensen HT, Lancet 2007; 370: 1773–9
(Denmark, Italy, US)

Editorial
O Lowe GD, Lancet 2007; 370: 1743-4
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Relative Risk of MI or Stroke



Venous Thromboembolism (VTE) and Stroke/MI

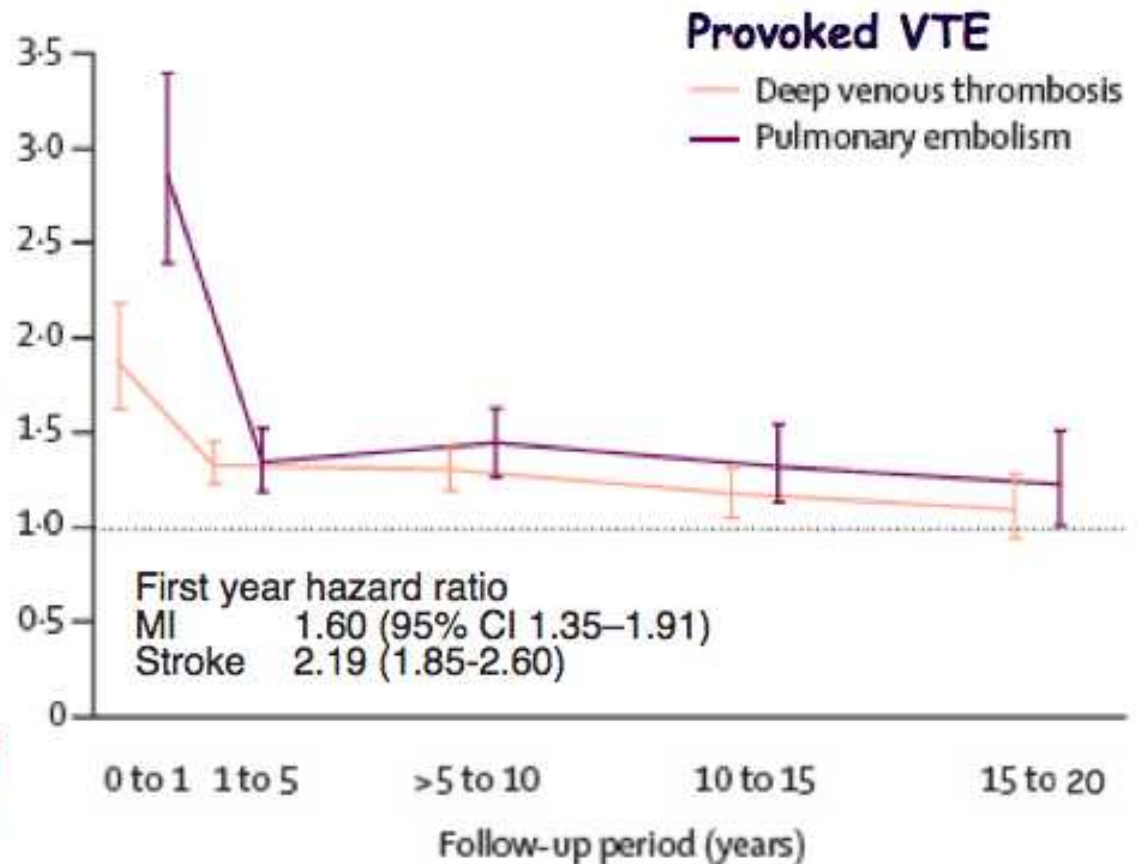
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Relative Risk of MI or Stroke



PFO as Predictor of Adverse Outcome in Patients With Major Pulmonary Embolism

Konstantinides S et al. *Circulation* 1998;97:1946

- 139 patients with major pulmonary embolism undergoing TEE
 - 35% with PFO
 - 59±17 (17 - 89) years
- Clinical endpoints
 - death
 - cerebral embolism
 - arterial thrombo-embolism
 - major bleeding

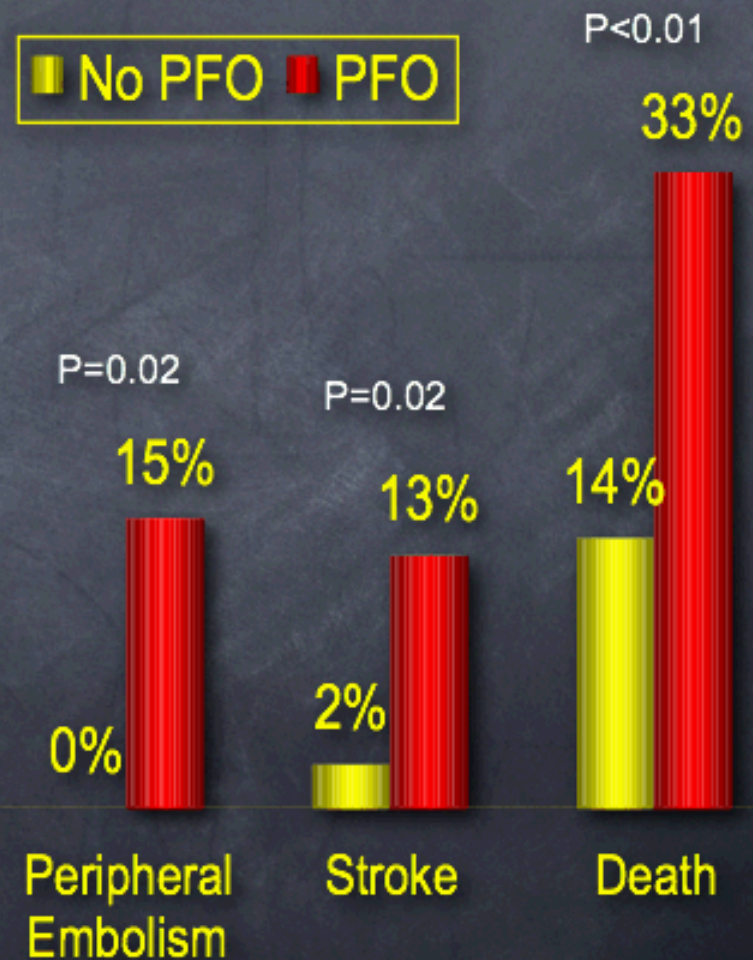
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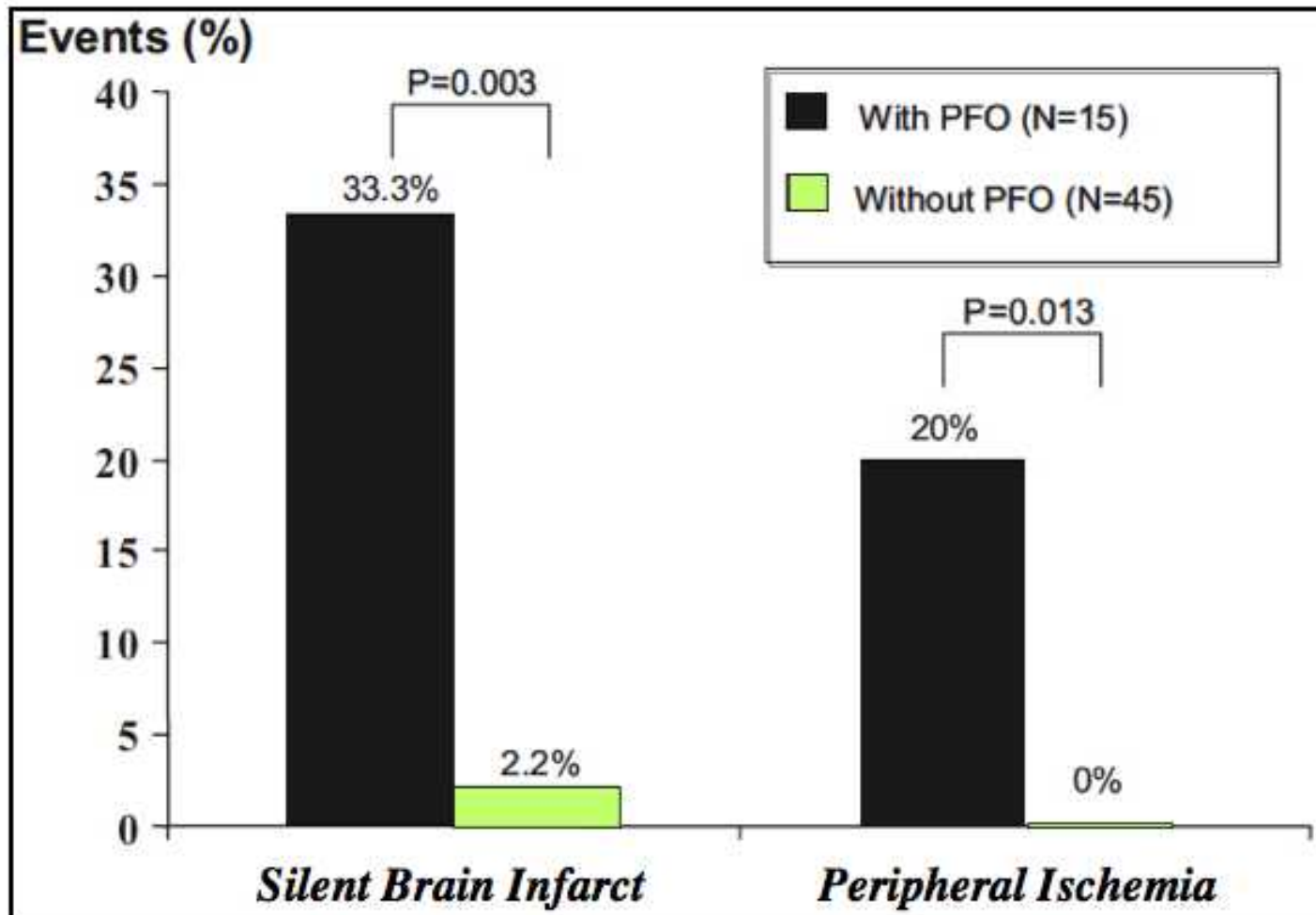
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PFO: Pulmonary Embolism and Stroke

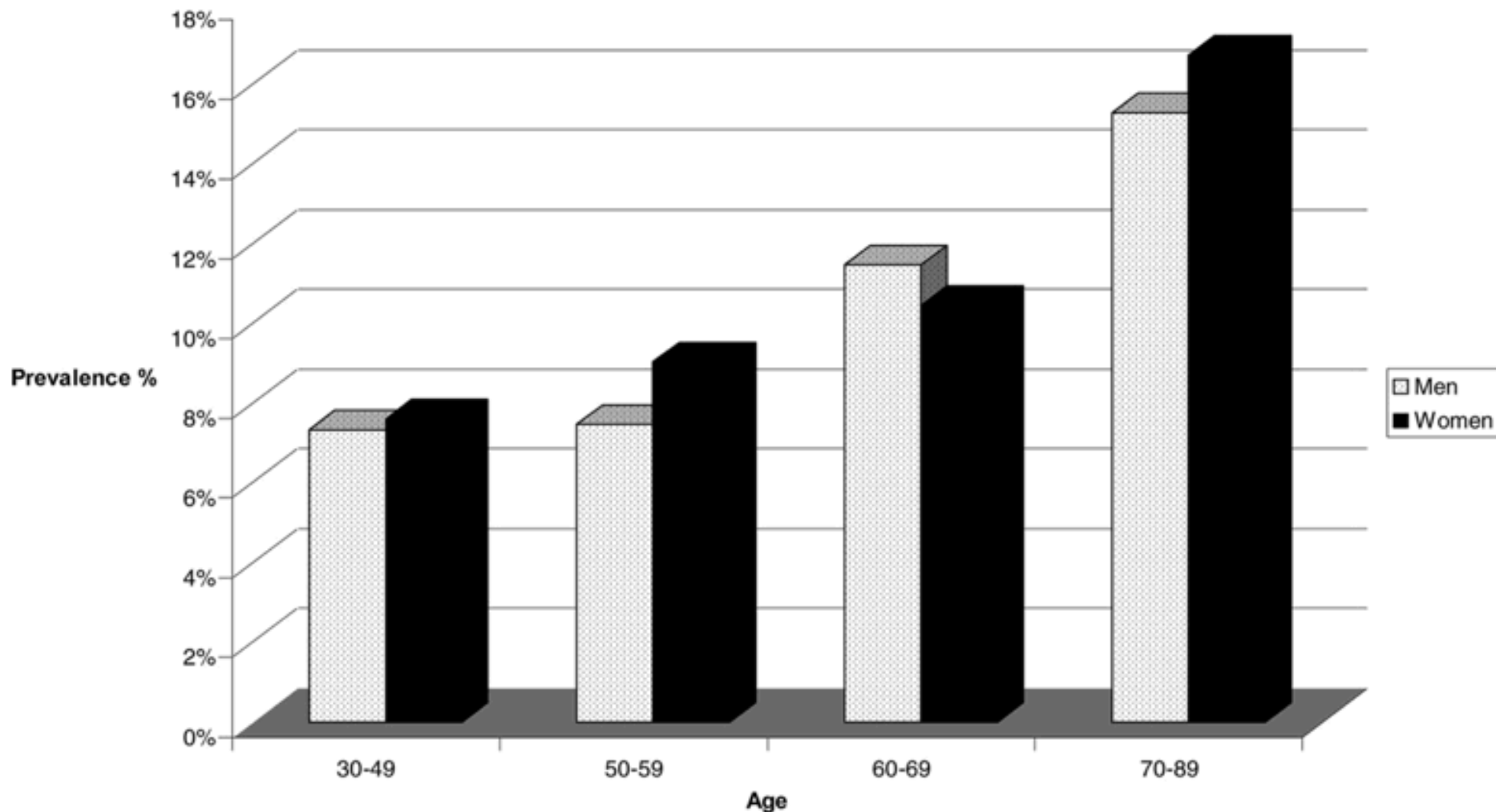
Clergeau MR, Stroke. 2009;40:3758-3762

- *MRI, diffusion-weighted*
- *60 consecutive patients with pulmonary embolism*
- *6 with MR brain embolism*
- *1 with clinical signs*
- *PFO in 15 patients (25%)*
- *Silent brain infarcts 33.3% with PFO and 2.2% without PFO, $P=0.003$*
- *PFO independent predictor of silent brain infarcts, OR, 34.9 [3.1 to 394.3], $P=0.004$*



Silent Cerebral Infarctions (by MR)

2,040 Framingham Offsprings (53% female; mean age, 62±9 years)



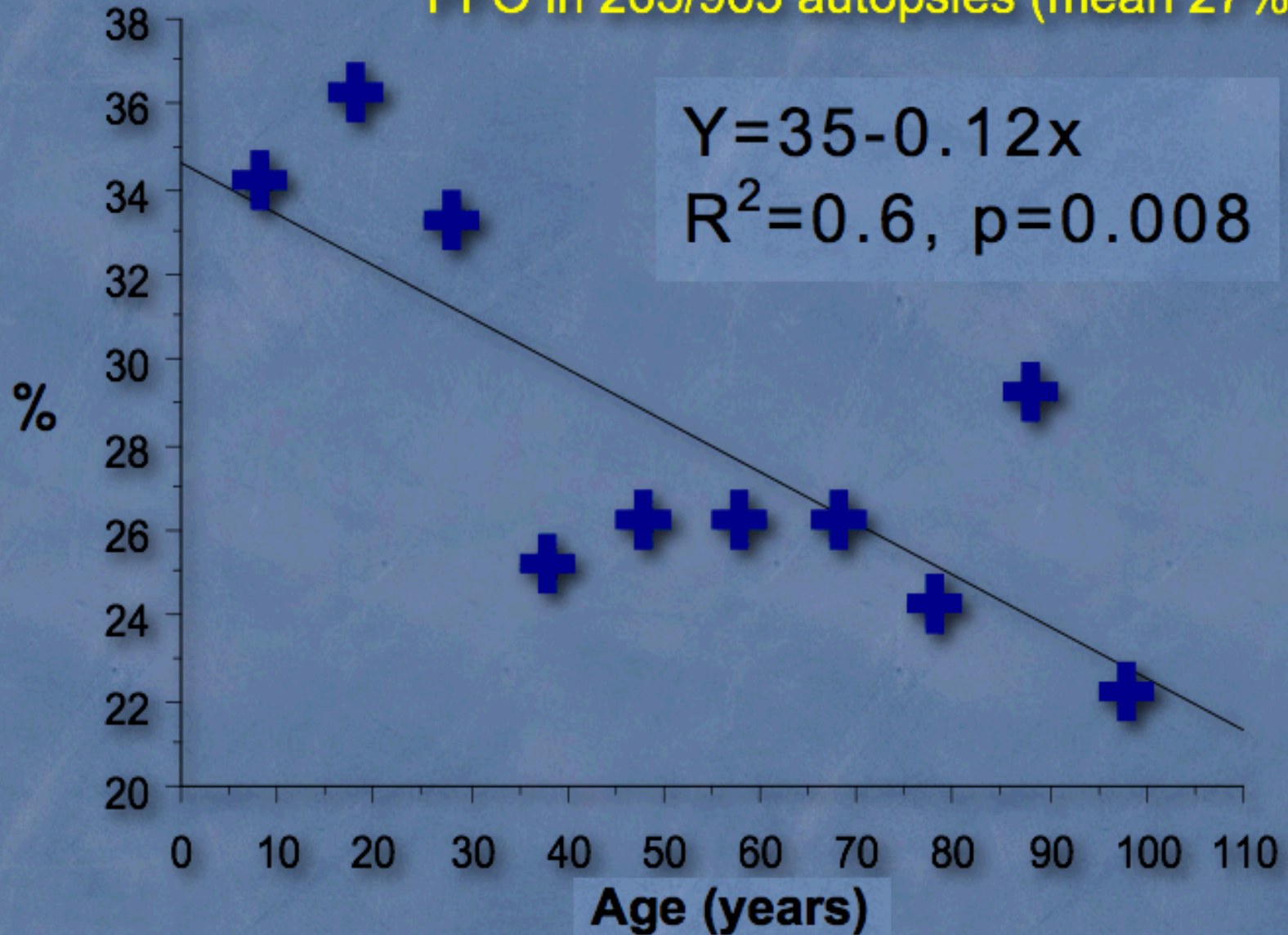
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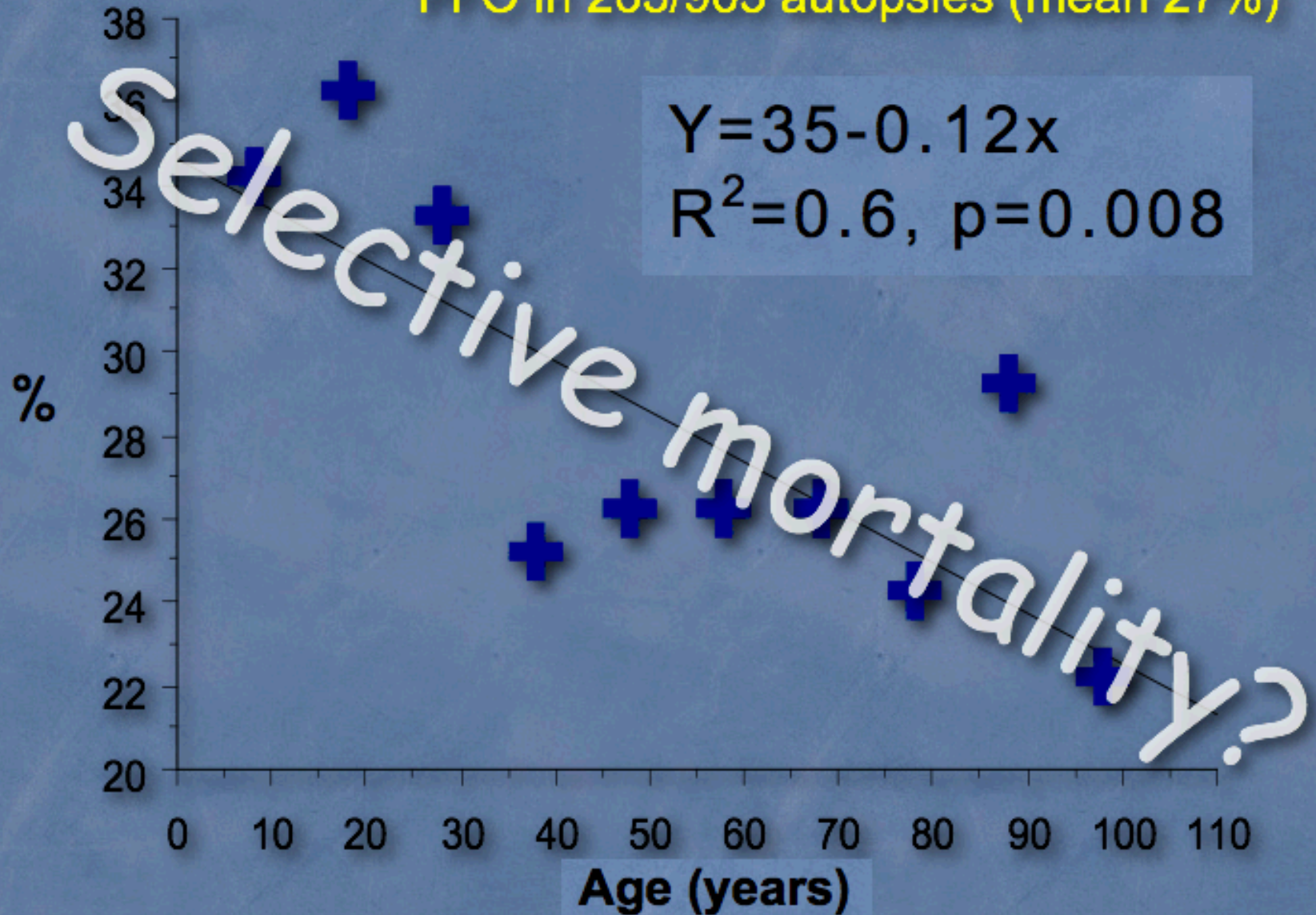
Prevalence of PFO According to Age

PFO in 263/965 autopsies (mean 27%)



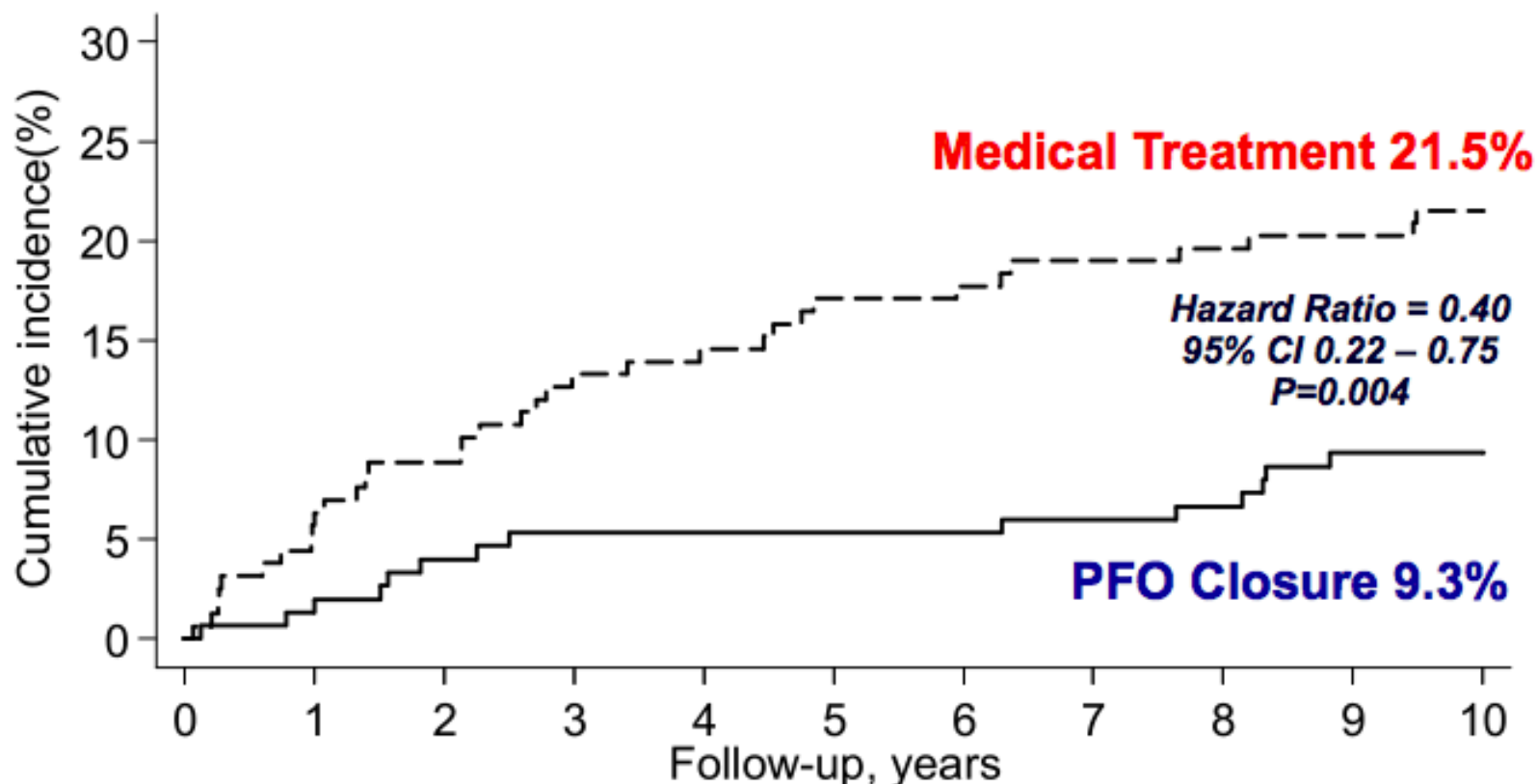
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Primary Endpoint – Intention to Treat Population

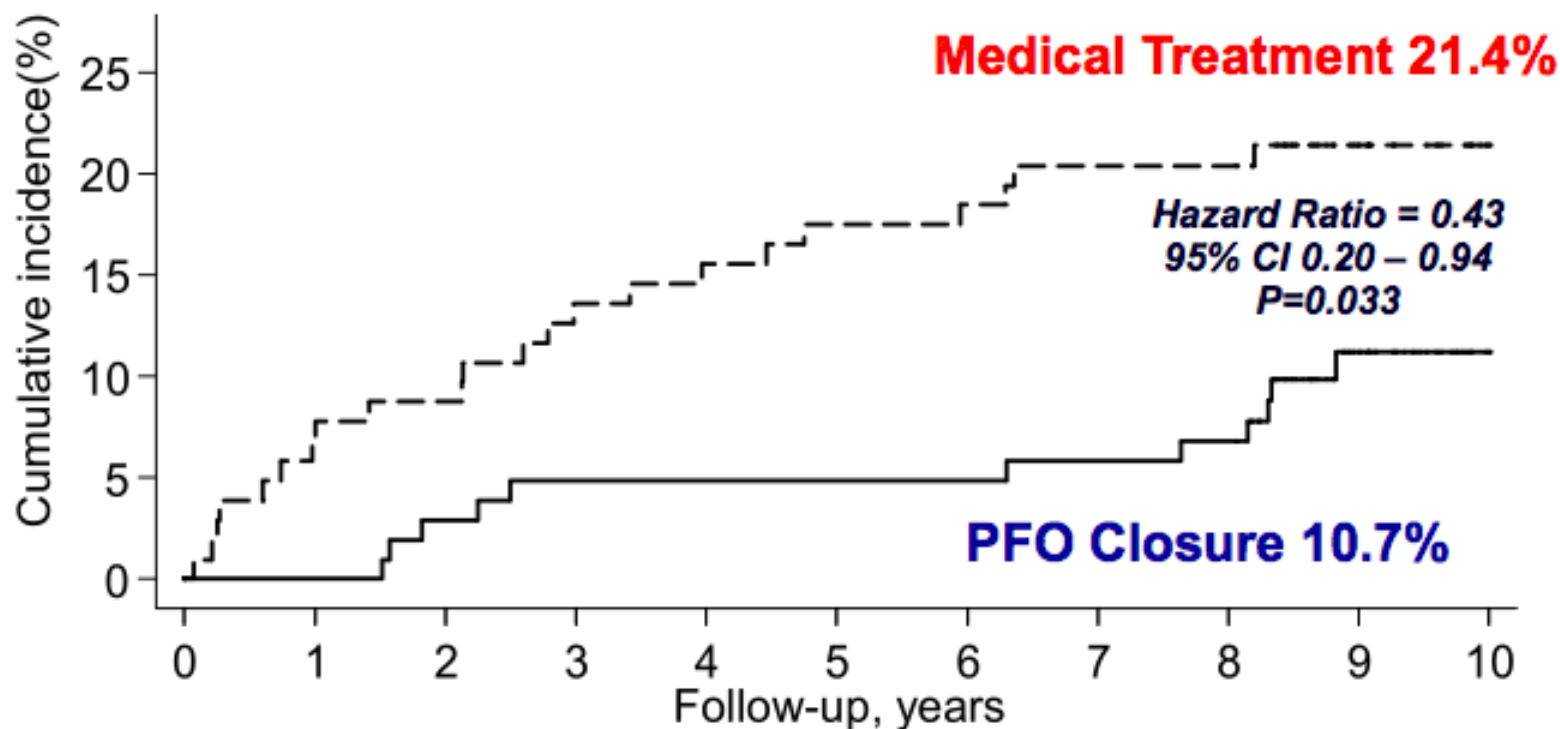
Ischemic Stroke, TIA, or Peripheral Embolism at 10 Years



No. at risk	0	1	2	3	4	5	6	7	8	9	10
PFO closure	150	148	144	142	142	142	142	141	140	136	136
Medical	158	149	144	137	135	131	130	128	127	126	124

Primary Endpoint – Propensity Score Matched Cohort

Stroke, TIA, or Peripheral Embolism at 10 Years



No. at risk	0	1	2	3	4	5	6	7	8	9	10
PFO closure	103	103	100	98	98	98	98	97	96	60	29
Medical	103	96	94	89	87	85	84	82	82	54	28

Event Rates per Year (%)

(After first event with a PFO, 308 patients, 10-year follow-up)

With Device (1,796 patient-years) **Without Device** (1,323 patient-years)

Death

Stroke

TIA

Periph. Embol.

Stroke/TIA/PE

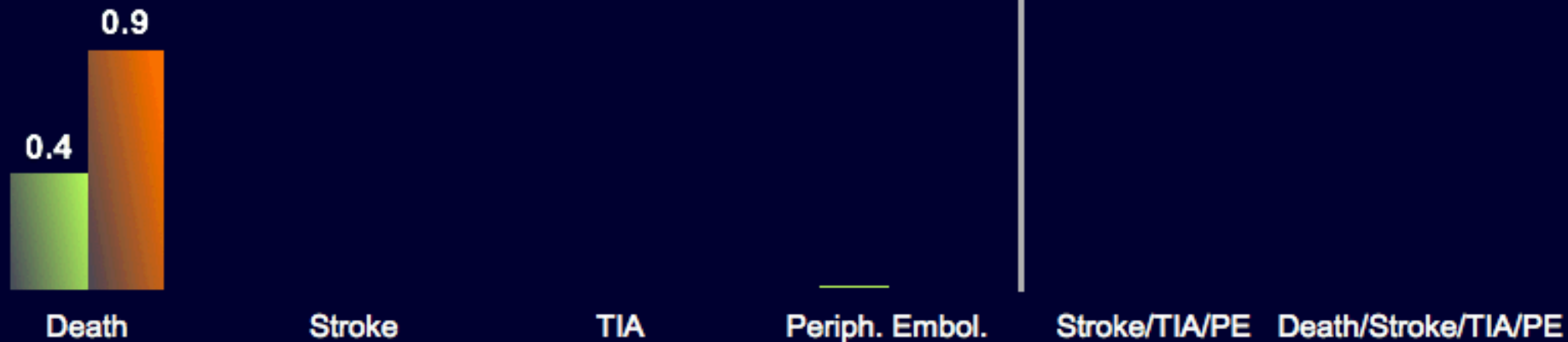
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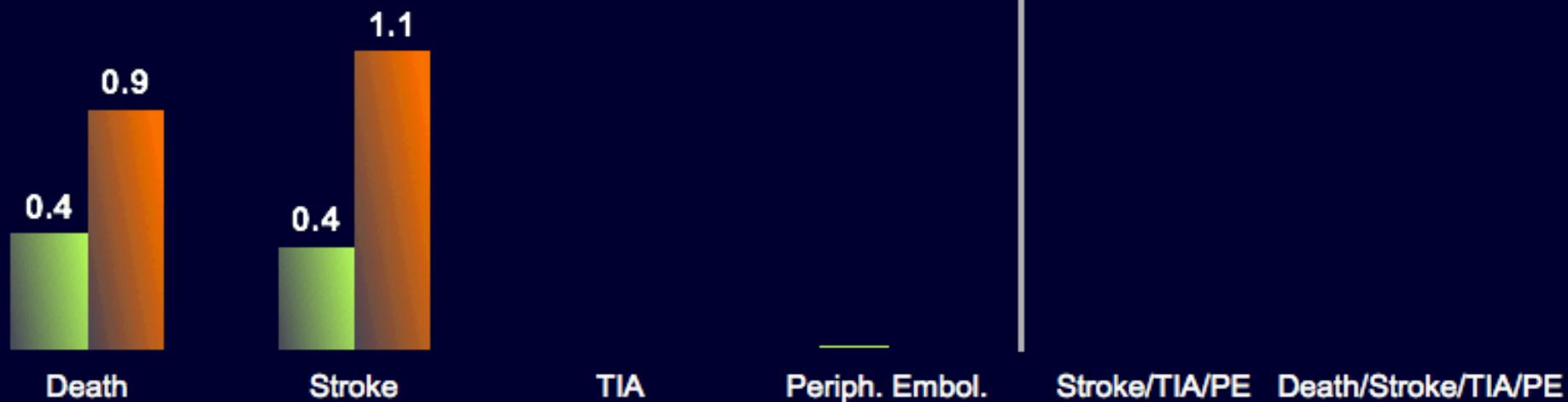


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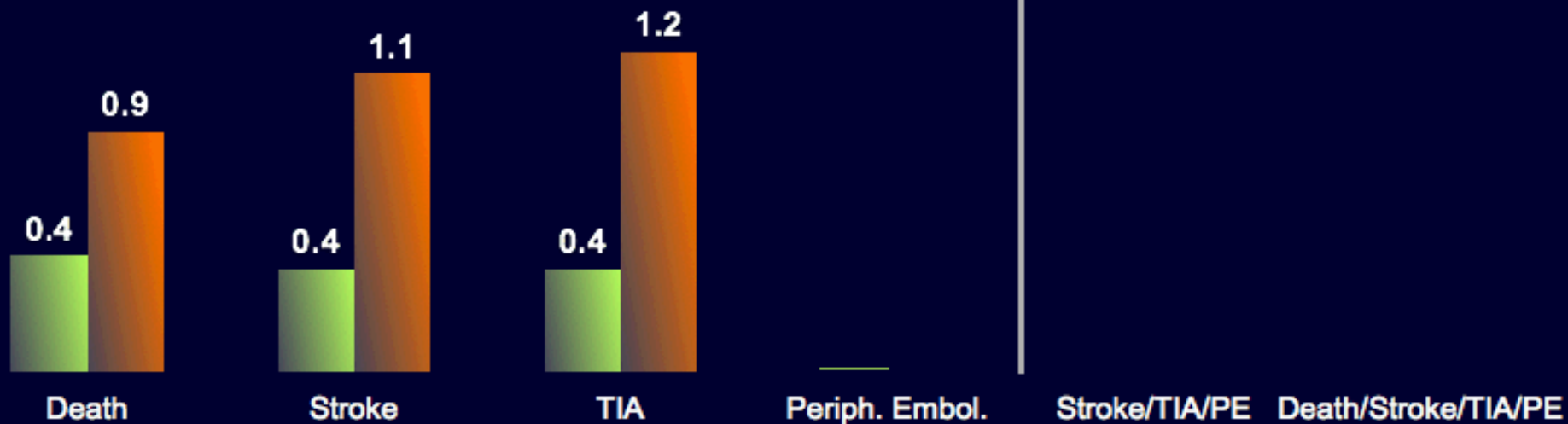


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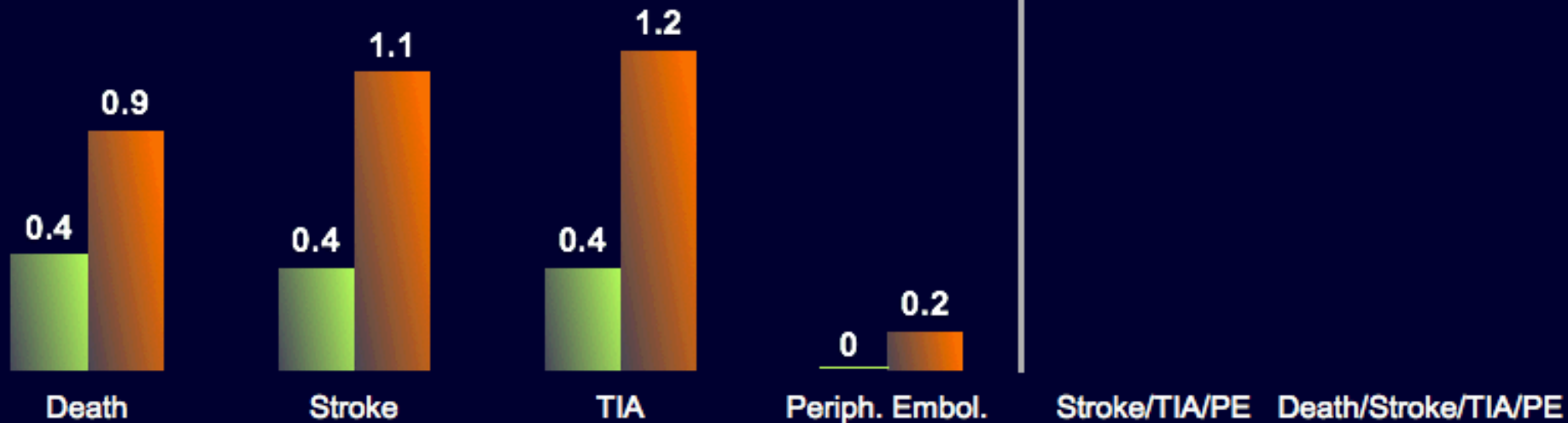


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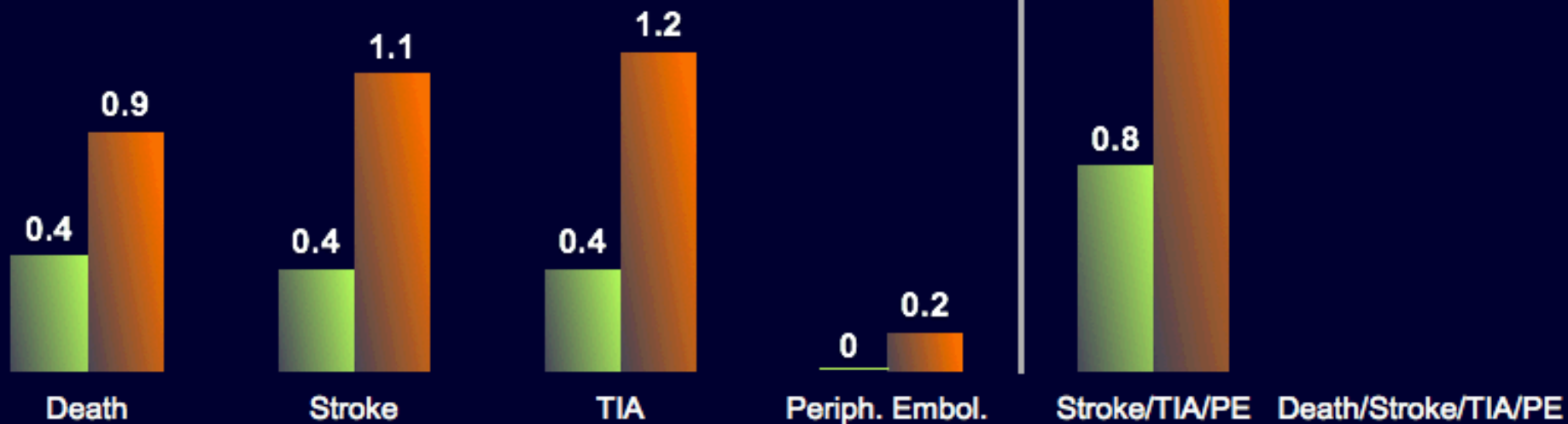


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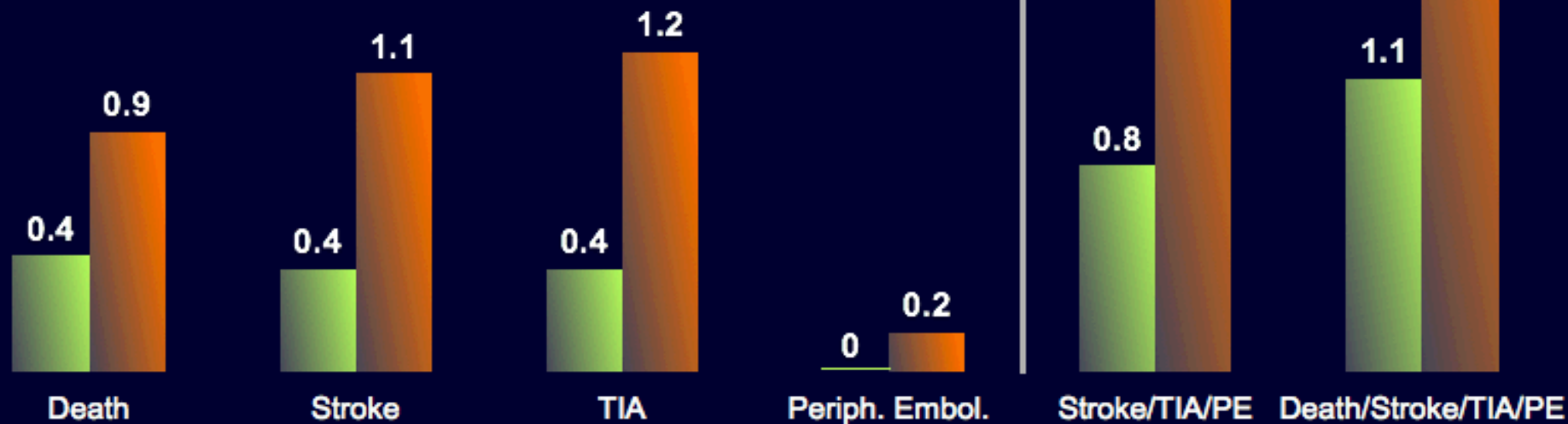


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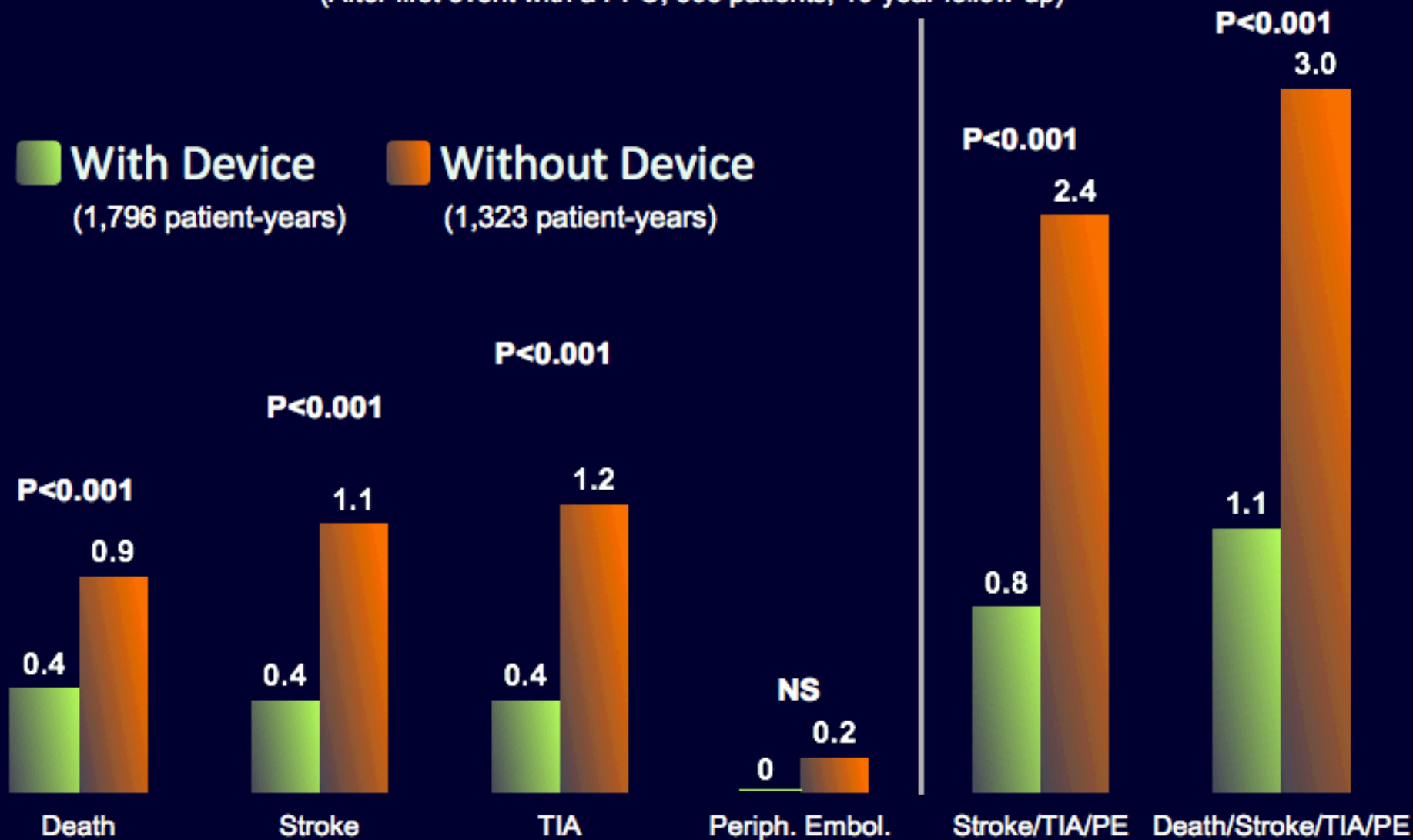


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Closure of Patent Foramen Ovale (PFO) for Cryptogenic Cerebral Embolism

Randomized Trials

Acronym

Place

Device

Patients

Status

*Endpoint driven; **Aspirin chronically in both groups

Closure of Patent Foramen Ovale (PFO) for Cryptogenic Cerebral Embolism

Randomized Trials

Acronym	Place	Device	Patients	Status
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PFO,
never leave home
with it!

Ischemic Stroke (Re-)Classification

- **Arterial occlusion**

- lacunar
- intracerebral
- vertebral
- internal carotid
- common carotid
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- left atrium
 - left atrial appendage
 - left atrial foramen pouch
- myxoma or other tumor
- vegetation (septic embolus)

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