PFO closure what is New?

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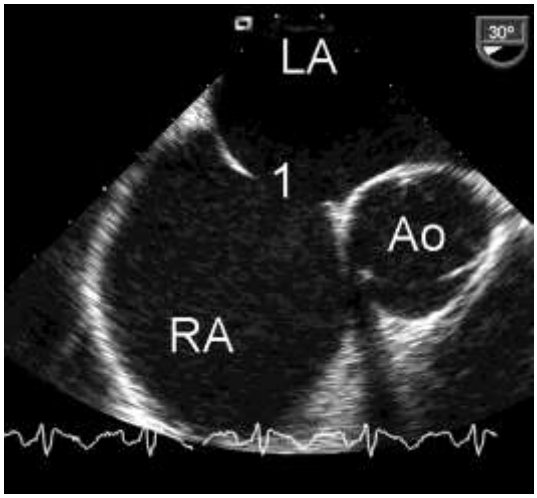
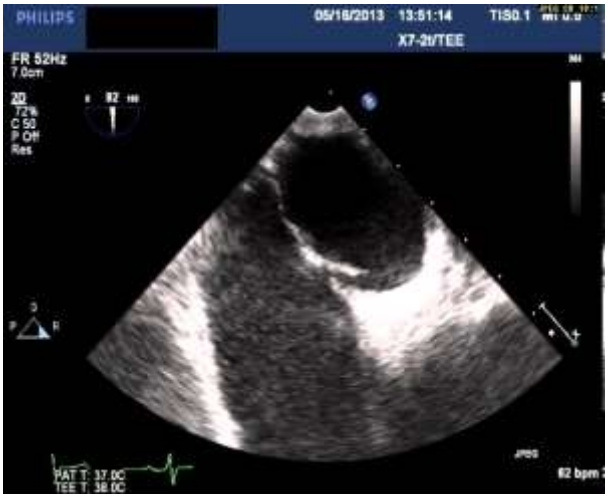
Lecturer of cardiology, congenital and structural heart disease unit

Ain Shams University

Disclosure:

I have nothing to disclose





ASD **PFO**

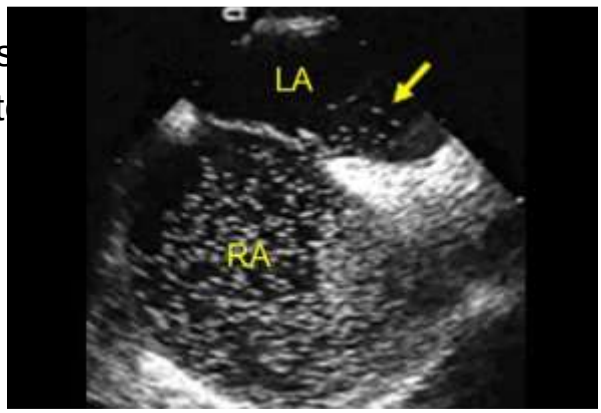
- A PFO occurs when the opening between the LA and the RA does not close. This opening can allow blood to pass from the right to the left atrium
- Many times the PFO is not discovered until adulthood, and linked to a variety of medical conditions

Conditions/Pathology Associated with PFO

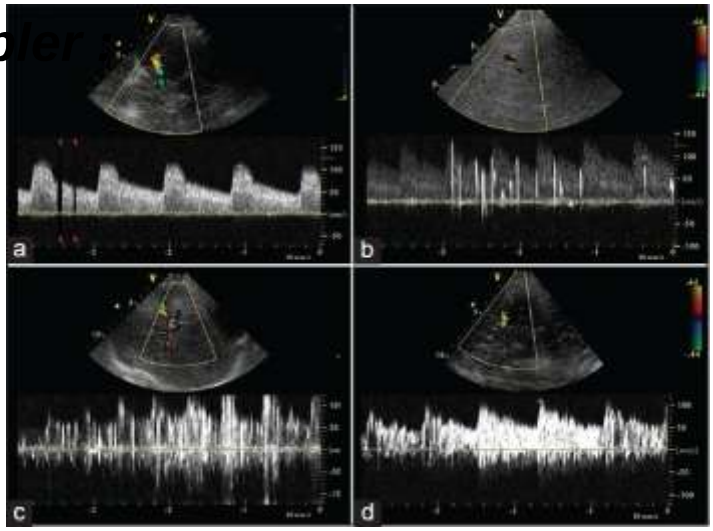
- *Cryptogenic Stroke*
- *Decompression Illness*
- *Transient global amnesia*
- *Paradoxical arterial embolism*
- *Obstructive sleep apnea*
- *Migraine*
- *Varicose veins/complications*
- *Liver transplant complications*

•PFO Diagnosis

- ***Bubble Study:***
- Ultrasound-based imaging modalities used in the detection of R to L shunt
- Transthoracic echo with agitated s
- Transesophageal echo with agitat
- Small shunt: 1 -10 bubbles in LA
- Medium shunt: 10 -30 bubbles
- Large shunt: > 30 bubbles



Transcranial Doppler



Paradoxical shunt quantification by contrast transcranial Doppler (TCD) based on the number of microembolic signals (MES):

a) 0 MES, no shunt;

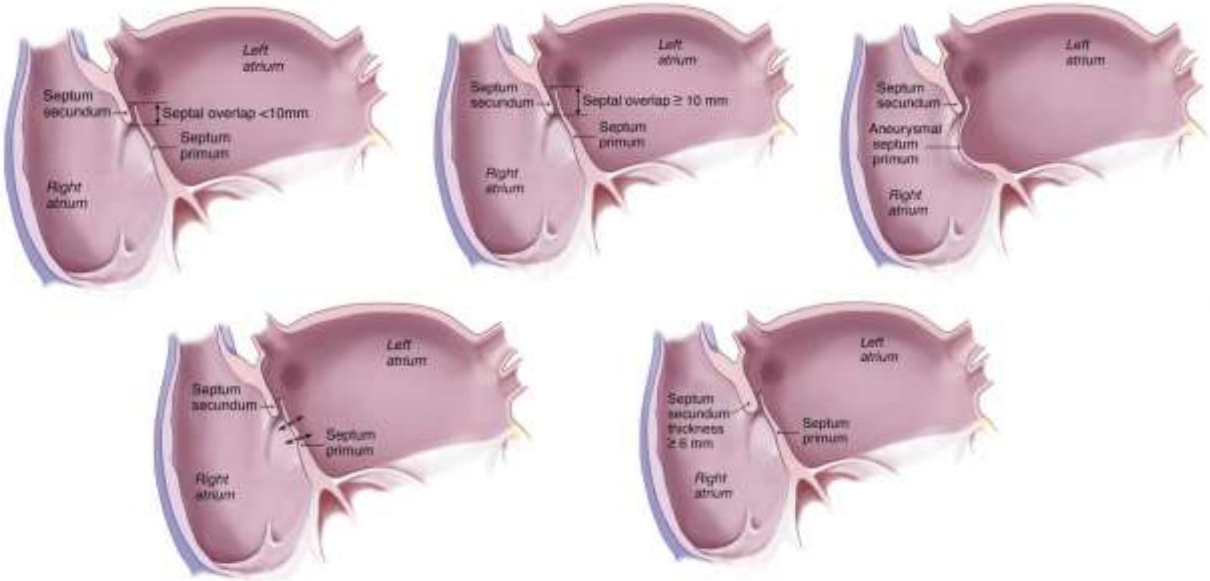
b) 0-10 MES, small shunt;

c) 10-20 MES, medium shunt;

d) large shunt (> 20

How to understand patent foramen ovale clinical significance: Part I
Falanga Gabriella, et al journal of cardiovascular echocardiography,Year : 2014 | Volume: 24 | Issue Number: 4 | Page: 114-121

PFO anatomy variable



Devices for PFO closure

PFO closure devices have underwent a major evolution during the last decades

AMPLATZER PFO Occluder

Percutaneous trans catheter device

- Self-expanding, double-disc design
- Nitinol wire mesh with polyester fabric/thread
- Radiopaque marker bands
- Sizes: 18, 25, 35 mm
- Recapturable and repositionable

Now FDA approved

Device Performance

Procedural Outcomes	n/N (%)
Technical success[1]	460 / 464 (99.1%)
Procedural success[2]	444 / 462 (96.1%)
Effective closure[3]	244 / 261 (93.5%)

Maximum Residual Shunting at Rest and Valsalva at 6 Months
Grade 0: 72.7%
Grade 1: 20.8%
Grade 2-3: 6.5%

1.Defined as successful delivery and release of the device for subjects in whom the delivery system was introduced into the body
2.Defined as successful implantation with no reported in-hospital serious adverse events
3.Defined as complete obliteration or trivial residual shunting (Grade 0 or I at rest and Valsalva) at 6

Amplatzer Like Devices

Occlutech® Figulla Flex II PFO device

A special oxidation process that creates a layer of titanium oxide gives the

Life tech CeraFlex

Nitinol wire frame coated with Titanium Nitride (TiN)

Sizes: 18, 25, 30, 35

Nit-Occlude

Nit-Occlud® PFO is knitted from a single Nitinol wire, making protruding fixation-clamps obsolete. Nit-Occlud® PFO`s unique single-layer distal disc, reduces the metal used

others

Ex: Hyperion™ PFO Occluders (there are two types: with hub and without hub

Gore Septal Occluder

Nitinol frame with ePTFEmembrane in overlapping petal conformation
•11Fr sheath
•Easy to deploy, retrievable
•No need for long sheath in LA
•Very soft and compliant
•Currently been assessed in REDUCE trial of patients with CS
–Data due 2017

60 patients
Technically successful in 98.3%
6 mths closure rate was 86.6%
1 year closure 93.3%
Knerret al CCI 2014; 1144–1151

Cardia Ultrasept

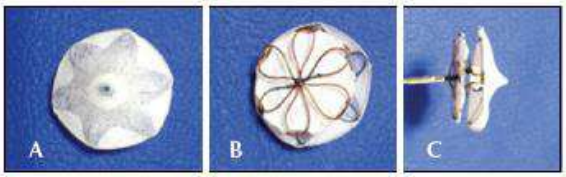


Figure 1 – Details of the new version of the CARDIA prosthesis. A, Left surface of the disc. Note the metal completely covered by the Ivalon™ sponges. B, Surface of the right disc, which is smaller than the left one, with the nitinol loops and the central capture pin clearly visible. C, Prosthesis profile view, held by the bioptome.

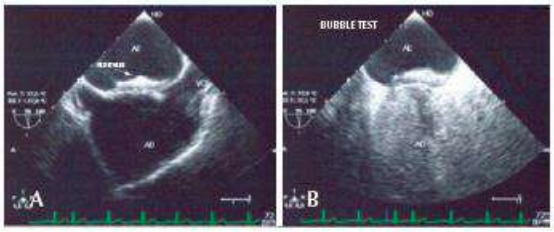


Figure 5 – Details of the control transesophageal echocardiography, six months after implantation. A, The prosthesis is well-positioned in the atrial septum. B, Bubble test, showing no bubbles passing into the left atrium, confirming the effectiveness of the device.

PREMERE™ device

Premere™ PFO Closure System

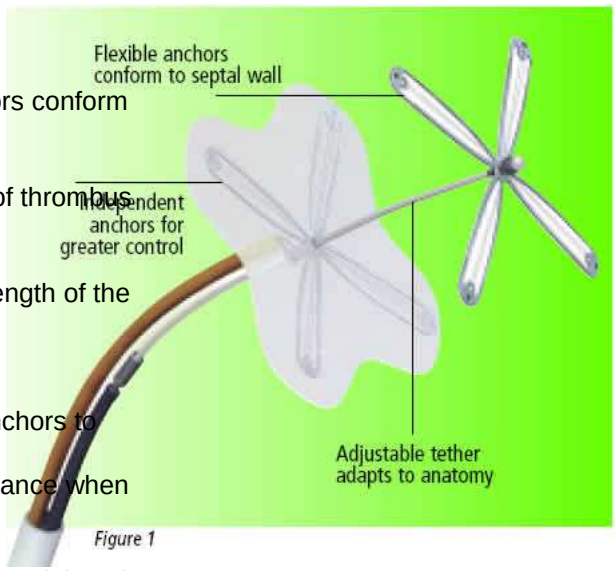
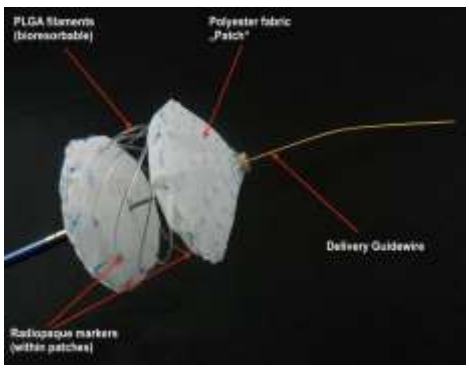


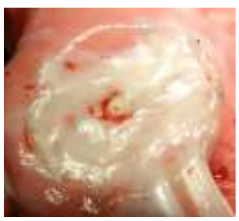
Figure 1

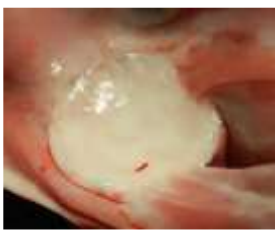
Flexible, low profile design – Flexible nitinol anchors conform seamlessly to
the septal wall
Minimal surface area – Small size minimizes risk of thrombus formation, as
well as interference with other atrial structures
Adjustable length tether – Adapts the interseptal length of the device to the
unique anatomy of a person
Optimal Placement Control
Easy to reposition – Easily reposition individual anchors to optimize placement
Easy to retrieve – Fully retrievable for the rare instance when retrieval may be
necessary
Minimal septal thrombus – Low surface area of left atrial anchor minimizes risk

Carag Bioresorbable Septal Occluder

PFO/ASD
•12F sheath
•Implant delivered over an 0.018” guidewire
•Two opposing polyester patches with platinum/ iridium markers
•PLGA (polylactic co glycolic acid) Framework
•Self centering, with‘LA first’ or‘RA first’ dep
•Fla
•Re
deli







TCT 2016
Washington, D.C., USA, Oct 29 - Nov 2, 2016

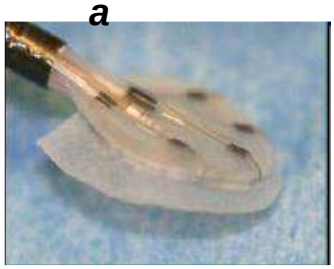
Prospective single center First In Human (FIH) clinical trial to evaluate the safety and effectiveness of a septal occluder with bioresorbable framework in patients with clinically significant atrial septum defect (ASD) or patent foramen ovale (PFO)

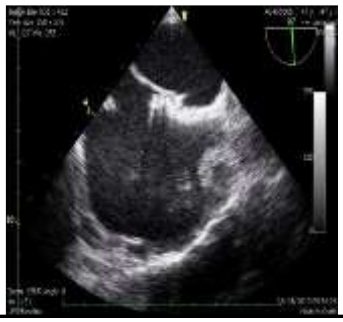
Horst Sievert[1], Björn Söderberg[2], Matthias Sigler[3], Gernear Gafoor[1,4], Ilona Hofmann[1], Laura Vaskelyte[1], Markus Reinartz[1], Predrag Matic[1], Katja Sievert[1]

[1]Cardiovascular Center Frankfurt CVC Frankfurt, Germany
[2]The Queen Silvia Children's Hospital, Göteborg, Sweden
[3]Pädiatrische Kardiologie und Internistische Intensivmedizin, Göttingen, Germany
[4]Swedish Heart Institute, Seattle, WA

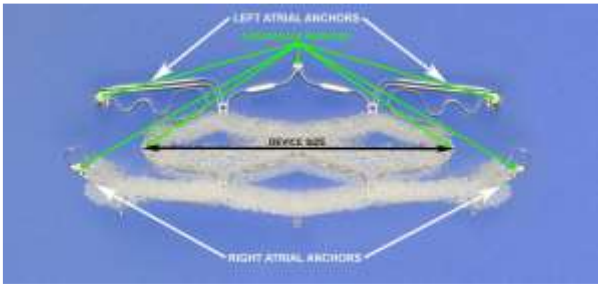
Non Umbrella Devices
In-tunnel devices

Ceira

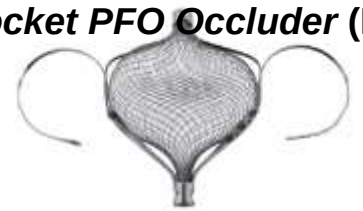




Coherex FlatSter



The *SeptRx® Intrapocket PFO Occluder* (IPO)



SeptRx® IPO—Intrapocket PFO Occluder

Noble Stitch

Novel CE marked PFO suture technology

•12 Fr system

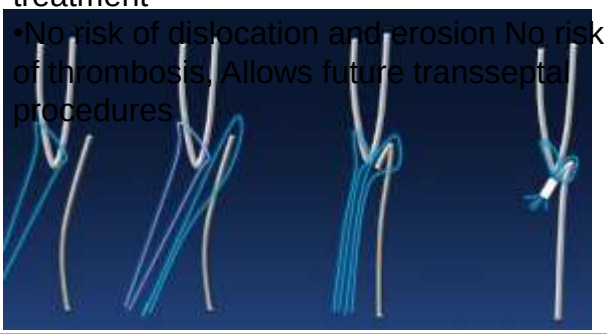
•Delivers separate sutures to primum and secundum septae

•Secured using single polypropolene KwikKnot

The advantages of using Noblestitch EL treating PFO are:

•No implanted device. Not required antiplatelet therapy or other medical treatment

•No risk of dislocation and erosion No risk of thrombosis, Allows future transseptal procedures



How it works

Percutaneous PFO Closure for Cryptogenic Stroke

Benefits of percutaneous PFO closure in the prevention of stroke has been and remains a controversial topic.

There were multiple retrospective and registries with evidence in both direction

During the last years there were 3 landmark RCTs have tried to tackle this question

Closure Medical Therapy for Cryptogenic Stroke with Patent Foramen Ovale

Anthony J. Furlan, M.D., Mark Reisman, M.D., Joseph Massaro, Ph.D., Laura Mauri, M.D., Harold Adams, M.D., Gregory W. Albers, M.D., Robert Felberg, M.D., Howard Herrmann, M.D., Saibal Kar, M.D., Michael Landzberg, M.D., Albert Raizner, M.D., and Lawrence Wechsler, M.D. for the CLOSURE I Investigators

N Engl J Med 2012; 366:991-999 | March 15, 2012 | DOI: 10.1056/NEJMoa1009639

CLOSURE Trial -2012

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

N Engl J Med 2013; 368:1083-1091 | March 21, 2013 | DOI: 10.1056/NEJMoa1211716

PC trial -2013

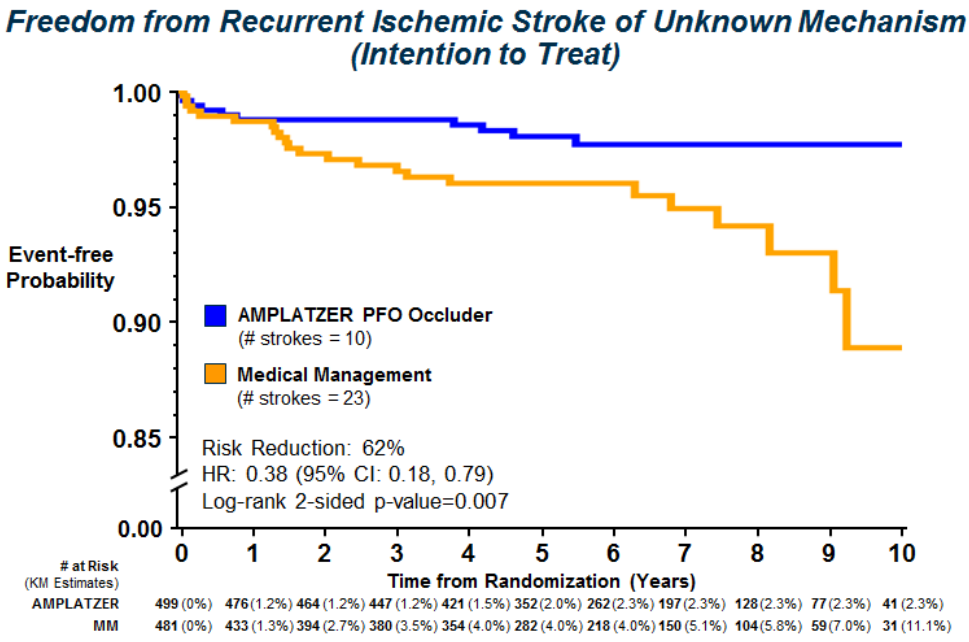
Closure of Patent Foramen Ovale versus Medical Therapy after Cryptogenic Stroke

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

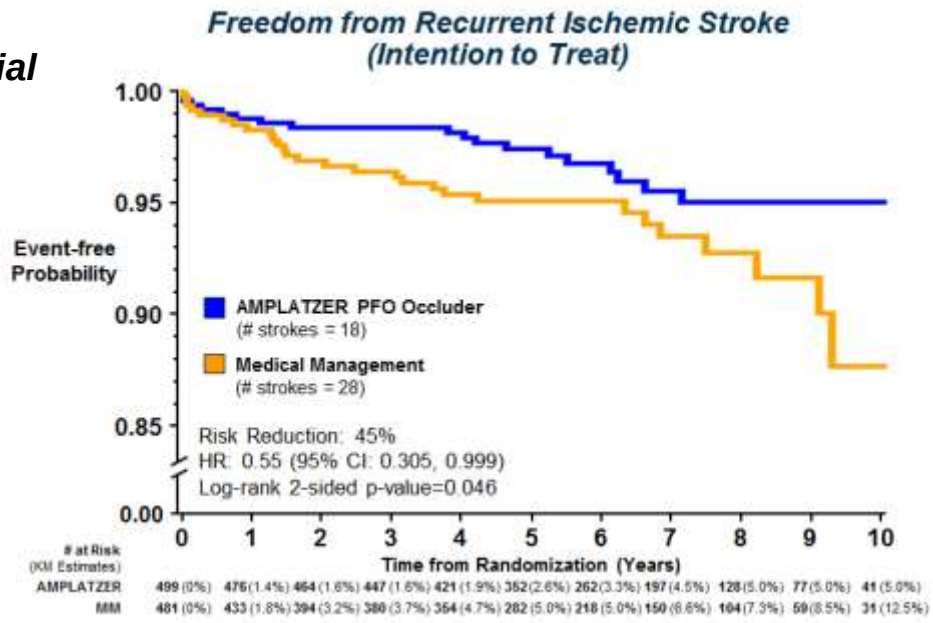
N Engl J Med 2013; 368:1092-1100 | March 21, 2013 | DOI: 10.1056/NEJMoa1301440

RESPECT Trial 2003

RESPECT Trial final results



RESPECT Trial final results



Device Indication

FDA Approval 10/28/16

The AMPLATZER™ PFO Occluder is indicated for percutaneous transcatheter closure of a patent foramen ovale (PFO) to reduce the risk of recurrent ischemic stroke in patients, predominantly between the ages of 18 and 60 years, who have had a cryptogenic stroke due to a presumed paradoxical embolism, as determined by a neurologist and cardiologist following an evaluation to exclude known causes of ischemic stroke.

RESPECT Post Approval Study

RESPECT PAS: Objectives

- *To demonstrate safety of the AMPLATZER PFO Occluder by assessing the 30-day rate of device-or procedure-related serious adverse events including those that led to death*
- *To demonstrate that the AMPLATZER PFO Occluder is effective by assessing the rate of recurrent ischemic stroke through 5 years*
- *To demonstrate effectiveness of the training program for new operators*

RESPECT PAS: Design

- Single arm, multi-center study
- **Approximately 1200 subjects**
- **Total duration of the study is expected to be 10 years**

RESPECT PAS: Status

- Site nominations underway
- Q1 2017 enrollments begin
- Enrollment completion expected in 2
- Study complete expected in 2026

Summary

- Umbrella devices remain the leading PFO technology and are generally safe and effective

- Positive outcome from RESPRCT trial presented at TCT 2016 and FDA approval of Amplatzer umbrella likely to stimulate growth and investment in novel approaches to PFO closure

PFO and Migrane

Randomized Trials
Effect of PFO Closures
MIST
PRIMA
PREMIUM
All small trials, various designs
None achieved primary endpoint for headache remediation with closure

Results of the PREMIUM trial: patent foramen ovale closure with the AMPLATZER™ PFO occluder for the prevention of migraine

Andrew Charles, Jonathan Tobis, Stephen Silberstein, Sherman Sorensen, Brijeshwar Maini, John Gurley, Phillip Horwitz
On behalf of the PREMIUM Investigators

CONCLUSIONS
PFO closure with the AMPLATZER TM occluder in migraine patients is generally safe
The PREMIUM study did not meet its primary endpoint of 50% reduction in attack frequency

The Percutaneous Closure of PFO in Migraine with Aura (PRIMA) trial

Aims: PRIMA is a multicenter, randomized trial to investigate the effect of percutaneous PFO closure in patients refractory to medical treatment.
One hundred and seven patients were randomly allocated to treatment with an ***Amplatzer PFO Occluder*** or control with medical.
The trial was terminated prematurely because of slow enrolment.

Results of PRIMA

Eighty-three patients (40 occluder, 43 control) completed 12-month follow-up.
Mean migraine days at baseline were 8 (+4.7 SD) in the closure group and 8.3 (+2.4) in controls.
The primary endpoint was negative with -2.9 days after PFO closure vs. -1.7 days in control group (P 1⁄4 0.17).

Conclusions: PFO Closure for Migraine

PFO device closure with the Amplatzer Occluder is safe.
PFO-migraine studies are challenging to enroll.
The primary endpoint has been missed x2 to reduce migraine days in a broader migraine population.
There are clearly “responders” and non-responders
PFO closure might decrease migraine attacks with aura in patients with predominantly migraine with aura attacks at baseline.

At present, PFO closure cannot be recommended for prevention of migraine in

Thank You