

Reducing Your Risk For Stroke

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Explaining Stroke



STOP Stroke.



Act F.A.S.T.



Spread HOPE.

MAY IS
NATIONAL STROKE
AWARENESS MONTH



**National Stroke
Association™**

www.stroke.org

National Stroke Association encourages everyone to spread awareness about stroke in May about how to:



- **STOP** primary and secondary stroke through risk factor management.
- **Act F.A.S.T.** to increase recognition of and response to stroke symptoms.
- **Spread HOPE** about recovery from stroke.

Visit www.stroke.org/SAM for free educational resources.



Reduce: stroke risk



Recognize: stroke symptoms



Respond: at the first sign of stroke,
Call 911 immediately!

- A leading cause of death in the United States
- 795,000 Americans suffer strokes each year
- 134,000 deaths each year
 - From 1996 to 2006, the stroke death rate fell 33.5% and number of deaths fell by 18.4%
- 6,400,000 stroke survivors



- A leading cause of adult disability.
- Up to 80% of all strokes are preventable through risk factor management.
- On average, someone suffers a stroke every 40 seconds in America.



- Stroke kills more than twice as many American women every year as breast cancer.
- More women than men die from stroke and risk is higher for women due to higher life expectancy.
- Women suffer greater disability after stroke than men.
- Women ages 45 to 54 are experiencing a stroke surge, mainly due to increased risk factors and lack of prevention knowledge.



- Incidence is nearly double that of Caucasians
- African Americans suffer more extensive physical impairments
- Twice as likely to die from stroke than Caucasians
- High incidence of risk factors for stroke
 - Hypertension
 - Diabetes
 - Obesity
 - Smoking
 - Sickle cell anemia

- Higher incidence among Mexican Americans than Caucasians.
- Mexican Americans are at increased risk for all types of stroke and TIA at younger ages than Caucasians.
- Spanish-speaking Hispanics are less likely to know stroke symptoms than English-speaking Hispanics, African Americans and Caucasians.



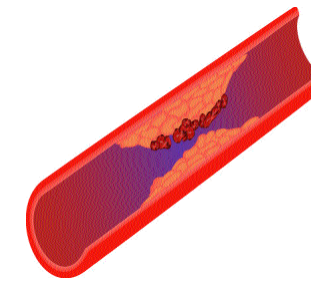
- President Gerald Ford
- Teddy Bruschi
- Sharon Stone
- Della Reese
- Kirk Douglas
- Roy Horn of Siegfried & Roy
- Mary Kay Ash
- Charles Schultz
- Harry Caray
- Charles Dickens
- Ed Koch
- Ted Williams

- Sudden brain damage
- Lack of blood flow to the brain caused by a clot or rupture of a blood vessel



Ischemic = Clot

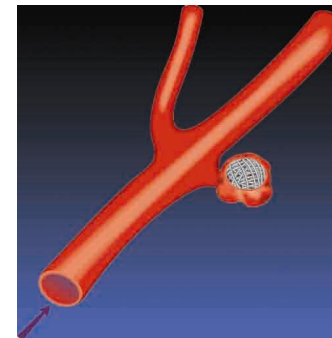
(makes up approximately 87% of all strokes)

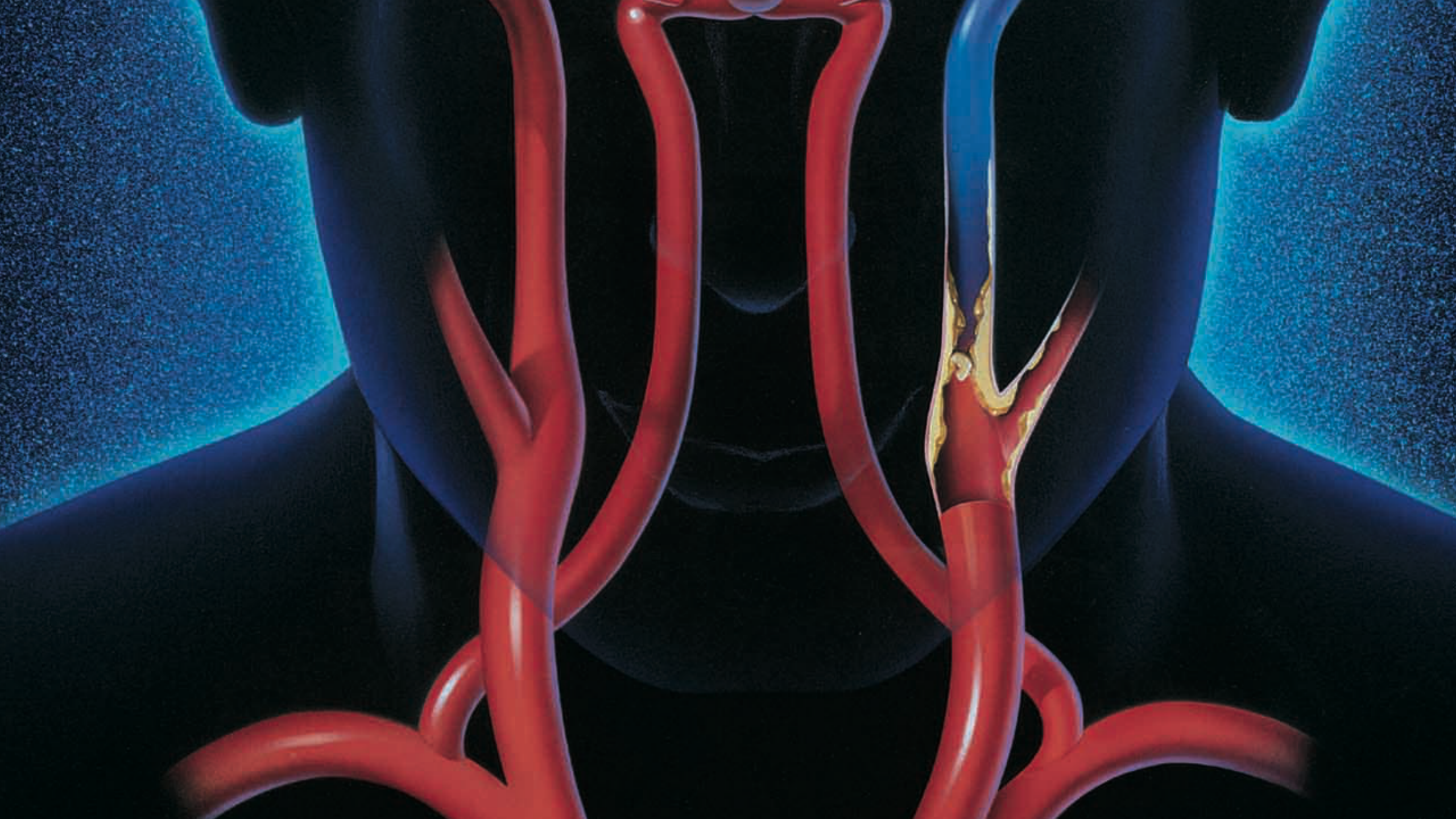


Thrombotic






Hemorrhagic = Bleed

- Bleeding around brain
- Bleeding into brain





Stroke Symptoms

Sudden and severe headache			
Trouble seeing in one or both eyes			Sudden confusion Trouble speaking
Sudden dizziness Trouble walking			Sudden numbness or weakness of face, arm or leg

**If you observe any of these symptoms,
call 911 immediately.**

Every minute matters!

- B = Balance: watch for sudden loss of balance
- E = Eyes: check for vision loss
- F = Face: ask the person to smile
- A = Arm: ask the person to raise both arms
- S = Speech: ask the person to speak a simple sentence
- T = Time: to call 911



Every minute matters!

- Transient ischemic attack (TIA) is a warning sign of a future stroke – up to 40% of TIA patients will have a future stroke.
- Symptoms of TIAs are the same as stroke.
- TIA symptoms can resolve within minutes or hours.
- It is important to seek immediate medical attention if you suspect that you are having or have had a TIA.



Myth:

- Stroke is not preventable
- Stroke cannot be treated
- Stroke only strikes the elderly
- Stroke happens in the heart
- Stroke recovery ends after 6 months

Reality:

- Up to 80% percent of strokes are preventable
- Stroke requires emergency treatment
- Anyone can have a stroke
- Stroke is a “Brain Attack”
- Stroke recovery can last a lifetime



The estimated direct and indirect cost of stroke was 73.7 billion in 2010.

The mean lifetime cost of ischemic stroke is about \$140,048 in America.



National Stroke Association recommends that you follow these guidelines to help people reduce their risk for stroke...





1. Know your blood pressure. Have it checked at least annually. If it is elevated, work with your doctor to control it.
2. Find out if you have atrial fibrillation (AF) – a type of irregular heartbeat. If you have it, work with your doctor to manage it.
3. If you smoke, stop.

4. If you drink alcohol, do so in moderation.
5. Know your cholesterol number. If it is high, work with your doctor to control it.
6. If you are diabetic, follow your doctor's recommendations carefully to control your diabetes.

7. Include exercise in your daily routine.
8. Enjoy a lower sodium (salt) and lower fat diet.
9. If you have circulation problems, work with your doctor to improve your circulation.
10. If you experience any stroke symptoms, call 911 immediately. **Every minute matters!**

National Stroke Association recommends that you learn stroke symptoms and how to respond to symptoms by calling 9-1-1.



Why People Don't Recognize and Respond to Symptoms

- Don't recognize symptoms
- Denial
- Think nothing can be done
- Worry about cost
- Think symptoms will go away
- Fear or don't trust hospitals

BCH is nationally recognized for excellent care provided to stroke patients – from the latest in emergency treatments and diagnostic technology to rehabilitation:

- **Quick access to neurologists**
- **Expedited care through Stroke Alert Protocol**
- **Specialized inpatient care**



The Joint
Commission®



American Heart
Association®
American Stroke
Association®

CERTIFICATION

Meets standards for

Primary Stroke Center





Ischemic stroke (Brain Clot)

Clot busting medication: t-PA (Tissue Plasminogen Activator)

Clot-removing devices: Merci Retriever, Penumbra

Hemorrhagic Stroke (Brain Bleed)

Clipping

Coiling

- 10% of stroke survivors recover almost completely.
- 25% recover with minor impairments.
- 40% experience moderate to severe impairments requiring special care.
- 10% require care within either a skilled-care or other long-term care facility.
- 15% die shortly after the stroke.



Physical Therapy (PT)

- Walking, range of movement

Occupational Therapy (OT)

- Taking care of one's self

Speech Language Therapy

- Communication skills, swallowing, cognition

Recreational Therapy

- Cooking, gardening



Lifestyle Changes for Survivors and Caregivers

- Daily living skills
- Dressing and grooming
- Diet, nutrition and eating difficulties
- Skin care problems
- Pain
- Sexuality/Intimacy
- Behavior
- Depression & Anger
- Emotional Liability
- One-sided Neglect
- Memory Loss
- Communication Problems

Types of Recovery Services

- Rehabilitation unit in the hospital
- In-patient rehabilitation facility
- Home-bound therapy
- Home with outpatient therapy
- Long-term care facility
- Community-based programs

What it does...

- Reduce the incidence and impact of stroke
- Advocate for prevention and public education
- Provide professional education and training
- Provide recovery resources for stroke survivors and caregivers

National Stroke Association

1-800-STROKES (787-6537)

www.stroke.org



Stroke: Straight from the Heart

Srinivas Iyengar, MD
Director, Structural Heart
Boulder Heart

What causes stroke?

- Emboli from valves/LV
- Vascular (i.e., carotid/aortic)
- Bleeding
- AF (mainly LAA)
- Cryptogenic (i.e., PFO)
- HTN

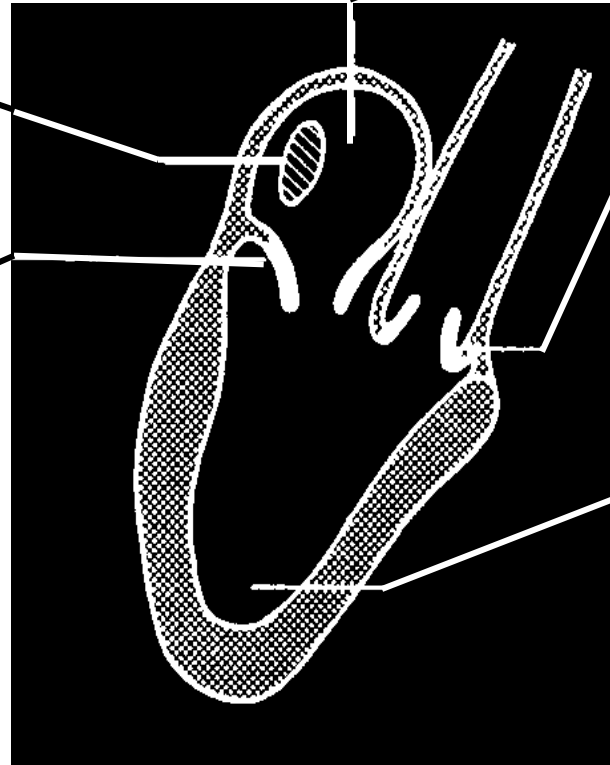
Sources of Cardiogenic Emboli

Paradoxical Emboli

- Patent foramen ovale
- Atrial septal defect

Mitral Valve

- Infective endocarditis
- Non-bacterial endocarditis
- Myxomatous valvulopathy
- Prosthetic valves
- Vegetations due to prothrombotic states



Left Atrium

- Atrial fibrillation
- Myxoma
- Atrial septal aneurysm

Aortic Valve

- Calcific stenosis
- Infective endocarditis
- Prosthetic valve

Left Ventricle

- Ischemic dyskinesia
- Cardiomyopathy
- Thrombi due to prothrombotic states

- Irregular heart rhythm
- Basically, the top part of the heart (“atria”) don’t communicate electrically with the bottom (“ventricles”)
- Results in symptoms of SOB, light-headedness, and palpitations

- High blood pressure
- Heart attacks
- CAD
- Abnormal heart valves
- Heart defects you're born with (congenital)
- An overactive thyroid gland or other metabolic imbalance
- Exposure to caffeine, tobacco or alcohol

- ECG is mandatory
- Not every “irregular heart rhythm” is AF!
- PVCs, APCs, skipped beats can all mimic feelings of AF
- AF does not have to be chronic, it can be short-lasting or come/go (i.e., PAF)

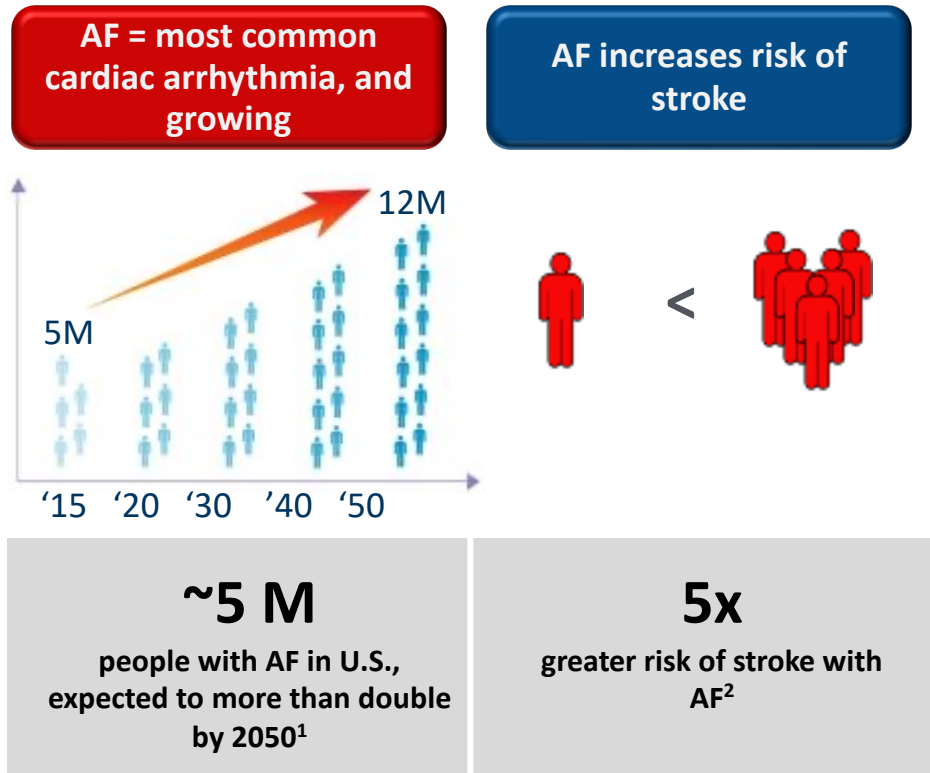
- Medications to control HR (i.e., beta-blockers, Ca-channel blockers) are first line.
- Anti-arrhythmic medications can be used to control rhythm.
- Cardioversion (either electrically or chemically) can be utilized for symptomatic AF.
- Ablation (surgically or percutaneously) can also be utilized.

But what else does AF cause?

- Stroke!!
- The left atrial appendage (LAA) which is in the left atrium can collect blood which forms clots that can break free in patients with AF.
- That's why we place patients with AF who have elevated risks for stroke on blood thinners.

- Work very well as long as compliance is maintained and no side effects seen.
- Warfarin - cheap but compliance with diet/testing an issue as well maintaining adequate levels.
- NOACs - costly, lack readily available reversal agents.
- All the above can exacerbate bleeding.

AF is a Growing Problem Associated with Greater Morbidity and Mortality



- Higher stroke risk for older patients and those with prior stroke or TIA
- 15-20% of all strokes are AF-related
- AF results in greater disability compared to non-AF-related stroke

1. Go AS, et al, Heart Disease and Stroke Statistics—2013 Update: A Report From the American Heart Association. *Circulation*. 2013; 127: e6-e245.

2. Holmes DR, *Seminars in Neurology* 2010;30:528–536.

Wolf PA et al, Duration of Atrial Fibrillation and the Imminence of Stroke: The Framingham Study, *Stroke* 1983; 14:664-667

AF-related strokes are debilitating

Stroke

#1 cause of **adult disability** worldwide¹

AF-related Stroke

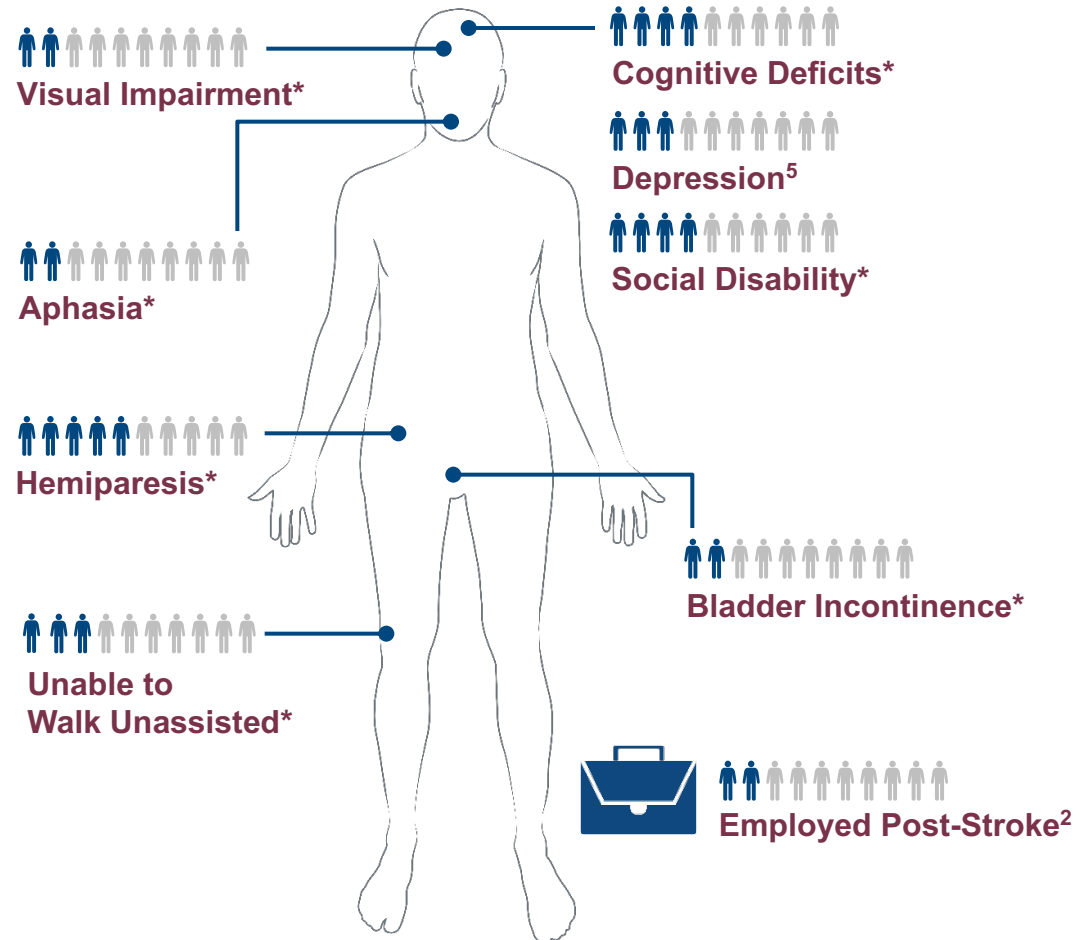
1.5X higher **disability**^{3**}

2X higher **mortality**^{3**}

70% result in **death or permanent disability**⁶

*at 6 months post-stroke⁴

**compared with stroke patients without AF



Anticoagulant Therapy Carries Risk of Intracerebral Hemorrhage or Death



**Spontaneous intra-
parenchymal bleed**



**Hemorrhagic
transformation**

Validated Scoring Systems to Assess Stroke Risks

CHA₂DS₂VASc Score (Stroke Risk)³

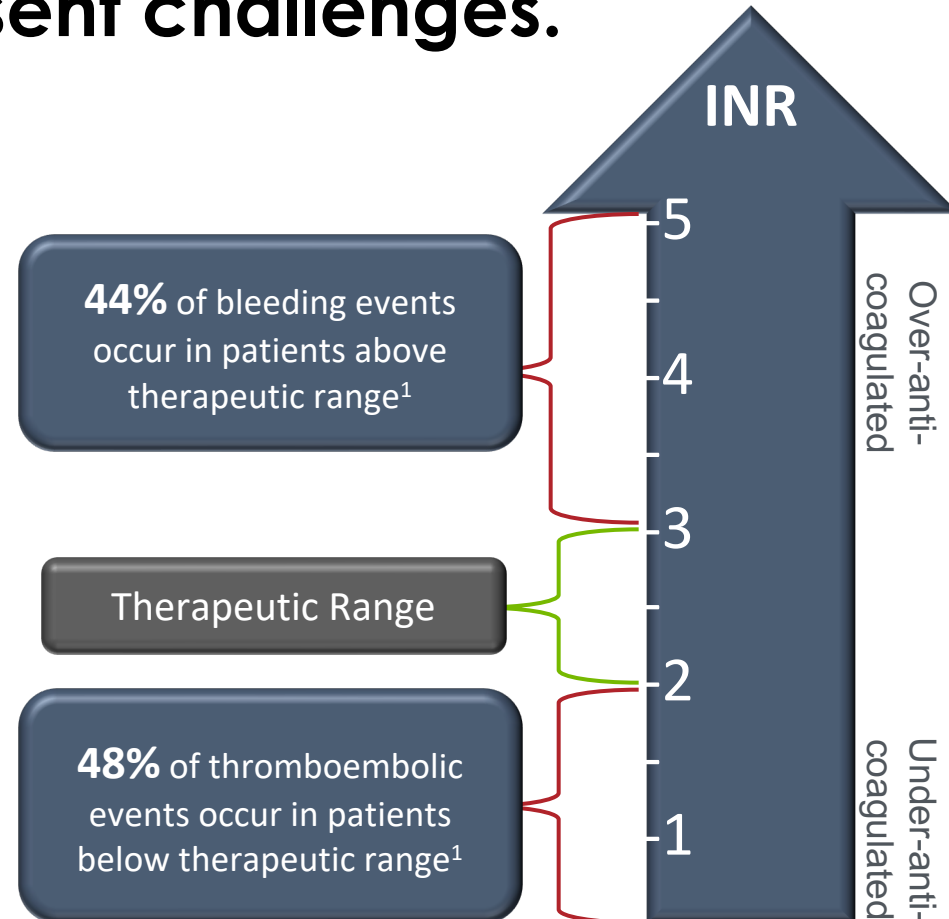
	Condition	Points
C	Congestive heart failure	1
H	Hypertension (SBP>160)	1
A ₂	Age ≥ 75 years	2
D	Diabetes mellitus	1
S ₂	Prior stroke, TIA or thromboembolism	2
V	Vascular disease (PAD, MI)	1
A	Age 65-74 years	1
Sc	Sex category (Female)	1
	TOTAL POINTS	

Score	Yearly Stroke Risk (%)		
	No Warfarin	With Aspirin ²	With Warfarin ²
0	0	0	0
1	1.3	1.0	0.5
2	2.2	1.8	0.8
3	3.2	2.6	1.1
4	4.0	3.2	1.4
5	6.7	5.4	2.3
6	9.8	7.8	3.4

Stroke Treatment Option: Warfarin

Warfarin is an effective means of stroke reduction in patients with AF but can present challenges.

- Many patients spend a significant amount of time outside of the therapeutic range.
- Warfarin tops the list for emergency hospitalizations for adverse drug events in older Americans²



¹ Oake N, et al. *Can Med Assoc J.* 2007;176(11):1589-1594

² Budnitz, MD, MPH, et al. *Annals of Internal Medicine.* 2007;147(11); 229

Challenge: Adherence and Major bleed rates with Novel Oral Anticoagulants (NOACs)

Treatment	Study Drug Discontinuation Rate	Major Bleeding (rate/year)
Rivaroxaban ¹	24%	3.6%
Apixaban ²	25%	2.1%
Dabigatran ³ (150 mg)	21%	3.3%
Edoxaban ⁴ (60 mg / 30 mg)	33 % / 34%	2.8% / 1.6%
Warfarin ¹⁻⁴	17 – 28%	3.1 – 3.6%

For those that remain adherent, there is an annual compounding bleeding risk.

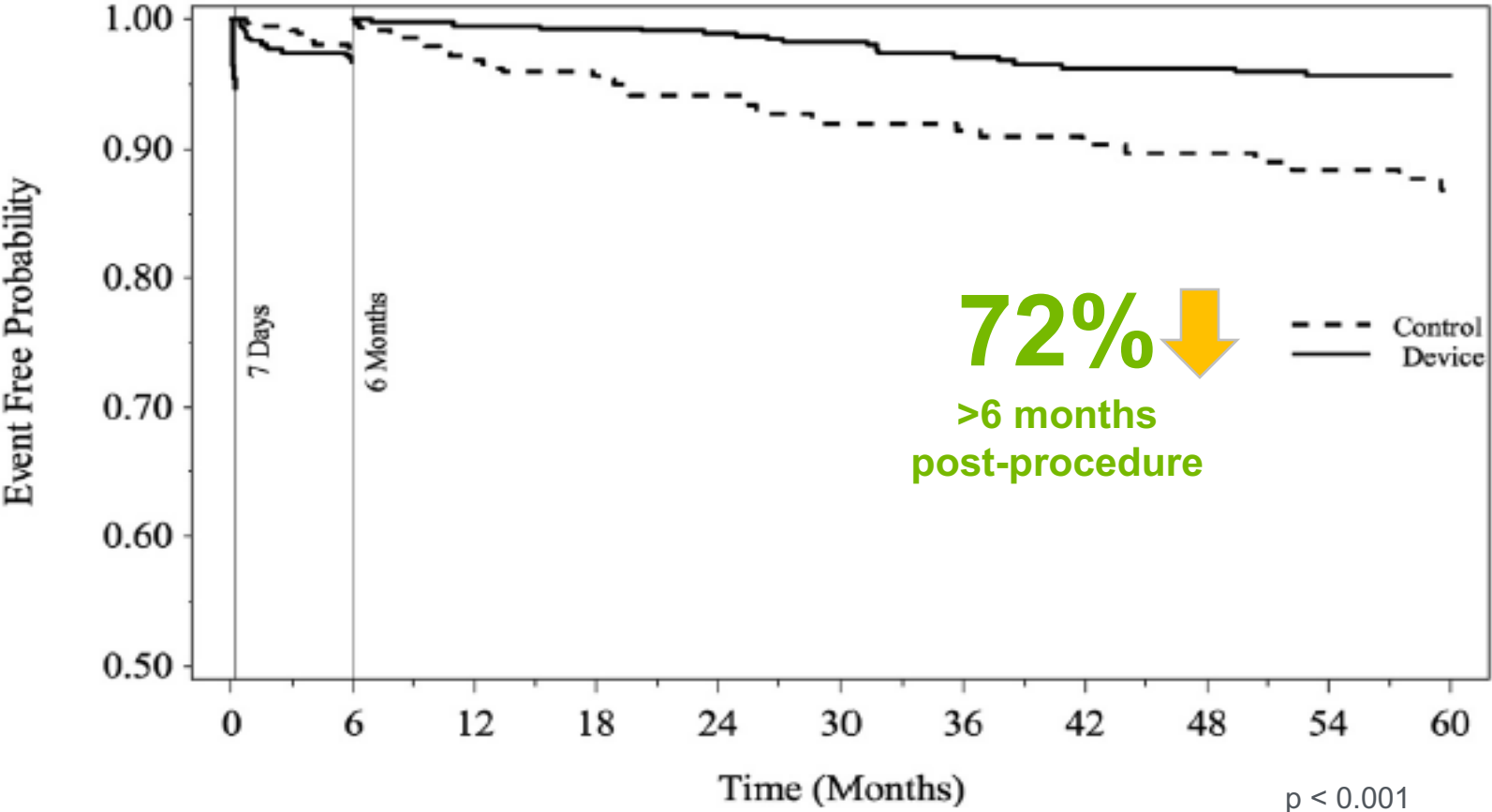
¹Connolly, S. NEJM 2009; 361:1139-1151 – 2 yrs follow-up (Corrected) ²Patel, M. NEJM 2011; 365:883-891 – 1.9 yrs follow-up, ITT ³Granger, C NEJM 2011; 365:981-992 – 1.8 yrs follow-up, ⁴Giugliano, R. NEJM 2013; 369(22): 2093-2104 – 2.8 yrs follow-up.

Results from different clinical investigations are not directly comparable. Information provided for educational purposes only

- AF is a growing problem associated with greater morbidity and mortality.
 - 5x increased risk of stroke
 - 90% of clots formed in LA come from LAA
- Current treatments with Warfarin or NOACs are effective, but many patients stop taking the medications.
 - ~1 in 4 patients discontinue blood thinners after 2 years
- Anti-coagulation bleeding risk compounds over time; may not be viable as a long-term solution for some patients.

Major Bleeding Reduction Superior to Warfarin 6-months Post Procedure

Freedom of Major Bleeding Over 3 Adjunctive Pharmacotherapy Intervals

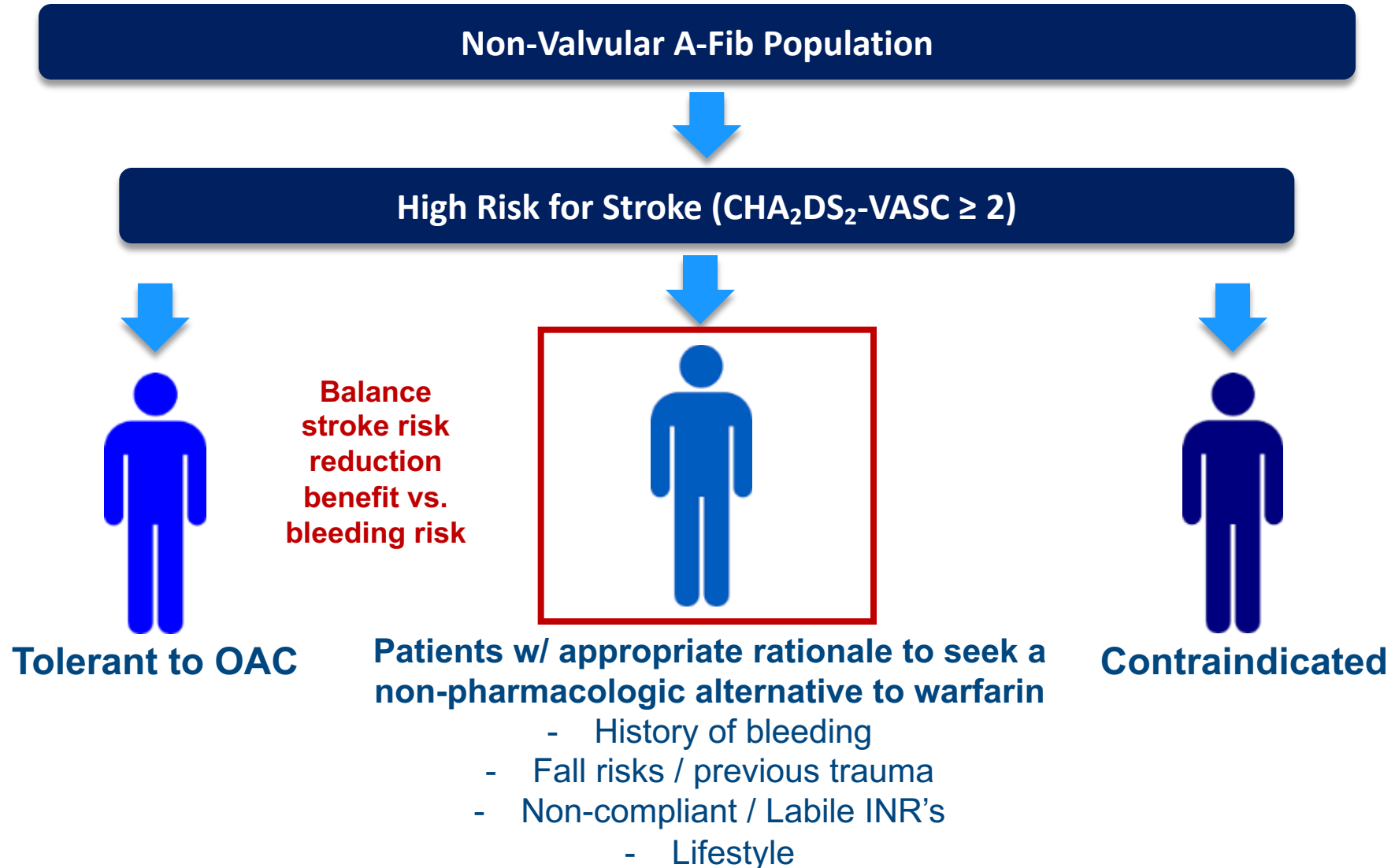


PROTECT AF: WATCHMAN Disabling Stroke Reduction Superior to Warfarin

Significant Reduction in Disabling Strokes

PROTECT AF	Event Rate (per 100 pt-yrs)		Rate Ratio (95% CrI)	Posterior Probabilities, %	
	WATCHMAN N=463	Warfarin N=244		Non- Inferiority	Superiority
Stroke (all)	1.5	2.2	0.68 (0.42, 1.37)	>99	83
Disabling	0.5	1.2	0.37 (0.15, 1.00)	>99	98
Non-disabling	1.0	1.0	1.05 (0.54, 2.80)	89	34

Disabling stroke defined as Modified Rankin Score 3-6

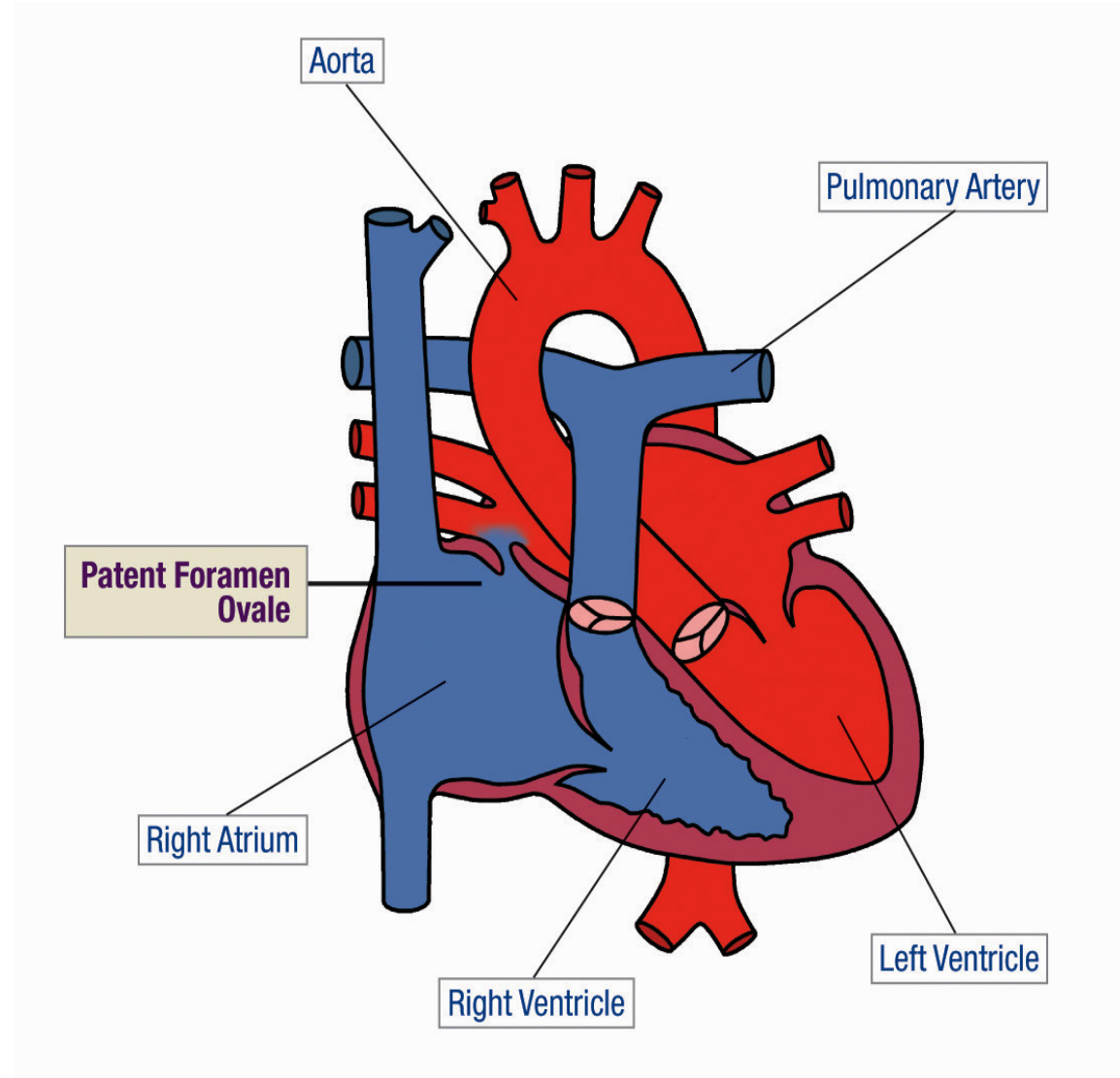


Patent Foramen Ovale (PFO)

- A patent foramen ovale (PFO) is a persistent, usually flap-like opening between the atrial septum primum and secundum at the location of the fossa ovalis.
- In utero, the foramen ovale serves as a physiologic conduit for right-to-left shunting.
- After birth, with the establishment of pulmonary circulation, the increased left atrial blood flow and pressure results in functional closure of the foramen ovale.
- This functional closure is subsequently followed by anatomical closure of the septum primum and septum secundum.

Patent Foramen Ovale (PFO)

- Persistent flap-like opening: atrial septum primum and secundum
- In utero, physiologic right-to-left shunting
- After birth, increased left atrial blood flow and pressure closes flap
- Anatomical closure follows



- The association between PFO and cryptogenic stroke has been identified increasingly over the last twenty years.
- Prevalence of PFO in the general population ranges from 15% to 25%.
- In patients with cryptogenic stroke prevalence of PFO is 40% to 60%.
- Evidence is mounting to seek a better alternative than just prescribing anti-platelet medications (i.e., ASA, Plavix).

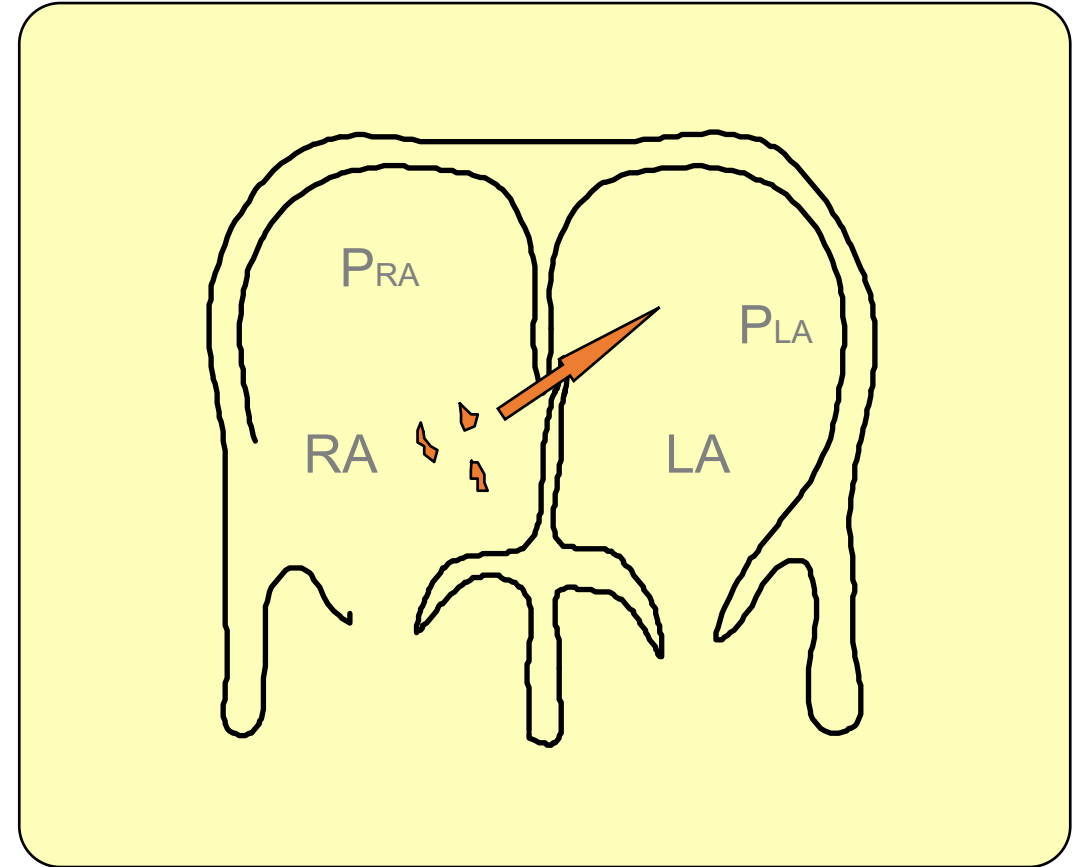
- Defined as cerebral ischemia of obscure or unknown origin
- The cause of CS remains undetermined because the event is transitory or reversible, investigations did not look for all possible causes, or because some causes truly remain unknown.
- One third of the ischemic strokes is cryptogenic.

- 700,000 strokes/yr in US
- 80-85% ischemic
- 30-40% of strokes remain defined as cryptogenic

- 40-60% frequency of PFO among cryptogenic strokes
- ~100,000 strokes/yr with PFO as only identified potential etiology

Pressure in RA > Pressure in LA:

- Early systole
- Valsalva
- Coughing
- Pulmonary hypertension
- COPD
- Pregnancy
- Asthmatics
- Wind instruments
- Decompression sickness (diving)
- High altitude flying
- Obstructive sleep patterns



- Historically, a number of trials had not shown a major benefit from PFO closure for stroke reduction compared to medical therapy.
- However, a number of these studies had “signals” of a positive benefit with device utilization.

The NEW ENGLAND
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

MARCH 21, 2013

VOL. 368 NO. 12

Percutaneous Closure of Patent Foramen Ovale
in Cryptogenic Embolism

Bernhard Meier, M.D., Bindu Kalesan, Ph.D., Heinrich P. Mattle, M.D., Ahmed A. Khattab, M.D., David Hildick-Smith, M.D., Dariusz Dudek, M.D., Grethe Andersen, M.D., Reda Ibrahim, M.D., Gerhard Schuler, M.D., Antony S. Walton, M.D., Andreas Wahl, M.D., Stephan Windecker, M.D., and Peter Jüni, M.D., for the PC Trial Investigators*

PC Trial: Percutaneous Closure of Patent Foramen Ovale (PFO) in Cryptogenic Embolism

414 patients with PFO and prior ischemic stroke, TIA, or peripheral thrombotic event.

4-Year Follow-up	Closure (n = 214)	Medical Therapy (n = 210)	P Value
Primary Composite ^a	3.4%	5.2%	0.34
Nonfatal Stroke	0.5%	2.4%	0.14
TIA	2.5%	3.3%	0.56

^a Death, nonfatal stroke, TIA, or peripheral embolism.

Conclusion: Percutaneous PFO closure does not reduce the risk of subsequent events in patients with cryptogenic thromboembolism.

Meier B, et al. *N Engl J Med.*
2013;368:1083-1091.

ORIGINAL ARTICLE

Closure of Patent Foramen Ovale versus Medical Therapy after Cryptogenic Stroke

John D. Carroll, M.D., Jeffrey L. Saver, M.D., David E. Thaler, M.D., Ph.D.,
Richard W. Smalling, M.D., Ph.D., Scott Berry, Ph.D., Lee A. MacDonald, M.D.,
David S. Marks, M.D., and David L. Tirschwell, M.D.,
for the RESPECT Investigators*

N Engl J Med 2013;368:1092-100.

DOI: 10.1056/NEJMoa1301440

CONCLUSIONS

In the primary intention-to-treat analysis, there was no significant benefit associated with closure of a patent foramen ovale in adults who had had a cryptogenic ischemic stroke. However, closure was superior to medical therapy alone in the pre-specified per-protocol and as-treated analyses, with a low rate of associated risks. (Funded by St. Jude Medical; RESPECT ClinicalTrials.gov number, NCT00465270.)

RESPECT: Closure of Patent Foramen Ovale (PFO) vs. Medical Therapy After Cryptogenic Stroke

980 pts randomized to medical therapy (warfarin or ≥ 1 antiplatelet) or closure using the Amplatzer PFO Occluder.

Recurrent Strokes per 100-Pt Yrs	Closure	Medical Therapy	P Value
Intention to Treat ^a	0.66	1.38	0.08
Per Protocol	0.46	1.30	0.03
As Treated	0.39	1.45	0.007

^a Primary analysis.

Conclusion: In patients with cryptogenic stroke, percutaneous PFO closure does not appear to prevent recurrent stroke, although secondary analyses suggest possible efficacy.

Carroll JD, et al. *N Engl J Med.*
2013;368:1092-1100.

ORIGINAL ARTICLE

Patent Foramen Ovale Closure or Anticoagulation vs. Antiplatelets after Stroke

Jean-Louis Mas, M.D., Genevieve Derumeaux, M.D., Benoît Guillon, M.D., Evelyne Massardier, M.D., Hassan Hosseini, M.D., Ph.D., Laura Mechtouff, M.D., Caroline Arquizan, M.D., Yannick Béjot, M.D., Ph.D., Fabrice Vuiller, M.D., Olivier Detante, M.D., Ph.D., Céline Guidoux, M.D., Sandrine Canaple, M.D., [et al.](#), for the CLOSE Investigators[†]

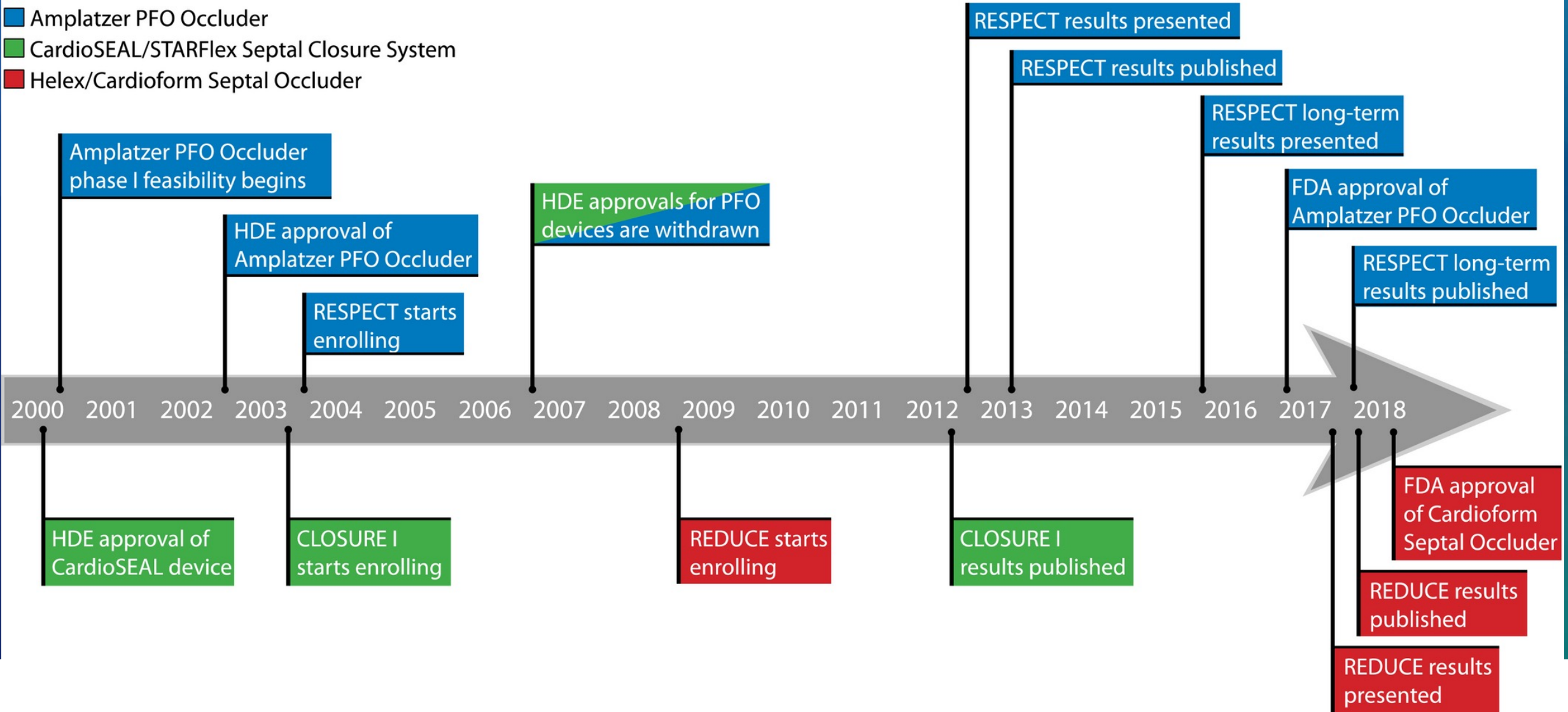
Patent Foramen Ovale Closure or Antiplatelet Therapy for Cryptogenic Stroke

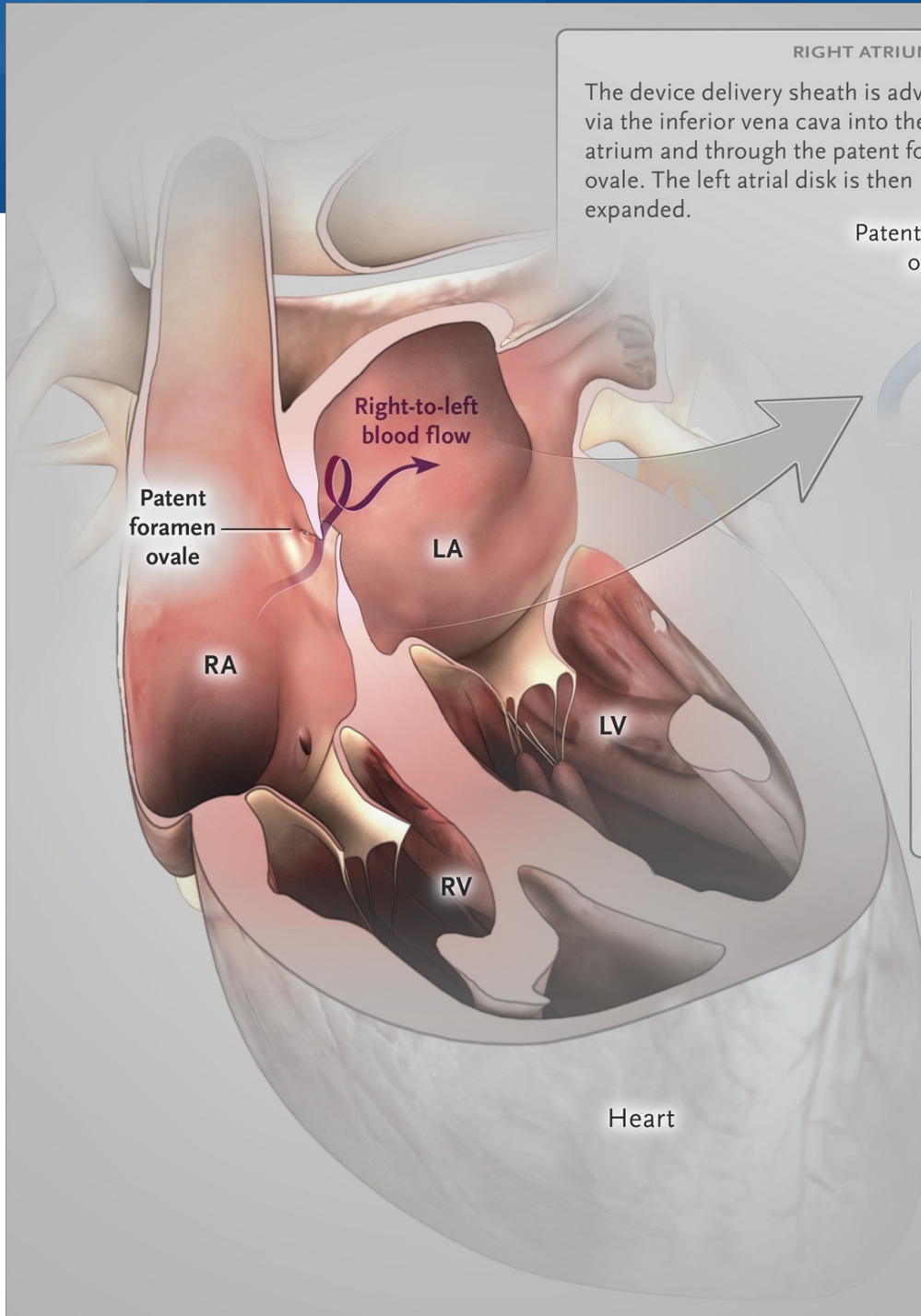
Lars Søndergaard, M.D., Scott E. Kasner, M.D., John F. Rhodes, M.D., Grethe Andersen, M.D., D.M.Sc., Helle K. Iversen, M.D., D.M.Sc., Jens E. Nielsen-Kudsk, M.D., D.M.Sc., Magnus Settergren, M.D., Ph.D., Christina Sjöstrand, M.D., Ph.D., Risto O. Roine, M.D., David Hildick-Smith, M.D., J. David Spence, M.D., and Lars Thomassen, M.D.

- Randomized 663 patients with cryptogenic stroke to PFO closure, antiplatelet therapy alone, or oral anticoagulation
- PFO closure (plus long-term antiplatelet therapy) bested the antiplatelet therapy group
- No strokes occurred over a mean of 5.3 years among those randomized to PFO, whereas 14 strokes occurred in the antiplatelet-only group (HR 0.03; 95% CI 0-0.12).
- Three strokes occurred in the anticoagulation group, but there was inadequate statistical power to compare these outcomes with the other two groups.
- Conclusion: Among patients 16 to 60 years of age who had had a recent cryptogenic stroke attributed to PFO with an associated atrial septal aneurysm or large interatrial shunt, the rate of stroke was lower with PFO closure plus long-term antiplatelet therapy than with antiplatelet therapy alone.

- Gore Helex Septal Occluder or the Gore Cardioform Septal Occluder (both WL Gore & Associates) against medical therapy alone, 2:1, in 664 patients
- Medical therapy consisted of aspirin alone, aspirin plus dipyridamole, or clopidogrel, with use of other antiplatelet agents or anticoagulants prohibited
- PFO closure was associated with significantly lower incidence of clinical ischemic stroke at 1.4% versus 5.4% (HR 0.23; 95% CI 0.09-0.62)
- Incidence of new brain infarctions was also significantly lower in the PFO closure group, although silent brain infarctions were no different.

- Amplatzer PFO Occluder
- CardioSEAL/STARFlex Septal Closure System
- Helex/Cardioform Septal Occluder





RIGHT ATRIUM **LEFT ATRIUM** **A**

The device delivery sheath is advanced via the inferior vena cava into the right atrium and through the patent foramen ovale. The left atrial disk is then expanded.

Patent foramen ovale

Atrial septum

Amplatzer PFO occluder expanded

Detailed description: This diagram shows a blue delivery sheath being inserted from the right atrium through the patent foramen ovale into the left atrium. A red arrow indicates the direction of advancement. The Amplatzer PFO occluder, a mesh-like device, is shown expanded against the atrial septum. Labels include 'RIGHT ATRIUM', 'LEFT ATRIUM', 'Patent foramen ovale', 'Atrial septum', and 'Amplatzer PFO occluder expanded'. A small 'A' is in the top right corner.

B

The left atrial disk is retracted against the septal wall, and the delivery sheath is pulled back into the right atrium, where the right atrial disk is deployed.

Delivery sheath

RIGHT ATRIUM

Detailed description: This diagram shows the delivery sheath being pulled back into the right atrium. The left atrial disk is retracted against the septal wall. A red arrow indicates the direction of sheath retraction. Labels include 'Delivery sheath' and 'RIGHT ATRIUM'. A small 'B' is in the top right corner.

C

The device is fully expanded, closing the patent foramen ovale. The delivery sheath is removed.

Waist

Right atrial disk

Left atrial disk

Detailed description: This diagram shows the device fully expanded, closing the patent foramen ovale. The delivery sheath is being removed. The device consists of a 'Right atrial disk', a 'Left atrial disk', and a 'Waist' in the middle. A red arrow indicates the direction of sheath removal. Labels include 'Waist', 'Right atrial disk', and 'Left atrial disk'. A small 'C' is in the top right corner.

Where do we go now?

- Every patient who has a history of TIA/CVA needs a professional neurologic evaluation.
- If a PFO is found, alternate reasons for CVA need to be evaluated first (i.e., AF, carotid).
- If a patient indeed has a documented neurologic event and has no other viable explanation other than a PFO, then closure can be considered.

- But what about anti-coagulation therapy (i.e., Coumadin, NOACs) when compared to closure?
- Trials are ongoing.
- If a patient has an alternate reason to be on AC tx (i.e., mechanical valves, hypercoagulable state) that would not push to close.

- Stroke can occur from a number of different avenues.
- Therapies to reduce stroke burden are essential to reduce morbidity/mortality associated with this condition.
- It's exciting to see future technologies develop.

Reducing Your Risk For Stroke

Alan Zacharias, MD
Associated Neurologists
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